

-Sketch-

project

**Manual for the crew of the
Main Battle Tank 60 (VT- 4)**

By the Cavalry Center

project officer

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Achievements in developing the military ethos of the Royal Thai Army.

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(for inspecting work)

introduction

Manual for the crew of the Main Battle Tank 60 (VT-4), translated from the Crew's Manual for the Main Battle Tank. VT4, JS T2-2350-400-00, CHANGE 02, 2019, of China North Industries Corporation (CHINA NORTH INDUSTRIES CORPORATION) with the aim of letting the crew know. to technical characteristics Capabilities, limitations, and details Various components and structure of weapon systems, turret systems, fire control systems. and the vehicle system of the main battle tank 60 (VT-4)

This manual for the crew of the Main Battle Tank 60 (VT-4) is available if any unit desires it. To give suggestions for improvement, please specify the page, item, and line as they appear in the manual. for the crew of Main Battle Tank 60 (VT-4) and should give reasons including To create Thoroughly understood can be completely improved. I would like to send this opinion to the Technology Division, Cavalry Center, Adisorn Camp, Pak Phrao Subdistrict, Mueang District, Saraburi Province 18000.

Cavalry Center

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1

Chapter introducing equipment (COMPLETE VEHICLE)

1

Section: General Introduction (GENERAL INTRODUCTION)

Main Battle Tank 60 (VT-4) is a belt-type armored combat vehicle. Driven by diesel engine. Able to conduct combat operations independently. and have flexibility in moving. Excellent on the ground. carry out a mission (Hunter-Killer) with a fire control system and a machine. Automatic loading of ammunition (Autoloader) facilitates aiming, shooting and loading of artillery ammunition. Quickly and precisely, the Main Battle Tank 60 (VT-4) has the ability to destroy tanks and vehicles. Enemy armor. Stop the firepower of enemy artillery. Destroy enemy weapons. Destroy operational facilities in the field. and destroy the enemy's effectiveness.

Part 2

MAIN FEATURES

A. It has a low profile, low weight and high survivability on the battlefield.

B. It has strong firepower. Equipped with a smooth-barreled cannon. (Smooth-bored main gun)

One 125 mm. cylinder, which can fire armor-piercing rounds that can take off the cover itself, stabilized by fins. tail (APFSDS), HEAT (HEAT) and HE-Frag (also called high-explosive (HE)) rounds, as well as guided munitions fired from Cannon barrel The tank is also equipped

One 12.7 mm anti-aircraft machine gun, controlled to fire from inside the vehicle (Remote controlled 12.7 mm AAMG) and one coaxial MG machine gun, size 7. 62 mm. one cylinder

C. Combine with fire control equipment to hunt and kill by tracking targets and

Set the direction of the gunner's scope while maintaining stability using a servo system. When sticking to the target and leading

The gun enters the target through the operator's digital panoramic sight. Create a thermal image Runs

completely on electricity and use digital gun control technology The tank can be operated

Missions on the battlefield can be carried out both during the day and at night. in the role of hunting and killing as well

Inspection system Automatic Target Acquisition and Target Holding Gunner and commander

The vehicle has a video screen for aiming fire and real-time display of battlefield information. The gunner's

scope can be used both during the day and at night. When shooting at a target

Move while the tank is running. Automatically sticks to the target. Supports shooting to hit the target as well.

The first shot is highly probable. The operator can take control off the gunner (Override).

To set the gun on the target and fire the gun manually

D. The tank is equipped with a dual-function automatic loader. Also control the work.

Microcomputer

E. The tank is equipped with a combination generator that uses an engine with cylinders placed in horizontally, which takes less time to remove and install. The generator can be removed.

from the generator room within 25 minutes and can install the generator

Return to the generator room within 35 minutes, supporting the generator's

The combination can be removed and installed in the generator room. and can be repaired quickly

Fast on the battlefield.

The tank is equipped with a 1200 horsepower diesel engine with an intake booster. (Gas-turbocharged) and intake cooler (Inter-cooled) that are compact, take up a lot of space.

It is small, economical and has reliable performance. The tank has a high energy reserve. Has a maximum speed of 70 km./hrs. The average speed in terrain is 35-45 km/h and the time to accelerate from 0-32 km/h is within 10-12 seconds.

The tank can cross a straight slope of up to 60 km. % Maximum ability to cross an incline 40% and has an operating range of 400 km.

fluid-mechanical (Hydro-mechanical transmission) has 6 forward speeds and 2 reverse speeds. Changing gears is possible.

both automatic and manual change Using a hydraulic steering mechanism to work

Stationary combinations and mobile Makes car turns and stationary turns easily possible.

Smooth. Rotating in place to turn in a circle takes no more than 18 seconds.

H. The combination brake system consists of: hydraulic pressure reducer and disc wheels are prohibited. Helps the tank have better wheel braking performance.

I. The tank uses a system to support the vehicle using a high-powered torsion beam. Consists of a power relief machine Hydraulic vibration Hydraulic press arm stop and a double latch belt with a latch rubber pad belt to ensure better vehicle support. and be confident that it is agile in good movement

J. Front slope of the turret. and the front slope of the vehicle is covered with armor plates. mixed type and can be equipped with additional armor plates. Both sides of the vehicle are equipped with shields.

The belt is made of non-metallic materials. To increase the survivability of the tank.

K. The inside of the tank is equipped with a general protection system. The system consists of

Detects nuclear, biological and chemical substances. Protection against pressure inside the vehicle higher than atmospheric pressure.

Outside the vehicle, there is ventilation and exhaust fumes inside the gun turret. There is air conditioning and also

The protection system includes a new type of environmentally friendly automatic fire extinguisher.

Fire signal inside the car and a second stage explosion suppression system, a smoke screen generator.

Hot laser warning device and smoke grenade launcher connector Make the tank survive in

More battlefields

L. The onboard information system of the main battle tank 60 (VT-4) is built with a local area network.

Three layers of control Duplicate data is separated in two layers. which consists of a control network

Communicate firepower protection network and vehicle data network using the user's monitor panel

The vehicle's steering wheel and the driver's display are the data gateways. Works with equipment at each

station Make the signal transmission Exchange and sharing within the system or between systems is

In addition, the tank has been structurally prepared. Systems and related components

Various functions for information networks between vehicles which supports the use of data networks between vehicles.

Possibility

M. Consists of a friendly-foe identification system.

Inquire, respond, and be situationally aware to reduce and prevent accidental killings on the battlefield, and

Guarantee that our tanks will not be damaged by friendly weapons.

N. Use a combined navigation system. It consists of a satellite-based global positioning system.

(GPS) and inertial navigation systems Each system can work independently or both.

The system works together giving a complete advantage

Part 3

MAIN PERFORMANCE PARAMETERS

A. General data

Ready weight	52 tons
Crew, engine	3 people
power, weight-	883 kilowatts (1,200 horsepower)
power ratio Weight pressing	16.98 kilowatts/ton (23 horsepower/ton)
on the ground (at the belt),	0.08955 megapascal (MPa)
average maximum air pressure (MMP) 281.07 kg newton/sq m. (kN/m ²)	
Operating temperature	-25° C to +55° C

range B. Tank proportions (Outline dimensions) (see Figure 1-1)

Length when the cannon is at the front of the vehicle (from the mouth of the barrel to the vent grille weather)	10,100 mm.
Length when the cannon is at the rear of the vehicle (from the mouth of the barrel to the mud guard)	9,750 mm.
Width of vehicle	
Includes belt guard	3,500 mm.
Does not include belt guard.	3,440 mm.
Length of belt in contact with the ground	4,747 mm.
Distance under vehicle	
in front of the car	530 mm.
behind the car	430 mm.
Vehicle height (to top of turret)	2,400 mm.

C. Mobility

Maximum speed on the	70 km./hr.
road Terrain speed	35 km./hr. – 45 km./hr.
Acceleration 0-32 km./hr.	10 seconds – 12 seconds
Longest operating distance on road	500 km.
(Equipped with spare fuel	
tank) Maximum operating distance in terrain	400 km.
(Install spare oil tank)	
The kidneys are straight.	60 %
The kidneys are slanted.	40 %
Cross	2.7 m.
ditches, cross vertical	0.85 m.
obstacles,	1.2 m.
wade through deep water. Ability	4 m. – 5 m. Underwater travel distance
to wade through deep water.	600 m.

(When installing deep water wading equipment) **D. Fire power**

Width of the mouth of a cannon	125 mm., smooth barrel.
barrel Number of bullets stored	38 matches
on the vehicle Power to destroy armor	
Armor-piercing rounds shed their shells on their own.	Can penetrate armor plates that have been rolled into meat.
Balances with the caudal fin (APFSDS).	of the same thickness 600 mm./at an angle of 0°
	within a distance of 2,000 m.
Anti-tank grenades (HEAT)	Can penetrate armor plates that have been rolled into meat.
	The same thickness can be 180 mm./at an angle of 68°.
	Within a distance of 2,000 m.
The elevation and depression angles of a tank gun.	
The gun is in front.	+13°/-5°
The gun is in the back.	+18°/0°

Lifespan of gun barrels	How to	500 matches (AP: HEAT :HE=4:3:3)
load ammunition / Rate of fire.	Width	Automatic / 6-8 shots/minute
of the barrel of the coaxial machine gun.		7.62 mm.
Wide mouth of anti-aircraft machine gun barrel		12.7 mm.
Number of coaxial machine gun rounds stored on the vehicle	3,000	shot
Length of machine gun shell together with core		54 mm.
Number of anti-aircraft machine gun rounds	780 matches	
car storage		
Machine gun shell length		108 mm.
Anti-aircraft		

E. Fire control system

Gunner's scope	There is a 2-axis independent balance stabilizer.
Panoramic scope	There is a 2-axis independent balance stabilizer.
of the vehicle commander	Select magnification power from 2 areas, able to cut
	Control (Override) gun orientation and
	Shooting a gun from a sniper
Laser distance finder	have
and computer	
Gunner's night vision camera	Create images with heat (Thermal imager)
Operator's Night Camera	Create images with heat (Thermal imager)

F. Gun control performance

Stabilizer for maintaining balance on 2 axes.	
propulsion	Electricity

G. Protection capability

protective armor	Composite armor
	and reactive armor plates (Reactive armor)
National protection equipment (NBC)	Provide collective protection

fire extinguishing ability	automatic fire extinguisher inhibit explosion
and prevent explosions	Step 2
Smoke screen equipment	
Turret	12 rounds of smoke grenades
The car	Smoke screen generator with heat
Gunshot warning tool	Linked to a smoke grenade launcher.
with laser light	
Department	have
Authentication System H. Electronic and electrical systems of tanks.	
Monitoring aid monitor	Daylight imaging camera (CCD) or camera
of the driver	Thermal imager takes images in the field of view and sends the images.
	to the monitor in front of the driver so that the
	The driver can observe the situation in front of the car.
	or behind the car from the image on the monitor
	The gain rate is adjusted automatically.
Surveillance cameras around you	have
Navigation equipment	global positioning system as well
	Satellites combined with navigation systems
	inert
Data network system	Intelligently send various types of data. Send commands.
	operations to a more advanced control unit through
	via connected networks and forward it to
	Other crew members Transmit light data
	Genius, the intention to practice and propose
	needs, including information about one's own car
	to other cars that are on the same side
	There is manual/automatic access to network groups.

To notify network groups at different levels in a working group (e.g. company level, battalion level) to ensure smoothness and accuracy. elements of data transmission and delivery speed data between vehicles

Tank electronic systems

The transmission channel of the controlled area network (CAN bus)

has a transmission speed of 250Kbps. There is separation of redundant data.

It uses the CAN 2.0B

protocol, designed to separate the electronics used between the CAN communication control system and the receiver/transmitter. of each control station

Crew monitor

1) The driver's display will start working within no more than 15 seconds and the operator's display not more than 90 seconds under normal temperature conditions. 2)

Prepare Connect the signal to work together with soldiers of the same side. News will be displayed. It consists of letters and various icons. News about various errors that must be checked and various warnings will be displayed on

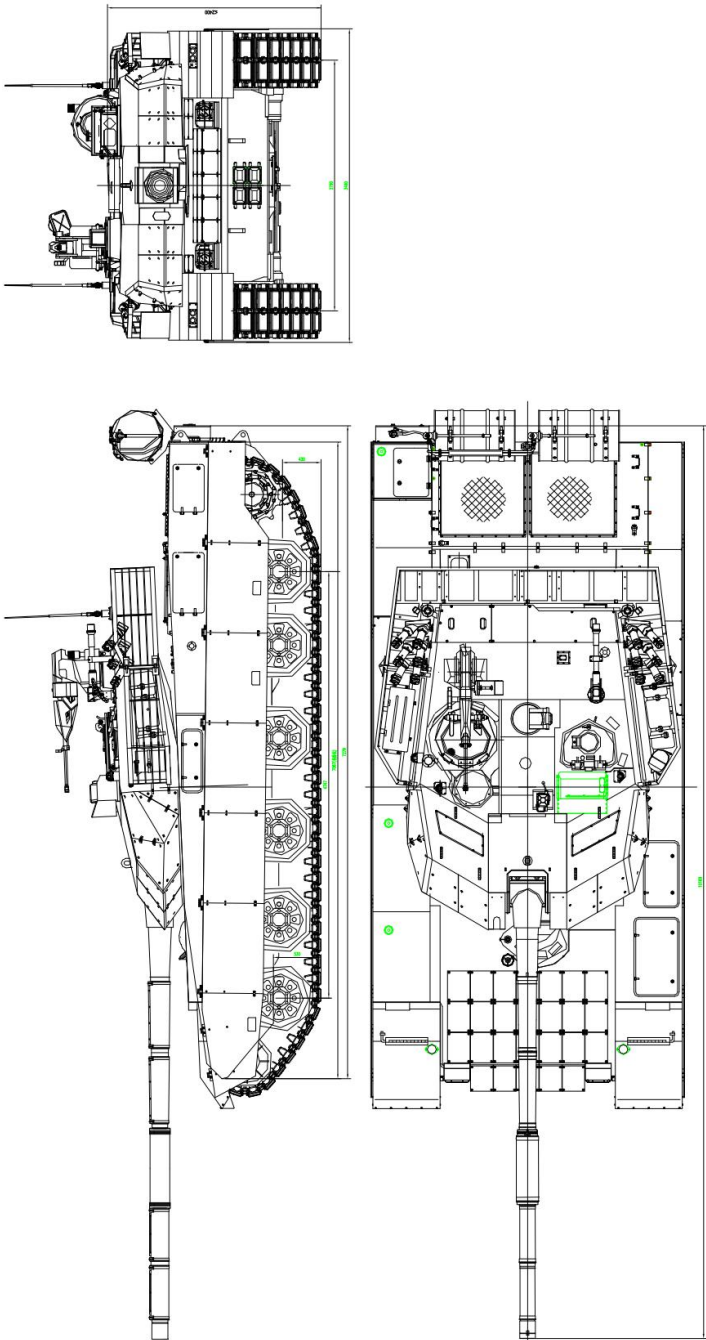
monitor. 3) Crew monitor size 1024 x 768

monitor display resolution 1024 x 768 generators

Auxiliary power unit has

Part 4

STRUCTURE AND LAYOUT



1) Turret

The turret consists of the turret. Storage hole at the end of the fort Removable composite armor plate Removable reactive armor plate Turret ring The turret side grille and cover provide access and exit for the crew. The 125 mm cannon, smooth barrel, is mounted at Center turret: 7.62 mm coaxial machine gun mounted on the right side of the gun mount along with the main gun. To the left of the cannon was a gunner's station complete with a seat and gunner's access cover. To the right of the cannon was the commander's station, complete with seats and covers for the vehicle's entrances and exits.

Car commander

In front of the gunner's seat there is a gunner's control device. The gun elevation mechanism, the gunner's scope, the gun's power supply and timer, and the laser range finder on the left of the gunner's seat. The shot has a mechanism to rotate the gun turret. Gun turret lock gun control box Fire control computer Gunner's power supply control box Communication control box inside the vehicle of Gunner No. 2, signal cable connection box Automatic Calibration Control Box Scope Control Box Above the gunner's seat is a frame over the gunner's head. Gunner's fan Bulb switch for interior lighting Gunner's turret Left detector mounting bracket Air conditioner ventilation vents

The gunner's side and two glass observation bars.

To the right of the gunner's seat is: A large support arm. Gun shield and fire extinguisher 1301 (B) In front of the commander's seat, there is: a display showing the surrounding surveillance equipment, a machine gun control box. Anti-aircraft Commander's control device Commander's panoramic sight. Commander's image display and fire control display. Laser alarm control box, anti-aircraft machine gun control switch, coaxial machine gun lighting lamp Monitor control box Car commander's mask Fire Extinguisher 1301 (B) The gun locks the cannon in line with the loading angle.

To the right of the commander's seat, there is: a screen to display images and control the situation of the commander. Commander's power distribution control box, communication control box inside vehicle number 1, control panel, ammunition loading Control and warning equipment for NCCC. Control and warning equipment for toxic substances and radiation.

On the left side of the commander's seat is a commander's gun shield.

Behind the commander's seat, there are: mouthpiece, headphones (with mounting base), switch button box.

Control the loading and unloading of ammunition.

Inside the hole at the back of the turret are: radio set, laser warning control box, gun receiver tilt angle detector, safety socket, optical detector, ammo. pushing rod, cross wind electronic box. , AC indoor unit, system management computer (PHM Computer), fire control computer Ventilation vents and passage pipes of air conditioners, etc.

In addition, there are integrated NCC protection devices, power boosters, power distribution boxes, equipment and the main unit of the verification

system. Side 2) **Chassis**

The vehicle body is constructed of armor plates of varying thickness by welding. The sloped armor at the front of the vehicle consists of composite armor. (Composite armor) and equipped with a reactive armor block, which enhances frontal protection. Both sides of the vehicle On the side is a belt guard (skirt) made of non-metallic material. The driver's cab is mounted on the left side. From the center of the front of the vehicle From the front to the rear on the left side of the driver's cab there is a fuel tank, the left front fuel tank. Extra battery hydraulic station Driver's monitor Driver's action button box, switch box, fire extinguisher and explosion suppression control box Fuel tank and Left front artillery ammunition rack From the front to the rear on the right side of the driver's cab. There is a fuel tank on the right front. fuel tank and artillery shell rack on the right front, etc. The driver's entry hatch is located in the center of the front of the vehicle. The driver's seat is located under the hatch. Driver's entrance In front of the driver's seat is a light bulb. steering wheel Thermal circuit breaker switch box The machine monitor helps monitor the contact control box. Inside vehicle number 2, the control box for the electrical system for the speed changer, the control box for the electrical system for braking the wheels. Brake drive box The inertial navigation device, brake lever, engine throttle, speed shift lever are located on the right front of the driver's seat. The driver's ventilation cover is located near the right front fuel tank on the driver's right front side. The emergency exit hatch is located on the vehicle's floor covering from behind the driver's seat to the ammunition rail.

(Carousel magazine) There were two optical detectors on top of the driver's cabin. The ammunition carrier and connecting rings are mounted on the tower floor. Truck rail protection plate

The ammunition is at the front of the tower. On the side of the protective plate near the driver's cab were a field shovel, a first aid kit, and a water bottle for the driver. Portable fire extinguisher behind the fuel tank and

The artillery shell rack on the left at the front left of the tower contains a box for collecting information about the vehicle. One fire extinguisher mounted on the left side of the armor plate. 200 Ampere contactor. Coarse fuel filter. Fuel distribution tap Two electrical wiring boxes Gyro body At the rear left of the tower compartment is a centrifugal fuel pump. System control box Engine electrical power, left center fuel tank Vacuum signal box, integrated NCCC controller, at the back of the tower room there is a water pump. Overflow valve and working mechanism The area in front of the right side of the tower and behind the fuel tanks and artillery shell rack. On the right side there is the main unit of the air conditioning unit and the filter for the driver. Light bulb box. At the back right of the tower there is a fuel tank in the middle. The contactor box, main power distribution box and fuel cut-off tap for the tank outside the generator room are mounted at the rear of the vehicle. Install a 1200 horsepower VT/E1 diesel engine. The engine has horizontal cylinders with the PTO end on the left side. The engine is connected to and mounted to a Ch1000B fluid-mechanical speed converter via a speed-up gearbox and three special coupling frames, which It is the basic component of a hybrid power generator. The front of the engine, from left to right, contains the secondary air filter and the air intake pipe. Store engine oil, storage tank, steering oil. Oil pipes and electrical wires The steering oil cooler is mounted on Steering oil reservoir Thermal smoke screen generator electromagnetic valve is installed on the machine.

To transmit

power, the top of the speed converter has two 600 mm fans with two fan vents. And there are two radiators, a high temperature radiator and a low temperature radiator. A watertight overflow tank is installed between the turbocharger.) two units, above the flywheel housing, there is space between the fan vent and the variable speed engine oil cooling unit.

3) Vehicle exterior

A. Outside the gun turret

The 12.7 mm anti-aircraft machine gun station, controlled from inside the vehicle, is installed behind the commander's entrance, outside the fort. gun Front end question transmitter and gun barrel measuring device Installed at the left front of the vehicle commander's entrance and exit. page Installed at the back Gunner's entrance and exit The smoke and kill grenade launcher is mounted behind the side grille. Turrets on both sides Anti-aircraft machine gun ammunition box Co-axial machine gun ammunition box, smoke grenade spare parts box Box of spare parts, canvas, and compressor controller. The air conditioner is mounted in the turret grille panel. The machine gun's spare barrel clamp is mounted on the side. Grille behind the gun turret (When going to the battlefield, spare machine gun barrels can be installed here.)

B. Outside the car

1) In front of the driver's compartment: The front of the driver's compartment is equipped with 26 reactive armor plates, a large light on the left side. project and a daytime camera in front of the car is mounted on the front left, the main headlight is on the right. Thermal imaging camera on the front of the vehicle and the horn is mounted on the right front. Two spare belt links and two towing wires are mounted on the lower front armor plate of the vehicle.

2) Left fender From front to back there is: Front left signal light First tool chest Second tool chest Third tool chest Filter room Left side primary air Heater room, air tank, fire extinguisher room and rear signal lights First tool chest There is a water tank for

washing the glass. and water pumps ; Filter

Left side primary air Left dust pump and the dust vent on the left side is installed in the engine compartment. Left-side primary air filter Inside the heating room there is a heater. Water pumps and heater control equipment including related pipelines Inside the air tank and machine storage room The fire extinguisher has two air tanks. pressure relief valve Electric pneumatic valve Control box, internal communication device, vehicle number 2, mouthpiece, headphones, and two fire extinguishers

3) On the right fender From front to back There is a signal light on the right front. Fuel tank. First external fuel tank. Second external fuel tank Third outer fuel tank, right pre-air filter chamber Battery room Auxiliary generator room, connecting plate, spare fuel tank and right rear signal light

In the right-hand side of the primary air filter room. Right pre-air filter, right dust extraction pump and the right-hand dust vent is installed in the right-hand pre-filter room. The battery room holds four batteries, a generator voltage regulator, a box to prevent reverse connections, two 600A contactors. An external engine mount outlet. Current measuring device. Generator control box fuse box Installed inside the room, the battery and generator help. The engine's oil storage tank helps and the engine control box Help install inside the generator room.

4) Under the right and left fenders are belts. Belt adjustment wheel Belt adjuster, press wheel, belt, press arm, press arm stop Vibration dampers, belt wheels and drive gears belt

Chapter 2 MAIN GUN

Section 1

General Description (GENERAL DESCRIPTION)

1. Brief introduction

Artillery is the main weapon of the firepower system. The 125 mm smoothbore cannon has higher efficiency characteristics. It has a reasonable and compact structure. Can be used to fire more bullets, more types, which creates intense firepower. and has excellent efficiency

The 125 mm smoothbore tank gun was prepared to fire splitter ammunition. Packed with armor-piercing (AP), anti-tank (HEAT) and grenade (HE) grenades, the 125 mm

tank gun is designed to: destroy tanks, armored vehicles.

Set up the cannon. and the enemy's main weapon B. Destroy the enemy's concrete stronghold. and kill targets that are military units. C. The

cannon is mounted on the gun receiver port inside the turret at the front. Shown by the fastening of the latch. Left and right gun mounts and counterbalanced by a gun balance weight mounted on the bottom of the platform. Prevents gun shock The cannon can rotate freely in height around the center of the gun receiver hub. and can rotate in the same direction as the turret.

The cannon's maximum elevation angle is limited by three metal platforms welded to the gun shield, and its minimum depression angle is limited by its welded metal platforms. with

the gun turret roof The cannon mounted inside the turret can be directed to fire using a fire control system. Orientation is operated with the gunner's joystick by switching on the stability control system or With a high-way mechanism and a directional mechanism when the stability control switch is not turned on. The high riser is mechanical in nature and is mounted on a special internal mount. Turret

As the tank transitions from combat locomotion to travel locomotion, position the main gun in the travel gun position at the predetermined angle. The cannon must be secured in the travel gun mount position when transported from the battlefield.

2. Operational performance. A. The cannon is mounted in the tank and works in

conjunction with the fire control system and loading machine. Automatic rounds B. The artillery can fire when the tank

is in a tilted position with an angle of less than 10° , and
While the tank is in motion. C.

The artillery can operate normally in the temperature range of -40°C to $+50^\circ\text{C}$. D.

The artillery should be serviced and maintained by Perform maintenance duties to keep guns in good technical condition.

Part 2

TECHNICAL PERFORMANCE

1. Data

A. Capability characteristics

Width of gun barrel 125 mm.

Bullet type APFSDS (armour-piercing shell stabilized by tail fin),
Use the term armor-piercing bullet (AP).
HE (High Explosive), also referred to as high-explosive ammunition (HE).
HEAT (High Explosive Anti-Tank), also used as a bomb.
Anti-Tank (HA)

Features in design Armor-piercing ammunition (AP): separate main carrier.

Loading ammunition and the bullet along with the supporting soil
Anti-tank grenades (HA) and explosive shells
(HE): Separate main load and shell.

Rate of fire 6 - 8 shots/minute

Shooting area Elevation and depression angle 20° ; Direction angle 360°

How to shoot It can work in two states such as electrical and mechanical.
(electromagnetic and manual)

Engine oil for recoil force 7.7 + 0.3 liters.

Oil returns the gun to its place. 5.1 l. ± 0.1 l.

Pressure in the barrel delivery unit 6.28 megapascals ±0.1 megapascals (MPa)

Return to place.

Normal retreat distance 270 mm. - 320 mm.

Maximum retreat 340 mm.

distance How to change a gun barrel The gun barrel cannot be removed from the front.

Reloading mode semi-automatic

Resistance to retreat <800 kilonewtons (kN)

maximum

The service life of the gun barrel is 500 rounds with a normal bullet chamber at normal temperature.

In the ratio of shells: Armor-piercing (AP): Combat grenade

Tank (HA): Bomb (HE) = 4: 3: 3

B. Structural features

Barrel length 6,000 mm.

Ready gun barrel length 6,350 mm.

assembly machine

Location of gun receiver hub 626 mm at the rear end of the gun cradle and
40 mm below the firing line.

Distance between gun receiver hub and
muzzle end 5,110 mm.

Distance between gun support hub and tip
of the final engine housing 1,240 mm.

Width of safety plate 593 mm.

Movement of the receiving arm 11.72 mm.

(Dynamic couple arm)

C. Weight

Gun barrel 1,064 kg.

Gun barrel with assembly tools recoil 1,700 kg.

device whole gun 1,906 kg.

(including high road machinery) <2,500 kg.

ammunition

Armor penetration (AP) 21 kg.

Anti-tank grenade (HA) 29 kg.

Explosive (HE) 33 kg.

2. Basic performance

A. Structural features

The gun barrel is monoblock and uses liquid for cooling.

Then chrome plated on the surface of the gun barrel. The entire gun barrel consists of a final engine housing.

Wedge shaped, end cap, semi-automatic return spring, cylindrical gun cradle, force receiver

Fluid-controlled recoil mechanism, 3 liquid-gas return chambers, and mechanical elevation mechanism with a clutch plate to absorb friction and

Two-layer aluminum sheet heat averaging casing

B. Type and weight of bullets

Armor-piercing round (AP) 7.34 kg.

Anti-tank grenade round (HA) 19 kg.

Explosive shell (HE) 23 kg.

C. Initial speed and pressure in the chamber.

Armor-piercing bullet (AP) Initial speed at normal temperature $\approx 1,730$ m./sec.
Ported pressure from copper compression meter.

At normal temperature ≈ 470.4 megapascals (MPa)

Anti-tank grenades (HA) Initial speed at normal temperature ≈ 905 m/s
Ported pressure from copper compression meter.

At normal temperature ≈ 294 megapascals (MPa)

Explosive shell (HE) Initial speed at normal temperature ≈ 850 m./sec.
Ported pressure from copper compression meter.

At normal temperature ≈ 343 megapascals (MPa)

Guided weapons fired from gun barrels.
(Gun-launched missile) Initial speed at normal temperature ≈ 470 m/s
Ported pressure from copper compression meter.

At normal temperature ≈ 60 megapascals (MPa)

D. Power of destruction

1) Armor-piercing bullet (AP) (at normal ambient temperature)

Able to penetrate uniformly rolled armor plates up to 600 mm. thick at an angle of 0° at Distance 2,000 m.

2) Anti-tank grenades (HA)

Able to penetrate rolled uniform armor (RHA) plates 180 mm thick / at an angle of 68° at a distance of 2,000 m.

E. Dispersion range of bullets at a distance of 1,000 m (the error value that may can happen)

Armor-piercing round Distance \times Direction $\ddot{y}0.30 \text{ m.} \times 0.30 \text{ m.}$

(AP) Anti-tank grenade round (HA) Distance \times direction $\ddot{y}0.30 \text{ m.} \times 0.30 \text{ m.}$

Explosive shell (HE) distance \times direction $\ddot{y}0.30 \text{ m} \times 0.30 \text{ m.}$

3. Failure process of barrel life

With the number of bullets being fired increasing causing some changes to occur, for example, initially cracks (mesh-like cracks), pits or chipping of the surface

Chromium plating appears in the barrel cone area. The next step is to cause damage.

Continuously developed When approximately 200 rounds are fired, the hole erosion will occur.

appears more and more erosion bands appear on the bullet control cone. and there is a trend that

Erosion on other barrel surfaces will develop. There will be severe cracks and

The mesh-like cracks are increasing. Even erosion marks that are chips or flakes will

Commonly appears on non-chrome-plated surfaces. from the development of erosion marks on the surface of the hull

These gun cameras Makes the mechanical capabilities such as the initial velocity at the muzzle and the pressure.

in the gun barrel will gradually decrease. Makes the accuracy of shooting accurate. (Dispersion symptoms in correct shooting) will

gradually decreases, eventually the trajectory of the external bullet will become abnormal. At this stage the gun barrel loses its capacity.

Normal cycling ability is lost and the barrel must be changed.

4. Criterion of barrel life. A gun barrel will reach the end of its

useful life and the following facts will appear: a. Armor-piercing (AP) bullets'

initial velocity will be reduced by 3.8% and the initial velocity of the bullet will decrease by 3.8%.

Anti-tank grenades (HA) and high-explosive shells (HE) will be reduced by 2.9%.

B. The accuracy distribution range for the target at a distance of 1,000 m is reduced to a level where the tolerance is probable. Both distance and direction will be more than 8 times that of the boat.

Normal gun camera

C. Some abnormalities in the bullet's behavior appear continuously (not less than 2 - 3 rounds), for example: Armor-piercing (AP) rounds enter the target in a sideways fashion. or breakage occurs and the safety latch of the exploding fuse (HE) cannot be released in accordance with The time or explosion that occurs when a bullet exits the barrel of a gun, etc.

D. The barrel tube wears causing the barrel diameter to increase by 3.4 mm at the 25 mm position. . The front of the bullet pressure cone.

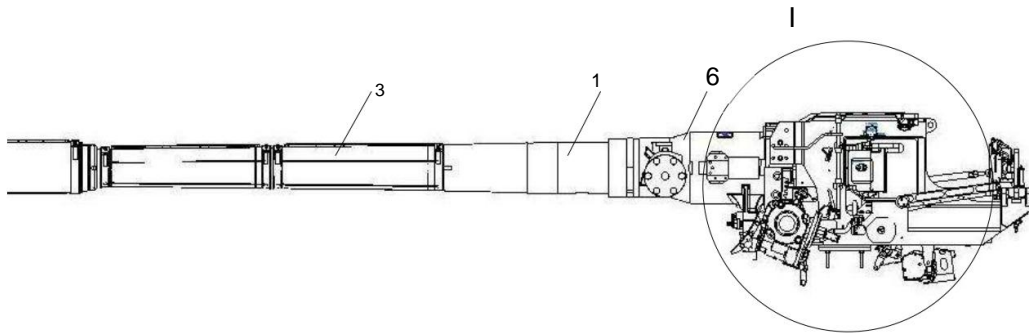
Part 3

Basic structure and working principles (STRUCTURAL AND OPERATION PRINCIPLE)

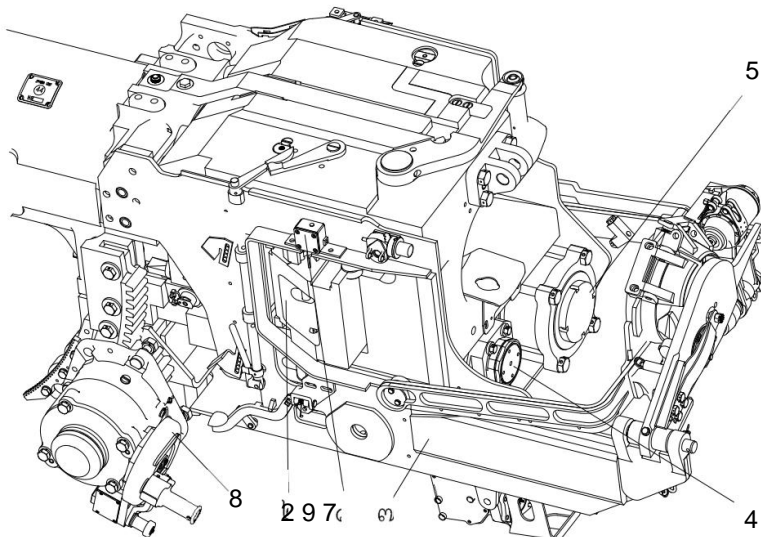
1. Basic structural composition The main components of a cannon

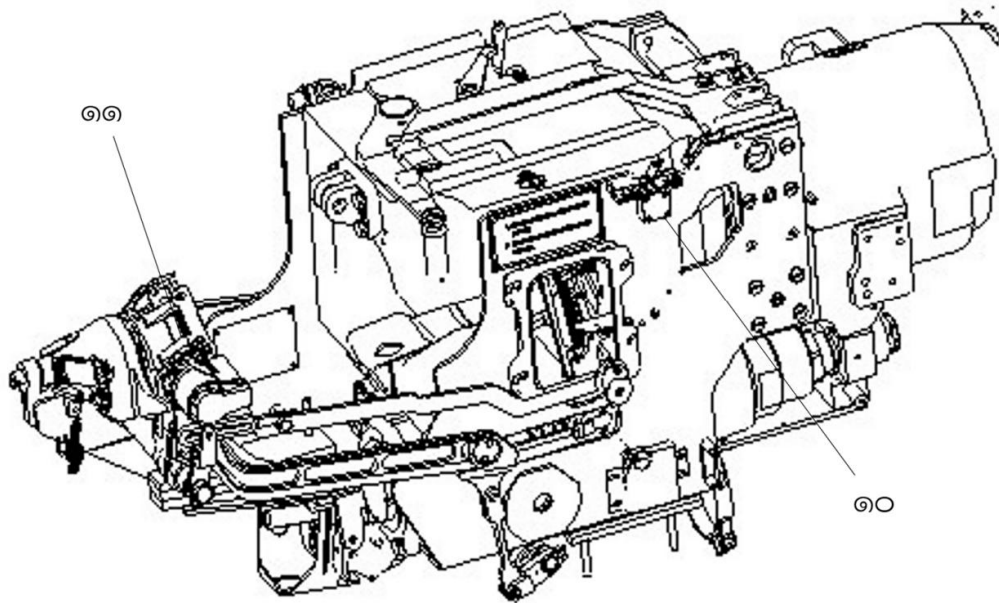
include (see Figure 1): barrel, housing. Machine turns off
Buttstock, heat exchanger, recoil receiver, barrel retracting unit, gun cradle, panels
safety, elevation mechanism, gun recoil contact switch, and on/off contact switch

The final machine rod is complete with steel to cover the ground for delivery.



I Enlarged view of the final engine housing assembly.



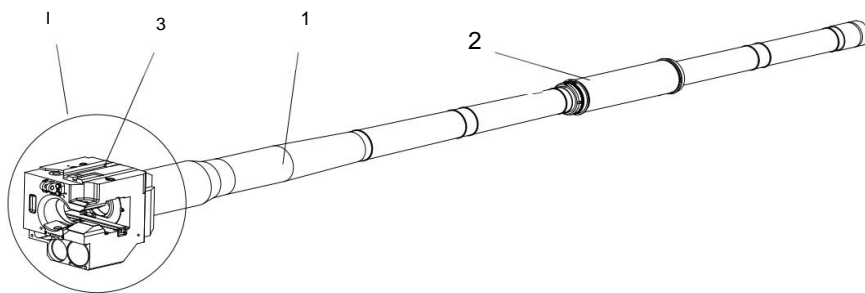


- | | |
|-------------------------------|---|
| 1. Gun barrel | 7. Safety panel |
| 2. The buttstock 3. The | 8. High way mechanisms |
| heat exchanger casing 4. | 9. Contact switch of the final closing machine. |
| The barrel return unit 5. The | 10. Reverse contact switch |
| recoil device | 11. Soil peeling machine |
| 6. Gun Cradle | |

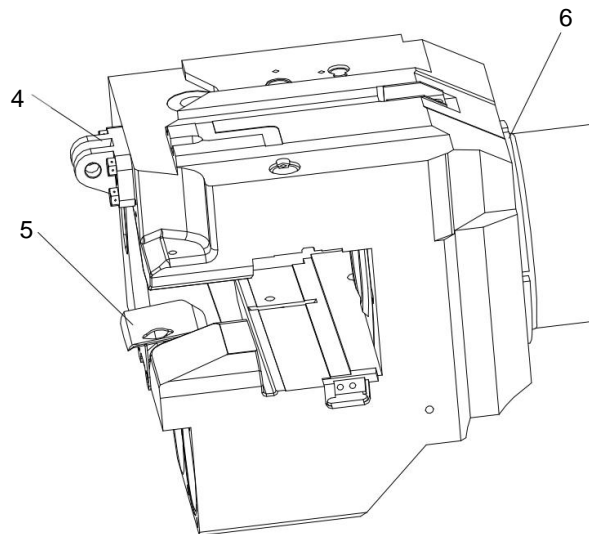
Figure 1: Basic structure of main gun

A. Barrel assembly (see Figure 2)

The barrel of a gun is responsible for releasing and guiding the flight of bullets and determining Initial velocity at the mouth of the gun barrel The main components of a barrel include the barrel, housing. buttstock, residual gas drain pot, connecting ring, ammunition tray, and gun mount travel



I Enlarged view of the final engine housing assembly.



- | | |
|----------------------------|--|
| 1. Gun barrel | 4. Travel gun mount |
| 2. Residual gas drain tank | 5. Bullet tray |
| 3. End engine housing | 6. Switch, contact of the engine housing, end closure. |

Figure 2: Barrel

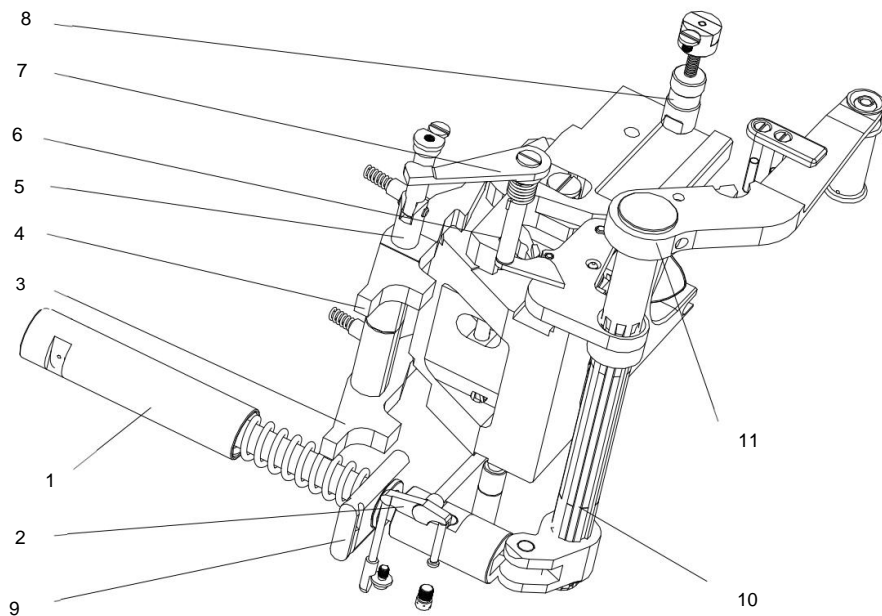
B. Breech block with semi-automat (see pictures 3, 4)

The buttstock is used to cover the end of the gun barrel. Makes it possible to shoot and withdraw.

Clay casings can be sent after firing. The finalizer bar is a wedge-shaped bar consisting of a bar clamp device.

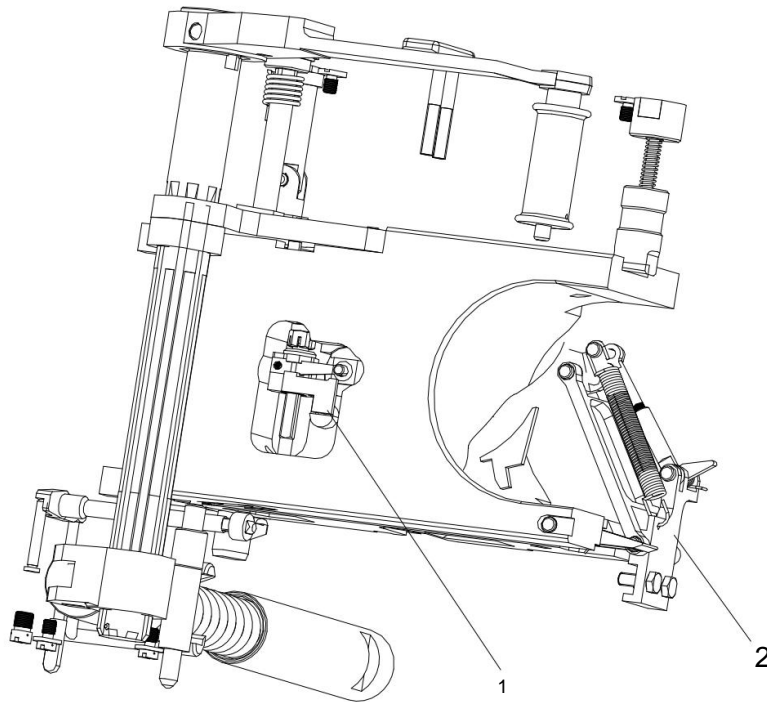
Finalizers, trigger mechanisms, safety devices, landing gear, finalizer rod opening and closing devices.

Semi-automatic, steel casing retainer and ammunition tray set.



- | | |
|-----------------------------------|-------------------------------|
| 1. Semi-automatic equipment | 7. Itchy bird |
| 2. Pedal | 8. End machine stop rod |
| 3. Lower casing | 9. Anti-shock pad |
| 4. brace Upper casing brace | 10 Crankshaft with fixing pin |
| 5. Steel shaft holding the sleeve | 11. Manual closing lever |
| 6. Rod shaft | |

Picture 3: Finishing machine bar (Breechblock)



1. Trigger device 2. Set of bullet trays

Figure 4: Finishing machine bar (Breechblock)

C. Thermal sleeve

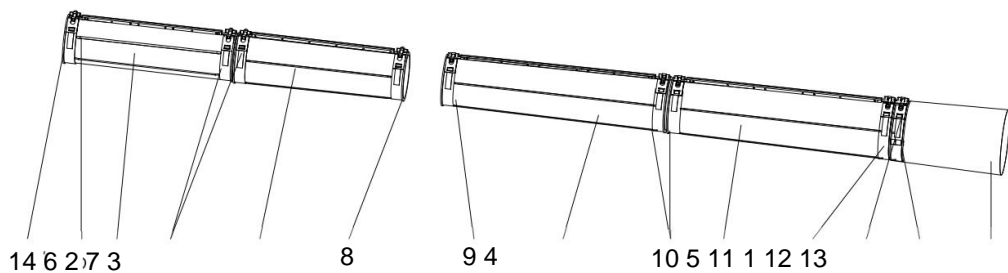
A heat shield is a set of sleeves used to protect the barrel.

The gun is bent due to the effects of uneven heating from the sun or wind and rain, and helps

Increases the possibility of a correct shot. Constructed from two layers of aluminum sheet and assembled into six sections. Each section is secured by a bolt to the outside of the barrel and supported by a silicone backing.

To prevent sliding forward and backward while shooting. Thermal casing has 5 parts. On the front there is a bolt that is attached to the top of the gun barrel and there is a drainage hole on the side. bottom

The protection efficiency of the average heat shield is not less than 60%.



1. Positioning ring

2. Sheath the part 1

3. Casing part 2

4. Casing part 4

5. Casing part 5

6. Steel strap 7. 1

Steel strap 2

8. Third steel strap

9. The 5th steel strap

10. Steel strap number 6

11. Steel strap number 7

12. Steel strap no. 8

13. Sheath part 5

14. Fastening sleeve

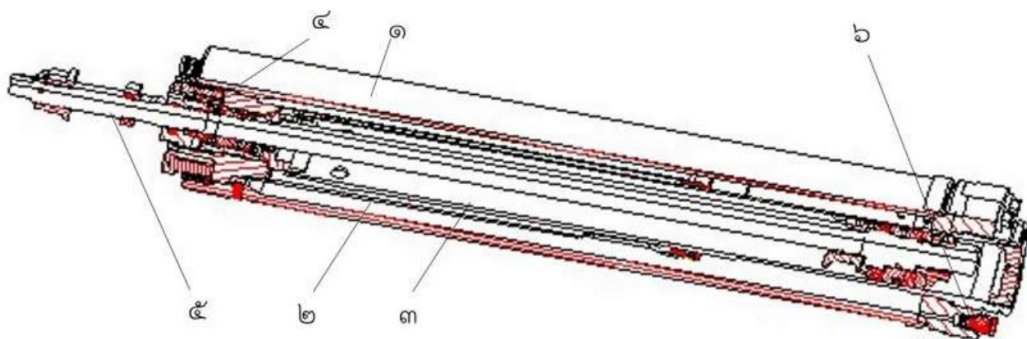
Figure 5 Thermal shroud

D. Reverse force equipment (Counter-recoil devices)

A recoil device is a set of components that provide flexibility between Gun barrel and gun cradle set The device absorbs most of the recoil of the kinetic energy to stretch. Recoil time between firing the gun cradle Reduce the force acting on the gun cradle and store. save some of the energy and allows the part that receives the recoil force to return the gun cradle to its original position in The final step in stopping the retreat.

1) The gun barrel returns to its place. (Recuperator) (see Figure 6)

The barrel returns the barrel to halt the recoil of the device as it recoils. rear and return the returning device to its original position before firing and maintaining the original position. The barrel return unit consists of an outer cylinder, a cylinder Medium, inner cylinder, leak stopper, return rod assembly and opening/closing device



1. The gun returns to the outside.

4. Leak-proof stopper

2. Center cylinder 3. Inner
cylinder

5. The gun delivery rod assembly returns to its place.

6. Open-close equipment

Figure 6: The gun returns to its place. (Recuperator)

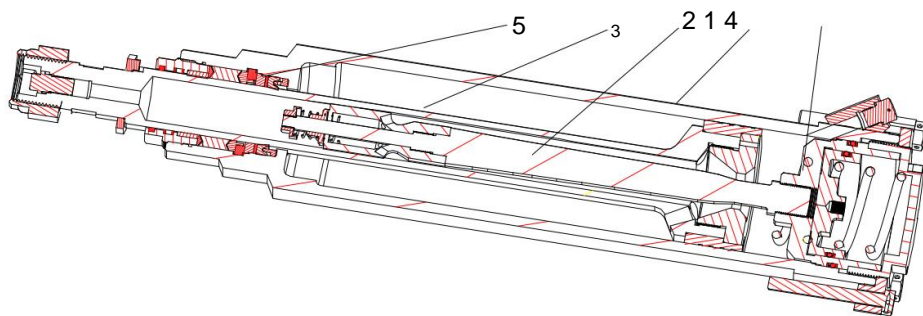
2) Recoil brake (see Figure 7)

Working of the recoil cylinder: The recoil cylinder receives kinetic energy.

Mainly, it controls the reverse movement of the equipment, which allows the recoiling part to be stopped. within a certain distance. and can stop the launch barrel from returning to its position during the final stage of the launch.

Returns the barrel into position for a stable, smooth stop.

The recoil device consists of a recoil cylinder (1), an adjusting rod (2), a recoil rod with a piston (3), a fluid control unit (4) and Leak-proof stopper (5)



1. Cylinder receiving recoil force 2.

Adjustment lever

4. Liquid control unit

5. Leak stopper

3. Recoil shaft with piston

Figure 7: Recoil brake cylinder

J. Cradle (See Figure 8)

The gun cradle is attached to the gun turret with gun receiver hubs on the left and right sides (2 and 3) used for connection. Gun barrel screen The recoil device and safety panel are combined, making the gun Can spin around in the vertical direction using a high-way mechanism. (or with a control cylinder electric hydraulic)

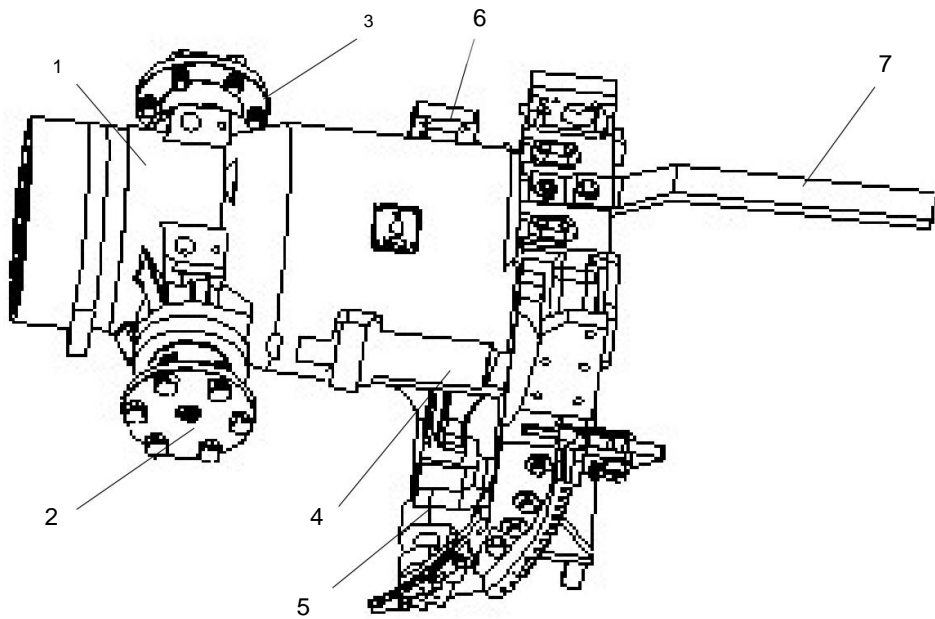
The gun cradle has a cylindrical structure and is combined with the barrel.

To fire, the front and rear platforms of the gun cradle guide and direct the gun.

The chamber is used to absorb the recoil force and return the barrel into place. The recoil force is transferred to the gun turret through the gun receiver hub, receiver plate (4), and the hydraulically controlled oil cylinder receiver plate. (5) is connected to the left side of the gun cradle and install a parabolic gear tooth plate. The coaxial machine gun mounting base (6) is connected on the right side of the gun cradle. The top of the gun cradle has a positioning wrench and an oil supply pipe for the gun receiver hub.

Both, at the bottom end, are provided with a mounting bracket with two holes for installing the gun return plunger and Stem receives recoil force The receiver at the front is used for mounting the gun shield. At the rear, a protective plate is installed.

Impact to reduce the force acting between the buttstock housing and the gun cradle when the barrel assembly is back in place.



1. gun cradle housing

2. Left gun receiver hub

3. Right gun receiver hub

4. Receiver stand
5. Platform for receiving electric hydraulic oil cylinders.

6. Coaxial machine gun mounting platform

7. Positioning wrench

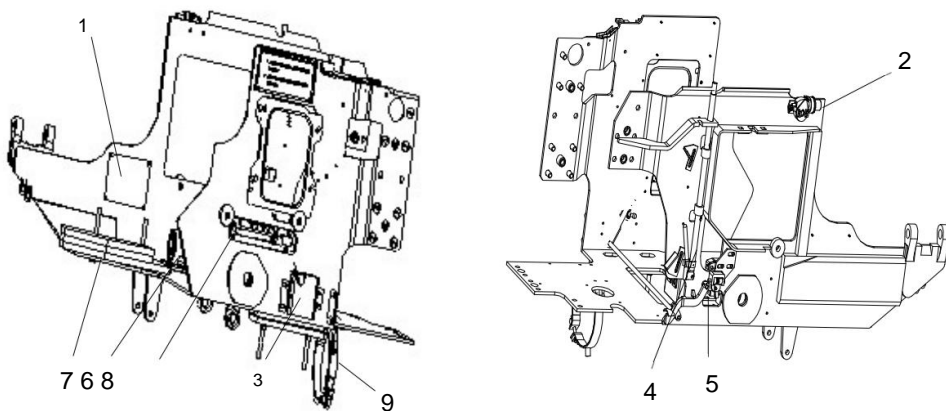
Figure 8: Gun cradle (Cradle)

F. Safety panel (Safe guard) (Figure 9)

Safety panels are installed to protect the crew during firing and are used for Install steel, soil casing and other minor equipment. Includes right, left and bottom mounting plates. Both side safety panels

The side is attached to the rear of the gun cradle with a positioning pin and retaining pin.

On the safety panel, a muzzle fluid inspection chart, elevation gauge, firing safety device, and cradle closure device are installed. buttstock, manual trigger, electromagnetic trigger device, steel balance plate, measurement device The gun's recoil, electric motor mount, and trigger lever are safety devices mounted on the right side of the safety panel. Two-position trigger device The lock and unlock buttons on the safety device are used to lock the manual trigger.



1. The plate for checking the amount of liquid in the gun barrel is returned to its place.

2. Altitude gauge 3.

Safety equipment for firing 4.

Device for closing the buttstock 5.

Manual trigger 6. Equipment

The trigger is released using an

electromagnet. 7. The steel

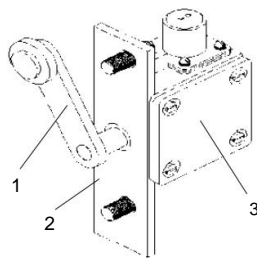
plate that balances the gun. 8. The gun's

recoil measuring device. Figure 9: **Safety panel (Safeguard)**

G. Gun recoil distance measuring device (Recoil contact) (see Figure 10)

The recoil sensor is used to signal the position of the camera's retract and launch.

Return to get the gun control system. so that the cannon could be hydraulically locked during firing. It is mounted on the right side of the safety panel and consists of a housing connector, a cover plate and Pedal axle



- 1. Pedal axle
- 2. Housing connector,
- 3. Closing plate

Figure 10, gun recoil contact device (Recoil contact)

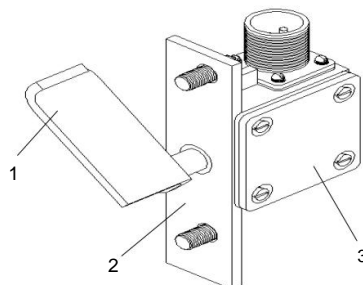
H. Breechblock contact (see Figure 11)

The finalizer bar detector signals the position of the finalizer bar.

end in the open and closed positions to the control system of the autoloader so that

Automatic reloading works. Consists of housing connection plate, cover plate and shaft assembly.

The stop plate is mounted on the left safety panel.

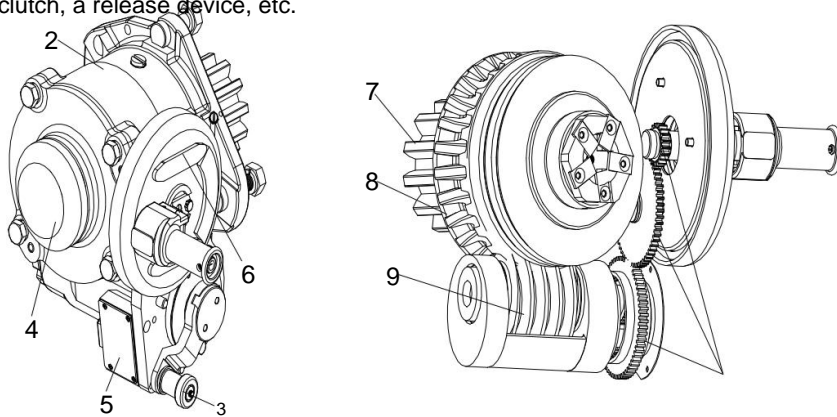


- 1. Stop plate shaft set
- 2. Housing connection plate
- 3. Cover set

Figure 11 Breechblock contact detector

I. Elevation mechanism (see Figure 12) Elevation mechanism is used

to work together with the gun and provide an elevated angle. of course, to the cannon by hand. Mounted on a mounting base inside the turret. The main gear of the device engages It is attached to a curved gear tooth plate mounted on the gun cradle. It consists of a gear turning device, a friction clutch, a release device, etc.



1. High angle mechanical switch box 2.

Manual gear turning lever

3. Gear turning lever position change switch

4. Gear drive

5. Housing cover,

6. Housing

7. Drive gear shaft

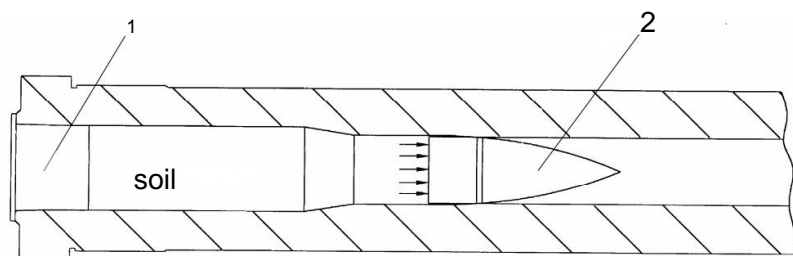
8. Worm gear

9. Worm gear shaft

Figure 12. Elevating mechanism.

2. Basic principles of shooting a cannon (Firing principle of gun) A

cannon is a special mechanical device that uses earth as the driving force. When loading ammunition and The soil is sent into the fire chamber. The buttstock covers and seals the barrel during firing. The fuse at the end of the casing is fired with an electric or mechanical trigger. Then the clay expands The explosion is sparked by the impact of the goblet. Causes the soil to burn immediately, causing clusters. The large amounts of high temperature and pressure smoke produced by the burning of soil Then go and push your child. The bullet moves away from the barrel at a high initial velocity. and sailed out into the air. The preset direction hits the target. When the bullet moves through the barrel The gun is fired, the recoil device receives the recoil force and returns the gun to its position by controlling the recoil mechanism. Before the recoil mechanism transmits The gun returns to its place. The final unit bar will open automatically. automatically and the soil casing will be pulled out. When the next bullet is loaded into the chamber, The finisher closes the end of the gun's barrel, starting a new firing cycle.



1. Ground cover 2. Bullet body **Figure 13**

Basic principles of shooting a cannon (Firing principle of gun)

3. Basic principles of semi-automatic operation (Operation principle of semi-automat)

Before starting to fire the first shot The finisher bar must be opened manually. In this case, the finisher bar leaf springs will be compressed. Causes the accumulation of force to close the final machine rod.

When the casing is loaded into the chamber, the edge of the casing rear plate pushes on the edge of the casing hook. The casing retainer allows the casing hook to release itself from holding the edge of the casing. Then turn the machine off.

The end will close automatically with the force of the end closing forceps.

while firing a cannon The recoil receiver receives the recoil and returns the gun.

into place under the control of the recoil mechanism. When returning the gun to the designated distance The stop on the gun cradle contacts the plunger of the semi-automatic device. and send the gun back into place.

Next, the end cap springs are compressed again to accumulate force for closing the end cap.

Finally, the connecting rod allows the drive shaft, drive shaft connection and shaft shaft to open the rods. Closing machine Rotate, which causes the shaft to open the end cap shaft to rotate and cause the end cap open shaft to open. Opening the automatic finisher bar ends. When the final actuator bar is fully opened,

The casing retainer holds the empty soil casing out with the casing hook. The stop on the gun cradle will

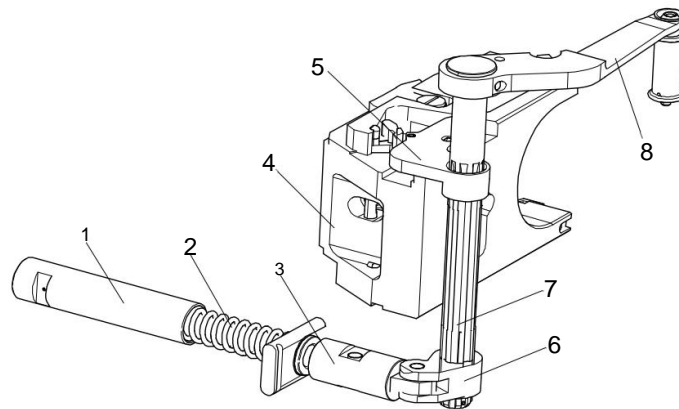
Release the plunger by the force of the semi-automatic mechanical actuator. When the plunger returns to the cannon, it is fired.

Return to normal position. When the next bullet is fired and the gun retreats a distance

The transmitter of a semi-automatic machine will, of course, release the stopper to return to the operating position.

Normally by the force of the spring, the beam receives a torque in preparation for returning the gun and opening the rod.

The machine ends next.



1. Leaf spring cover

5. The shaft opens the shaft of the final machine.

2. Tweezers close the end machine bars.

6. Transmission shaft connection set

3. Transmission

7. The shaft opens the shaft of the final machine.

shaft 4. Final engine rod 8. Final engine rod opening lever

Figure 14 Basic principles of semi-automatic operation (Operation principle of semi-automat)

4. The recoil cycle - returns the gun to its place. (Recoil-recuperation cycle)

Under the control of the recoil cylinder and the return cylinder, the cannon retracts.

after going within the specified distance And when the recoil distance of the gun is reduced in some way, the receiver

The recoil force of the cannon returns the gun to its normal position before firing. during movement

Backing the recoil unit will cause the recoil cylinder to move. and the oil absorbs the recoil force within the tank

The force is injected through holes arranged in a circle between the connecting rod and the force reduction ring, causing

Irreversible conversion of reversing kinetic energy into thermal energy. Meanwhile

The gun returns to its position, having reserved some of its recoil power. When the backward movement of

When the gun is finished, the recoil assembly returns the gun to its normal position before firing with the help of a

The energy stored in the barrel returns the gun to its normal position.

5. Firing mode: The fuse of the

bullet has two systems: igniting with Electricity and firing with a firing pin And there are two modes for controlling fire: a. Electric firing (Electric firing)

Electric Fire Mode: The firing cycle is controlled by the trigger switch button located on the trigger. The gunner's controls and a trigger switch on the lever allow for manual

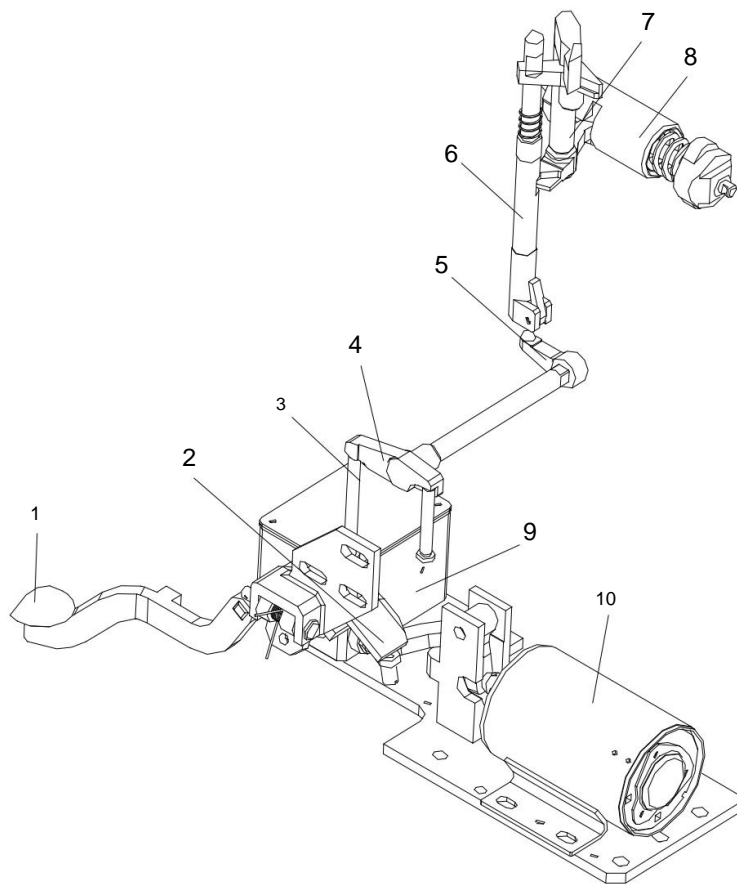
elevation of the gun. During the detonation Electricity flows from the power distribution box located underneath. of the safety panel, electrical contact pads, contacts on the final engine housing and the conductors that forwarded to the tip of the firing pin. When the electric current reaches the ground breaking screen, it will be ignited.

B. Mechanical firing

Mechanical trigger mode has two methods of operation: electromagnetic trigger and electromagnetic trigger. or by force of the hand

Electromagnetic trigger: In this mode, it is operated by using the trigger switch button on the The gunner's control lever or trigger switch button on the handgun provides manual control of the trigger circuit. Open or close the switch position. During the detonation Electricity flows from the power distribution box that bottom of the safety panel to the electromagnet. The electromagnetic contact head then pushes up on the sliding plate. The sliding plate pushes against the transmission shaft. Push the pedal up into the groove in the rear end rod. Move with the connecting rod and sliding plate. Then the lever will move from the shallow groove to the deep groove, causing the firing pin to rise to hit the gun and break it under the pressure of the gun. firing pin tweezers Electromagnetic triggering is a secondary triggering method that is achieved by changing Electrical energy is converted to mechanical energy in the event of a failure of electrical firing.

Manual trigger: Push the safety lever from the locked position to the unlocked position. Then pressing down on the trigger with your hand will cause the slide to push against the trigger lever causing it to move. The rod connecting rod in the final engine rod moves to push against the transmission rod. Then the transmission lever will push the rocker. The gun should move out of the shallow trench into the deep trench. Makes the firing pin float free and be able to run and hit. The impact cup breaks under the pressure of the firing pin spring.



- | | |
|-----------------------|--|
| 1. Manual trigger | 6. Pedals connected to the bird's rods |
| 2. Sliding plate | 7. Bird's Gun |
| 3. Transmission shaft | 8. Firing needle |
| 4. Pull the trigger. | 9. Electrical power distribution box |
| 5. Transmission shaft | 10. electromagnet |

Figure 15: Mechanical firing mode

6. Basic operating principle of residual gas drainage boiler (Operation principle of bore evacuator)

The residual gas drain pot is for removing soot residue left during firing. This is to prevent soot from entering the turret when the end cap is opened. To reduce the concentration of The carbon monoxide gas inside the turret is reduced. In addition, the residual gas vent helps eliminate light. The chamber is created during firing and vents soot from the gun barrel to adjust.

Conditions of inspection and firing

During the shooting After the bullet passed through a hole drilled in the wall of the gun barrel, some soot was released. It is taken into the gas vent pot through a hole in the gun barrel and pressure builds up inside the vent pot. After the bullet passes the tip of the gun barrel, the pressure of the soot inside the barrel drops rapidly, causing the soot cloud to Accumulated smoke In the vent pot, gas is sucked into the barrel through a hole in the barrel tube wall. create space Negative pressure rises from behind the soot cloud, which flows at high speed through holes in the wall of the barrel tube. The result is That is, the remaining soot clouds inside the gun barrel are collected and pushed out. from the barrel

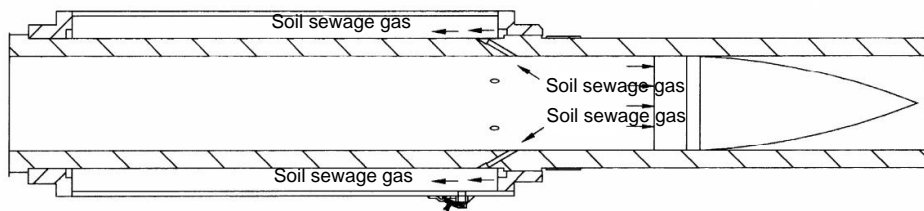
The period of time for the soot clouds in the residual gas venting pot to flow out will take longer. The time period for the results to occur will follow. Even though it takes longer than the time it takes to open a bar.

Machine for closing and securing sleeves at the same time The outflow of the vapor stream group not only pulls

The soot from the holes in the walls of the gun's barrel all but disappeared. But it also draws in soot from the inside of the fort. For example, a residual gas vent can cause the air inside the gun turret to escape.

It is pure and also helps prevent flames from returning into the turret.

I The bullet inside the gun barrel.



II After the bullet has left the barrel,

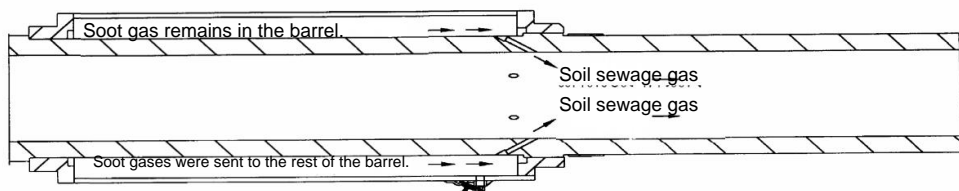


Figure 16: Basic operation of the residual gas evacuator (Working principle of bore evacuator)

7. Basic operating principle of the thermal average sheath (Operation principle of thermal sleeve)

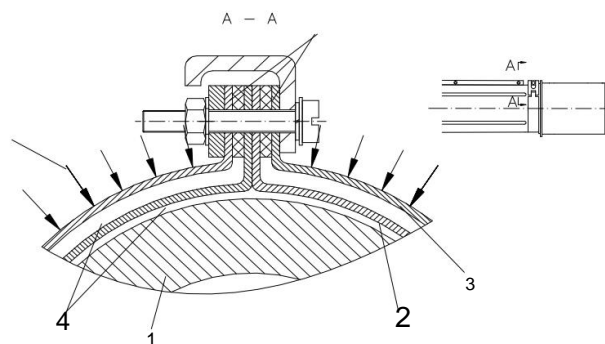
The heat sink for the tank gun was divided into 6 parts. Part 2, Part 4, and 1, Part 5 formed the frame. Built with two layers of aluminum sheets, the third part is a sheet.

Single-layer aluminum and section 6 is a single-layer aluminum sheet in the shape of a cone. Thermal average casing

It is a metal alloy of heat insulators and heat conductors. When the temperature is not Evenly caused by sunlight, wind or rain, etc. acting on the outer surface of the sheet.

Aluminum Heat is first conducted on the outer surface of the aluminum sheet. Then the impact Heat is reduced by the silicone rubber sheet. and the air between the aluminum sheets

When heat is applied to the inner aluminum plate, the heat is distributed evenly. by conducting the heat of the air and the inner silicone rubber sheet. Finally, the temperature on the surface of the vessel Scopes are averaged evenly. and causing the deflection of the gun barrel to decrease and the possibility The accuracy of the first shot is higher.



- | | |
|-------------------------|--|
| 1. Gun barrel | 4. Air cavity |
| 2. Inner aluminum sheet | 5. Insulation layer |
| 3. Outer aluminum sheet | 6. Sunlight and wind or rain that have an effect after shooting. |

Figure 17 Basic operation of the thermal shroud (Operation principle of thermal shroud)

8. Elevating and balance of gun

The self-balance of a tank gun is related to the gun receiver. which can happen by adjusting Balance the weight When the gun angle is set to 0° and one high-explosive round (HE) is loaded in the chamber. The time period for the gun to be unbalanced shall not be greater than 29.4 Newton-meters (N·m). In this case, the operation of The machine provides manual elevation or gun elevation and depression control with a system. Maintaining balance makes it easier and freer.

Chapter 3

Fire control system (FIRE CONTROL SYSTEM)

1

Episode: General mention (OVERVIEW)

The fire control system uses a direct control scheme combined with aiming.

Auto, using built-in scope and navigation This increases the ability to check.

Battlefield situation during day/night, target search, aiming at target

Auto, using video footage from the scope and shooting at moving targets while the vehicle

Mobile The system consists of a gunnery scope secondary system, a control computer secondary system.

Firing (FCS Computer), Gun Control System Secondary System and Commander Scope Secondary System

The features of the gunner's scope and the operator's scope are the ability to

Autonomous stabilization, allowing images to be seen through the gunner's scope and the operator's scope.

Stable under conditions where the tank is moving on rough terrain in bumpy terrain.

The operator's scope secondary system can be used to scout/search for targets on the battlefield,

360 degrees, targeting the gunner. and can control the cannon and shoot at the target.

with direct control over the gunner when necessary.

The gunner controls the line of sight (LOS) via the control stick and the gun moves.

Follow along the line of sight. After the gunner aims at the target and fires a laser rangefinder, The fire control system (FCS) computer randomly selects variables that affect the ballistics, calculating the values.

The shooting angle includes both the elevation angle and the direction of the trap angle. and automatically orients the gun in the correct position. Then control the fire using the firing window once the cannon reaches the firing position.

The system also provides the operator and gunner with a visual and fire control display. The crew can monitor the battlefield and aim at targets through the display. and control Shooting The shooting display and control can display the optical image and video of the Thermal images or system data can be viewed. This allows the crew not only to use the sights of the scope in You can not only monitor, but you can also use the monitor to monitor and aim or fire.

The crew may use a number of options based on the battlefield situation and preferences.

You can also use it personally.

The system can independently produce stable video images for island aiming when the gunner issues an automatic island aim command. The fire control system enters automatic island aiming mode. to quickly capture and lock on to your target. Measure the distance of the target to be shot. Adjust the shooting angle in the height and trap angle in the

direction with speed and accurate shooting results The optical field of view (FOV) of the gunner's scope has variable magnification. 1 as used in monitoring the battlefield scene.

Continuously, there is also The system also comes with an automatic detector for correcting shooting errors. The fire control computer can also process various data. Any other To reduce the impact from Various environmental

factors that happened in the shooting Normally, the primary function of the system is to operate in the mode. Controls fire using visual-stabilization (IS) and can also operate in fire control mode. The fire control system provides a secondary sight for controlled fire using a simple fire control system (SFCS (simplified FCS)). Regular standard The scope fires manually.

The secondary gun control system allows the gun barrel shaft to maintain stability at a specified angle and also eliminates the effects of roll and vibration. of the vehicle. At the same time, the cannon can be controlled both in height and in direction to bring the gun into a new position without Using the control stick of the crew to control

The gunner's and operator's scopes can work together with the thermal imager, allowing Can shoot both during the day and at night. The system is

also responsible for controlling the fire and guidance of missiles fired from tank guns. Against stationary or moving targets in fire control mode with the Stability System (IS).

From the gunner's station

The system also provides an uninterruptible power supply (UPS) to ensure optimum performance. Power source when the tank's power supply system malfunctions The backup power supply system can supply power to the thermal imaging system and the operator's sights for a period of not less than 15 minutes for use in Surveillance and search for targets

Part 2

MAIN PERFORMANCE DATA

1. Firing modes of FCS

A. Visual Fire Control Mode – Maintains stability (IS) of the gunner during the day/
nighttime

B. Day/Night Gunner's Normal Fire Control System (SFCS) Fire Control Mode

C. Automatic aiming fire control mode of daytime scope/thermal imaging scope.

D. Day/night mode for controlling fire over the operator's gunner. E.

Semi-automatic electric fire control mode (not using stabilization system)

2. Operation **when changing modes Fire control** (Firing mode changeover

function) A. Firing with the computer set to normal fire control mode (SFCS):

1) The heading angle of the system is controlled by semi-autonomous electric
propulsion (not using stability control) and manual

elevation control is used. 2) The heading angle of the system is controlled Semi-
automatic electric drive (not using maintain stability) and use high angle control with electric propulsion (not using
maintaining balance)

3) The direction angle of the system is controlled by a stability control system.
Automatic and uses high angle control with the drive of the stability system.

4) The operator's control over gunnery mode works by driving angles. Direction
and elevation of the gun with a stabilization

system. B. Fire control mode by setting the computer to picture mode – stabilize.

Balance (IS):

1) Controlling the gunner's fire with visual-stabilization (IS) mode.

2) Automatic aiming control mode can be accessed in visual mode - Maintains stability (IS) of the gunner only.

3) Fire control mode above the commander's gunner can enter and use the mode. Operate the gunner in visual-stability mode (IS) or normal fire control mode (SFCS).

4) The gunner can use the thermal imager in all fire control modes. Mentioned above

5) The gunner uses the secondary scope's sight lines to fire as desired using Change the Field of View (FOV) switch on the secondary gunner's scope.

3. Firing response times

Control with stability control system in both direction and height angle S - S in mode Image - Maintain balance (IS) : Takes time (t) \approx 5 seconds.

Direction angle control with stability control system - manual height angle control S - M in visual mode - stability control (IS): takes time (t) \approx 5 seconds.

Manual angle and elevation control M - M in Image-Stabilizing (IS) mode: Take time (t) \approx 10 second

Manual control of direction angle and elevation angle M - M in automatic island aiming mode: takes time (t) \approx 5 seconds.

4. Gunner's first-round-hit probability

Controlled by the S - S stabilization system with armor-piercing bullets (AP) connected to the front. of a target size (2.3 x 2.3 m.) at a distance of 2,000 m.: Probability of hitting correctly (P) \approx 68%

Direction angle control with stability control system - manual altitude control S - M (gently) with armor piercing (AP) bullets connected to the thigh. The target size (2.3 x 4.6 m.) Distance 2,000 m.: Probability of hitting correctly (P) \approx 68%

5. Accuracy of the gun when using the stabilization system (Gun-stabilizing accuracy)

Accuracy of the gun when using the stabilization system in the directional angle: 1.5 mm

Accuracy of the gun when using the stabilization system at high angles: 0.8 mm.

6. Measuring distance with laser (Laser range finding)

A. Measuring distance with a gunner's laser.

Range: 200 m. – 9,900 m. under standard conditions in the laboratory;

200 – 7,000 m under normal environmental conditions (except when it rains, fog and sandstorms) Distance

measurement accuracy: ± 10 m.

Frequency of firing the laser beam to measure repeated distances: 10 times/minute

Emergency distance measurement: 1 time/3 seconds, continuous 10 time

distance measurement Non-parallelism in the axes of the laser scope and daylight scope: ± 0.3 mm

Horizontal resolution: 40 m.

Actual distance measurement rate: $\pm 98\%$

Selecting the measurement target: First/Last

Service life $\pm 10,000$ b. time

Measuring distance with the operator's laser.

Range: 200 – 9,900 m. under standard conditions in the laboratory;

200 – 7,000 m under normal environmental conditions (except when it rains, fog and sandstorms) Distance

measurement accuracy: ± 10 m.

Frequency of repeating the beam to measure distance: 10 times/minute

Emergency distance measurement: 1 time/3 seconds, continuous 10 time

distance measurement Non-parallelism in the axes of the laser scope and daylight scope: ± 0.3 mm

Horizontal resolution: 40 m.

Actual distance measurement rate: $\pm 98\%$

Selecting the measurement target: First/Last

Service life $\pm 10,000$ time

7. Visible light fovy of gunner' sight

a. Main camera field of view (FOV): $6 \times 10^\circ$ to $10 \times 6^\circ$ can be changed all the time

B. The pupil, or diameter of the light ray that passes through the lens of the eye and enters the eye (Exit pupil):
7.2 – 4.6 mm.

C. Eye comfort distance (Exit relief): 24 mm.

D. Diopter adjustment range: -5~+3 D

E. 1 x Width of lens film (vision block): $1 \times 20^\circ \times 45^\circ$

F. Camera scale line illumination: Yes

G. Gun barrel reference point system: Yes.

H. Magnification power of auxiliary sight: $6 \times 10^\circ$

8. Field of view of the commander's sight (Fov of commander's sight).

A. Field of view and magnification: $6 \times 17^\circ$, $10 \times 6^\circ$

B. Diameter of the light ray that passes through the lens and enters the eye or aperture (Exit pupil):
5 mm. x 3 mm.

C. Eye comfort distance (Exit relief): 24 mm.

D. Adjustment range for the lens cap: -5 to +3D.

9. Work on automatic range adjustment of the gunner, scope of adjustment and

(Gunner's automatic range-setting function, scope and **accuracy**)

A. Direction adjustment range (Scope in azimuth): ± 25 mm.

B. Accuracy: The average deviation is not more than 0.21 mm.

C. Scope in elevation: 0 – 60 mm.

D. Accuracy: The average value of the deviation is not more than 0.21 mm. At 0 – 30 mm, the average value of the deviation is not more than 0.21 mm. More than 0.32 mm at 30 – 50 mm

10. Automatic sensors

A. Target angular velocity sensor

Directional measurement range (Range in azimuth): - 20 millimeters/second to + 20
mil/second

Accuracy: Measurement error ± 0.16 mm/s at

Angular velocity $\dot{\gamma} \leq 5$ mm/sec. Measurement error $\pm 3\%$ at speed.

Angular $\dot{\gamma} > 5$ mm/sec.

B. Turret azimuth angle measuring device

sensor)

Measuring range: $0 - 360^\circ$

Tolerance: $\pm 0.5^\circ$

C. Charge temperature sensor

Measuring range -25°C to $+60^\circ\text{C}$

Accuracy: Tolerance $\pm 3^\circ\text{C}$

D. Weather measuring device (Meteorological sensor)

Crosswind range: -20 m./sec. to
 $+20$ m./sec.

Accuracy: Error ± 1 m/s

Air temperature measurement range (Air temperature
range): -40 to $+70^\circ\text{C}$

Accuracy: Tolerance $\pm 3^\circ\text{C}$

Air pressure measurement range: $1,100$
 $- 600$ millibars (mbar)

Accuracy: Tolerance ± 30 millibars

E. Measurement of tilt angle (Tilt sensor)

Measuring range: - 250 to + 250 mm

Accuracy: Tolerance ± 8.5 mm.

11. Manual setting function

A. Selection of bullet type: AP1, AP2, HE, HA and MG.

B. Soil temperature: -39°C to $+69^{\circ}\text{C}$ in the lowest region of Area 1.

C. Air temperature: -39°C to $+69^{\circ}\text{C}$ in the lowest region of Area 1.

D. Lateral wind speed: -20 m./sec. to + 20 m./sec.

E. Altitude (atmospheric pressure): 0 – 7,000 m.

F. Accuracy of barrel velocity: 1 – 9 grades in the lowest range of Area – 0.5%

G. Manual distance adjustment: 200 m. - 4,000 m. in the minimum range of 10 m.

H. Synthetic correction: for all 4 types of bullets in the lowest range of the range ± 10 mil

12. Resolving range and accuracy of computers (Resolving range and accuracy of computer)

Distance correction: more than 200 m and more than 4,000 m.

Correction: Tolerance ± 0.1 mm for explosive shells.

Anti-tank (HA), tolerance ± 0.2 mm at distance 3,000 – 4,000 m.

13. Adjusting the reticle and the stability of the reticle's zero line. (Boresighting zero stability of line of sight)

A. Adjusting the sight line Boresighting

The datum of the barrel axis shall be used to adjust the reticle of the gunner's scope.

Shoot and the operator's scope at a distance of 500 – 2,500 m.

B. The stability value that is the center of the line of sight. (including tolerances that are Center of the barrel spool)

After installing the fire control system on the tank. Adjust the gunner's scope. (main scope), thermal imaging scope, target tracking unit and operator scope to 0.4 mm, and secondary scope. of the gunner to be at 0.6 mm.

14. The accuracy corresponding to the reticle line with the gun. (Synchronizing accuracies of los with gun)

Deviation in the alignment of the reticle of the gunner's main scope.

Shoot and your scope

The operator and gun line must be within 0.32 mm of the angle $-6\ddot{y}$ to $+14\ddot{y}$ and

The gunner's secondary scope is 1.06 mm.

15. Frequency range that allows firing while moving (Permissible firing frequency while moving)

Frequency allowed for firing while moving: >0.5 Hz

16. Effective working conditions and effective island sighting range

Efficiency (Effective operation condition and effective range of auto -tracker)

A. Effective working conditions

Target difference in normal visible light conditions: \ddot{y} 0.05

Visibility under illumination: 500 – 10,000 lux (Lx)

When multiple similar targets are captured on the screen and are not suitable for Automatic target capture mode is used. Change the automatic island aiming mode to

Targeting yourself

B. Effective distance: 500 m. – 2,200 m. in normal light (TV) mode and 500 m – 2,000 m in Thermal Imaging (TI) mode

C. Aiming Speed: The maximum angular velocity of the target aiming in the direction Not less than ± 20 millimeters/second

17. Image display and operation for correcting zero adjustment in shooting mode with Island aiming (normal light and thermal image) (Screen display and zero correction function of auto-tracking firing mode) (Visible light and thermal image)

Reticle line, rectangular frame in auto capture or inner circle frame

Capturing images manually

Automatic measurement/manual measurement – Laser (L): AM_

Tracking gate sighting frame - RD

Range beyond the island's aiming range: Over-range - OV

System malfunction Fault - F

Bullet type - AP (HE HA)

Range - D: 0000 (m.(m)) Aiming

deviation – X-axis: 0.0 (mil)); Y axis: 0.0 (mil)

18. Functions of auto-tracking mode

- A. Aiming for islands under normal light
- B. Aiming the island using a thermal image
- C. Aiming for the island manually
- D. Manual distance measurement control
- E. Use the "Far" remote capture window.
- F. Use the "Near" close-up capture window.
- G. Fine-tuning targeting

19. Characteristics of the operational capability of the thermal image (Operation performance features of thermal image)

- A. Effective working conditions

Under normal weather conditions during the day and night Except when it rains,

Snow, fog and sandstorms This will make it easier to work with the thermal imager in all weather conditions.
normally effective

B. Effective conditions of the inspection distance

Target detection distance: 8.3 km.

Target recognition distance: 3.3 km.

Distance to distinguish targets: 1.8 km.

C. Vision range

Wide field of view (Wide FOV): $9.0 \times 6.75^\circ$

Narrow field of view (Narrow FOV): $3.0^\circ \times 2.25^\circ$

The area is expanding with electronics (Electronic magnification).

: $1.5^\circ \times 1.12^\circ$

D. Time to prepare for use of the thermal imaging scope.

The time from turning on the thermal imager until it can be used normally.

Should not exceed 11 minute

E. DC power supply voltage: 22 – 29 volts (V/DC).

20. Control of the gunner's alignment over the commander's gunners and their location.

Target (Commander's override gun-laying and target designation)

The operator can control the cannon and fire above the gunner. When the operator Set the target location for the gunner. The turret accepts control from the operator over the gunner to Rotate the turret to a new target. It will automatically stop after reaching the target. In this case, the designated target will be within the shooter's field of view.

21. Displaying information in the operator's scope and the gunner's scope.

(Information display in commander's and gunner's sights)

A. Gunner's scope: Target range and fire readiness indicator.

B. Operator scope: Displays the azimuth angle value ("Azimuth angle value").

Distance measured by laser ("Laser range"), selection of "First/Last" laser distance measurement and information

Shooting "Ready"

22. Max. gun laying speed in azimuth)

- A. Maximum speed of orientation of a semi-automatic gun: angular velocity ($\ddot{\gamma}$)
 $\ddot{\gamma}_{30} \ddot{\gamma}/\text{sec}$.
maximum
- B. Maximum gun orientation speed in normal control mode SFCS: $\ddot{\gamma}_{\text{max}} \ddot{\gamma} 30 \ddot{\gamma}/$
 second
- C. Maximum gun orientation speed in IS stability mode: $\ddot{\gamma}_{\text{max}} \ddot{\gamma} 30 \ddot{\gamma}/$
 second
- D. Maximum gun aiming speed in fire control mode over the operator's gunnery:
 $\ddot{\gamma}_{\text{max}} \ddot{\gamma} 30 \ddot{\gamma}/\text{sec}$. 23. Max.

gun aiming speed in azimuth)

- A. Maximum speed of orientation of a semi-automatic gun: $15 \ddot{\gamma}/\text{second} \ddot{\gamma} \ddot{\gamma}_{\text{max}} \ddot{\gamma} 9 \ddot{\gamma}/$
 second
- B. Maximum gun orientation speed in normal control mode SFCS: $15 \ddot{\gamma}/\text{sec} \ddot{\gamma}$
 $\ddot{\gamma}_{\text{max}} \ddot{\gamma} 9 \ddot{\gamma}/\text{sec}$ C.
- Maximum gun orientation speed in IS stability control mode: $15 \ddot{\gamma}/\text{seconds} \ddot{\gamma}$
 $\ddot{\gamma}_{\text{max}} \ddot{\gamma} 8 \ddot{\gamma}/\text{sec}$ 24. Minimum speed

for automatic orientation of the gun in various control modes. Angular
 velocity ($\ddot{\gamma}$) Minimum $\ddot{\gamma} 0.05 \ddot{\gamma}/\text{sec}$ 25. Maximum

speed for gun orientation at high angles in various control modes.

Angular velocity ($\ddot{\gamma}$) maximum = $5 - 7 \ddot{\gamma}/\text{sec}$. 26.

Minimum velocity for gun orientation at high angles in various

control modes. Angular velocity rate ($\ddot{\gamma}$) Minimum $\ddot{\gamma} 0.05 \ddot{\gamma}/\text{second}$

27. Transition process

A. Horizontal transition, time spent in normal fire

control system (SFCS) mode at Maximum aiming (9 - 15°/sec) at an angle of 50 mm using 0.5 - 2 swing cycles. B. Vertical transition.

Time spent in Normal Fire Control System (SFCS) mode for movement

From a loading angle of 10° at an angle of 50 mm using 0.5 - 4 vibration cycles.

28. Stiffness

Vertical stiffness Normal control mode SFCS: constant gravitational force (G) ≈ 415 Newton-m/mil (N-m/mil)

29. Stability value (Stable moment)

Maximum vertical stability value: $\approx 2,540$ Newton-m. (N-m)

30. Angle limiting function A. Before the gun reaches the mechanical

limit positions of elevation and depression angles in firing mode. Normally in a fire control system (SFCS), the angle limiter operates to cut off the elevation and depression cycle before the gun reaches the mechanical elevation and depression limits. In Stability Mode (IS), the angle limiter is activated to break the aiming cycle in elevation or depression before the gun reaches the mechanical elevation and depression limits in the mode. Controlled by the operator, the angle limiter is activated to break the cycle of aiming at high or depressed angles.

31. Gun drift (Gun drift) A. In normal

control mode (SFCS) (allowing adjustment of drift), drift

The level path will be in the region of 12 mm/min and the vertical buoyancy will be in the region of 12 mm/min.

B. In the IS control mode, horizontal buoyancy is in the region of 12 mm/min and vertical buoyancy is in the region of 12 mm/min. /minute

c. in operator control mode Level buoyancy will be in the region of 12 mm/min and vertical buoyancy will be in the region of 12 mm/min.

32. System safety control

When the driver's inlet/exit cover switch or the gun turret lock switch is in the closed position. The system in the direction will not work.

33. Ability to adapt the voltage supply (Adaptability of power supply voltage)

Fire control system The DC voltage from the power source will be used and Can work normally in the voltage range of 22 - 29 volts.

34. Gun laying function on slope (Gun laying function on slope) When the tilt angle of the tank is 15°, the directional system can rotate the turret at a speed of Gun orientation not less than 20°/second

35. Period of use of the continuous fire control system

Limitation on the period of continuous use of the fire control system, 4 hours, none.
Restrictions on use on the battlefield

36. Adaptation to the environment (Environment adaptability)

Normal fire control system operation under temperatures of -25°C to +55°C.

Part 3:

Components of the fire control system (COMPOSITION OF FIRE CONTROL SYSTEM)

The fire control system consists of four secondary systems – the gunnery scope secondary system, the fire control computer secondary system, the gun controller secondary system and the gun control secondary system.

Commander's scope

number set	code	Device name	quantity	Meaning cause
1	YV0012A.01	Gunner's Sight (with sliding platform and connector)	1 set	
2	YV0012A.0102	Box for counting time and supplying power to distance meter as well. Laser (Laser power counter box)	1	
3	YV0012A.0103	Gunner's scope control box	1	
4	YV0012A.0105	Muzzle reflector	1	
5	YV0012A.0106	Protects the gunner's scope head (with sight plan)	1 set	
6	YV0012A.0108	Gun hub mod	1	
7	YV0012A.0109	Missile navigation kit	1	
8	YV0012A.0113	Thermal Imager (TI)	1	
9	YV0012A.0201	Fire control system computer (with Work on aiming the island)	1	
10	YV0012A.0202	Image display and control	2	
11	YV0012A.0203	Weather measuring device (with equipment measure)	1 set	

number set	code	Device name	quantity	Meaning cause
12	YV0012A.0204	Tilt Angle Detector	1	
13	WMV001.0205	Soil Temperature Detector	1	
14	YV0012A.0206	Uninterruptible power supply (UPS)	1	
15	YV0012A.0207	backup power supply battery	1	
16	YV0012A.0208	Turret angle measurement device	1	
17	YV0012A.0209	Indoor reticle alignment measurement device	1	
18	YV0012A.0210	Electronic alignment control box Thermal	1	
19	YV0012A.0211	imaging camera signal connection box (TI)	1	
20	YV0012A.0212	System management computer (PHM)	1	
21	YV0012A.0213	Gun barrel position measuring device	1	
22	YV0012A.0215	Fire control system wiring	1 set	
23	YV0012A.0301	Gun control box	1	
24	YV0012A.0302	Starting distribution box (box)	1	
25	YV0012A.0303	Gyro set	1	
26	YV0012A.0304	Velocity rate gyro	2	
27	YV0012A.0307	Control rod (Console)	2	
28	YV0012A.0308	Electric cylinder (Electric cylinder)	1 set	
29	YV0012A.0309	Boosting converter	1	

number set	code	Device name	quantity	Meaning cause
30	YV0012A.0310	Motor controller	1	
31	YV0012A.0317	Gun control system cable (GCS cable)	1 set	
32	DCL-7	Electromagnetic clutch (Electromagnetic clutch)	1	
33	WS205B-09	Angle limiter	1	
34	YTD5-3	Turret motor	1	
35	YTD2.2-3	Elevation motor	1	
36	YV0012A.04	Operator's panoramic sight	1	
37		Vehicle documents: quality certificate, etc.	1 set	

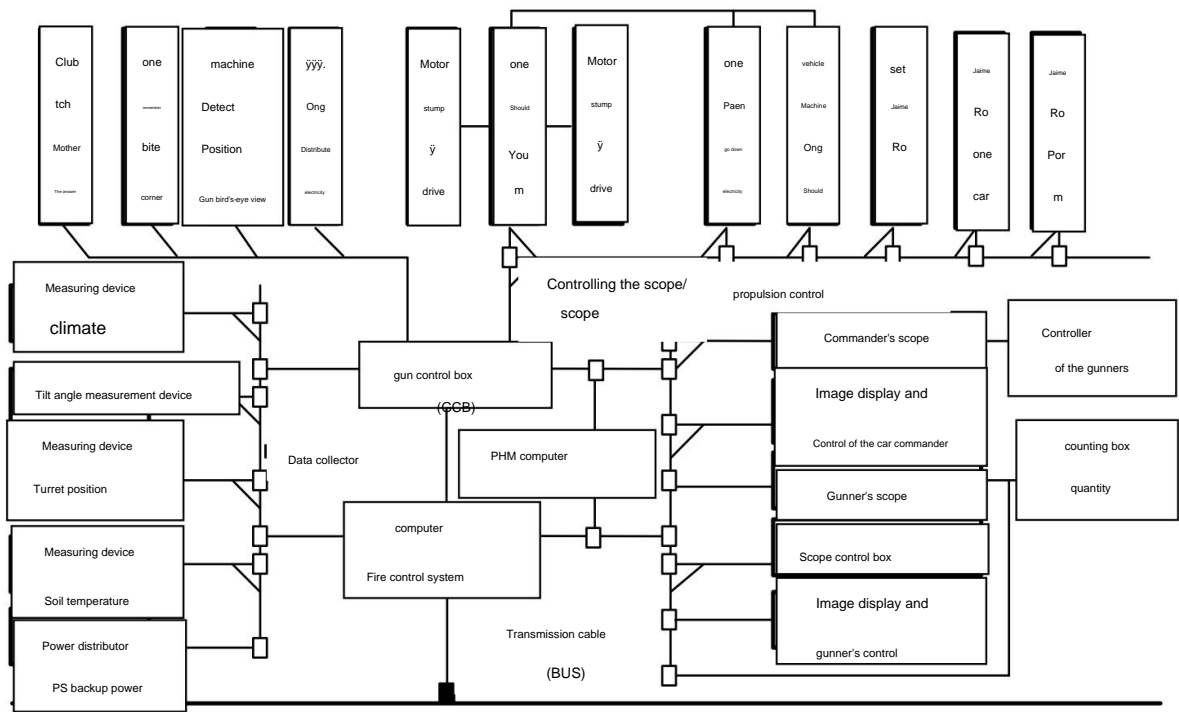


Figure 1 : Diagram of FCS structure

3.1 GUNNER'S SIGHT SUBSYSTEM The gunner's sight

secondary system consists of a gunner's sight. (with base head slide and connecting rod), laser shot counting box, gunner's scope control box, gun muzzle reflector, protective cover Camera head gear guard (with flange), gun hub troubleshooter, missile control unit and the gunner's

thermal imaging sight (TI) A. Gunner 's sight

B. Working

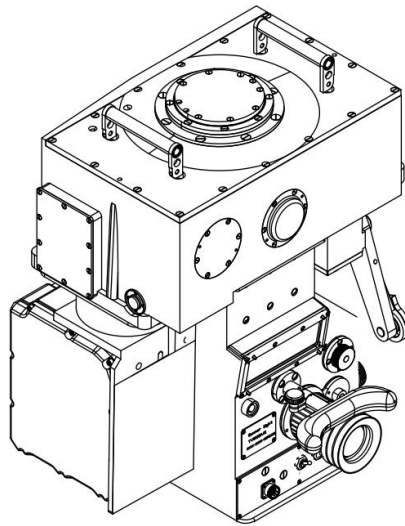


Figure 2: Outline of gunner's sight The gunner's sight is an

important part of the VT4 tank's fire control system. It is on the left side of the cannon in front of the gunnery station. There is the field of view of the scope. Daytime and visual range of the laser rangefinder while maintaining stability. The high-precision inertial aiming mirror is used for battlefield surveillance, aiming and aiming, and measuring target distance, with precision Relation to the angular velocity of Moving targets and their relationship to the gun's position and reticle. The gunner's scope can be used. Create a secondary scope for shooting by using the scope's scale lines and setting the distance as well. Oneself and control the adjustment of the missile munitions when firing the missiles. 1) The main functions of the scope are as follows:

a) Aim and aim at the target in the fire control mode with the maintaining system.

Balance (IS)

b) Aim and target perch in normal fire control system (SFCS) mode. c) Aim and

perch on target in guided missile fire control mode. d) Measure target

distance and relationship. and the angular velocity of the target. e)

Aim the target using a secondary sight when the system is defective.

2) Scope control mode:

The main modes are stability mode (IS), fire control system mode.

Normal (SFCS) and missile firing

modes a) IS mode In IS mode,

a stable structure is required. that can isolate vehicle vibrations that affect surveillance and aiming To achieve The purpose of maintaining visual stability. The gyro detects the vibration of the tank, and the sight control box sends control signals to the torque drive motor. To be able to drive the upper aiming mirror to rotate in harmony in sequence. According to camera principles, the angle of the rotating top view mirror must be half the angle of the vehicle's vertical rotation angle. For example, when the vehicle rotates angle α (\ddot{y}) in the direction of the depression angle Top view mirror It should be rotated with a depression angle of $\ddot{y}/2$ to ensure that the outlet shaft rotates at the same angle as the The axis of the eyepiece During aiming You want the gun and the reticle to rotate in sync with each other. For example, when the top viewfinder mirror rotates at an angle, $\ddot{y}/2$ in elevation, the reticle and gun must rotate in elevation by an angle of \ddot{y} . Rotation of the scope mirror by an angle of $\ddot{y}/2$ is achieved by A 1/2 turn of the claw changes the position/mechanism of the pushrod. b) Normal Fire Control

System (SFCS) control mode When using the Fire Control

System in Fire Control mode, Normal (SFCS) The reticle moves along the axis of the barrel. When the turret changes position from the starting point The axis is stationary and the transducer rotates by the same angle. Therefore, when the angle signal between The stationary shaft and the rotating shaft are not aligned. Because the motor drives the torque after The signal has been amplified. The line of sight is then driven along the gun to a new position. Because the servo system is very sensitive, the line of sight is considered to have moved. along the lines of a real gun This allows the gunner to see the new position the gun has moved to.

1) Conditions when the power distribution system is defective

When it appears that the power supply system is defective The secondary sight should be switched to using a secondary sight. The mechanical linkage of the secondary sight reflector in the scope along with the elevation/depression angle of the gun. Occurs from the rotation of the steel plate and connecting mechanism 1/2 turn, causing the reticle to move along the gun axis. The operation of the mechanism is to rotate the turret and lift the gun manually to Scout and aim at the target from the scope's eyepiece. according to the type of ammunition chosen and The range of the target adjusts the reticle to align with the firing angle on the secondary scope's scale line towards the target. As a result, The gun will adjust the firing angle settings to be correct according to the target being fired. In such a case The accuracy of firing from a stationary or momentarily stopped vehicle can be guaranteed. c) Guided weapon mode

(Guidance mode) When the scope is in the guided

weapon control mode. The main function is to be able to use Guided missile work under control of the guidance process in normal cruise and in cruise status. high before hitting the target. After the beam passes through the projection lens, the laser beam is sent out. away from the power source and is projected onto the beam adjusting dish after passing through the reflector system. and will project the beam of light onto the beam adjusting plate again. After passing through the high cutting control panel and A grating fiber optic lens projects a beam of light onto the focal plane of a compound objective lens. After passing through the objective lens and upper mirror, It reflects the light beam and creates a pattern. Controlling missile weapons

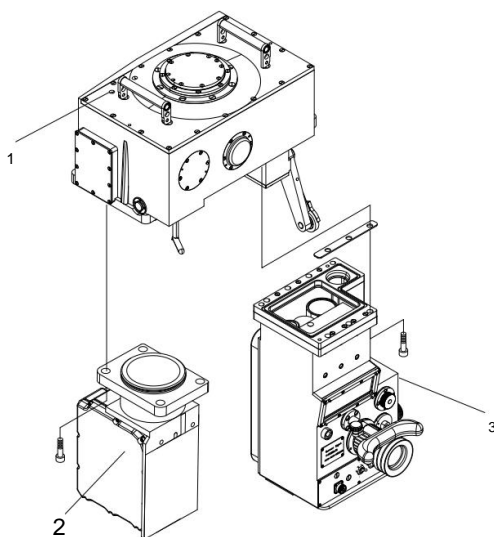
B. Structure of the gunner's scope The

gunner's scope is connected to the turret via a carriage and coupling using a mount. Modular connection, main components include image stabilization mirror, scope head, lower housing and data unit. An image stabilizing mirror is connected to the housing. The lower part is bolted and fixed to the turret through a flange.

The camera head's image stabilizing mirror consists of a reflective mirror with High strength, position change claw/1/2 turn drive mechanism, servo system Stabilize two sets of images in the directional and elevated angles. (consisting of two hydraulic levitation gyros, piezoelectric gyro One Piezoelectric, large torque motor drives Two high-precision rotary transformers) and a gun alignment mechanism provide

balance

Scope system (Lower housing) includes a 1x wide field of view surveillance camera, a main Magnification camera with 6x magnification. – 10 times, measuring beam transmission line range, laser rangefinder receiver system, secondary scope and data set, etc.



- 1. The mirror maintains the stability of the camera head image.
- 2. Thermal imaging camera set
- 3. Lower housing

Figure 3: Structure of gunner's sight

C. The main function of the gunner's scope

1) Optical performance:

Sight box capability	Main scope	Secondary scope	Surveillance camera Expand 1 Equal
Magnification	6 times – 10 times	6 times	1 Equal
Field of View (FOV)	10° - 6°	10°	45x20°
Aperture (Exit pupil)	7.2-4.6 mm.	3.8 mm.	—
Sight distance (Exit relief)	24 mm.	24 mm.	—
Eyepiece screw cap area (Diopter)	-5D to +3D	-5D to +3D	—
Indent value (Parallax)	ÿ60"	ÿ60"	—
Resolution	Center point ÿ12~8" 3/4 FOV ÿ 24"	Center point ÿ12" 3/4 FOV ÿ 24"	—
Visible light coefficient Through film (Light transmission coefficient)	ÿ0.3	ÿ0.3	ÿ0.4
The weakening value of the laser at 1.06µm	ÿ40db	ÿ40db	ÿ40db

2) Connection for thermal image transfer

Connection diameter ÿ is 116.

3) Capability of laser distance measurement

a) Range: 200 m. - 9,900 m.

b) Space resolution: lateral resolution ± 1 milliradian (mrad), longitudinal resolution 50 m.

c) Target reflection selection: First/Last d) Distance

measurement error: 10 m.

e) Actual distance measurement rate

f) Distance measurement error ratio: $\pm 1\%$ 1 time/6

Working frequency value: i) seconds g)

Emergency distance measurement frequency: 1 time/3 seconds, 3 continuous

measurements j) Non-parallelism between the transmitted laser beam/receiving antenna

Reflected light beam from the line of sight: ± 0.15 mm

4) The value of the offset speed of the

main line of sight. Indentation speed (bidirectional) ± 8 mm/min when

the scope is turned on. 5) Target angular velocity range and accuracy

value The position of the main line of sight Width range: direction ± 20 mm/s, distance (height) 7 ± 10 mm/s. Angular velocity error $\pm 3\%$ whenabsolute value speed Target angularity of main line of sight > 5 mm/s, error value ± 0.15 mm/s when absolute angular velocity ± 5

mm/s 6) Accuracy in maintaining stability along the main

line of sight Standard deviation 1 ± 0.15 mil (bi-direction), 1 ± 0.12

mil (bi-directional) in production inspection

7) Error in synchronizing the line of sight at the same time.

(LOS synchronization error)

Main reticle: In SFCS mode, coupling arm error (bi-directional) ± 0.2 mm when the main reticle is in the high-angle region - 8° to $+18^\circ$ Secondary scope reticle: The resulting error of the linkage arm.

(bidirectional) ± 0.2 mm

8) Error in angle measurement

Error in output angle measurement ± 0.2 mm when the main line of sight It is in the directional angle range of $\pm 4^\circ$ and is in the elevation angle range of

- 8° to $+18^\circ$ 9) The error value for automatic distance adjustment.

The standard deviation of automatic distance adjustment ± 0.15 mm within the distance adjustment range in the y direction is 25 mm and 60 mm in the distance adjustment range in the high angle range.

10) Range of movement to change the position of the main line of sight (Main LOS displacement range)

Not less than - 4° to $+4^\circ$ in direction and - 8° to $+18^\circ$ in distance. The gyro must be able to use power to change its state back in the event There has been a change in the number of positions. a lot

11) Main line of sight movement speed (Main LOS mobile speed) lowest speed

(Bidirectional): $\pm 0.15^\circ/\text{sec}$ Maximum speed: $\pm 30^\circ/$

sec in one direction; $\pm 5^\circ/\text{sec}$ and $\pm 7^\circ/\text{sec}$ in distance

12) Non-parallelism of the optical axis of the CCD camera image sensor.

Non-parallelism of a CCD camera when the optical axis is obtained about the orientation of the CCD camera.

Main reticle ± 0.5 mm

13) The mean line of sight disturbance is zero (LOS zero disturbance).

Average interference value to the center of the main line of sight ± 0.2 mil, average interference value is the center of the secondary reticle ± 0.4 mm

14) Adjusting the accuracy of the auxiliary sight reticule.

setting accuracy)

Adjusting the accuracy of the secondary scope line ± 0.45 mm.

15) Adjusting the distance to be the center of the auxiliary sight zero

adjustment range)

Centering the secondary scope in both direction and distance.

± 8 mm when the line of sight is in the zero state.

16) Information field parameters

In navigation mode The data range of variable values must correspond to the table below.

nature	Position of the zoom system	
	Start	end
Linear radius extent along the Z/Y axis (m) Full	2.7 ± 0.3	2.7 ± 0.3
range of radius along the Z/Y axis (m)	$3.3 - 0.3 + 0.5$	$3.3 - 0.3 + 0.5$
Intensity of sunlight (g/m ²)		
In the center of the information district, not less than:	2.0×10^{-2}	2.0×10^{-2}
On the edge of the linear area, not less than:	0.4×10^{-2}	0.4×10^{-2}
Non-linear instruction units of specific characteristics	± 0.06 in the command unit 0-0.6; ± 0.15	
Direction not more than:	in the command unit 0.6-0.8	

Remember:

a) It is allowed to limit directional characteristics with an order of 0.8 units in a position.

End of the zoom system under the condition that the linear radius control disc is maintained.

b) The maximum value of an order should not deviate from the order unit by more than 5%.

17) Tolerance of both axes and self-test frequency. The scope must be able to ensure that:

a) The center of the data area is below the line of sight. In idle mode

High Cutting and High Cutting Mode

•After normal temperature variations and shock, misalignment The match between the zero command axis of the data range and the main line of sight should not be greater than 0.5 m at a distance. From the programmed 300 m - 5,880 m. •After operation at -

25°C, the misalignment value should not be greater than 3.0 m in position. The last point of the zoom system •After operation at +60°C, the

misalignment value should not be greater than 2.2 m in the final position of the zoom system.

b) When the alignment square frame center of the alignment test system aligned with the tip of the arrowhead of the scale lines of the main scope Misalignment between axes The line of center of the command in the data range to the main line of sight should not be more than 0.5 m at a distance of 300 m -

5,880 m. c) When the center of the square frame Alignment of the alignment test system Aligned with the tip of the arrowhead of the main scope's scale line. and with the system information area Test itself returns to normal temperature after normal testing, high temperature and low temperature testing. Test results after impact and all vibration tests should meet the following requirements:

Various frequency counting values (9K, 11K, 15K and 18K) should not exceed 17, 21, 30 and 36 respectively

18) Height of high cruise mode In HIGH

FLIGHT mode, the center of the information range is increased by 3.6 ± 0.4 m relative to the main line of sight within the programmed distance. I

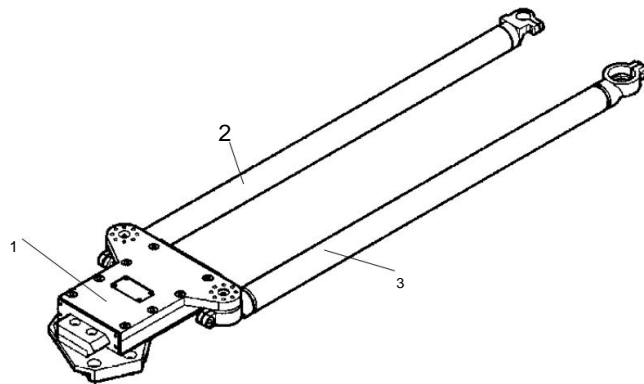
19) Cycle for launching

In the temperature range from +25°C to +60°C, the scope must be able to see The firing cycle may be continuously fired no less than 5 ¹⁰ seconds at a time from +24°C to -25°C. The scope must be able to continuously see the firing cycle at least 20 times.

Things to remember

The duration of one cycle is 22 seconds \pm 1 second.

2. Sliding block and linkage set



1. Sliding platform set

3. Lower connecting rod set

2. Upper connecting rod set

Figure 4 : Outline image of the sliding platform and connecting rod set.

(Outline of sliding block and linkage assembly)

A. Functions of the slide stand and connecting rod set

The slide assembly and connecting rod assembly are used for mechanical interlocking to achieve
Corresponds to the high angle between the scope and the cannon.

B. Structure of the sliding platform and connecting rod set

The connecting rod set consists of an upper connecting rod and a lower connecting rod. Slide platform set Consists of a joint housing, rail parts. and the moving parts mounted on the gun cradle.

The upper connecting rod connects to the upper gunner's scope receiver hub and the lower connecting rod connects to the

The hub holds the lower gunner's scope.

3. Laser power counter

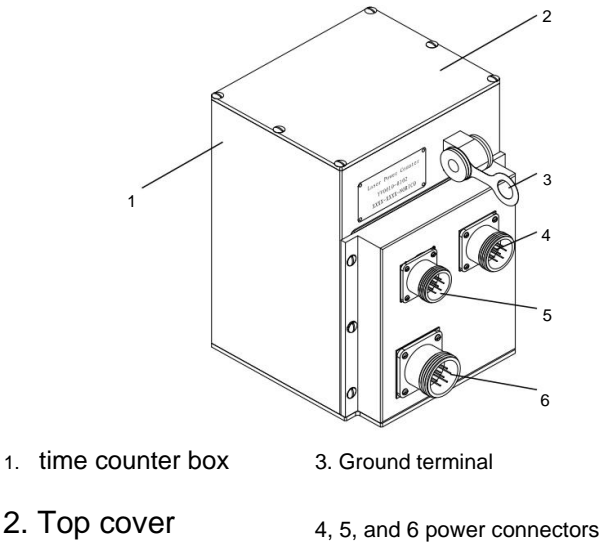


Figure 5: Outline of the power supply and laser firing time counter.
(Outline of laser power counter)

A. Function of laser power counter)

A laser shot counter is mounted on the front left wall of the turret wall.

Produce the voltage of the xenon lamp. Induce voltage on xenon lamps and high-frequency diodes used.

Works with the voltage required by the laser device. Can perform the function of counting numbers, locking signals distance and send the distance signal to be displayed in the scope and the fire control computer respectively. It also performs self-testing functions, and blind zone prevention functions in Distance 200 m. Work on separating the first target/last target (to eliminate reflections) faulty light)

Basic working principles of the power supply and timer of the laser distance meter. Shown in Figure 6.

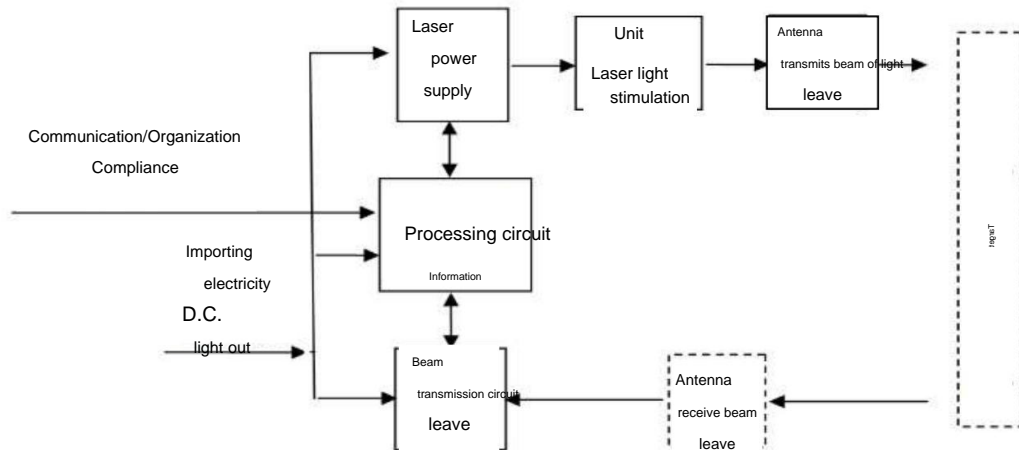
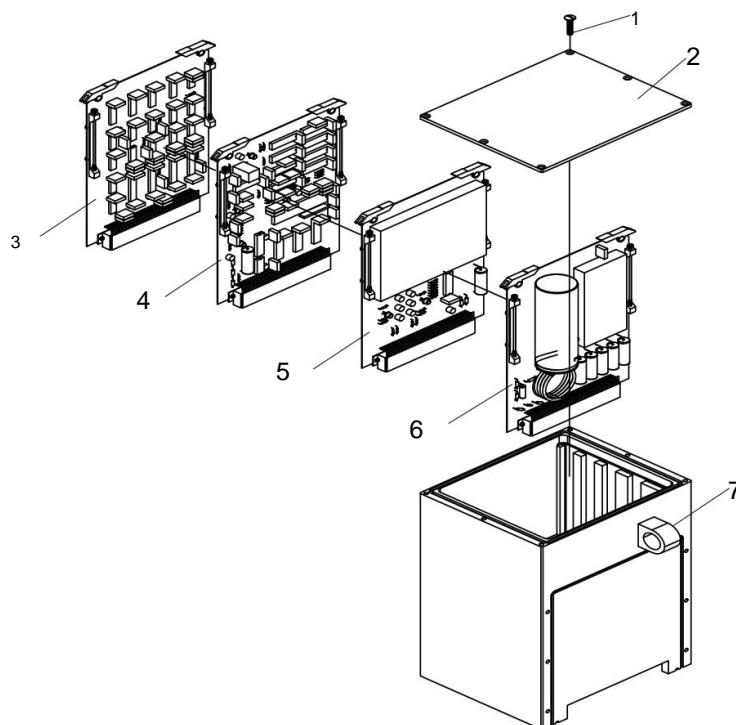


Figure 6: Basic working principle diagram of the power supply and time counter for the laser distance meter.

B. Structure of the power supply and time counter for the laser distance meter (Structure of laser power counter)

The laser rangefinder power supply and counter consists of a housing, power connectors, main circuit board, laser power supply board, board. Normal power supply circuit, control circuit board and time counter circuit board, etc.



1. bolt

2. Lid

3. Time counter circuit board

4. Control circuit board

5. Normal power supply circuit board.

6. Laser power supply circuit board

7. Housing

**Figure 7: Structure of the power supply and time counter for the laser distance meter.
(Structure of laser power counter)**

C. The main function of the power supply and counting time of the laser distance meter.

Input DC voltage: +22 Volts to 26 Volts.

Output voltage: +6 Volts \pm 0.2 Volts, -6 Volts \pm 0.2 Volts and +5 Volts \pm 0.1 Volts

Xenon bulb voltage: +600 to 750 volts.

Serial connected and output function: Yes

Maximum distance: \approx 9,990 m.

Nearest distance: \approx 200 m.

Tolerance in distance measurement: 10 m.

Measurement resolution range: 50 m.

Selecting the measurement target: First/Last

Frequency of measuring distance: normally 1 time/6 seconds; Measure emergency distance 1 time/3 seconds
and measure the distance 3 times continuously

Actual distance measurement rate: \approx 98%

Distance measurement error rate: \approx 1%

4. Gunner's sight control box

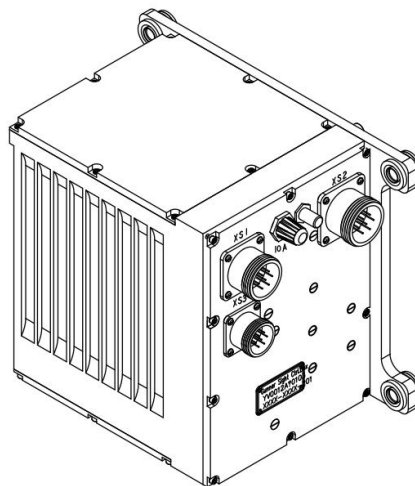


Figure 8: Outline of gunner's sight control box

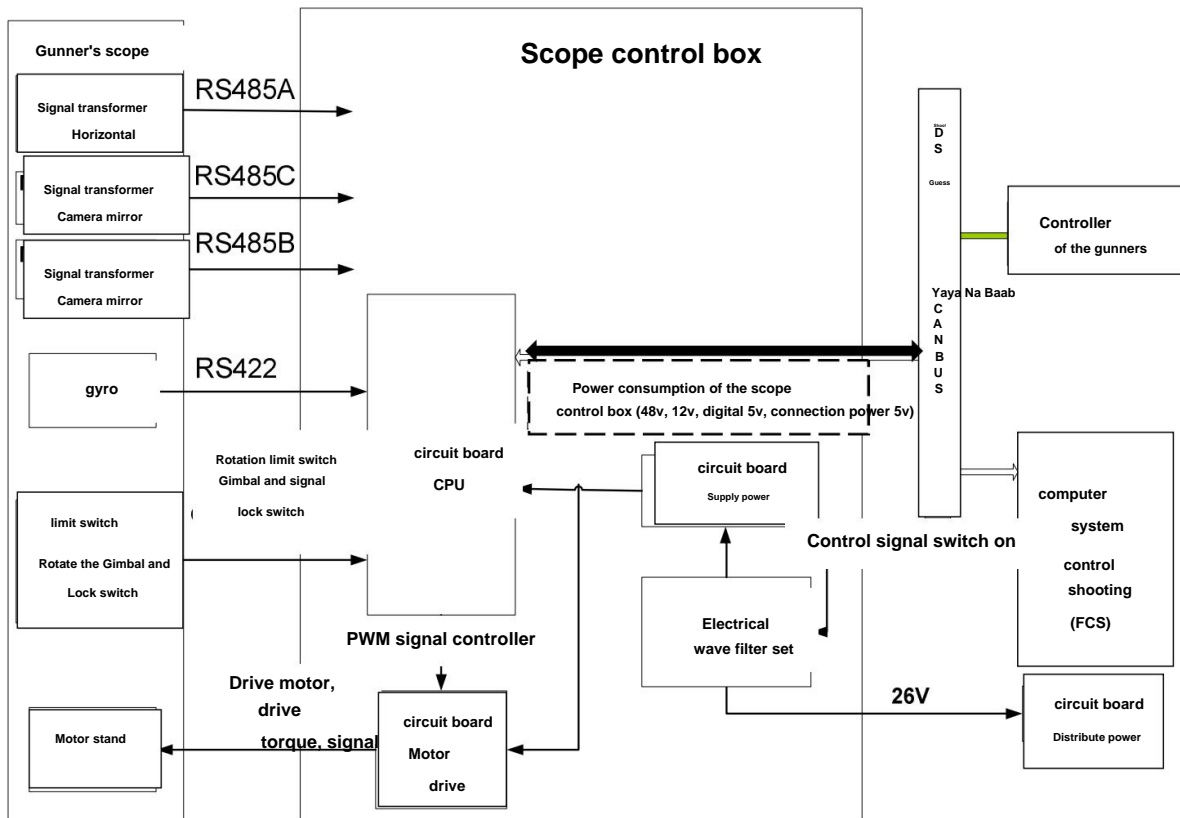
A. Main functions of the gunner's scope control

box The gunner's scope control box serves as a control, stabilizing device. and drive the scope head It is mounted on the left wall of the turret. In the firing mode with the stabilizer system The stabilizing control box can control the mirror in the scope head gear to achieve independent stabilization and then signal the angle along the axis of the mirror to rotate. Makes the cannon capable of Move along the line of sight. and know how to set the automatic launch angle and use the trap angle while doing so. Shooting without disturbing the reticle

Principle of operation in stability mode (IS): The control box is sensitive to Receives error signals and forwards them to the fiber optic gyro in the scope. After processing with the software An error signal from the gyro controls the motor module to drive the output to go. Drive the motor in the scope. The motor drives the scope mirror and gyro to rotate to eliminate erroneous electrical signals, thus achieving independent stabilization of the scope mirror. which helps make the line The sight line is free from interference from vehicle movement. At the same time, the mirror swivel signals the angle error between the reticle and the cannon. to control the artillery Move along the reticle until the angle error is eliminated. In normal fire control mode SFCS The scope

mirror moves with the gun. large to make the reticle line correspond with the movement of the artillery. Working principle of normal fire controller mode SFCS:

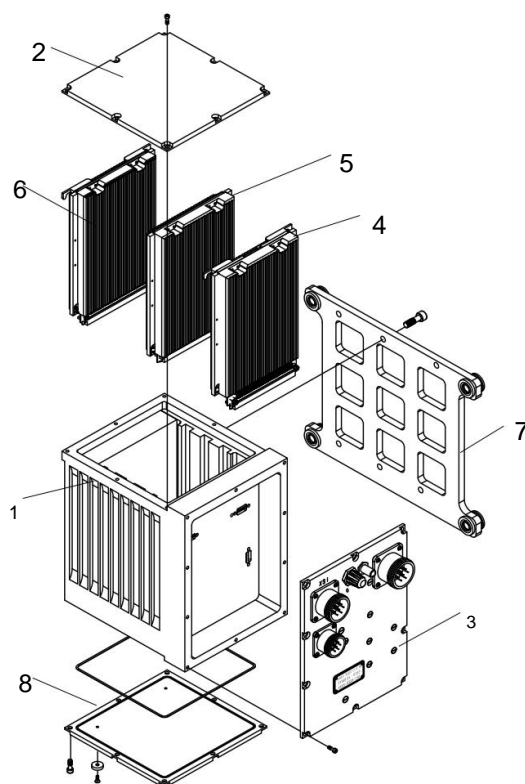
The control box receives The error angle signal between the reticle and the cannon is sent from the mirror head axis. The axis angle conversion module processes it to convert the error angle signal between the reticle and the cannon. mistake The drive motor module will Drive the motor in the scope. And a motor in the camera head drives the scope mirror to move with the cannon. to eliminate wrong angles This allows the reticle to remain consistent with that of the cannon.



**Figure 9: Basic working principle diagram of the gunner's scope control box.
(Gunner's sight control box operation principle diagram)**

B. Structure of the gunner's scope control

box The gunner's scope control box consists of a housing, a central processing unit (CPU) circuit board, a motor drive circuit board, a signal conversion control circuit board, Main circuit board, interference filter board and mounting base, etc.



1. Housing

2. Top cover

3. Front panel

4. Signal conversion control circuit board set

5. Central processing unit (CPU) circuit board set

6. Motor drive circuit board set

7. Installation disc

8. Bottom cover

**Figure 9: Structure of the gunner's scope control box.
(Structure of gunner's sight control box)**

C. Working principle of the gunner's scope control box

- 1) Create direct current voltage, alternating current voltage and frequency.

The control box can generate DC voltage +5V ($+5\pm0.2V$), +5VA ($+5\pm0.2V$), +15V ($+15V\pm0.3V$), -15V ($-15V\pm0.3V$) and 27V ($+27\pm0.5V$) respectively, and produce an AC voltage of $23\pm1.2V$ and a frequency of $1.2\pm0.02kHz$ (driver converter from rotation) respectively

- 2) Three-axis motor rotation limit signal collection (gimbal): Collects input/output (I/O) signals for motor rotation limit protection. three axis

- 3) Collect lock signals and control 27 volts of power.

Collect the correct lock contact signal. and control the 27 volt power not to be exported

When the locking contact is closed

- 4) Connect in series with the fire control computer and fiber optic gyro.

- 5) Adjusting and recording the level/vertical misalignment variable 0 - 100.

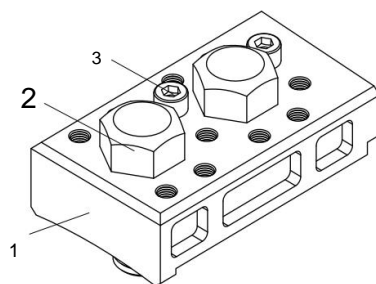
- 6) Output torque control motor signal.

- 7) Connect to CAN bus signal cable

- 8) Collect signals of rotation converter.

The control box can collect signals from the rotating transducer in Level, vertical, from the gun and bearing with a tolerance code 30

5. Muzzle reflector



1. Muzzle reflector

2. Anchor shot

3. Bolts

Figure 10: Outline of muzzle reflector

A. Function of muzzle reflector

The muzzle reflector is used for adjusting the reticle inside the tank.

An image of a point of light from a point projector reflects the point of light into the field of view in the scope. of the gunner, which will be used as a reference line of the gun (LOW (line of

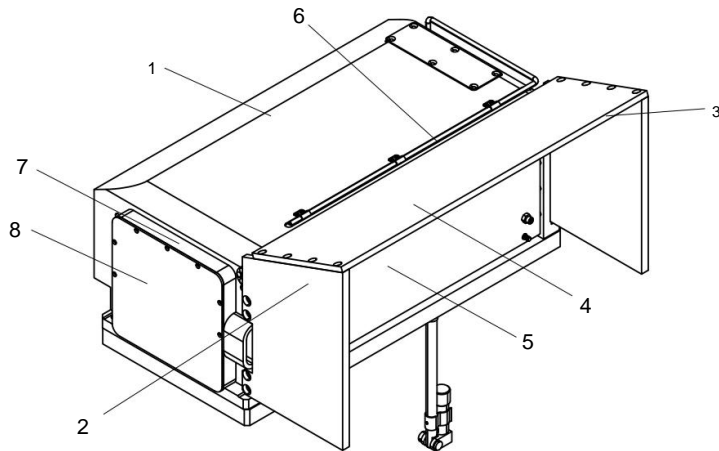
weapon)). B. The structure of the muzzle reflector. and principles for adjusting the reticle

The muzzle reflector is mounted on the muzzle with the mirror facing it. The gunner's scope shoots the beam of the projector's LED lamp that sends out a point of light that is reflected. It is re-entered into the gunner's scope by means of a muzzle reflector. After that, you will enter into the field of view in the gunner's scope to create a point of light. Align the points of light with circles. In the shooter's field of view, the initial position of the point of light determines the current position of the gun. Barrel alignment (LOW) If the gun barrel is bent at a certain angle. Normal position of the glass line The light reflection will change. The position of the point of light in the shooter's scope field of view also changes, and the circle and point of light become separated. The separation of the circles and points of light indicates that the zero value between the reticle and the barrel has changed.

C. Working principle of the muzzle reflector. The

smoothness of the reflective surface of the muzzle reflector after

Chrome plated and polished: $N = 1$ and $\gamma N = 0.5$

6. Protection of the scope head (Protection hood (with flange))

- | | |
|----------------------------|-----------------------------|
| 1. Protects the scope head | 5. Power transmission shaft |
| 2. Water pipe cleaning | 6. Right side cover |
| 3. Left side cover | 7. Cover plate |
| 4. Protective glass sheet | 8. Flange |

***Figure 12: Outline of the gunner's scope gear protection.
(Outline of gunner's sight head gear protection hood)***

D. The main function of the scope head cover is to protect it.

The scope head protector serves to protect the gunner's scope. There is equipment for
A cleaning attachment is used to remove dust and dirt from the scope's protective glass.

E. Structure of the scope head protection

The scope head protection cover consists of a protective housing, protective glass,
Covers, handles, power transmission rods and glass cleaning devices, etc.

7. Guided missile control set (Guidance set)

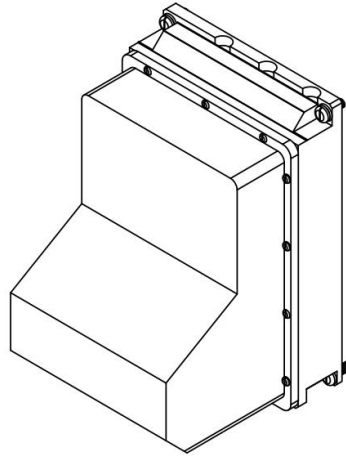


Figure 13 Outline of guidance set A. Operation of the missile

control set

The missile control unit is the center of control in the gunner's scope. The VT4 tank's fire control system is integrated with the scope using four mounting bolts and two positioning pins in the form of a module, and connected to the control system computer. Shooting to know the laser guidance of the guided missile and control the launch.

B. Structure of the missile weapon control unit

The missile control unit consists of a housing, a module assembly, a rotating shaft assembly, a rotating shaft assembly, a lens assembly, a fiber optic unit, a navigation module. Power supply and installation base, etc.

Overall dimensions (LxWxH): 260x180x200 mm. Total

weight: not more than 5 kg.

F. Main functions of the missile control

unit Laser navigation data range radius: 2.7 ± 0.3 m in linear and full range.
Strip **3.3-0.3+0.5** m.

Intensity range of the laser radiation field: $\pm 2.0 \times 10^{-2}$ g/m²

In the center of the data area and On the edge of the linear range $\pm 0.4 \times 10^{-2}$ g/

m² Misalignment between the laser data range command axes and the line of
Scope axis: ± 0.5 m

times Capacity to transmit continuous laser beam data range: ± 10
at ambient temperature $+25^\circ\text{C}$ to $+60^\circ\text{C}$ and ± 20 times at ambient
temperature
 -25°C to $+25^\circ\text{C}$

8. Gunner's TI sight

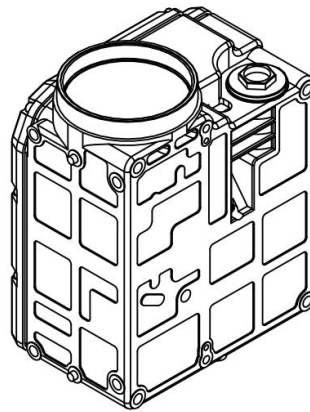


Figure 14 Outline of FC thermal imager A. Operation of the thermal imager

The thermal imager can detect and convert the infrared radiation of image scene to create a standard composite video image format of 625 lines (CCIR625). After that will be sent to the video display unit.

B. Structure of the thermal imaging scope

The thermal imager consists of a set of four optical-mechanical modules, such as a camera base structure, a conductive reflector unit. Light, sweeper and detector assembly, etc., and four electronic modules, etc., adjacent circuit board, main circuit board, power distribution board. and integrated circuit board base, etc. The camera base structure has a housing like an infrared television camera with a dual vision range. An infrared television camera consists of a lens. There are two pairs of near-infrared front ends. The field of view/concentration lens and rear lens assembly are used for the convergence of incident infrared radiation. The dual lenses are mounted directly to the camera housing. Television Field of view/focusing lens Mounted on guide rail for field switching, light spot adjustment and thermal compensation. Under the control of the main circuit board The rear lens unit is used as a time delay lens unit. Meanwhile It serves to adjust the visual axis. There is a temperature sensor for thermal compensation control. The camera base also serves as a housing for mounting the camera reflector, sweeper and detector. Detects the focal plane of infrared radiation with a 288x 4 generation 2 and a closed vacuum sealed Dewar flask and built-in refrigeration stirrer used. For converting the incident infrared radiation into an electrical signal. Temperature detection, bias supply, operation commands and output for detectors are possible. By the adjacent circuit board and the main circuit board. The cooling drive is controlled by the main ci

The sweeper consists of a vibrating mirror, a drive control circuit and a detection lens. It is used to sweep the incident infrared beam by synchronizing and concentrating the beam on the detector. The operation of the sweeper is controlled by the

main circuit board. A reflector camera kit consisting of two mirrors and a lens is used for Reflects the path of the infrared beam that hits at an angle of 90° and changes direction in Vertical and horizontal to match the camera module configuration on the scope base frame.

The power distribution board is used for system power filtering and surge protection. Total backup power and surge filtering, power protection, and surge control. remote work, etc.

The integrated base panel provides three external power connectors with a power filter, video/cable filter system connected in series. and connect to the image. digital video

C. Main functions of the thermal imaging camera

- 1) Detector: 8 micrometers (μm) - 12 micrometers (μm)

Target detection distance: 10.5 km.

Target recognition range: 4.0 km.

Target separation distance: 2.5 km.

- 2) Field of view:

Wide field of view: 9.0°×6.75° Narrow

field of view: 3.0°×2.25° Electronic

magnification power SŸ: 1.5°×1.12°

- 3) Cooling): Use a closed vacuum sealed bottle and a stirrer to cool.

Cold together

- 4) Time to prepare for use of the thermal imaging camera: Time to set up and turn on

The temperature of the switch for operating the thermal imaging camera until it can be used normally should not exceed **11** minute

3.2 COMPUTER SUBSYSTEM

The secondary computer system consists of a fire control computer (with aiming functionality), a fire display and control system, a detector. measure weather (with probe), tilt angle detector, soil temperature detector, UPS backup power supply, power supply battery Spare, directional turret angle detector, indoor alignment detector, alignment electronics box, connection box Thermal imaging scope, muzzle sight and control system wiring

shooting, etc.

1. Fire control system computer (FCS computer)

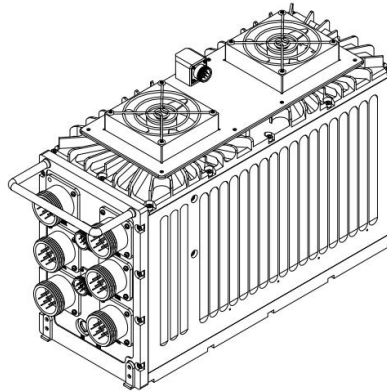


Figure 15 Outline of the fire control system computer (Outline of FCS

computer) A. The main functions of the fire control

system computer The fire control computer is the main control device of the control system. The VT4 tank's firing module, mounted on the turret ring rail at the rear left of the gunner's station, is used to configure various processing settings to collect data. Data and processing, solving technical problems, controlling the system, processing images and driving the display, connecting the display screen, controlling the automatic aiming, controlling the release. Missile weapons, communication signal connection Serial and communication

via a set of CAN bus signal cables, etc. 1) Working in collecting data

The fire control system computer can collect cycling and environmental data. that affects the possibility of hitting the target (including configuring distance with a laser distance meter) data entered from various measuring devices, various data sets that , data Input for debugging data. Set system errors and more, automatically displaying manually entered data and adjusted manually from various measurement devices. in real time) various video signals used for aiming, with video images sent directly to computer to perform centralized processing This will help reduce signal connectivity in the central area. and helps improve the reliability of the transmitted signal. The fire control system computer will Collects and processes video signals from the gunner's CCD scope,

the operator's CCD, and then transmits the processed video signal to the display and controls. of the commander and gunner for use in battlefield surveillance, target acquisition, aiming and Shoot and use in auto-aim mode.

2) Working to solve problems:

Computer fire control systems can complete the solving of mechanical equations, accurate firing equations and accuracy equations. 3) Operation of the control system: a) After measuring the distance to the target in the mode Controlled by a maintenance system Gunner

stabilization (IS) and gunner control

modes for the commander are now available. computer system The fire control will edit the fire data cyclically. Enter the aiming and trapping angles and adjust them. Firing data for artillery through the gun control system. After adjusting the cannon into position Will send a signal ready to fire.

b) After measuring the distance to a target in control mode with a normal fire control system (SFCS), the fire control computer edits the data in a single shot. Then send a control signal to the scope mirror in accordance with the firing data and drive the gunner's scope. Keep within sight and trap angle in the direction

c) When the gunner uses the automatic perch aiming mode to fire, the computer fire control system places a reticle on the perch video image to allow the gunner to aim perch and lock on. Meaning Error angle information is output to the gunner's scope control box for driving the cannon on target after measuring the distance to the target. This means that the computer will cycle through the firing data. then sends the directional trap angle and aiming angle. After the artillery had adjusted its position A ready-to-fire signal will be displayed. Zeroing can be done via the display and fire control and Fire control system computer and the adjustment values can be saved in the computer. d) When the shooter uses the

thermal imaging (TI) scope to fire, the computer system The fire control sends

information such as bullet type and target distance, etc., overlay to the thermal imaging (TI) video image, in addition to mechanical functions. Written above

e) The fire control computer can be controlled via a screen.

Displays images and controls the shooting of the operator and gunner, for example. Turn on the system control switch.

Fire Control, Select Fire Control Mode, Select Bullet Type, Enter Data, Change Video Image, Align and Save Alignment Data, Save Fire Data, Adjust Settings. Define gun control parameters, adjust operator and gunner's scope parameters, change Chinese/English interface, etc.

4) Working in a serial communication connection (Serial interface communication function)

Signal connection via serial connection cable 422, computer

The fire control system can communicate with the gunner's scope control box, adjusting fire data.

Missile launch (expansion), Inclination detector, Faction verification connector adjustment.

Target (IFF (identification of friend or foe), laser power supply and timer, box

Alignment electronics and thermal imager, data output speed adjustment and reliability

5) Working in communication via CAN bus (CAN bus communication function)

The fire control system computer can provide interaction between the sets.

Controls all fires connected through the CAN bus network via the CAN bus transmission line and

It is also possible to share data with the vehicle information system through the connection of the CAN bus transmission line. How to control the alignment time? will be used to be able to control the signals that will Export according to a specifically specified cycle. This ensures that the signal control system will be stable. Stable and reliable

B. Structure of the fire control system computer The fire

control computer consists of a housing, base plate assembly,

DY1 circuit board, DY2 circuit board, KZB circuit board, CDR circuit board, export/import (I/O) circuit board,

AD circuit board, CPU central processing circuit board, COM communication circuit board, GZB circuit board,

VGB circuit board, MCPU main central processing circuit board

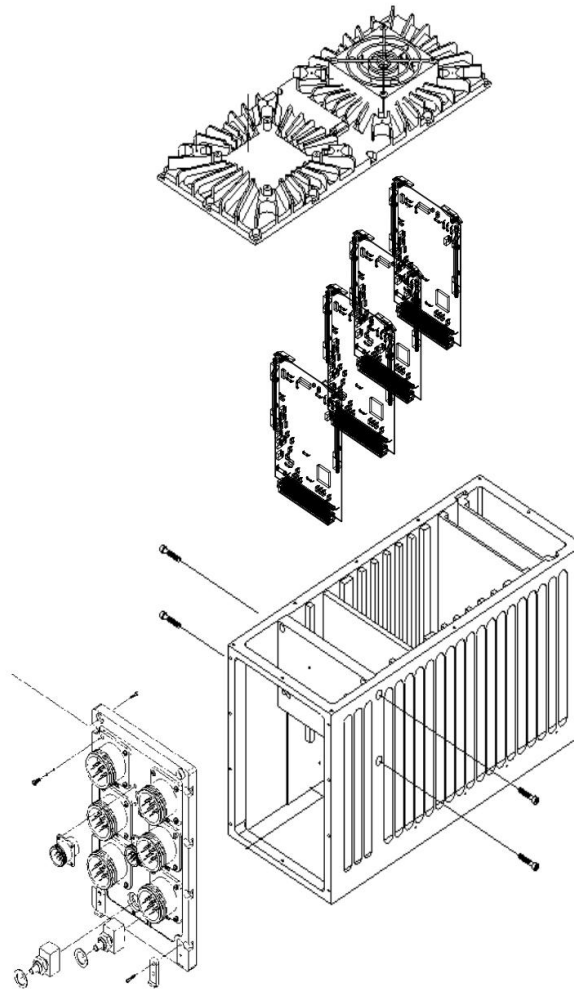


Figure 16: Structure of the fire control system computer (Structure of FCS computer)

C. Fire control system computer performance (FCS computer performances) 1)

Resolution range: **80** mm in elevation; -30 mils- +30 mils in the directional angle

2) Solving the distance problem: 200 m. - 4,000 m. for armor-piercing bullets.

(AP), 200 m. - 4,000 m. For anti-tank grenades (HA), 200 m. - 6,000 m.

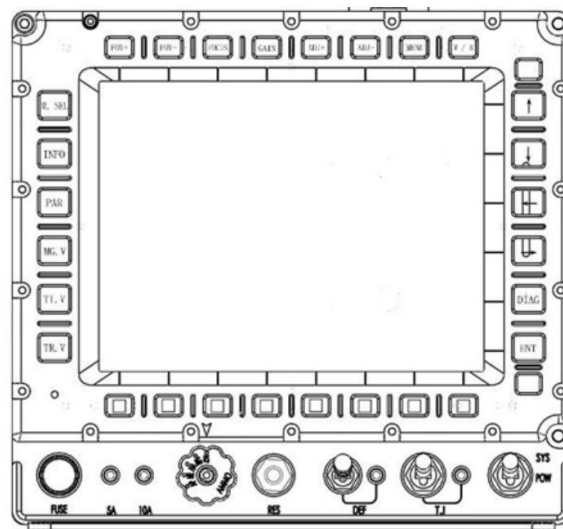
for high-explosive (HE) shells, and 200 m - 2,000 m for machine gun (MG) shells.

3) Accuracy in solving mathematical problems: ± 0.1 mm at angles 0 - 40 mm, ± 0.2 mm at angles 40 - 80 mm.

4) Operating voltage: 22 - 29 volts direct current from the power supply.

of the car

2. Display and control terminal



**Figure 17: Shooting display and control screen.
(Appearance of display and control terminal)**

A. Operation of the display and fire control The

display and fire control display are components of the fire control system. Its working principle is used to display the internal contents of the launch and collection control system computer. Controller and gunner switch button information Connections between people and devices are made

possible through the use of Switch and keyboard buttons The launch control screen is a display screen for the launch control computer. Low temperature heating strengthens it. Compatible with LCD monitor with 800 x 600 resolution under control of firing control computer.

The image and fire control display collects information from the action switch buttons.

The driver and keyboard data are sent to the fire control computer via a connection signal.

RS232 format and shows the operator's thermal image data via a thermal image connection signal cable.

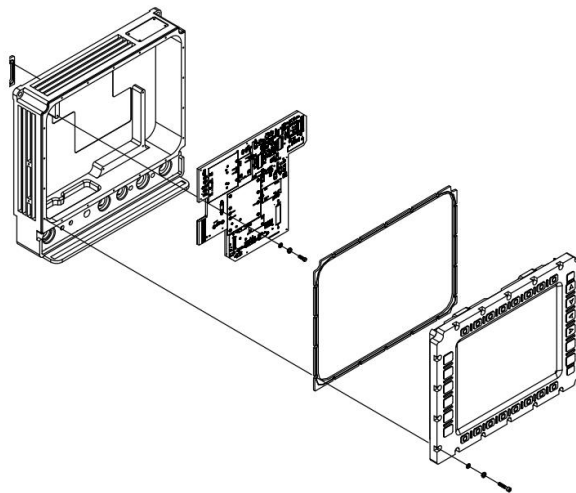
Hot RS422

Power control is achieved by operating a switch.

B. Structure of the image display and firing control screen

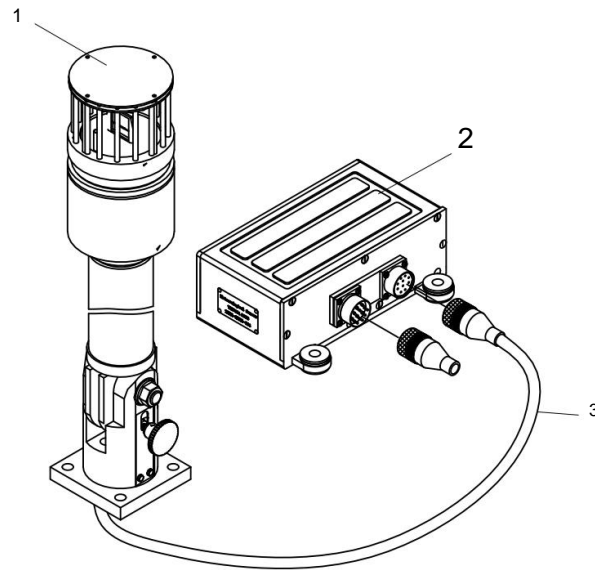
The image and launch control display consists of a housing, a power distribution board, and a front panel assembly. (Select button + LCD screen + protective glass) Various switches, light bulbs

Signals and connectors



**Figure 18: Structure of the display and firing control screen.
(Structure of display and control terminal)**

3. Weather measuring device (Meteorological sensor (with probe))



1. Measuring

3. Signal cable set

head set 2. Electronic box set

**Figure 19: Outline of the weather measuring device.
(Profile of meteorological sensor)**

v. work

A weather monitor was mounted on the rear left side of the gun turret deck.

Outside, the wind speed can be measured at the actual current time. (Perpendicular to the barrel axis artillery), air pressure and ambient temperature at the location of the tank being operated and send the values

It can be measured in the form of voltage connected to the fire control computer.

B. Structure

The weather detector consists of a measuring probe. (Side wind measurement device, ambient temperature detector, and barometric pressure monitor) protective grille and Electronic boxes, etc.

C. Working principle of the weather detector: 1)

Lateral wind speed measurement range: -20 to +20 m./sec. 2)

Error: Error in Measurement not more than 1 m./second 3) Ambient

temperature measurement range: -40°C to +70°C 4)

Error value : Measurement error not more than 3°C.

5) Air pressure measurement range: 1,100 - 600 millibars (mbar) 6)

Error: The measurement error is not more than 30 millibars

(mbar)

4. Tilt sensor (Tilt sensor)

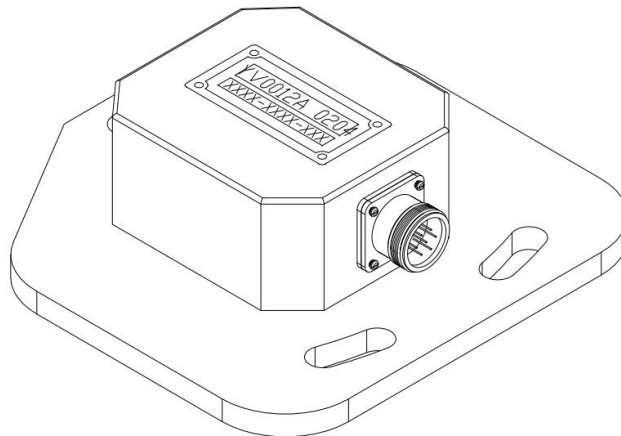


Figure 20: Profile of tilt sensor. A. Working of the tilt angle

detector. The gun hub inclination angle

detector measures the current angle value as well as the value of The angle between the axis of the gun receiver hub and the horizontal. Then send the measured angle value in the form of voltage. to the fire control computer

B. Structure of the tilt angle measurement device

The tilt angle detector consists of a housing, a flexible speed riser, an electrical circuit board, wires and connectors.

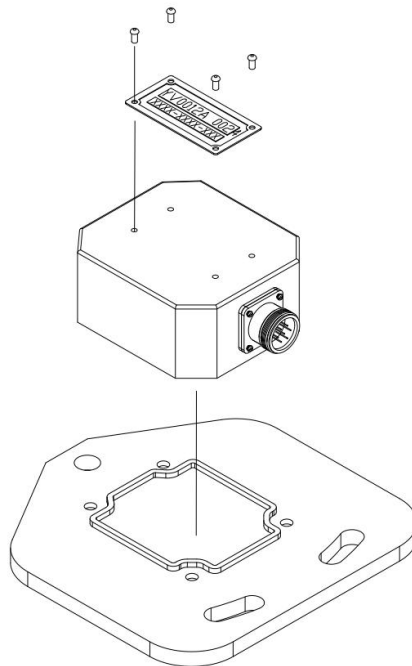


Figure 21: Profile of tilt sensor C.

Performance of tilt sensor

- 1) Minimum angle resolution: $\pm 20^\circ$
- 2) Measurement range: -250 to +250 mm
- 3) Error: The measurement error is not more than That is ± 8.5 mm.

5. Charge temperature sensor

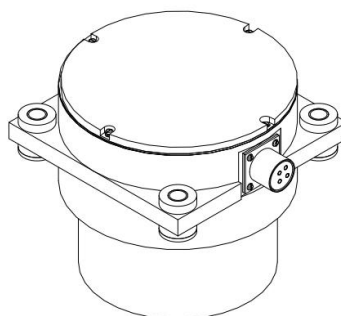


Figure 22: Outline of the soil temperature measuring device.

(Profile of charge temperature sensor)

A. Operation of the soil temperature measuring device

The soil temperature detector can measure the soil temperature and send the measured value in the form of voltage to the fire control system computer.

B. Structure of charge temperature sensor)

The soil temperature detector consists of a measurement unit, a measuring device, a circuit board, housing and connectors.

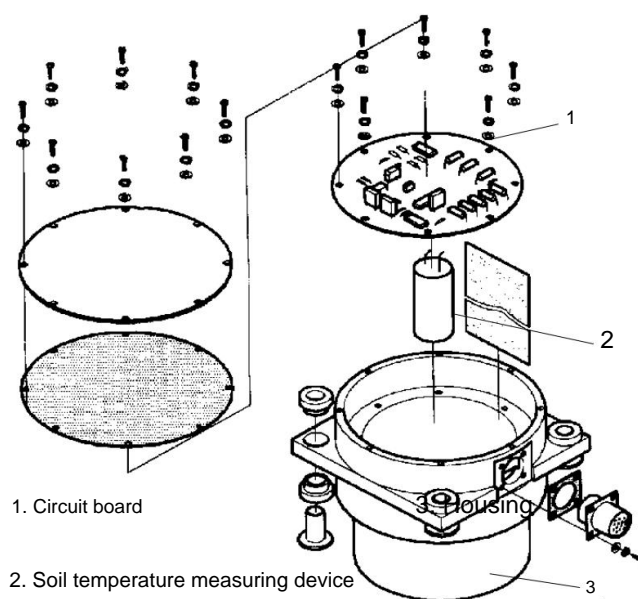


Figure 23: Structure of the soil temperature measuring device.

(Structure of charge temperature sensor)

C. Working principle of soil temperature measuring device

- 1) Measuring range: 25°C to +60°C
- 2) Error: Error not more than 3°C.

6. Backup power supply (Ups power supply)

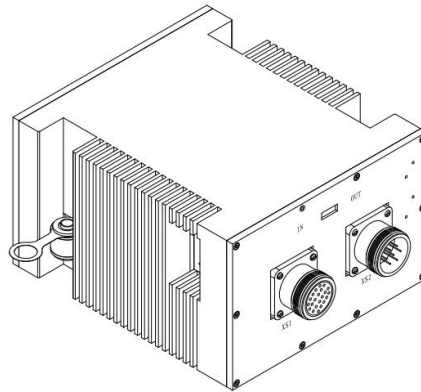


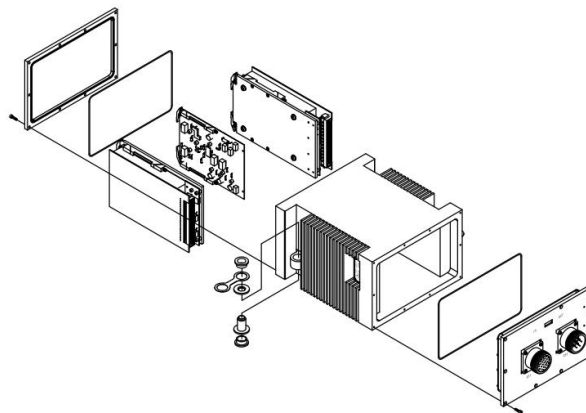
Figure 24: Profile of UPS power supply

A. Operation of the backup power supply

When the tank's power supply system is not in normal working condition, the power supply The backup power can supply stable DC power to fire control computers, measuring instruments and other equipment. and the image and fire control display, the gunner's thermal imaging scope, the camera The operator's panoramic sight and the gunner's scope are also operated with redundant power supply.

B. Structure

The backup power supply consists of two power supply modules, a lower cover, the module housing, a control circuit board, and a housing.



**Figure 25: Backup power supply box structure
(Structure of UPS power supply box)**

C. Scope of work principles

1) Output voltage: With an external power supply of 29.5 volts \pm 0.5 volts, the output voltage will change according to the force. The voltage of the backup power supply battery changes without

Using external power supply: \sim 36 Amperes(A)

2) Load adjustment ratio: \sim 2%

\sim) Voltage adjustment ratio: \sim \sim % \sim) A condition in

which the output current decreases continuously for the measurement of time at

Current change: \sim 2V

5) Over-current protection: The point at which the current exceeds \sim 36 amperes (A), the voltage at Input 22 volts - 29 volts, output power 28 volts \pm 0.5 volts, current rating 20A, the backup power supply

battery will use The power supply network is automatically activated if the switch is turned off.

Main power

7. Backup power supply battery (Ups battery)

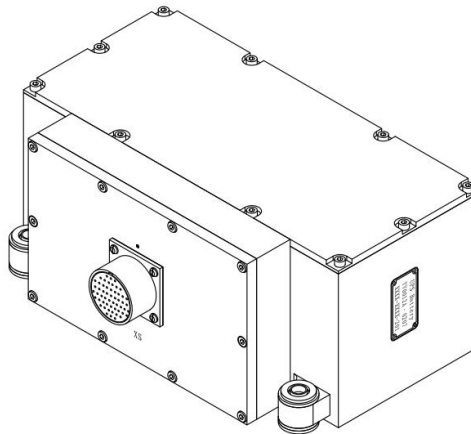


Figure 26 Uninterruptible power supply outline (Profile of UPS battery)

v. work

The auxiliary power supply battery is mounted on the rear left rear of the turret. When the power supply system of the tank is not functioning properly The power supply battery provides power to the Fire control system computers, various measuring instruments, thermal imaging and firing control monitors, gunner's thermal imaging scopes, scopes the commander's panoramic, the gunner's scope, etc. The power supply time is not less than 10 minute

B. Structure

The battery backup power supply consists of a HF-YJDC battery pack, a circuit board Model HF-YJDC etc.

C. Working principle of backup power supply batteries

1) Status indicator light bulb

Charge indicator lamp: While the power supply battery is back-up The battery is being charged. The red light bulb will blink.

Fully charged indicator lamp: While the battery is supplying power The power reserve is fully charged. The red light bulb will stop flashing.

Discharge indicator lamp: While the battery is in charge of power. Power reserve The green light bulb will light up without blinking.

Insufficient power indicator: While the battery is supplying power

There is not enough backup power. The green light bulb will blink.

The indicator light indicates when the battery packs are unbalanced: when the voltage values of the two batteries differ by more than 0.4 volts. The battery pack is unbalanced and the green indicator lamp will flash intermittently. ON-OFF-ON-OFF-OFF-OFF-OFF Battery

pack low voltage indicator lamp: If the battery pack voltage If one of the battery pots is less than 1.0 volts, the battery pot_{set} will be in a low voltage state. At this time, the red indicator lamp will flash rhythmically. ON-OFF-ON-OFF-OFF-OFF-OFF

2) Principles and reasons for controlling electric discharge.

If B+ is higher than 20 volts, V+ is lower than B+ and which of the five control units Connect to a normal connection port. The backup power supply will discharge.

3) Ability to discharge

While the discharge current is 0.8 amps, the discharge capacity is 8 amp hours (AH)

While the discharge current is 8 amps, the discharge capacity is 5 amp hours

While the discharge current is 40 amps, the discharge capacity is 2.5 amp hours

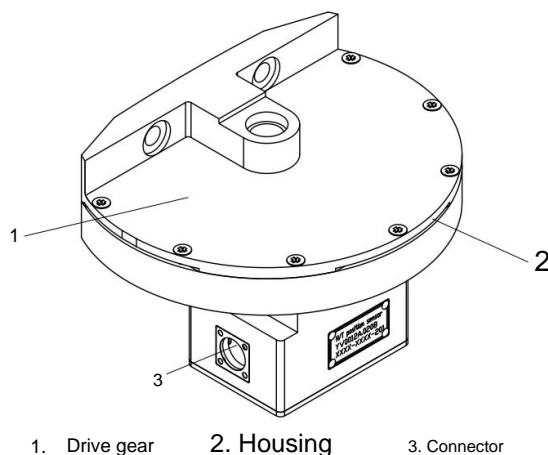
4) Rated voltage value:

The rated voltage value is 24 volts. The actual voltage used is related to the capacity. Remaining and load of battery The lowest voltage value is 20 volts.

5) Discharging electric current

The discharging current of the backup power supply should be within 0 - 40 amps, approved current discharge range is 40 amps.

8. Turret angular velocity sensor



**Figure 27: Outline of the turret angular velocity measuring device.
(Profile of turret angular velocity sensor)**

v. work

The turret angular velocity measuring device is mounted on the turret ring rail and is used to measure the angular relationship of the turret with respect to the vehicle. real time Then send the signal of the angle. For use in the following work A turret angular velocity measuring device is connected to the turret. The gun has gears that engage with the turret ring gear. Under the use of a tooth gap composition in combination with an absolute electrical encoder, of fiber optics with high accuracy. The absolute angle in the direction between the turret and the vehicle can be calculated by calculation. in

real time B. Structure

The angular velocity measuring device consists of a housing, a gear subassembly, an optical fiber absolute encoder. circular shafts, anti-friction ball bearing supports, and circular electrical connectors, etc.

C. Working principle

- 1) Angle measurement range: 0°-360°
- 2) Measurement error: $\pm 0.5^\circ$
- 3) Technical

index of serial communication (Technical index of serial communication)

- a) Use an EIA-STANDARD serial compliant communication connection.

- RS422

- b) Data transfer rate is 115,200 bits/second (b/s).

9. A reticle measuring device inside the gun barrel and an electronic reticle adjustment box.

(Inner bore sighting sensor and bore sighting electronic box)

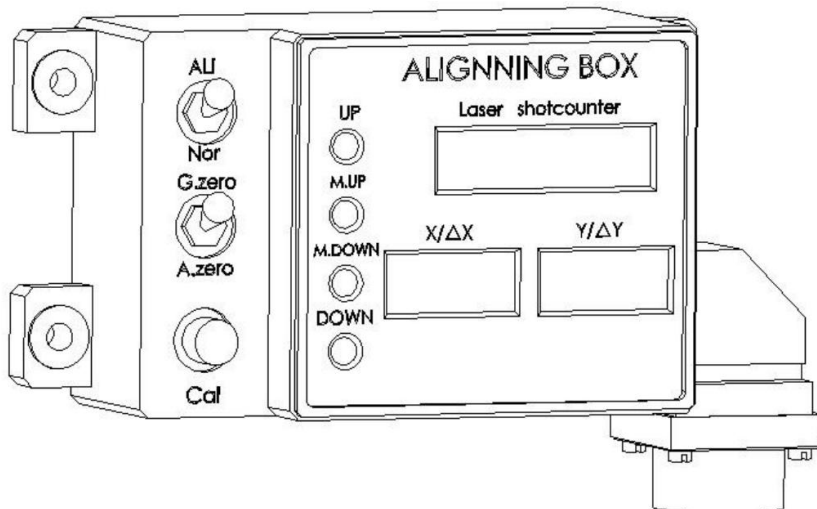
A. Operation

The automatic gun barrel reticle adjustment system consists of a reticle measuring device.

Inside the barrel and electronic reticle adjustment box

In a high temperature environment Symptoms of misalignment of the zero value that occur due to the shaft Gun barrel deflection and mechanical clearance changes The reticle inside the gun barrel can This is achieved through an automatic reticle adjustment system within the gun barrel. which can be checked and corrected The misalignment of the zero values in the field of view of the daytime main scope and firing line. The same as Automatically corrects

zero misalignment. The electronic reticle scope is organized to collect Number of times to measure distance value with laser while the system stimulates energy control box The electronic reticle remembers the number of laser measurements after the shooter fires the laser. The data is not lost even if the laser is measured. even if the electronic reticle adjustment box is turned off.



**Figure 28: Outline of the electronic reticle adjustment box.
(Profile of bore sighting electronic box)**

B. Working

1) Mechanical index of serial communication

- a) The connection is a conformal serial communication type.

EIA-STANDARD- RS422

- b) Transfer rate 9,600 bits per second (bps)

2) Mechanical index for changing the position of the gun barrel.

- a) Electrical output terminal conditions

If the reticle value of the gun barrel is "+", it means the gun is in the correct position.

"Lower" and located "Left"

If the reticle value of the gun barrel is "-", it means the gun is in the correct position.

"Higher" and "right"

b) scope

Output Range: Measurement data is continuously output with angle values.

1.8 mm (2 directions)

Measuring range: ± 1 mm (2 directions)

- c) Measurement error: not greater than d) Special 0.1 mil

limits: If the normal measurement signal value is very weak, it will be displayed.

The letters "UE" came out.

3) Errors and limits for the number of times measuring distance with a laser.

- a) Cumulative error for distance measurement: $\ddot{y}\ddot{y}$ time

- b) Scope of distance measurement: \ddot{y} 99,999 time

10. Ti interface box

A. Operation

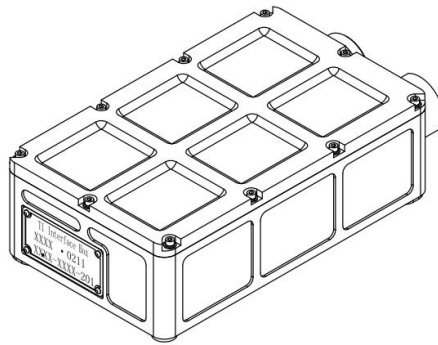
Thermal imaging camera connection box It is the main component for the system.

Controls the firing of the VT4 tank. Its main function is Transmits a low signal video signal (LVDS).

Differential digital video signal to the low-level video signal (LVDS) connector.

After the signal is sent, the low-level video signal (LVDS) is clear and stable.

is stable, and the video content is the same as before transmission.



**Figure 29: Thermal camera image signal connection box outline
(Profile of TI interface box)**

B. Structure

The thermal camera video signal connection box consists of a housing and relay circuit board (Broadcast video signal)

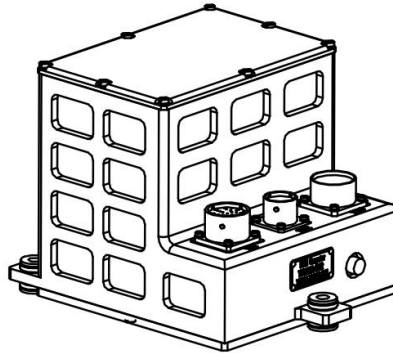
11. Computer manages the health of the system (Healthy management computer)

v. work

The system's integrity management computer is located rear-left in the turret. Testing for defects and insulation Fault diagnosis can be used by

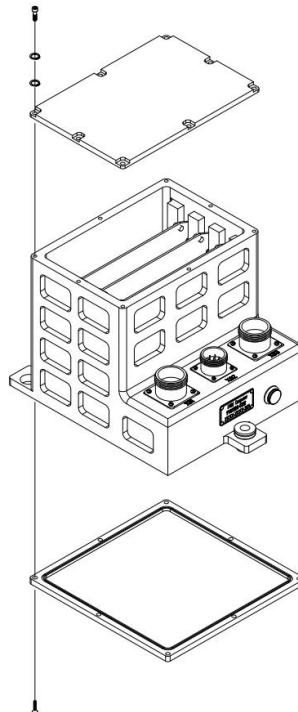
Collect data through the data transmission system, evaluate the integrity of the control system.

Firing, recording the analysis of defects and confirming the possibility of defects.



**Figure 30: Computer layout for managing system integrity
(Profile of health management computer)**

B. Structure



**Figure 31: System integrity management computer structure
(Structure of health management computer)**

12. Muzzle position sensor

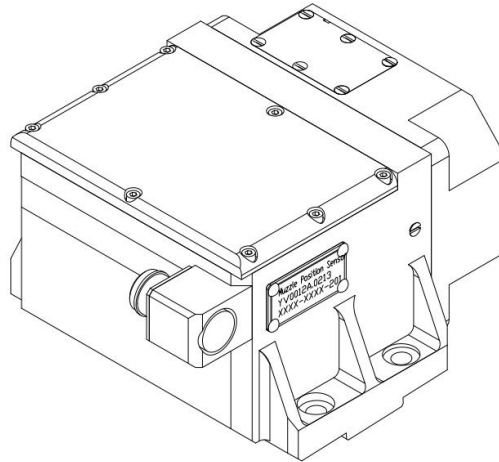


Figure 32: Outline of the gun barrel position detector.

(Profile of muzzle position sensor

v. work

The muzzle position detector is mounted on the gun cradle.

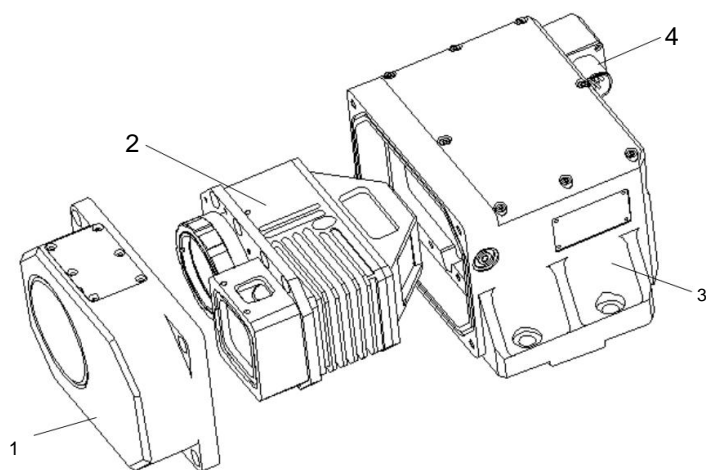
Mark (0.15 mm.) mounted in position on the muzzle of the gun barrel. Used for checking
Change the position of the muzzle according to the situation before and after shooting, movement and
vibration

B.

Structure The barrel position detector consists of a front cover,

Inner camera housing, housing and connectors The camera inside includes the camera kit, housing.

Inside, a reverse rotating prism and a CCD camera as shown below.



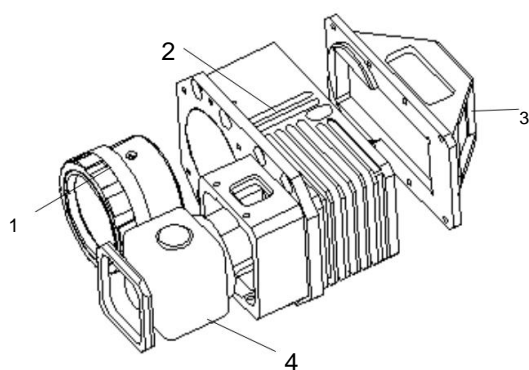
1. Front cover

3. Housing

2. Camera inside

4. Cable connector

Figure 33: Structure of the gun barrel position detector.



1. Camera equipment set

3. Reverse rotating prism

2. Inner camera 4. CCD camera

Figure 34 : Structure of muzzle position sensor inner sight body

3.3 GUN CONTROL SUBSYSTEM

The gun control support system consists of a gun control box, a start-up power supply box, a gyro unit, a rate gyro, a controller, an electrically powered cylinder. , power supply, set Drive unit, control signal cable, electromagnetic clutch, angle limiter, turret drive motor and High drive motor

1. Gun control box

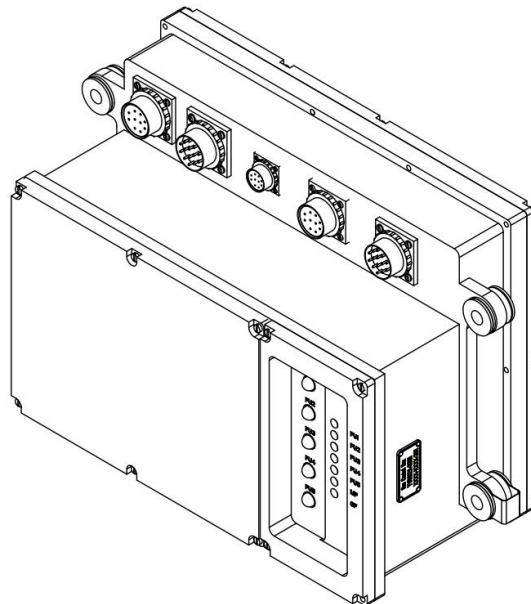


Figure 35: Profile of gun control box

A. Operation of the gun control box

The gun control box is mounted on the turret wall to the left of the gunner's seat. It is an important component in operating the control system. Guns such as opening and closing controls, power distribution Control lights, signal collection, operating mode control, tracking, troubleshooting Maintain stability, adjust system status, control and protect communication signals and circuits. shooting and so on

B. Structure of the gun control box

The gun control box consists of a control circuit board, a circuit board, a control circuit board. Operating mode, fuse set and center housing

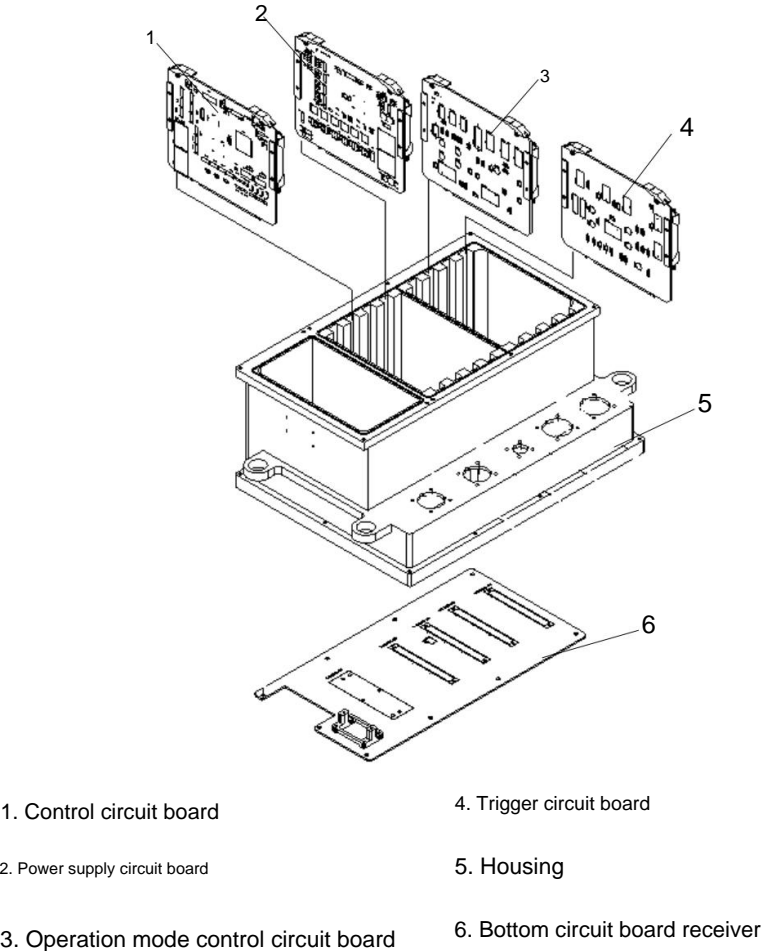


Figure 36: Profile of gun control box

2. Starting distribution box

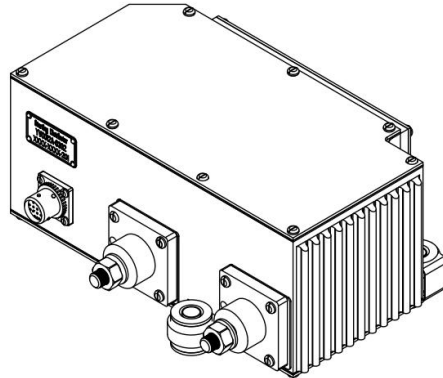


Figure 37: Profile of starting distribution box

A. The power distribution box operation starts.

The start-up power distribution box is mounted on the rear of the turret and is used to start the gun.

Operates the gun control system by increasing the voltage and operating the system normally. The same as turning off the power switch and stopping the system.

B. The power distribution box structure starts to work.

The start-up power distribution box consists of switches, terminals and housings, etc.

3. Gyro set

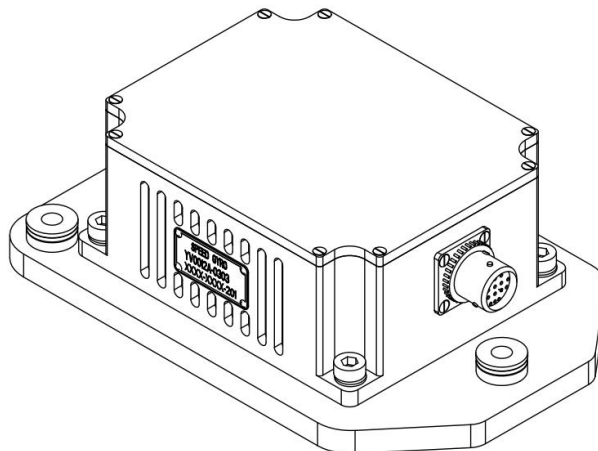


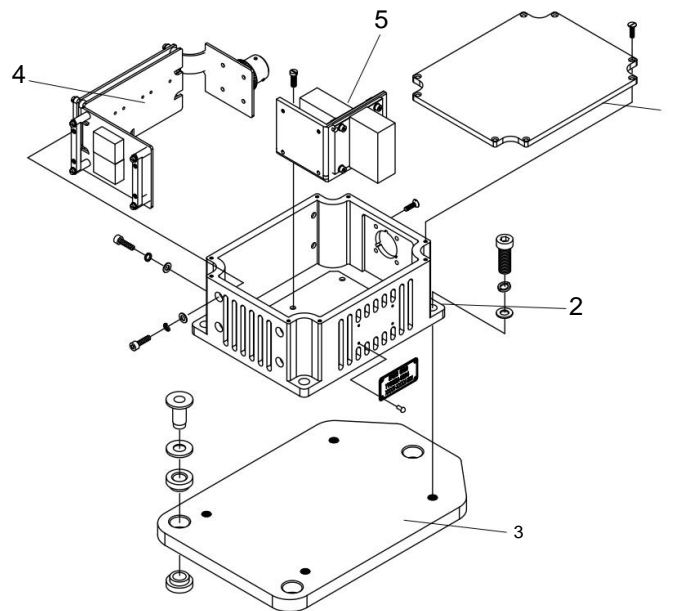
Figure 38: Profile of gyro set

A. Working of the gyro set

A gyro unit mounted under the gun cradle can measure the position, angle and angular velocity of the gun. Turret and gun body Then send the signal to the fire control system after changing the signal to DC voltage and create a signal to drive the new position of the gun and send

it to system B. Structure

of the gyro set The gyro kit consists of a fiber optic gyro, control circuit board, housing and connectors, etc.



- | | |
|------------------|--------------------------------------|
| 1. Top cover | 4. Control circuit board set |
| 2. Housing | 5. Set of sub-components of the gyro |
| 3. Support plate | |

Figure 39: Structure of gyro set

C. Working principle of the gyro

set Its function is to send and receive data signals via CAN bus connection signal.

Maximum angular velocity measurement range: $\pm 36^\circ$ /

second. Output signal level: Angular velocity signal value greater than $500^\circ/\text{sec} \pm$

2.5%

Symmetry coefficient of the output signal: not more than 5%.

Negative (-) voltage measurement. null: speed channel area. The angularity at the zero position is (-10 to 10)

signal output pole and range: along with the positive direction of the sensitive axis. When importing a signal, clockwise rotation has a negative pole and counterclockwise rotation has a positive pole.

Signal output area is -32768 to $+32767$ 4. Rate gyro set

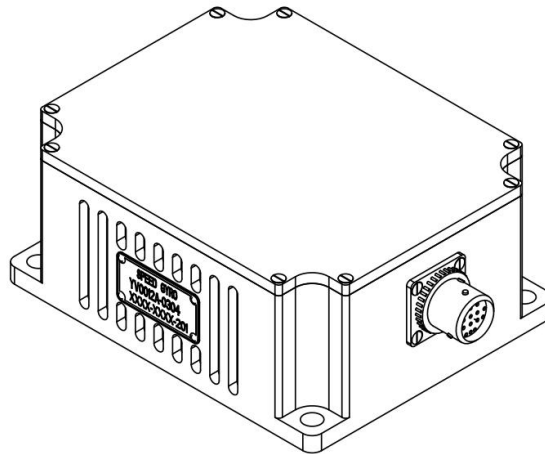


Figure 40: Profile of rate gyro set

A. Working of the rate measuring gyro

set The gyro unit is mounted on a plate on the left side of the vehicle and on the right front of the operator. Control the cars in the turrets in order. It measures the angular velocity of the tank and gun turret in the horizontal direction and then converts the angular velocity to the voltage. Including preparation for sending The signal goes out at the front. For this reason, the structure of the hybrid control system is created. B.

Structure of the rate-measuring gyro

unit. Same as the gyro

set C. Working principle of the rate measuring

gyro set Provides for sending and receiving signal data from CAN bus transmission

line. Maximum angular velocity measurement range: $\pm 36^\circ$ /

sec. Transmission data gradient. Exit: Angular velocity signal value is greater than $500^\circ/\text{sec}$.

$\pm 2.5\%$

Symmetry coefficient of the output signal: not more than 5% Zero

voltage value: The range of the angular velocity field at the zero position is (-10 to 10)

Terminal and signal output range: along with the positive direction of the sensitive axis.

Responding to the signal input, clockwise rotation is negative and counterclockwise rotation is negative. The watch has positive polarity. The signal output range is -32768 to +32767 5. Control console

(Console)

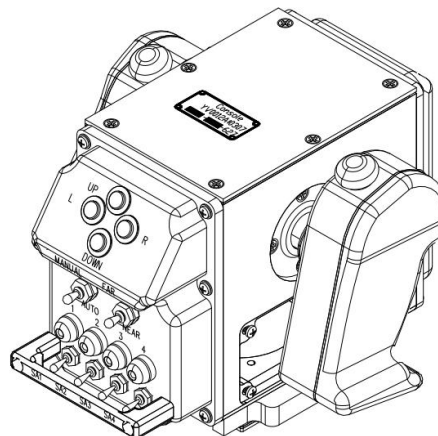


Figure 41: Profile of control

v. work

The gunner's control lever is mounted in front of the seat and under the gunner's scope. The gunner can turn the switch on/off to Control the secondary system of the gun controller from the gun lever, controlling aiming and aiming at targets, controlling laser range measurement, automatic loading of bullets in firing, controlling how much gun can be fired. Guns and machine guns joined the axis. and operate in controlled mode Automatically aim for the island

The operation of various switches Switch buttons and signal lamps on the control handle
Of the gunner:

1) Rocker switches (Switches)

SA1- System start-up switch

SA2- Automatic mode control switch

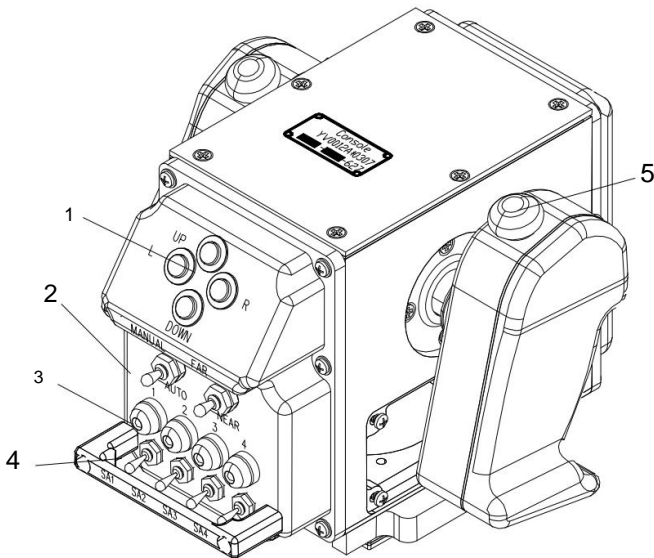
SA3- Fire safety switch

SA4- Automatic/manual reload control mode switch 2) Handle

buttons: Right switch button : Cannon trigger switch

button, laser rangefinder switch button, and automatic aiming lock switch button. Left
switch button: Coaxial machine gun trigger

switch button, ammunition loading switch button. Auto and auto aiming unlock switch
button



1. Switch button for automatic aiming adjustment. 4. Control mode switch (4) 3.

Detailed form (4) Signal lamp (4)

2. Automatic island aiming switch. 5. Handlebar switch button (6). **Figure**

42. Switch panel on the control handle (Console panel) . 3) Signal

light bulb. Light bulb. Signal number 1 - Warning lamp starts working in the direction. 2nd signal light bulb - Warning light bulb starting distance operation. Third signal lamp - warning lamp for connecting the trigger circuit. 4th signal lamp - Manual reloading warning lamp.

4) Automatic island aiming switch panel

Panel Switch Button – The switch button provides fine-tuning of the automatic aiming for

Target lock

Push the switch on the panel. –Tracking switch for aiming at target

automatic

Switch on panel – Automatic aiming range measuring switch “manual/

automatic targeting”

B. Structure of the gunner's control stick The

gunner's control stick consists of a left/right joystick, voltage divider. Elevation and direction angles and drive mechanisms, switch knobs, switch buttons, signal lamps, connectors and housing

C. Working principle of the gunner's control stick The joystick

on the controller can rotate about the axle axis to lift it up. Or press down to make the cannon follow or aim at a high angle. The maximum joystick rotation angle is $\pm 30^\circ$. The controller joystick can rotate around the vertical shaft in left or right rotation. In order to make the cannon stick or aim in a direction, the maximum angle of rotation of the joystick is $\pm 30^\circ$. A larger angle of rotation of the joystick will make it easier to shoot. The stand rotates faster. If the lever is released at any position The control lever returns to the zero position under the force of the leaf springs. 6. Electric cylinder

(Electric cylinder)

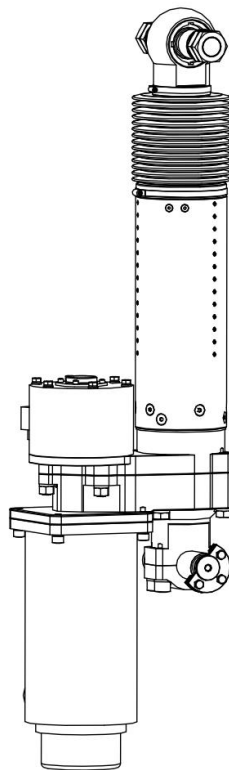


Figure 43: Profile of electric cylinder

A. Operation of the electric cylinder

The electric cylinder is the high-speed mechanism of the gun control system. It can
Converts the force of rotational resistance into linear thrust to drive the gun up or down. Another function of the electric cylinder
is to receive signals from the gun control system for use in locking.
Electric gun, working principles include:

1) Work together with the gun control system to push the gun to move at a high angle and

Angle of depression

2) In the electrical operation mode Can stop and lock the gun according to system commands.

gun control

3) In manual mode The electric cylinder can rotate freely.

B. Structure of the electric cylinder

The electric cylinder consists of a high-speed drive motor, a speed changer and
Electromagnetic brake on high roads The high-speed drive motor is a permanent electromagnetic motor. Changer set
The speed consists of 2 sets of gear wheels and 1 set of gear shafts, the electromagnetic brake is of the double friction type
and leaf spring type. Double coil, see picture 44.

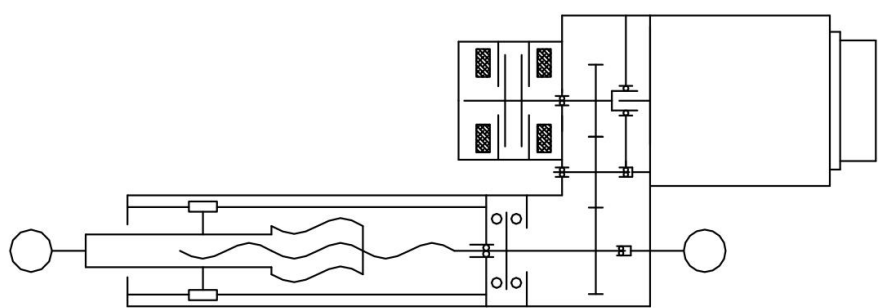


Figure 44 Electric cylinder speed changer (Electric cylinder transmission)

The output power from the motor is transmitted through the speed reduction gear to the gear shaft and
The gear axis converts the rotational force into direct motion. The gear axis
The power shifter is supported by a bi-directional thrust shaft support. The delivery rod of the electric cylinder is connected.
with a nut securing the gear shaft and a sliding mechanism to stop the rotation There is a ring on the top of the
Transfer shaft and lower ring on the cylinder housing

C. Working principle of electric cylinder

1) Movement in expansion and contraction not less than 150 mm.

2) Rate of speed change The rotational motion is changed to

Direct movement with electric cylinder Speed change ratio: While the motor

One revolution of the shaft expansion and contraction is 11.72 ± 0.1 mm.

3) Ability to bear weight

The maximum electric cylinder output weight is 15 kilonewtons (KN). The speed is 10 mm/sec Time used %

Weight is 100 mm/sec, time used is 80% 40 kN, speed is Weight is 5 kN, speed

15% ȳ) Service life Continuous work is 800 hours.

5) Locking weight range: The locking weight range of the transmission shaft is not less than 20 kilograms.

Newton;

6) Retraction period: The recoil period of the electric cylinder at the end of the Export not more than 0.5 mm.

7) Friction force when there is no load in counterclockwise rotation: Friction force

When there is no load in counterclockwise rotation, the pressure of the electric cylinder is not more than 400 newtons (N).

7. Boosting power supply

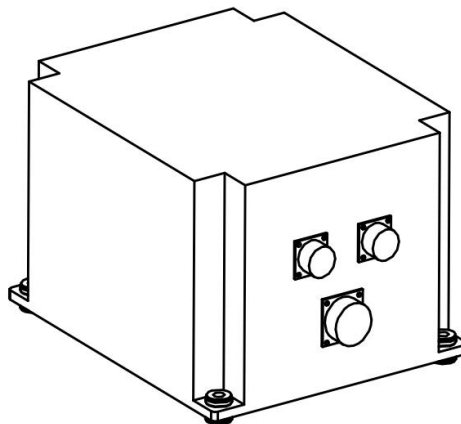


Figure 45: Profile of boosting power supply

v. work

The power booster is located on the right side of the turret's rear. Used for changing
The 26 volt direct current power of the low voltage power supply is converted to 270 volts (V/DC) to be
used as the system drive power. in the direction and height Used to maintain the stability of the voltage.
Export and protect system power supply

B. Core competencies

1) Nominal output voltage rate: 22 volts to 29 volts. 2)

Nominal no-load output voltage rate: 270 volts ± 15 volts. 3) Continuity

of maximum electric current: 20 amps (A) 4) Charge

time 0 volts to 270 volts: ≈ 120 seconds 5) Resistance Insulation

resistance: 20 megaohms (M Ω)/500 volts.

Driving equipment (Driver)

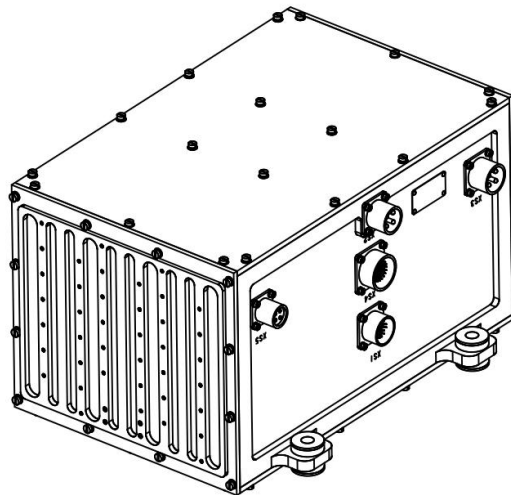


Figure 46: Outline of the driving device (Profile of driver)

C. Working

The actuation device is positioned lower than the gun body. Device for power amplification and speed adjustment control. Used for processing sent control signals. from the gun control box by increasing the output voltage to match the system control signal to Drive the turret motor and high-altitude drive motor to drive the turret and cannon in the direction and direction. different speeds

The basic working principle of the drive device is referred to in Figure 47.

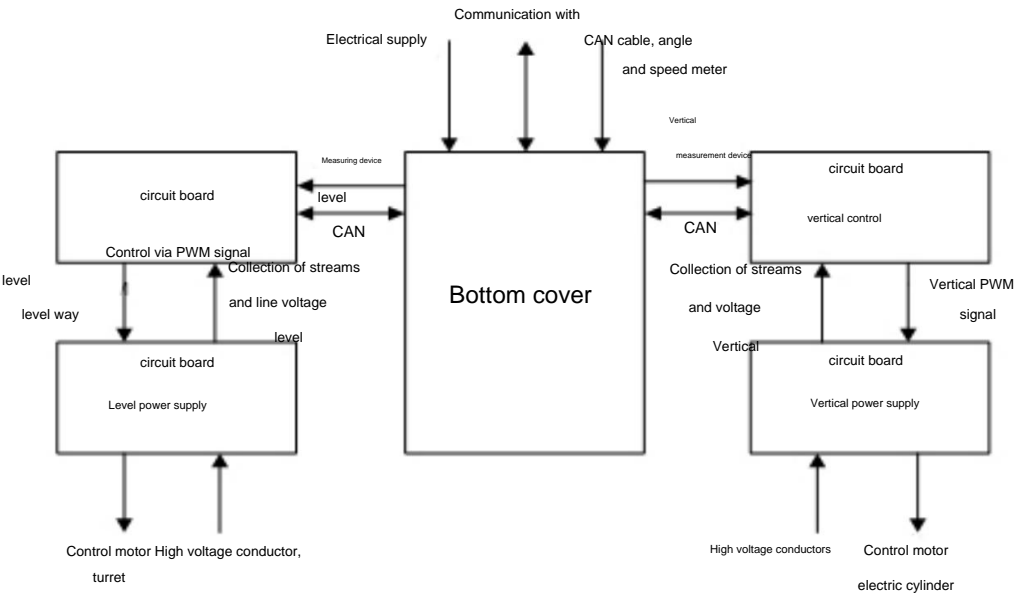


Figure 47 Working principle of drive device (Working principle of driver)

D. Structure

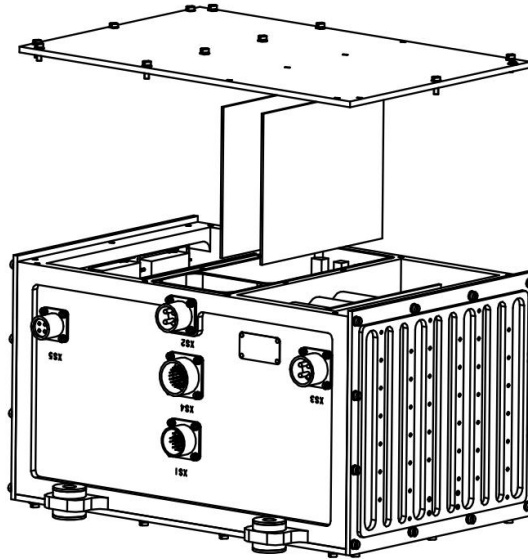


Figure 48: Structure of the driving device (Structure of driver)

Mon. Working

- 1) Works with CAN bus communication cables. 2) Signal conversion (Decode): There is work for converting signals of

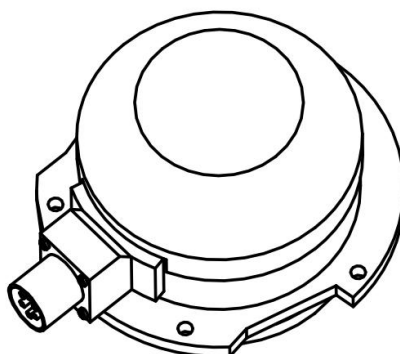
Angle and speed meter

- 3) Collect electricity
- 4) Collect the voltage from the path of the voltage carrying device.
- 5) Able to control the motor by using a PWM device.
- 6) Increase the voltage or discharge electrical charge from the voltage conductor. Limit value in

Discharge is 360 volts.

- 7) Insulation resistance value should not be less than **50** megaohms (M Ω).

8. Electromagnetic clutch (Electromagnetic clutch)

**Figure 49: Profile of electromagnet clutch**

A. Operation of the electromagnetic clutch

An electromagnetic clutch is mounted on top of the housing of the machine, rotating the turret and Used for turning on/off the power supply switch of the torque transmission mechanism. It is also used to avoid turning the turret. While locked

B. Structure

An electromagnetic clutch consists of a claw, a magnetic pulley, a switch rocker, and a connector. and housing etc.

C. Working principle

1) Operating voltage rating: 24 volts (V/DC) 2)

Starting voltage (Voltage drop R (VO)): 18 volts 3) Discharge voltage

(Forward voltage (VF): 15 volts 4) Engaging force (force between charges F):

392 newtons (N) 5) Resistance value of accelerator coil QQ: 1.1 to 1.25

6) Resistance value of induction coil GQ: 43 to 48.6

9. Angle limiter

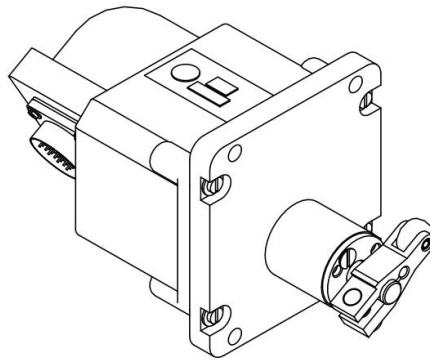


Figure 50: Profile of angle limiter

A. Working angle limiter The

angle limiter is mounted on a bracket above the height mechanism. When turning the gun and Approach the maximum elevation angle or minimum depression angle. The angle limiter disables the aiming circuit system. in height to limit the hydraulic output control signal in height from the gun control box and Prepare to cut the circuit in the gun turret lock.

B. Structure of the angle limiter

The angle limiter consists of a housing, a shaft and two push plate pulleys, and four switch switches.

C. Working principle of angle limiter

Rotation angle of the rocker: When the rocker rotates clockwise or counterclockwise from the neutral position, the rotation angle shall not be larger than 35°.

Cutting angle Switch: When the rocker rotates clockwise or counterclockwise from the neutral position.

Go to the position where the switch is actuated. The rotation angle of the pedal must be less than 10°.

3.4 COMMANDER'S PANORAMIC SIGHT SUBSYSTEM)

1. Commander's panoramic sight

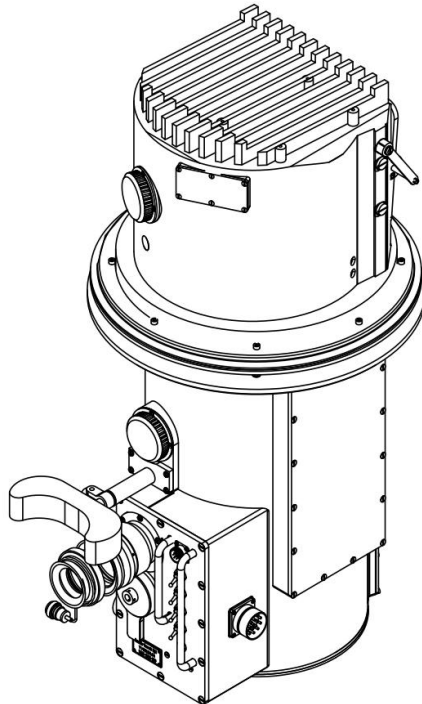


Figure 51: Scheme of the commander's panoramic sight camera.

Profile of commander's panoramic sight)

v. work

The operator's panoramic sight is mounted on the front left side of the operator's seat.

Used for scouting the battlefield, searching for targets, displaying targets to the gunner through control.

Above the gunner, monitor and supervise the gunner's firing status. and control fire over the gunner.

When a dangerous target is found

Operator's panoramic sight Connected to the turret with a fixing piece. Consisting of a laser rangefinder, a rangefinder controller, and a scope controller. Operator's Noramic, Signal Collection Device, Thermal Imager, Protective Head, Scope inner housing, main housing, secondary control panel assembly, bottom cover, etc.

1) Laser distance measuring

device Used for sending a laser beam to measure the desired distance with a value of 1.06 micrometers (μm). 2)

Distance measurement controller. Used to provide a high voltage and low voltage direct current power supply. required to measure the distance as well as controlling the distance measurement process During distance measurement, the emitted light signal can be collected and the reflected light signal can be amplified accordingly. Control signals produced by various steps in measuring distances. In this case, the target distance is Collected according to the time difference between the emitted light signal and the light signal. that reflects back Finally, the target distance is transferred to the computer and displayed on the monitor

3) Panoramic scope controller

The panoramic scope controller adopts force stabilization. Highly accurate inertial sensors are used for panoramic surveillance and as a basis for directional and distance aiming. The control mode provides operator control over the gunner. Controlling the car, setting the location The operator's goals, the operator's autonomy. The operator can control the gun. According to commands sent from the fire control computer. Commands received from the control computer The shot is forwarded to the operator's thermal imaging camera. Then the value of the thermal image returned The information received will be forwarded to the fire control computer. Commands received from the fire control computer will be executed. Forwarded to the laser distance meter. Then the value of the laser distance meter returned will be corrected. Send back to

the fire control computer. 4)

Signal collector. The signal collector displays the measured distance in the panoramic camera's viewfinder. along with indicating a ready-to-fire or defective signal light Used to collect the forward gyro signal, which is then sent to the panoramic camera's signal collector after it has been calculated. Completely It is also used to collect signals from various switches. On the front and rear control panels, gun control signal, camera line illumination signal. Send to collector Signals of the panoramic scope and fire control computer

5) Thermal imaging scope

Thermal imaging scope is A device that uses a beam of light to detect visible objects. and cannot be seen without the need to come into contact with objects By creating a bright image according to Response of incident electromagnetic energy within a frequency range or wavelength. of infrared light, 8 - 12 micrometers (μm). As a key component of the fire control system, the crew can use a thermal imaging scope that can be used to detect Long range, aiming and shooting day/night and in bad weather conditions

6) Protective head cover

The protective cowl is mounted on the outside of the turret. Installed with protective glass compartment Visible light and infrared light glass window Used to protect the internally exposed parts.

Housing outside the turret

7) Inside scope housing

The inner scope housing is an integral part of the operator's panoramic scope. It is constructed in a complex design and will include All stabilization systems, image tracking, daylight camera systems and rotational systems The main components include: reflector bracket, level drive motor, level contact switch, rotating plate and rotating housing, etc. 8) Housing Assembly The main function of the housing assembly is to

protect the bottom

of the camera housing, the inner sight, and signal cable connections. external Consists of a housing, connector set, front cover and desiccant box. 9) Sub-assembly of the instrument panel.

A sub-assembly of an instrument panel used for monitoring in the visual and Change the viewing range switch.

10) Bottom cover set

The bottom cover is used to refract the path of visible light and eliminate it. image rotation

11) Sight heater sub-assembly The sight heater sub-

assembly is used to defrost the During low temperature operation and testing If the power supply is switched on Frost will never form again.

B. Working principle of the operator's panoramic sight camera

1) Working principle of the independent stabilization system

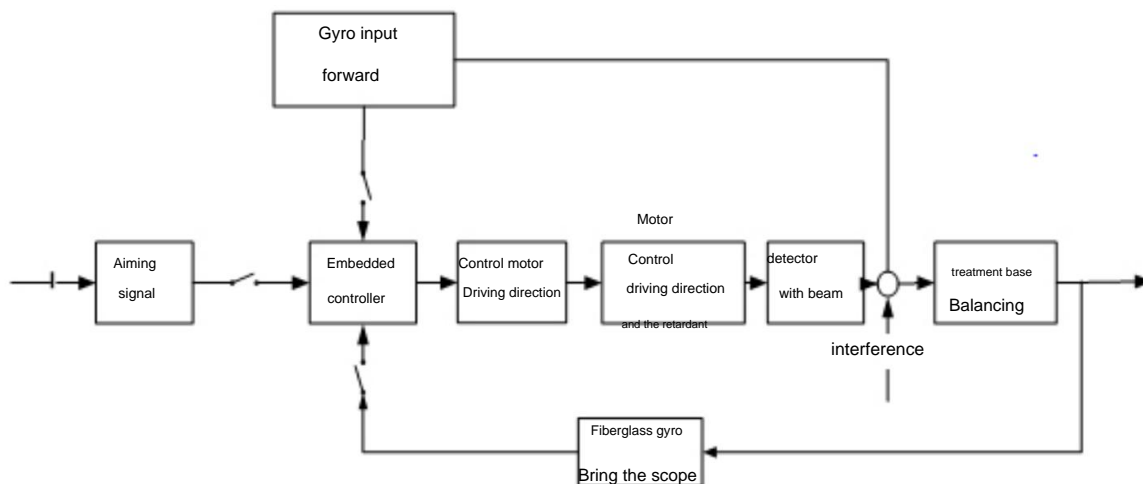
When the gyro stabilizer base leaves its original position in the inertial space, direction while the vehicle is moving The camera's fiber optic gyro senses an angular velocity 1 times that of the operator's from the expansion shaft panoramic sight. The signal will be broadcast further. to the controller embedded in the panoramic camera. of the operator via serial communication cable. Meanwhile, the embedded controller receives angular velocity signals from the gyro control. Enter the forward value mounted on the operator's panoramic sight. Interpolates speed, angular, direction and forward input signals. Calculate frequency and rotate direction of The motor controls the direction of rotation (Stepper) and sends an excitation signal to the control electronic circuit. Rotation direction and the motor controls the direction of rotation. The balance adjustment base driving motor measures the Angular velocity rotation speed which has a value equal to the angular velocity of the flow rate out and the direction is reversed. Therefore, the direction of the stabilizing base is maintained in position. of the original inertial space and maintain the line of sight to be stable. 2) Basic working principles in aiming and searching. Signals for aiming and searching will be sent into the embedded

controller. in the operator's panoramic sight via a

communication cable. After calculating the value It sends an excitation signal to the direction control motor to drive the circuit and drive the direction control motor. The motor driving the stability base will rotate with an angular velocity according to the value. division Input signal in direct rotation The direction of rotation is related to the polarity of the input signal. The rotational angular velocity is sensed by the gyro. until the angular velocity of the base rotation The value is equal to the value of the signal used for aiming and searching. Now, aiming and searching of the camera The operator's panoramic aim can be carried out according to the desired angular velocity.

The basic operating principle of the operator's panoramic sight is referred to in

Picture 52



**Figure 52: Basic working principle of the operator's panoramic sight.
(Working principle of commander's panoramic sight)**

C. Structure of commander's panoramic sight The commander's panoramic sight is a combination of

detectors. The beam consists of a multi-band optical fiber system and sub-assemblies containing Integrated stability controls such as monitoring and aiming visible at 2x magnification, CCD daytime camera, mechanical sub-assembly Night view, optical distance meter Laser intensity 1.06 micrometers (μm), etc. Determination of the operator's panoramic sight. It will be combined in one piece and digitally. It has a small, compact, lightweight and simple structure.

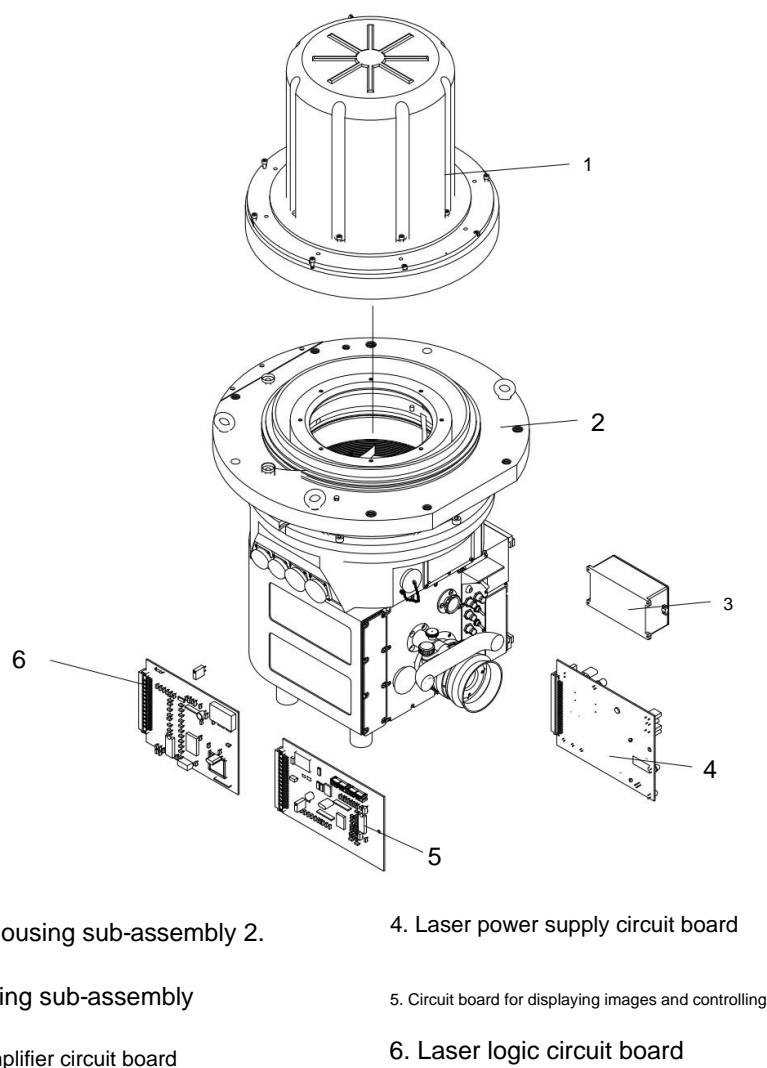


Figure 53: Structure of the operator's panoramic sight.
(Structure of commander's panoramic sight)

D. Capabilities of the operator's panoramic sight.

1) Camera capabilities

a) Capabilities of daylight cameras

Magnification of the field of view: 6 times, 10 times

Field of view: 10° , 5.5°

Sharpness adjustment range: -5D to +3D

b) Capabilities of the thermal imaging camera

Wide Field of View (WFOV) $(9.00^\circ(6.75^\circ) \times (1 \pm 10\%))$ Horizontalx

Vertical (HxV)

Narrow Field of View (NFOV) $(3.00^\circ \times 2.25^\circ) \times (1 \pm 10\%)$ Horizontalx

Vertical (HxV)

Electronic Magnification (EM) $(1.50^\circ \times 1.12^\circ) \times (1 \pm 10\%)$ HorizontalxVertical (HxV)

2) Image tilt and relative tilt.

while the reticle is at the zero position The tilt of the image will not be more than 90° .

minutes and the relative inclination of the scale line shall not be greater than 60° (minutes).

3) Capabilities of the laser distance measuring device

Measuring range: 200 m. - 9,990 m.

Distance measurement error: Accurate 10 m.

distance measurement rate: $\geq 98\%$;

Defect alarm rate: $\geq 1\%$; Frequency of use:

Normal: 6 seconds/time; Emergency: 3 seconds/time, measure distance

Can be used continuously 3 times

Spatial resolution: Level: ≤ 1 milliradian (mrad); Vertical path: 50 m.

Tolerance between the laser beam antenna, the receiving antenna

Laser and line of sight not more than 0.15 mm.

Selecting multiple targets: first and last targets

4) Directional error The

directional output error of the panoramic scope is not more than 0.3 mm in the range of vertical angles -5° to $+15^{\circ}$ and in Plate of -5° to $+5^{\circ}$ angle

5) Aiming speed of the reticle line

Minimum $\dot{\gamma}$ 0.015°/second (two directions),

maximum in the direction $\dot{\gamma}$ 30°/second, maximum in the distance 5°/second

- 7°/second 6) Correct value of stability of the

orientation. Sight line Stability error: standard deviation in the direction $1\ddot{\gamma}$ 0.2 mm, distance $1\ddot{\gamma}$ 0.15 mm

Under the condition of oscillation the distance is 3° , the frequency is 1 Hertz (Hz) ; The directional oscillation is 2° , the frequency is 1.2 Hz; The tilt is 2° , the frequency is 0.8 Hz, the stability accuracy is $1\ddot{\gamma}$ 0.2 mm in the direction and $\ddot{\gamma}$ 0.15 in distance

7) Aiming range of the line of

sight The aiming range is 360° in the direction and -10° to $+43^{\circ}$ in the range. An indicator signal from the affected aiming cycle can be output while in position. Be limited in distance. 8)

The speed of the floating line of sight. The

floating speed of the line of sight is not more than 8 mm/min.

(bi-directional)

9) Angular velocity error of line of sight Tolerance range:

± 20 mm/s in the direction, ± 10 mm/s in the opposite direction.

phase

The measurement line-of-sight error in angular velocity is not more than 3% of the angular velocity, if the absolute value of the angular velocity is not greater than 5 millimeters/second, the error will not be more than 0.15 millimeters/second.

10) Inaccuracy in gun control

Inaccuracy of the panoramic camera in aiming along the gunner's line of sight.

Shot is not more than 1 mil in the range of -5° to $+15^{\circ}$ directional angles and in the -5° directional angle range. to $+5^{\circ}$

11) Inaccuracy of direction indicators

The direction scale indicator can be formatted. Error indicator not more than 5°

12) Zero buoyancy value

The zero buoyancy value of the line of sight is ± 0.2 mm. Zero buoyancy value of the thermal imager is ± 0.3 mil.

13) Depth of field of the thermal imaging scope

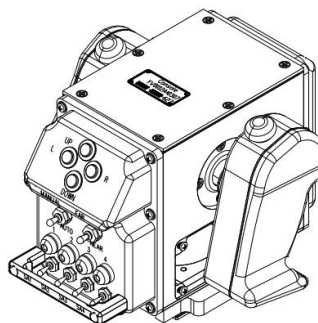
while the temperature between the target radiation and the background radiation There is a difference of not less than 6,000 resolution with a visibility not 10 km., greater than Relative humidity less than 60%, narrow field of view (NFOV) or Electronic magnification power not less than 2,000 m.

14) CCD camera optical axis misalignment.

Misalignment between the optical axis received from the CCD camera and the optical axis.

The main reticle is not more than 1 The surface on the CCD scope should be kept free of dust.

2. Commander's console



**Figure 54: Outline of the operator's control stick.
(Profile of commander's console)**

A. The operation of the vehicle operator's control stick.

The operator's control stick is mounted under the operator's sight. It is used for Control the scope for aiming the island, aiming and controlling the gun orientation over the gunner and Firing from the operator's position

B. Structure of the operator's control stick

The operator's control stick consists of a receiver plate, a voltage divider and a voltage divider. Adjustable in direction and distance and connecting mechanism, left joystick, right joystick, switch knob, switch button and signal bulbs The operation of the control panel is as follows:

Switch SA1 is the trigger switch above the gunner, while switch SA2 is the trigger switch above the gunner. is in the closed position. and turn on the SA1 switch (upper position), the system enters operator mode over the gunner, while Switch SA1 and Switch SA2 are closed, the system enters gun control mode.

The SA2 switch is a switch for controlling the anti-aircraft machine gun (AAMG) from inside the vehicle. If the switch is in the on position, (upper position) can aim and fire anti-aircraft guns from Operator's control stick

The SA3 switch is a firing safety switch. If this switch is turned on (up position), the operator Can be fired in gunner control mode.

Switch SA4 is a lock/unlock switch. "locking/unlocking" aiming the island Anti-aircraft machine gun

The switch button on the index finger of the right hand is used as a switch button to fire a laser that measures the distance to the operator. Used to measure distance

The thumb switch button is the trigger switch button for a cannon. Used for vehicle operators in Shooting mode above gunner

The switch button on the index finger of the left hand is the targeting button while the system is not in operation. Control mode for the operator over the gunner. When the operator presses this button when the target is found. The gun will move. along the line of sight of the operator. When the switch button is released, the gun will stop moving. This switch button is a reload button. The operator's gunshots while the system is in the operator's gunnery control mode.

The left thumb switch button is a machine gun firing button, used by the commander for controlling the common machine gun. axis while the operator is in control mode over the gunner. Used for controlling the firing of combat machine guns. aircraft when the anti-aircraft machine gun (AAMG) is switched on

Signal lamp from 1 to 4 C. Principle Used to indicate the status of the switch response.

of operation of the vehicle operator's control stick. When turning

the control lever on the control unit along the level axis in the distance and direction for controlling surveillance and aiming the operator's panoramic sight in the vertical direction.

The lever rotates with a maximum angle of $\pm 30^\circ$. Rotating the lever with a larger angle will result in

Movement of the field of vision is faster. When the joystick is released in any position, the joystick will rotate.

Automatically returns to the zero position due to elastic force. While the system is in control mode

Shooting above the gunner Rotating the control rod along the horizontal axis on the machine controls the height and angle of the lift.

Press to control the cannon's elevation and depression angle. Turn the lever along the vertical axis.

left and right to control the turret rotation left and right.

Part 4:

Basic working principles of the fire control system.

(WORKING PRINCIPLE OF FCS)

Killer fire control system "hunter-killer" has been prepared with the system. Maintains independent stability for the operator's panoramic sight and the artillery gunner's sight. Equipped with a dual-axis stabilization system that can follow the cameras. Gunner's aim and panoramic scope of the vehicle commander.

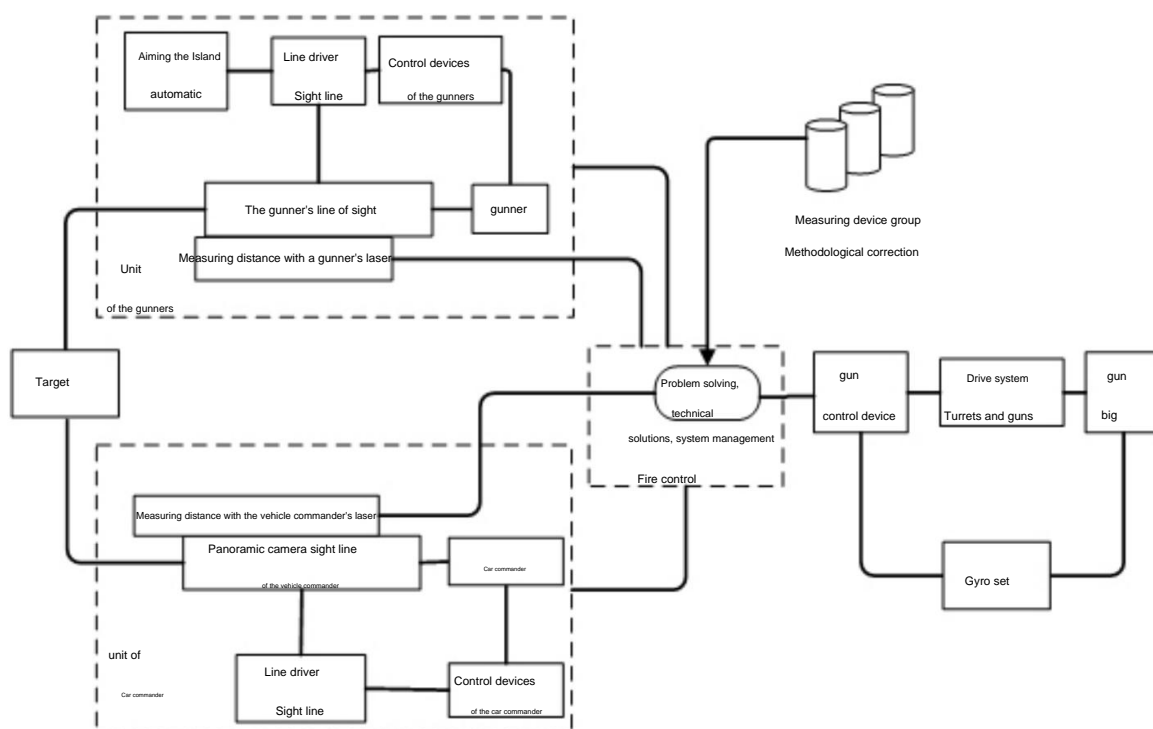


Figure 55 Operation mode of the fire control system (Operation mode of FCS)

while the system is under the control of the gunner. The cycle of the control system will It consists of a gunner's scope, a fire control computer and a gun control system. It creates loop patterns under the support of various sensors. Any other The fire control computer will Calculates firing data, sending initial firing angle and trap angle values to the gun. Therefore, the conditions for controlling the The gun was fired and the gunner's control of the fire was achieved. while the system is under the control of the gunner. of the vehicle commander The loop consists of the operator's panoramic sight. The fire control computer and gun control system create a pattern of cycles under control. Support of various measurement devices The fire control computer calculates firing data and trap angles. that is more accurate Sends the correct initial launch and trap angle values. Controlling the status of shooting a gun and the commander's control of the fire was achieved. according to the needs of different missions The crew

can choose between operating modes. of different fire control systems The main operational control modes are: A firing mode in which the gunner sets the firing range.

Visual firing mode maintains the shooter's stability.

Fire control mode over the operator's gunner. Basic

1. working principle of the firing mode in which the gunner sets the firing range (Working principle) of gunner's range –setting firing mode)

In the shooting mode where the gunner sets the shooting distance himself. The gunner's scope moves with the gun. The gunner monitors the battlefield through a sight or display and controls it. and control movement of the gun using aiming signals via the gunner's control stick. causes the reticle to be driven to aim Stick to the target The desired initial launch and trap angles are obtained from the built-in engineering solver. Output to the reticle control module to control the gunner's scope for firing angle adjustments. and the initial trap period automatically after setting. The gunner aims at the target using regular marking lines. Sight the scope again to fire. Gunner's Range Control Module Refer to Figure 56.

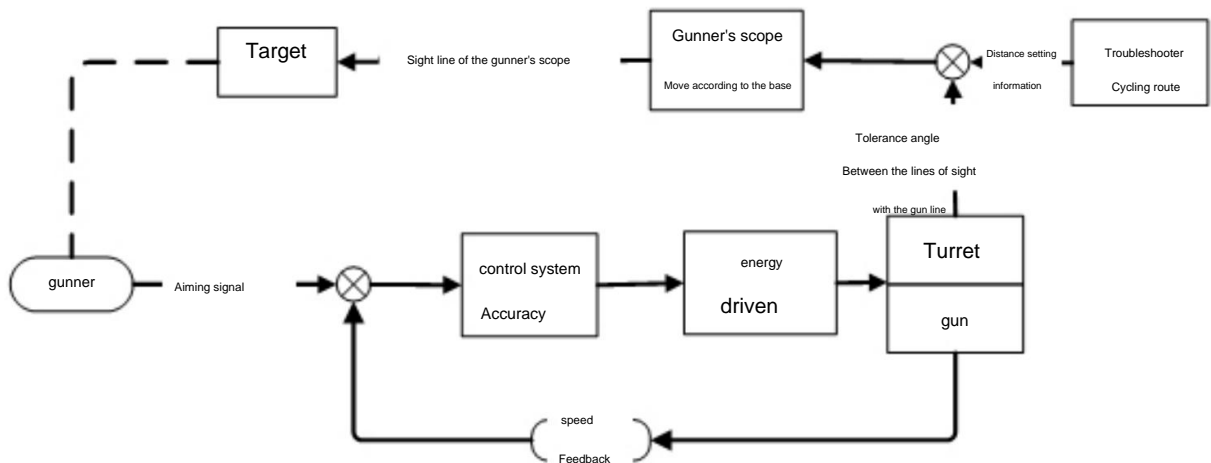


Figure 56 Module *of gunner's range- setting control*

2. The basic working principle of the visual firing mode maintains the stability of the gunner.

(Working principle of gunner's image stabilized firing mode) The gunner's

scope will be

independent sample The gunner surveys the battlefield and aims at targets through the sights on the scope or display.

Shooter imagery and control Under this condition, the gunner can aim the target manually and Shoot with regular bullets or with guided weapons. The gunner can also hit targets.

Selecting the automatic island aiming mode

A. Manual aiming and firing when a target is detected. The gunner

tracks the target using the gunner's joystick. If the target moves out of line of sight in the field of view, The gunner can send signals through Use the gunner's control stick to control the line of sight to follow the target at an angle. The distance between the line of sight and the line of fire is created due to the movement of the reticle. Tolerance angle According to the control signal of the gun control system, it is sent to the technical debugging unit for driving. The gun should move along the aiming line.

If there is no aiming signal The gun is stabilized in the specified reticle position. while the vehicle is moving Angular movement occurs between the turret and the gun in the gap. of the area of inertia, which will cause an angle error between the line of sight and the line of fire. Due to the interference of the ground wire The angle deviation drives the gun along the reticle. Cyclic control of the gun control system The gyro measures the gun's rotational speed at the current time. and creates feedback. Therefore, the duty cycle created allows the gun to move steadily.

Stability and Aiming Module of Stabilizing Image Mode Refer to

In picture 57

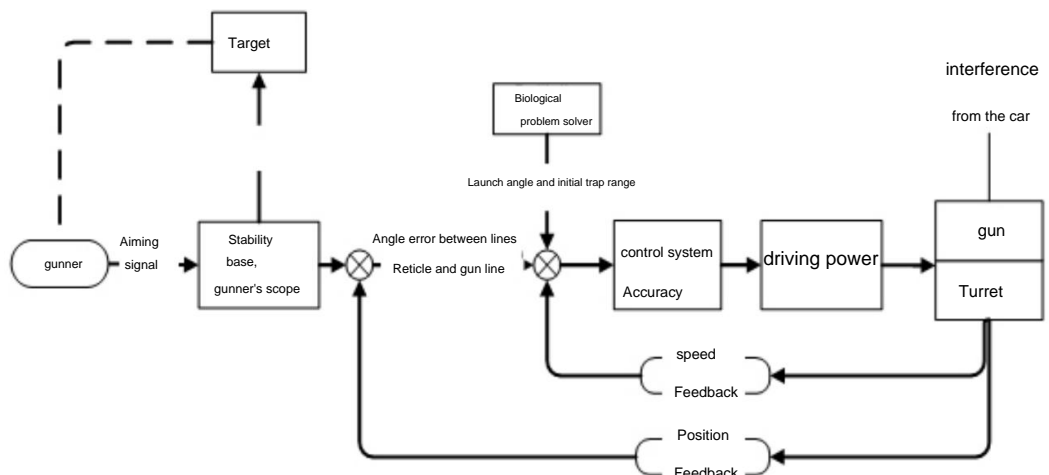


Figure 57. Stability and Aiming Module of the Stability Image Mode.
(Stabilized and tracking module of image stabilized mode)

According to the information of the selected bullet type, target distance, automatic detector (Target angular velocity Soil temperature Weather measuring device and tilt detector) and manual distance setting. (reduced initial velocity and combined corrections) The fire control computer calculates the gun's launch angle and initial intercept range along with the error angle. To be used as a signal sent to the gun control signal to allow the gun to determine the firing angle and initial intercept range. If the difference between the gun and the reticle in distance and direction is less than the limits of designated shooting frame The gun enters the frame to fire. At this time, if the gunner presses the "Firing" trigger switch on the gunner's control stick, The gun will fire immediately. The gunner's firing module is mentioned in Figure 58.

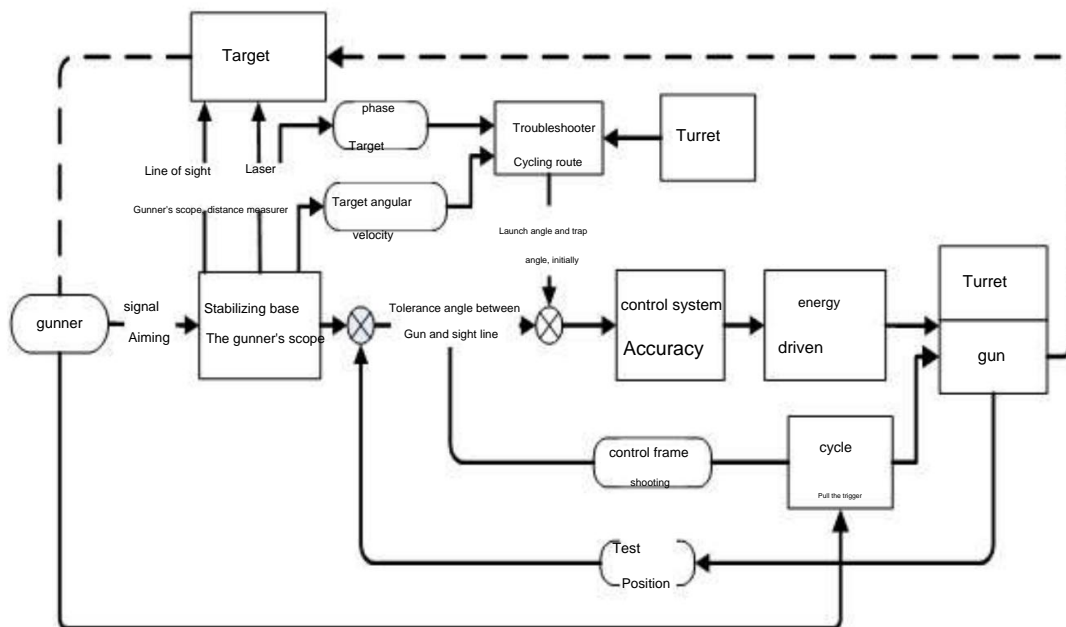


Figure 58: Module of gunner's firing

B. Shooting mode with auto-aiming and firing from gunner-aiming.

(Gunner's auto tracking aiming and tracking firing mode)

In the gunner's automatic island aiming mode The automatic island aiming module will pick up. The image signal from the CCD daytime camera or the video signal output from the thermal camera, based on the automatic islanding calculation, the islanding module tests and transmits the desired angle signal. The error comes out in both direction and distance to the aiming control circuit of the scope. Automatically aligns the reticle with the target. Other working principles It is the same as aiming and sticking by hand. The control module is referred to in Figure 59.

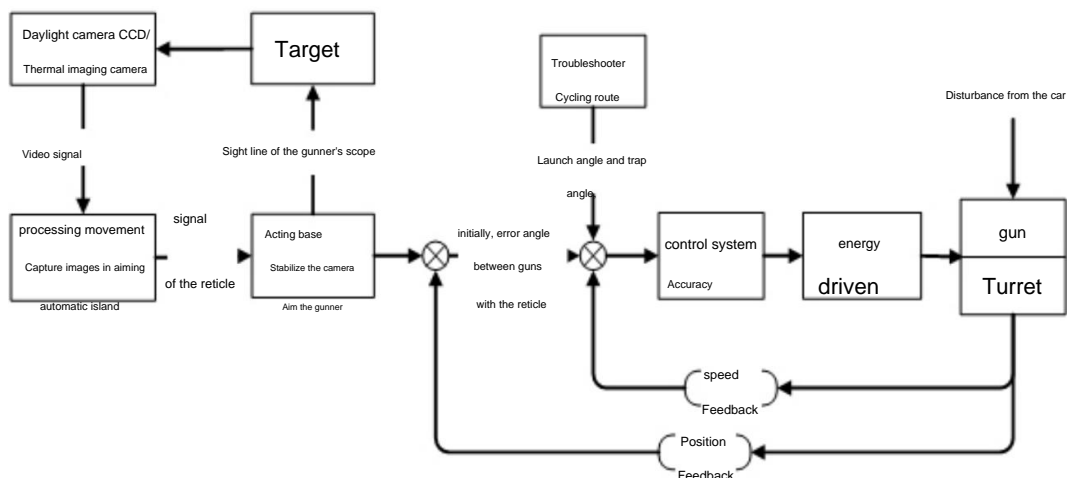


Figure 59: Module of gunner's auto tracking

C. Gunner's firing with gun.

launched missile)

While firing a guided weapon Control principles and procedures of the system It's no different from shooting with normal bullets, but selecting the type of bullet as a guided missile, then the system will Enter missile control mode while pressing the trigger switch down. The scope controls the control zone. and guide the missile fired from the cannon until it hits the target. The control mode is described in Figure 60.

When firing a guided weapon, the system slows down the reticle speed. At the same time, it blocks automatic island aiming, operator control of fire over the gunner, and target designation.

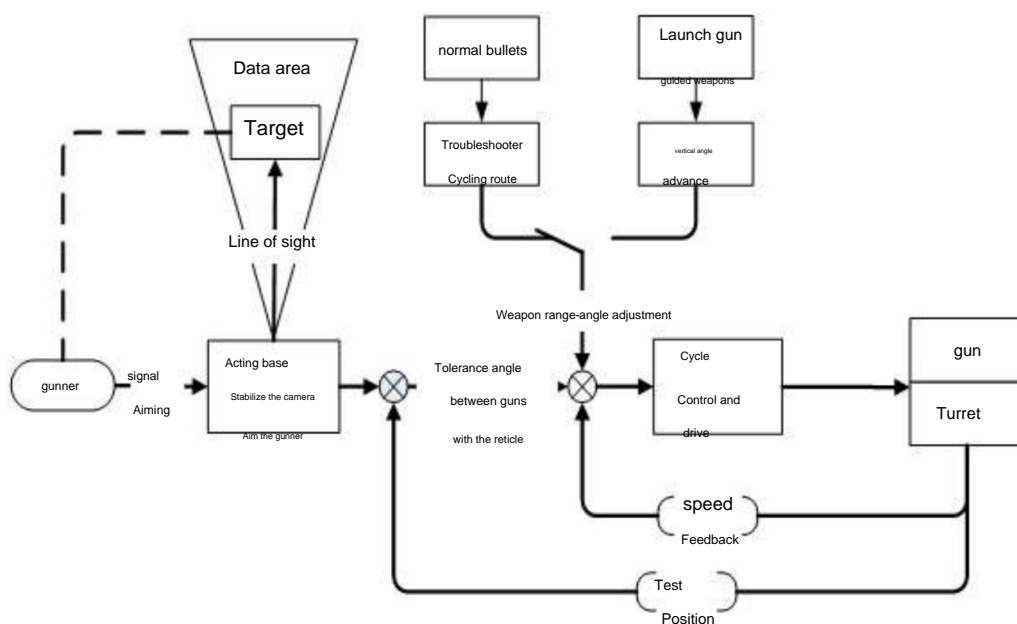


Figure 60: Module of gun launched missile control

3. Principle of shooting by the commander in the mode of controlling fire over the gunner (Principle of commander's override firing mode)

In the mode of shooting above the commander's gunner. The operator's panoramic sight will maintain balance independently. The commander surveys the battlefield and aims at targets through channels. the aim of the panoramic scope or OPERATOR'S DISPLAY AND CONTROLS. If the target moves body away from the line of sight. The operator will operate the vehicle by sending signals from the use of the engine lever. controls the operator's control and controls the line of sight to aim according to the target's movement. An error occurs between the reticle and the firing line due to the movement of the reticle. The error angle sent to the gun control system's control signal is sent to the troubleshooting unit. The road after processing is used to drive the gun to move along the sight line. If there is no aiming signal. The gun is held in a specified

position along the reticle. of the vehicle commander while the vehicle is moving. An angle shift will occur between the turret and the gun in the gap in the area of inertia that creates an angle error between the line of sight and the line of fire. due to interference from the ground wire. The angle of error drives the gun along the reticle through the Control loop of gun control system. The gyro measures the gun's rotational speed based on the current time and Feedback is created, so a cyclic action is created to keep the gun moving steadily. Module for firing the operator over the gunner. Refer to in figure 61.

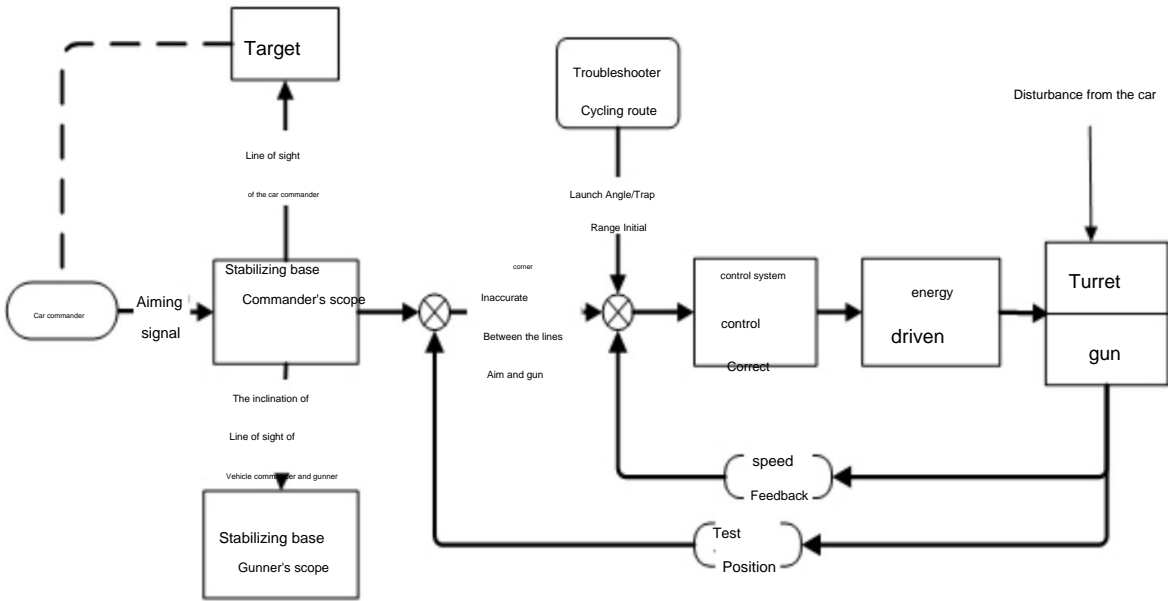


Figure 61: Commander's override firing.

Part

5: TURRET TRAVERSING MECHANISM

1. General

The turret rotating mechanism is mounted on top of the turret ring. The drive gear will engage with the gear of the turret ring to drive the turret's rotation in a 360° radius and provide the firing angle. in the direction for artillery and co-axial machine guns

2. Main performance parameters

A. Power transmission rate

By hand	1,098.4
Electrically	553

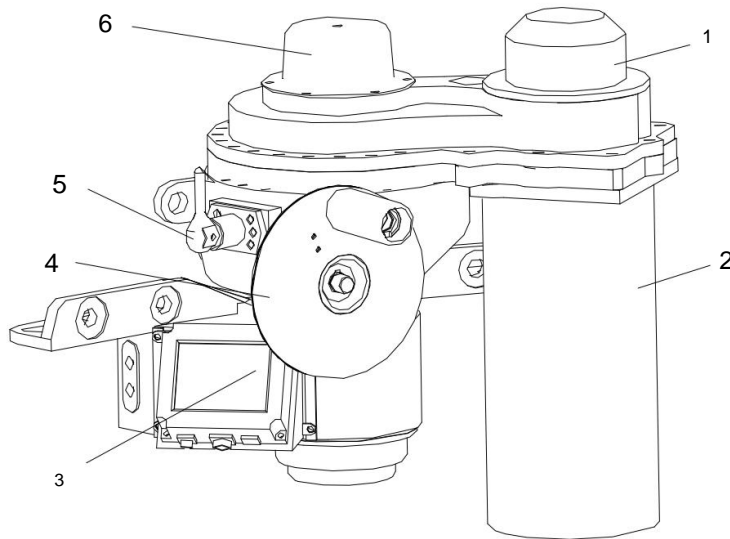
B. Safety torque range (Safety moment) 340 to 390 Newton meters.

C. Set the locking moment to 35 to 40 Newton meters.

D. Power transmission angle (Transmission clearance) 2.5 mm (measured at the mouth of the gun barrel)

3. System composition

The turret rotating mechanism consists of an electromagnetic clutch (1), a rotating motor (2), a directional angle device (3), a rod. Manually turning the turret (4), working position changing device (5), safety clutch (6), drive gear and housing, etc. (See picture 62)



- | | |
|---------------------------|--|
| 1. Electromagnetic clutch | 4. Manual turret turning lever |
| 2. Motor driving rotation | 5. Equipment for changing working positions |
| 3. Direction angle | 6. Safety clutch (with cover that can be opened) |

determination device **Figure 62 Turret traversing mechanism**

4. Working principle

The turret mechanism can be driven electrically and manually by changing its position. Position changing devices and electromagnetic clutches When the lever position is pushed, the device changes. Working in the upper position It will be a manual working position. When the lever is in position The bottom is the electrical working position. As shown in Figure 63.

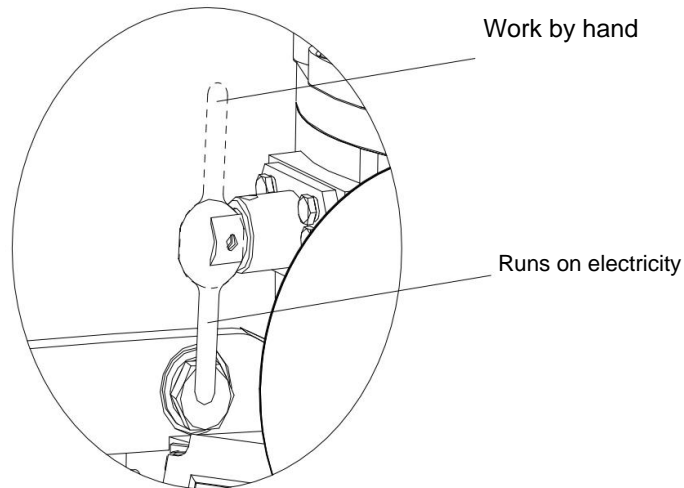


Figure 63: Change-over device

Electric propulsion is used by the following mechanism, see Figure 64.

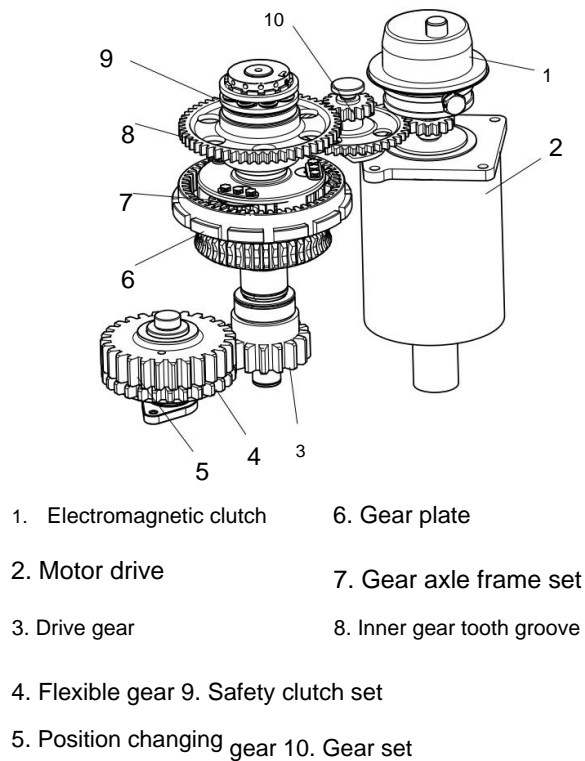


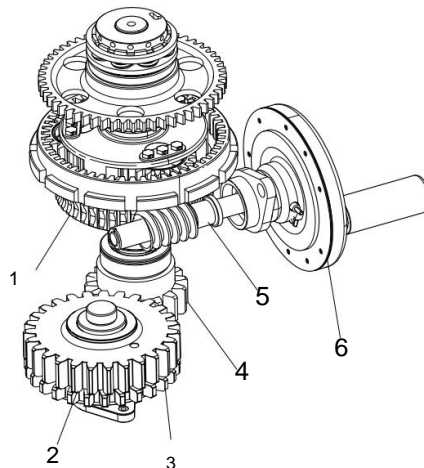
Figure 64: Principle of driving the turret rotating mechanism with electricity.

(Principle for electric drive of turret traversing mechanism)

Working principle: Turn on the SA1 switch. On the gunner's control stick, an electromagnetic clutch (1) connects power and a drive motor (2) transfers torque to the gear set. (10) through a pair of gears The gear then transfers torque to the position changing gear (5) through the inner gear tooth groove (8).) the satellite gear set in the frame of the shaft gear set (7), the gear inside the gear plate (6) and the gear body (3). Finally Torque is transferred to the turret ring for electrical drive. If there is a lot of resistance in the turret The safety clutch protects the turret mechanism from damage by the movement of the Friction disc

The power output gear of the rotating turret mechanism consists of a pair of concentric gears (4 and 5). and torque springs to limit the engagement distance of the gear teeth of the turret ring.

Turning the gun turret manually uses the mechanism as follows, see Figure 65.

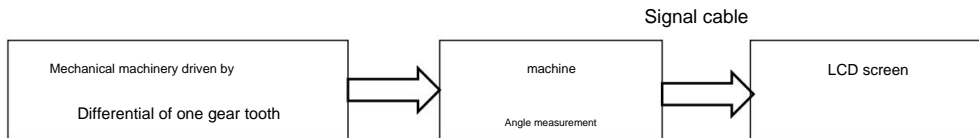


- | | |
|---------------------------|--------------------------------|
| 1. gear plate | 4. Drive gear |
| 2. Position changing gear | 5. Worm gear |
| 3. Flexible gear | 6. Manual turret turning lever |

**Figure 65. Manually driving the turret turning mechanism.
(Manual drive of traversing mechanism)**

Principle of operation: Close the SA1 switch on the gunner's control stick. The electromagnetic clutch will be demotivated and laid off. The manual turret lever (6) transmits torque to the worm gear (5). The torque is then transferred to the position changing gear. (2) through the worm gear and drive gear (4) on the gear plate (1). Finally, the torque is transmitted to the turret ring rail. using manual movement

Operating principle of electronic direction angle setter (Operation principle of electronic azimuth indicator):



It consists of a drive mechanism with a single tooth differential. Angle meter, power cord, and LCD (liquid crystal display). The meter collects the angle signal through a mechanism. It is driven by a single tooth gear and outputs an angle signal via a signal cable. Then the angle values, the gun point outline and the tank outline are displayed on the display screen when the turret is rotated. Guns. The relative position of the turret to the vehicle is displayed on the LCD screen when aiming and firing. The directional firing angle for the main guns is displayed. A directional compass can also be used for inspection. and can adjust some specific parameters for maintaining stability in the directional angle. If necessary to set the direction angle value to be zero. Insert a 1 mm diameter steel wire into the small hole at the top of the detector and press and hold for a long time. for more than 2 seconds, then the value will return to the zero position.

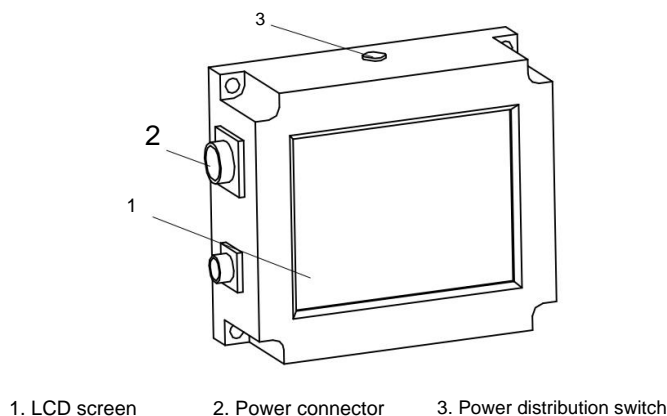
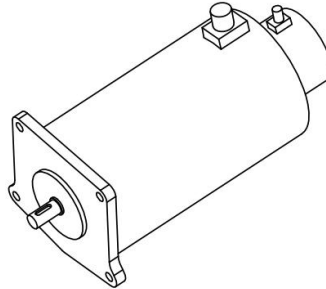


Figure 66: Profile of display screen

5. Rotation control motor (Executive motor) (mechanism for rotating the gun turret)***Figure 67: Profile of turret motor***

v. work

The motor controls the rotation of the turret. Assemble the set with the turret rotating mechanism. It is a permanent electromagnetic motor. It transmits rotational speed and torque under the control of The output voltage and current from the turret rotation drive through the turret rotation mechanism.

B. Capability

Power: 5 kilowatts (kW)

Input voltage: 270 volts (V)

Input current: 20.5 amperes (A)

Torque: 13.6 newton meters (N·m)

Rotation speed: 3,500 revolutions/minute (r/min)

Chapter 4

Automatic ammunition loading machine (AUTO LOADER)

1

Episode AUTO LOADER SYSTEM

1. General

The automatic ammunition loader (Autoloader) is an integrated system of mechanical mechanisms and Electrical equipment for automatic loading and manual loading of ammunition. Ammunition loading machine Automatic works in conjunction with a 125 mm tank gun and cannon with separate ammunition. Automatic ammunition loaders perform the function of automatic loading of ammunition. Loading ammunition semi-automatic Emergency reloading Loading/unloading ammunition and loading Manual bullet At the same time, there is also the function of checking for errors. Carry out work mode and display the ammunition loading status and failure information through the ammunition loading control box screen. The gunner's control panel can display relevant information and recognize communications between the gunners. and automatic ammunition reloading system

2. Main performance and parameters

Reload rate	7 - 9 shots/minute
Supported bullets	Armor-piercing rounds (APFSDS), anti-tank grenade rounds (HEAT), Explosive Ammunition (HE), Guided Weapons (Gun-launched missile)
Number of bullets carried in the rail	22 rounds (including 4 guided missiles stored in the storage compartment
carrying ammunition	Special ammunition: The remaining 3 types of ammunition are stored in the compartment. general ammunition storage)

Bullet reload angle, working type	Elevation angle: 4°30' Automatically loads bullets. Loading ammunition semi-automatic Loading/unloading ammunition, loading emergency ammunition The commander reloads the ammunition. Automatic manual reloading
-----------------------------------	---

capability	Left and right tilt angle ±15° (bar can be closed
Loading bullets into the magazine (Loading adaptability)	The machine can be closed manually when the angle of inclination to the left is greater than 8° if the soil delivered with the casing becomes stuck during packing. fire when tilting to the left and right. The crew Jams can be cleared manually.)

Automatic ammunition loading machine can work normally	When the tank moves at a speed of ≤ 25 km./hr. on Roads with moderate undulations or potholes
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Time taken to load ammunition Loading 22 rounds of ammunition takes 5 - 6 minutes.

Ammunition loading mode Automatic reloading of ammunition is controlled by computer or handloading ammunition.

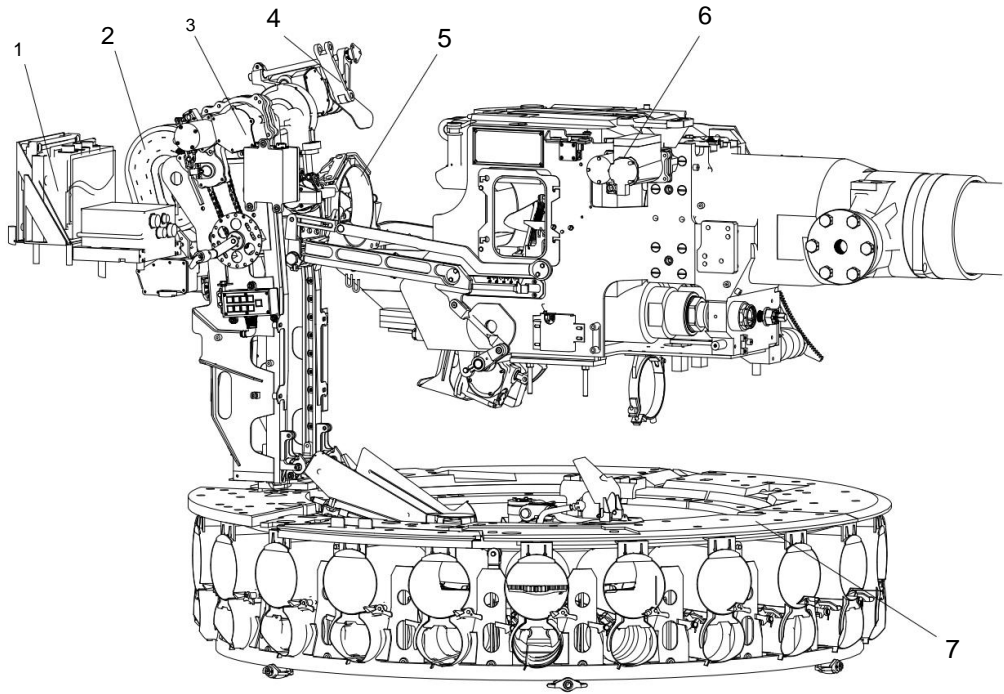
3. System composition and principle

A. System Composition

The automatic reloading system consists of the following secondary components (Figure 1):

A chain that pushes bullets into the chamber (2), a pulley for lifting the bullet storage compartment (3), a mechanism for opening the window for selecting the casings for delivery (4), a machine that ejects the casings. Delivery (5), artillery lock (6), ammunition rail (7), equipment

Collects data signals and drive gears and control cables, etc.



1. Data signal collection device and gear. 2. Chain that pushes

bullets into the chamber. 3. Pulley to

lift the bullet storage compartment.

4. Window opening mechanism. Copy the soil cover and send it.

5. Machine for ejecting soil casings

6. Artillery lock device

7. Ammunition rail

Picture 1: Automatic ammunition loading machine (Auto loader)

1) Data signal and gear collection device: receives position and sequence signals.

Commands all parts of a mechanical device and sends information to trigger operations.

2) Chain that pushes bullets into the chamber: Used for pushing bullets and clay along with their casings into the chamber.

3) Pulley for lifting the ammunition storage compartment: Used for lifting the ammunition storage compartment up to align with the bullet pressure line.

The bullet enters the chamber. The line pushes the soil casing into the fire port. or the way of carrying ammunition

4) Mechanism for opening the clay casing window: used for opening and closing the clay casing window.

5) Ejector: Used for catching the ejector that is held back from the magazine after firing. and ejected the casing from the turret.

6) Cannon locking device: used for locking the cannon in the line of the reloading angle. 7)

Ammunition rail: used for storing 22 rounds of ammunition and moving for loading. Save the storage space. Bullets of the type desired by the gunner go to

the exit port. There are two tension devices installed on both sides of the bottom

of the pulley. Used for fixing the position of the pulley relative to the ammunition rail. and pull out the exit part of The shell on the base rotates upward to smoothly pass through the

chamber. The tension device is a mechanism with a left-hand and right-hand thread. and can be adjusted tightly It can be raised or lowered by turning the threaded sleeve. Both ends are attached to the hinge with a storage hoist. Ammunition and ammunition

rail base respectively. B. Operating principle in

automatic ammunition loading mode. When the gunner presses the automatic reload button, the machine loads Auto Ammunition automatically completes the process of loading the bullet into the chamber.

First, the cannon moves upwards to the reload angle and the gun lock locks the cannon to the reload angle. The ammunition rail rotates to a specified position and is Brake and stop at that position. Then the soil casing ejector will lift up. When the cannon is in the magazine loading corner, the Hoister lifts the ammunition chamber. Go up to the ball container line. The bullet and bullet pusher chain push the bullet into the chamber. Delete information about loaded bullets. The bullet is cocked into the magazine and the magazine release chain retracts it to its original position. After the casing selection window opened, the empty casing was ejected from the turret. The shell selection window closes and the chain pushes the bullet into the chamber. The ammunition chamber lift pulley is lowered until the gun is loaded with the casing. In the packing line The dozer chain is delivered with the sheath into the chamber. and the chain will withdraw back to its position. Initial position The magazine pulley and magazine ejector return to their original positions. The cannon is unlocked and returned to its original firing position. Automatic working diagram (see Figure 2) Below shows the control principles of an automatic reloading machine. 1) Lifting the cannon (Gun

laying) to the loading angle and locking the gun. big

When the automatic reload button is pressed on the gunner's control unit. Gun raising signal The cannon is sent to the gun stabilization system and the cannon is raised to the loading corner. and hydraulically locks the cannon at the loading angle.

While moving the cannon to the reloading point, The motor of the cannon locking machine It works to extend the locking pin and press on the surface of the cannon safety panel. When locking the cannon at the loading angle Once the bullet is fired, the cannon lock will send a signal (K1) to cut off the motor. At the same time, the cannon will move slowly within the range. The loading angle is determined after a short hydraulic lock of the gun when the gun lock shaft pin is inserted into the gun's mounting bolt hole on the cradle. Under the force of the leaf spring, the cannon is mechanically locked at the loading angle, which now changes the hydraulic lock signal (K3) of the gun lock. Large to lock the cannon hydraulically. It locks the cannon both mechanically and hydraulically.

2) Rotation, braking and stopping of the ammunition rail. When

pressing the reload button The ammunition rail locking electromagnet will be actuated. Activate and turn on the electromagnetic unlock signal (K1) to unlock the ammunition rail. at the same time The ammunition rail motor works to drive the ammunition rail to rotate.

When the ammunition rail turns The shaft of the bullet positioning device sensor. (Magazine identifier) will start simultaneously. When the selected bullet chamber approaches the bullet exit (at a distance of 1 bullet chamber before the bullet exit), the computer brakes the rail. truck The bullet follows the signal of the bullet locator and the computer controls the amount of time the braking takes. After this time has elapsed, The ammo rail will start rotating again. When the ammo compartment Selected has reached the exit of the bullet. The computer unlocks the truck rail electromagnet. Bullets follow the signal received from the bullet positioning device. and the leaf springs will push the lock shaft latch to press. onto the wall inside the top rail of the ammunition rail. Meanwhile change unlock signal The electromagnet (K1) opens the low speed circuit. The ammunition rail rotates at low speed when the locking shaft pin is inserted into the locking hole of the top rail. Replace the electromagnetic lock signal (K2) and The ammunition rail will stop rotating.

3) Lifting of the case ejector frame after the cannon is locked. The casing ejector motor

will work to start lifting. Frame of soil ejector Then the frame of the soil casing ejector will lift up. after crisp The soil casing ejector has lifted the body to its position. The lift-to-position signal (K2) will change to deactivate the motor. Finished lifting the frame of the soil casing ejector.

- 4) Lifting the ammo tray to the ammo loading position .

projectile ramming position)

When the ejector frame is raised and the cartridge rail stops rotating and is locked, the cartridge hoist electromagnetic lock operates to release the hoist into position. at Set to turn on the motor to lift the ammunition chamber. Then the pulley will start to lift the storage compartment.

ammunition

When the catcher and ammunition storage compartment are raised to the bullet loading position, the pulley at the bullet loading position signal is changed to demagnetize. Electricity and Activate the low speed circuit of the pulley. Then the pulley will move slowly. When the pulley's locking pin shaft If the pulley is inserted into the groove of the locking plate, the pulley will be locked. The pulley motor will now be cut off. and the bullet is raised to the loading position.

- 5) Pushing the bullet Clearing data and the withdrawal of Sojdan Ammunition.

(Ramming of projectile, de-memorizing and withdrawing of ramming chain)

Pushing the bullet into the chamber with the bullet push chain is divided into two steps. First, the bullet is pushed into the chamber first. After the chamber is raised to the loading level and loaded, the propeller chain motor operates to push the bullet into the chamber. When the propeller chain pushes the bullet, stretch out The start signal of the bullet push chain (K2) is changed. The pulley is locked to prevent malfunction Meanwhile, Sojdan Ammunition was preparing to withdraw. When the

bullet is pushed into position in the chamber, Will change the chain position signal, push the bullet (K1) to cut off the motor of the bullet push chain. while the control system deletes the data. Where this ammunition is stored After deleting data The circuit instructs the motor to rotate in reverse to cause the chain to push. The bullet returns to its original position. Change the bullet push chain starting position signal (K2) to cut off the bullet push chain motor operation. and supply electrical power to the electromagnet Then unlock the pulley.

- 6) Opening the window to select soil for delivery. Ejecting the soil cover and closing the selection window

Ejecting window opening, case ejecting and window closing)

As the bullet is pushed into the chamber. Motor of window opening mechanism Copy the soil and send it to work. When the window has opened to the position The window signal has reached the open position.

(K2) will be changed to cut off the motor of the window opening mechanism and Activate the electromagnet to eject the earth sheath. At this time, the locking shaft latch of the ejector The grounding sleeve releases the twist shaft of the sleeve ejector. and the empty clay casing will be ejected with a casing ejector. After the empty clay casing has been ejected, The circuit commands the motor to rotate in reverse of the mechanism. Opening the soil selection window will work. The window will then close. As the window is closed into position, a signal to the window opening mechanism is sent when the window is closed. The remaining position in the closed position (K1) is switched to deactivate the motor of the window opening mechanism.

7) Lowering the pulley to the position of loading soil and delivering it together with the casing. Earth pushing ready Casing into the chamber and withdrawing the chain back to its starting

position. After the bullet is pushed and the bullet pusher chain is retracted, the pulley's electromagnet is actuated to unlock the pulley. When in position Circuit to control motor rotation Reversing the direction of the pulley will work. and the ammunition storage compartment will move downwards When the soil storage box is ready The casing is close to the filling line. The earth channel hoist signal sent with the sheath in position (K2) is changed to release the hoist electromagnet and cut into the low speed circuit of the hoist. Hoist motor Then the motor The pulley will rotate at a low speed. When the locking shaft of the pulley is inserted into the grounding groove with the bushing, (Cartridge tray notch) of the locking plate. The pulley is locked. The motor of the bullet pusher chain drives the chain and pushes the cartridge along with the casing into the chamber. When the dozer chain

is delivered with the sheath into position in the chamber Below the edge of the end plate of the casing It will move against the sleeve retainer and close the end machine shaft. Disable the contacts. KS end machine rod, the reverse rotation motor circuit of the bullet push chain will work. and the bullet pusher chain will retract when the bullet pusher chain returns to its starting position. The initial position signal of the bullet push chain (K2) is changed to deactivate the bullet push chain motor and electromagnet. So the pulley will be unlocked.

ŷ) Returning to the starting position of the pulley and ejector frame.

After pushing the soil and sending it with the casing into the port. The pulley will be unlocked with Open the motor cycle. and the ammunition storage compartment catcher (Catcher) will be lowered along with the compartment. Pick up empty ammo. When the holder moves away from the soil packing line, it is delivered with a sleeve. The transmitter earth position signal with casing (K2) is changed to open the motor circuit, reverse rotation of the transmitter earth casing ejector motor, then the ejector frame. The ground cover will begin to move down. The starting position signal of the earth-casing ejector (K1) will change to deactivate the earth-casing ejector motor. When the channel holder Keep the ammunition close to the starting position. The pulley initial position signal (K4) is changed to release Pulley electromagnet The locking shaft pin presses and slides on the locking plate. at the same time cycle The low speed of the hoist motor will work. When the locking shaft latch slides and inserts into the notch of the locking plate, the pulley is locked. At this time, the electromagnetic signal of the pulley (K1) changes and cuts out.

Motor operation of the pulley

9) Unlocking and returning to the starting position of the cannon

When the earth casing ejector frame is lowered to the starting position Position signal The start of the ejector disables the gun locking device's motor and the lockshaft latch withdraws to unlock the cannon. When the latch withdraws Gun lock device signal

K3 and K2 will change in sequence. Disable the gun locking device motor and release the cannon hydraulic lock.

The cannon will then return to position. Determine the initial shot aiming by Automatic and ready to fire

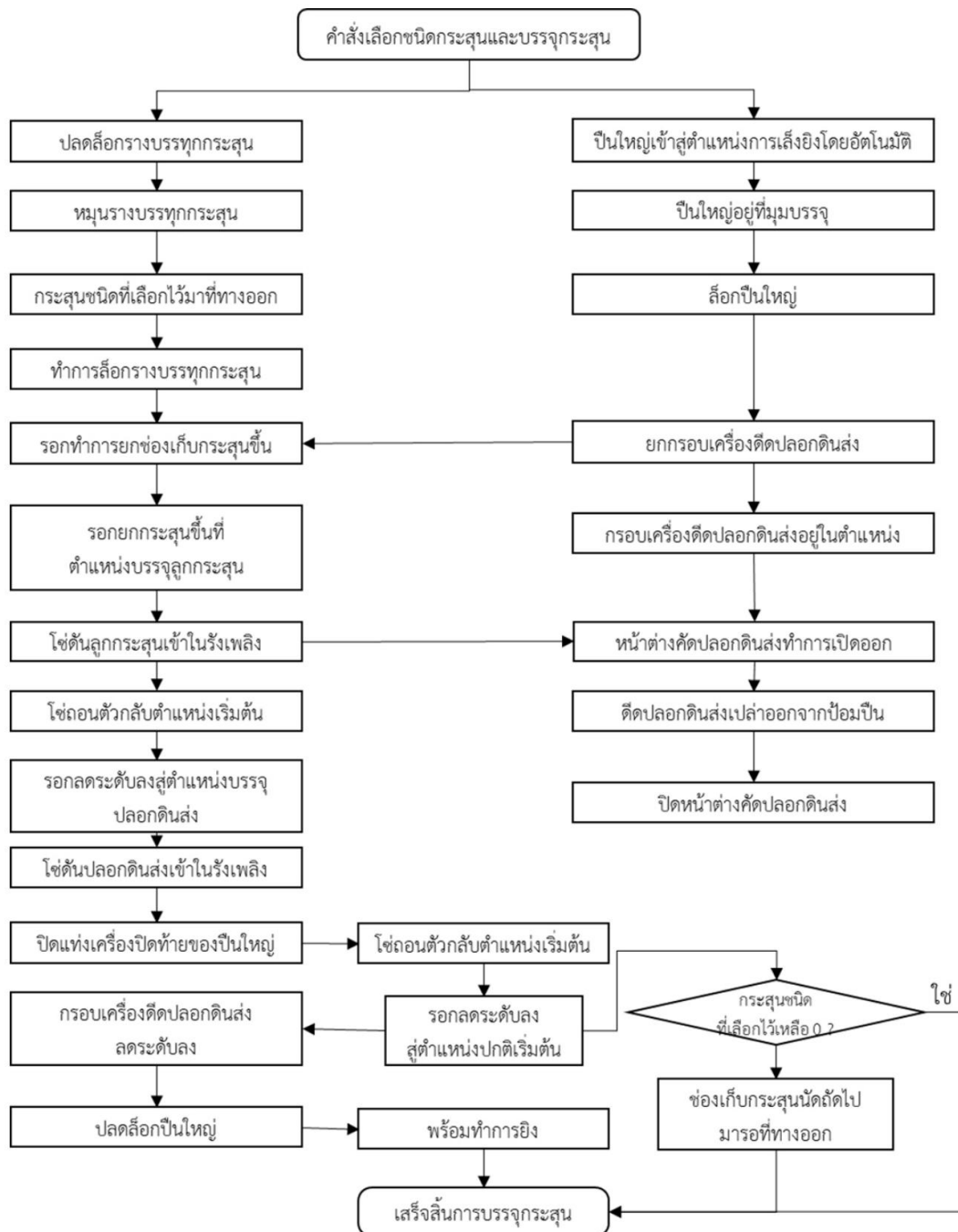


Figure 2: Working diagram of the automatic ammunition loading machine.

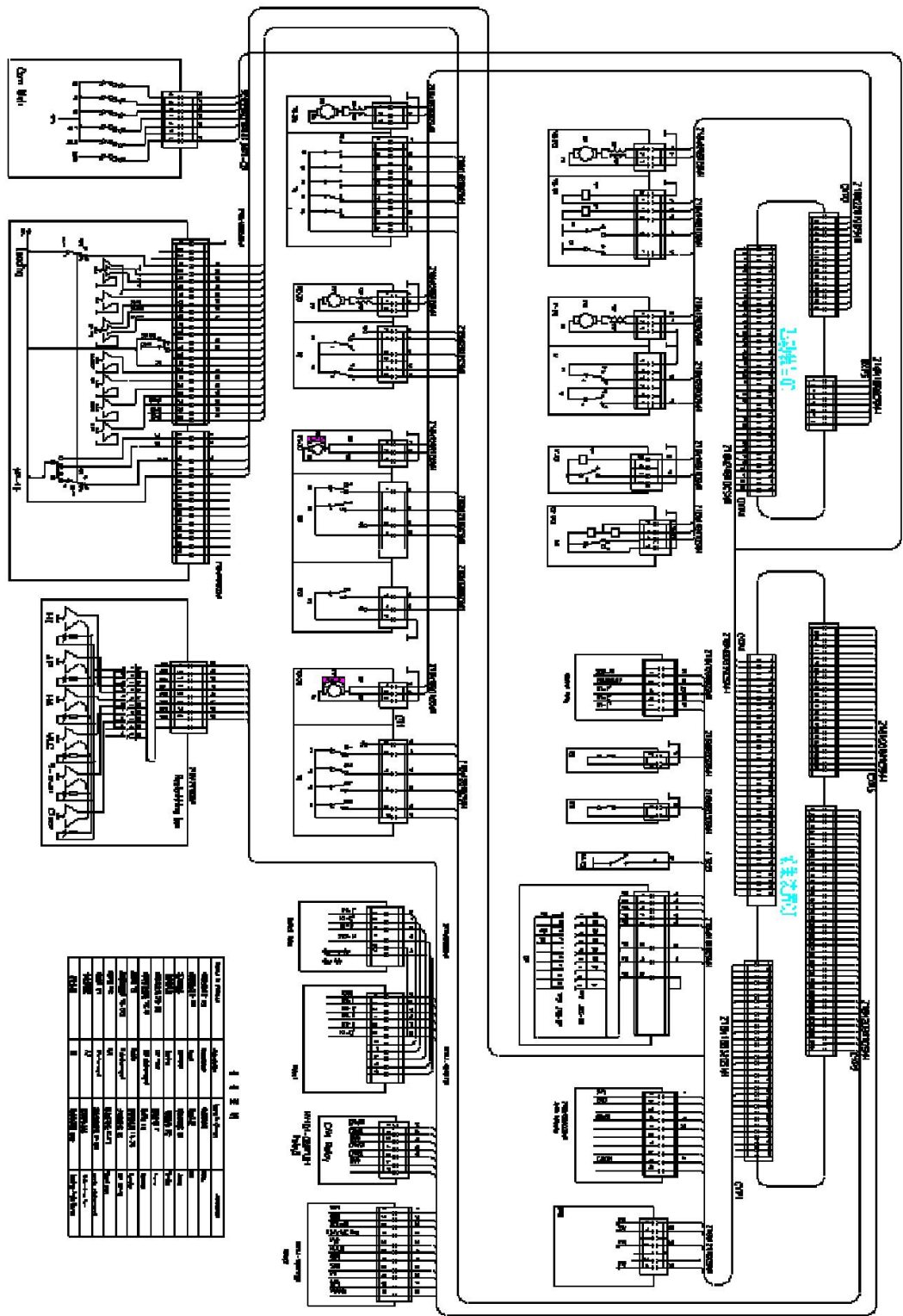


Figure 3: Wiring diagram of autoloader.

Part 2

GUN LOCKING DEVICE

1. General

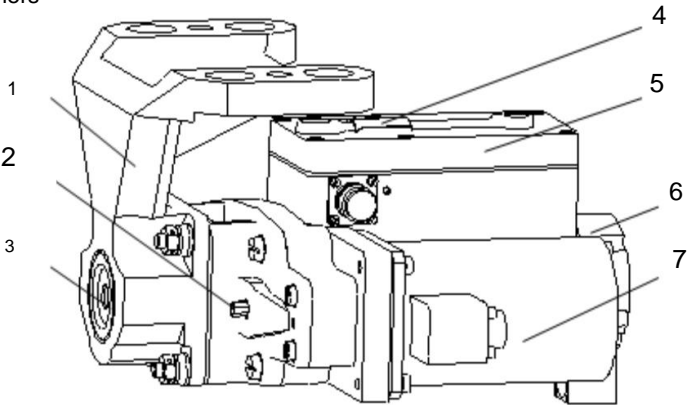
The gun locking device is mounted on the right front of the turret. Serves to lock the cannon at the loading angle.

4°30' bullet while autoloading Semi-automatic ammunition loading and
ejecting empty shell casings

2. System Composition and operation principle)

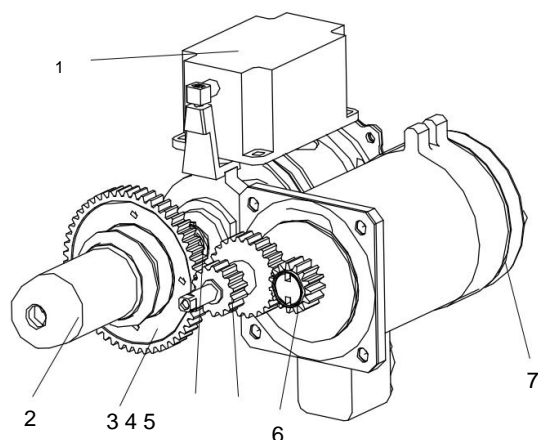
A. Main structure of the system (Refer to picture 4)

The gun locking device has main components: the gun locking pin (1), the gun locking shaft pin (3), the square shaft (2), the switch box (5).), special wrench (4), signal detector K3 (7) and
Driving equipment, others



- | | |
|----------------------------|--------------------------------------|
| 1. Fixing legs | 5. Switch box |
| 2. Square shaft | 6. Lock signal detector
hydraulic |
| 3. Cannon lock shaft latch | 7. Motor |
| 4. Special wrench | |

Figure 4 Gun locking device

B. Drive device of gun locking device

- | | |
|----------------------------|----------------------------|
| 1. Level measuring device | 5. Power transmission gear |
| 2. Cannon lock shaft latch | 6. Motor gear |
| 3. Gear | 7. Motor |
| 4. Threaded shaft | |

Figure 5. Working principle of gun locking device.

The driving part of the gun locking device consists of two sets of gears and a pair of shaft drives.

Thread-Panth

Motor (7) drive motor gear (8), motor gear (8) power transmission gear (5), motor (7) gear The driving force (3), together with the nut, drives the threaded shaft (4) to move in a straight line. The cannon lock shaft pin (2) is connected to the threaded shaft (4) with threads, driving the cannon lock shaft pin. (2) Move and extend with the threaded shaft (4).

The square shaft on the left side of the PTO gear extends from the housing. Use a special wrench.

Tighten the square shaft so that the cannon locking shaft pin (2) can be extended or retracted.

C. Switch box

The level detector is installed inside the switch box. Consists of a control unit Gun lock position signal with hydraulic lock signal measuring device mounted at the end. of gun locking devices by following the retractable movement of the locking pin (2) the output shaft switch of Two measuring devices provide signals to control the extension (or retraction) of the locking latch. The position signal of each switch:

K1: Position lock signal; K2: Unlock signal; K3: Signal
Hydraulic lock

Part 3

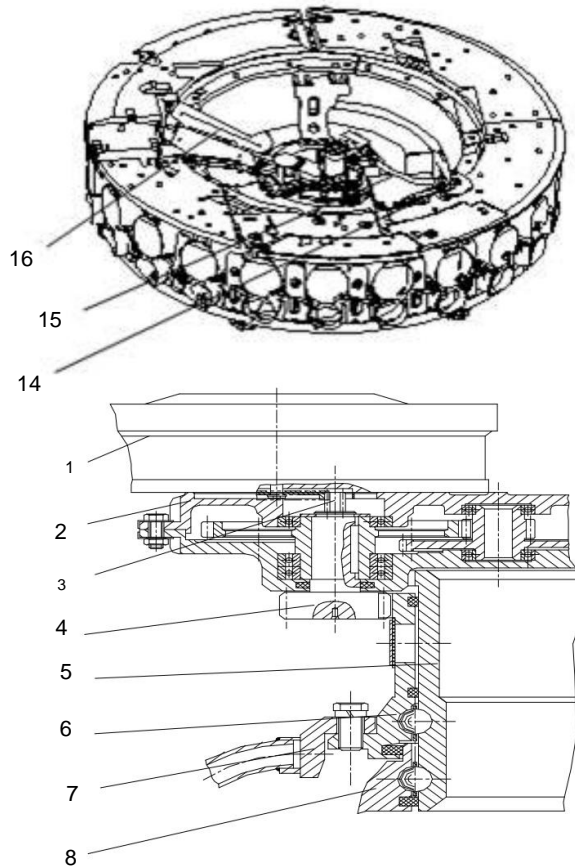
Ammunition rail (CAROUSEL MAGAZINE)

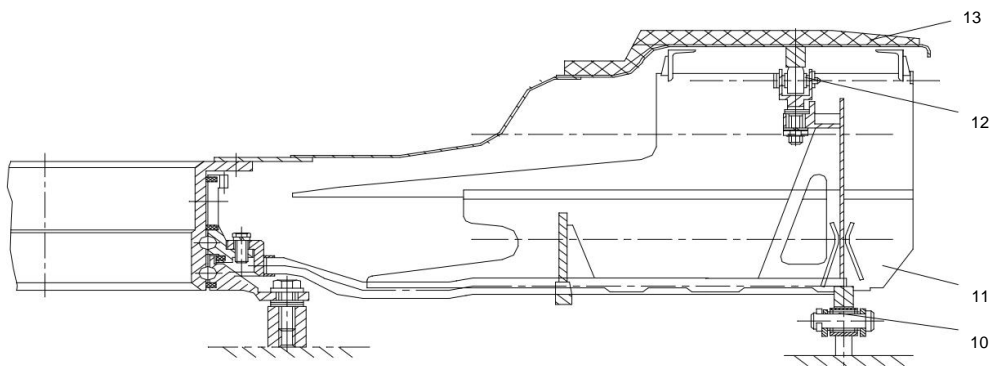
1. General (General) The

ammunition rail is installed on the floor of the tower room. It stores 22 rounds of ammunition, an automatic ammunition rail and delivers the selected ammunition to the ammunition exit.

2. System Composition and operation principle)

The ammunition rail has main components: ammunition storage compartment (11), rotating ammunition rack (7), rotating base (13), manual release arm (14), motor reduction gear. router (2), manual rail turning system, roller device (5), support wheel (12) and locking device, etc.

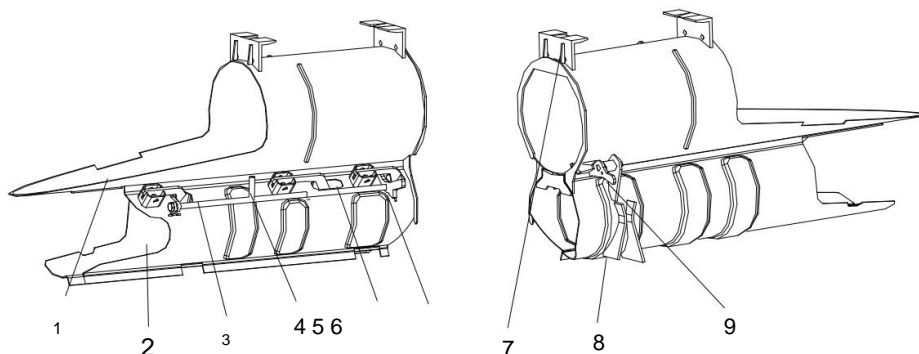




<p>1. Bullet type positioning device</p> <p>2. Motor reduction gear</p> <p>set 3. Output gear of the positioning device</p> <p>Bullet type</p> <p>4. Output gear of the truck reduction gear</p> <p>ammunition</p> <p>5. Wheel covers</p> <p>6. Upper ring</p> <p>7. Rotating ammunition rack</p>	<p>8. Lower ring</p> <p>9. Installation base</p> <p>10. Support wheels</p> <p>11. Ammunition storage compartment</p> <p>12. Receiving wheel</p> <p>13. Ammunition rail base</p> <p>14. Release lever</p> <p>15. Ammunition rail swivel</p> <p>16. Bullet exit port</p>
---	--

Figure 6: Ammunition rail

a) Ammo tray



1. Soil storage compartment delivered with casing

2. Bullet storage compartment

3. Armor-piercing bullet holder 4.

Bullet holder release lever

5. Request to confiscate anti-tank grenades.

6. Request to hold the explosive ammunition.

7. Request to lift the ammunition storage

compartment. 8. Lead steel plate.

9. The earth protection sheet is delivered with a casing.

Figure 7 Ammo tray

The ammunition storage compartment is used for bullets and propellant, delivered with casings. Contains channels

Bullet storage (2) and soil storage compartment with casing (1) are welded together and the lifting hook

Ammunition storage compartment (7) is welded at the top. It is also equipped with a release lever for securing the bullet

(4), a guide steel plate (8), and a protective earth plate with a sleeve (9) used for loading the bullet into the loading rail.

Bullets and 3 mounting hooks (3,5,6) for securing 3 types of bullets respectively.

There are a total of 22 ammunition compartments arranged on rotary shelves. Ammo compartment

Restricted by vertical barriers on the rotating rack. Four yellow ammunition storage compartments are for guided

weapons only. and can carry only guided weapons and explosive shells.

When the ammunition chamber rotates within the ammunition rail and is lifted onto the loading line, With the pulley lift the ammunition compartment. The bullet and the shell are always held together by hooks (3, 5, 6) and the shield (9). Loading steps Automatic, first step, hoist to lift the storage compartment The bullet rises to the loading line. At this time, hooks (3, 5, 6) are used to secure the bullet in the storage compartment. The bullet is released by a bullet release stop on the pulley. When the bullet has been unlocked The bullet push chain can push the bullet. After Souj pushes the bullet out of the ammo chamber and already loaded into the port The pulley lowers the bullet chamber and makes the chamber ready. The casing is now at the loading line. The earth shield delivered with casing (9) is unlocked with the release stop plate. The soil is delivered with a casing on the pulley. In order to be able to push the soil for delivery along with the casing out of the soil storage compartment.

b) Rotary base

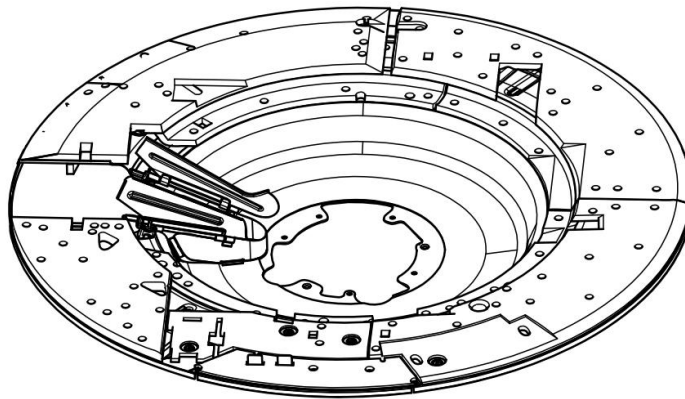


Figure 8. Rotary base . The base of the

bullet rail (13) (see Figure 19) is also connected to the cylindrical roller. Bolt on center section and is supported by the support wheels (12) of the shelf (7) at the edge. Its main function is as a support plate for the bottom of the loft. battle

On the base of the ammunition rail There is a motor reduction gear set (2) of the ammunition rail and Bullet-type positioning device (1) Bullet-loading rail rotating lever Some ammunition and machine gun ammunition, etc., are mounted on top of the ammunition rail.

At the rear of the base of the ammunition rail. There is an ammunition exit door (16). This door opens automatically when the ammunition storage hoist is raised by the pulley, and the door closes after the pulley pushes. The ammunition compartment returns to the ammunition rail. These functions are mechanically interconnected. The exit door is normally closed to prevent objects from falling into the ammunition chute.

c) Rotary shell rack

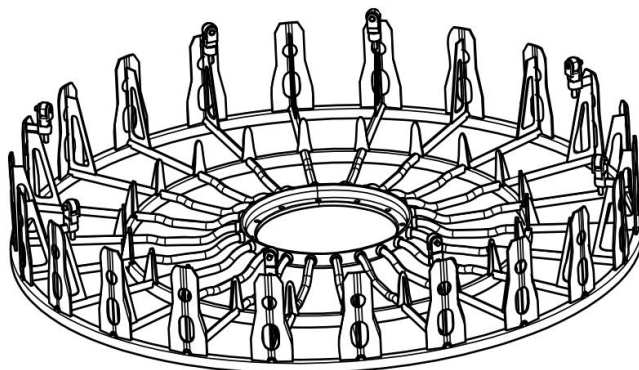
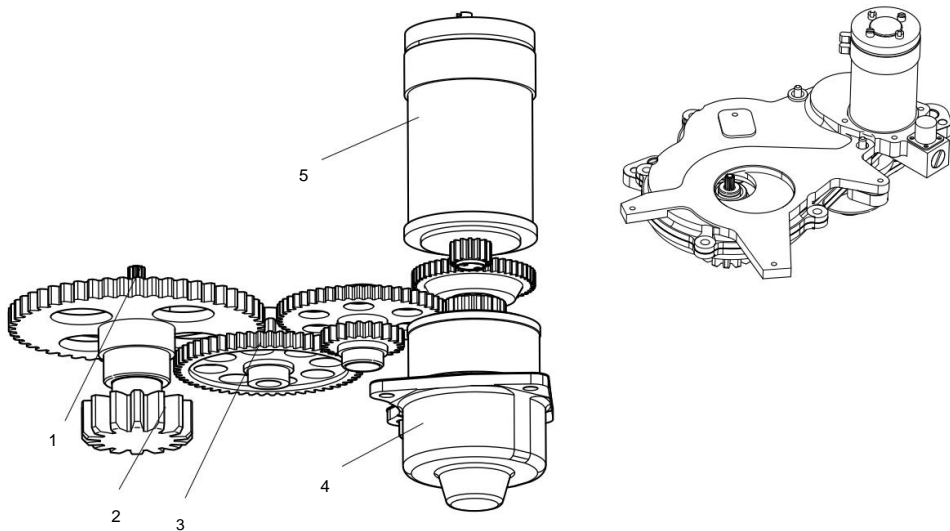


Figure 9 : Rotary shell rack

The rotating ammunition rack (7) is a spoked structure divided into 22 compartments for 22 ammunition storage compartments. The inner ring is welded. It is connected to the upper rail (6) with bolts and the outer ring is supported by rollers (10) mounted on the lower armor plate of the body. car Ammo rack The rotary chamber stores the ammunition chamber and sends the selected chamber to the exit in while the ammunition rail was rotating

d) Motor reduction gear set

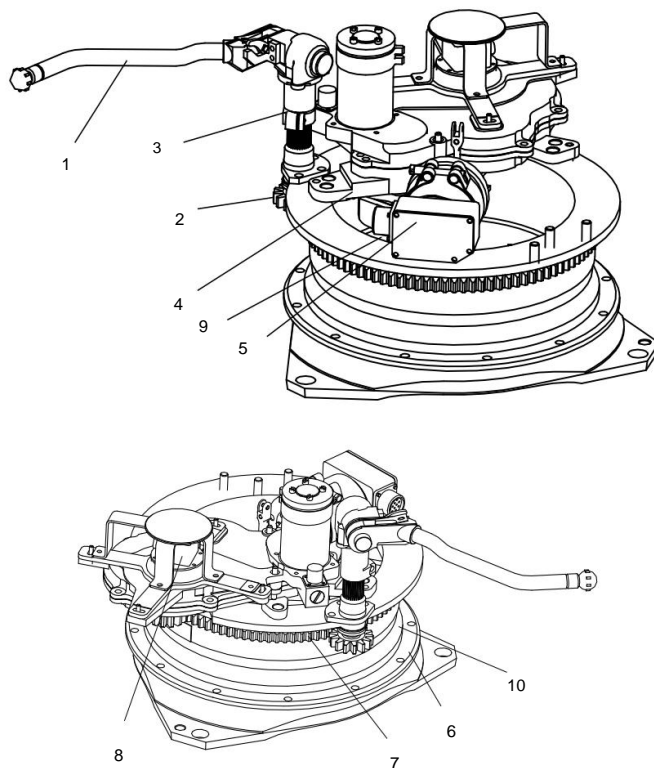


- | | |
|------------------------|-----------|
| 1. Spur gear sends PTO | 4. Buffer |
| 2. PTO gear | 5. Motor |
| 3. Drive gear | |

Figure 10 Motor reduction gear set

The motor reduction gear is a 4-stroke drive reduction device. The main components are It consists of a motor (5), a buffer (4), a drive gear (3), a PTO gear (2), and a spur gear. power output (1), etc. The bottom of the PTO gear (2) is connected to the ring gear of the upper rail to Drives and rotates the ammunition rack mounted on the top rail. Thus causing the ammunition rail to move. Can rotate about the center point (such as rotating the rail to load ammunition Canceling the loading of ammunition and loading) at the top of the reduction gear Spur gear transmitting power (1) connected to gear Bullet-type positioning device To drive a bullet-type positioning device. according to the rotation of the floor Drop your bullets together.

e) Roller device



1. Ammunition rail swivel

2. PTO gear

3. Rail swivel connecting rod

4. Motor reduction gear

5. Electromagnetism

6. Lower ring

7. Upper ring

8. Bullet type positioning device.

9. Rubber support

10. wheel cover

Figure 11: Roller ***device and manual driver device***

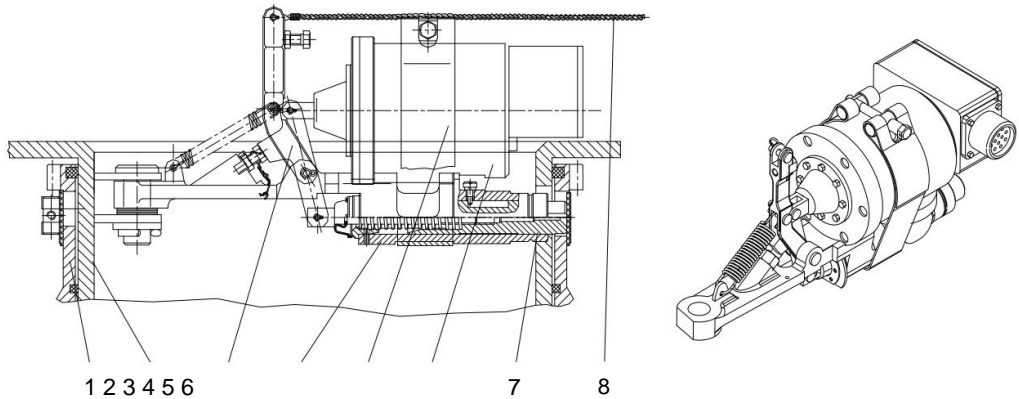
The rail swivel device is mounted in the center of the rail on every cartridge (see Figure 6). All parts and assemblies of the rail are connected to the rail. Collage them together using Ammunition rail rotating device Rail rotating equipment It is the main supporting part of the ammunition rail. and performs the main function of rotating the ammunition rail. Rail rotating equipment There are main components: Wheel cover (10), upper ring (7) and lower ring (6).

At the top of the upper ring gear (7) (see Figure 11), the outer gear tooth is connected to PTO gear of the motor reduction gear (4); 22 locking holes spaced along the circumference. are equal and are used to lock the ammunition rack and ammunition exit when the ammunition moves into position. set. The lower part of the upper ring is connected to the ammunition rack, and the inner part is integrated with The protective cover (10) passes through the roller. The lower ring gear (6) connects to the protective cover (10) through the roller. At the same time, the ring gear The lower part (6) is mounted on a base which is connected to the lower armor plate of the body. car with bolts The motor reduction gear (4) is installed on the protective cover (10) with bolts and The bullet-type positioning device (8) is mounted on the motor reduction gear (4) with a bolt.

f) Manual drive device

The rail swivel lever is used to manually rotate the ammunition rail. The rail swivel connecting rod (see Figure 11) has the main component of the ammunition rail swivel (1) (with a gear with a spring attached to it. one-way rotation - ratchet) rail-turning rod (3) (including a gear with a spring that allows one-way rotation and double bevel gear), PTO gear (2) and release lever; The PTO gear (2) is connected to the teeth. outside of the upper ring gear (7). To rotate the ammunition rack manually, first Pull up and hold the release lever (this release lever is connected to the loading rail's locking electromagnet). ammunition with a steel wire running through a pulley), then move the ammunition rail lever (1) up and down. The above method involves turning the ammunition rail manually.

g) Locking device of ammo tray



1. Upper ring

5. Clamp on the electromagnetic housing.

2. Roller track

6. Electromagnetism

3. The linkage to the lock house.

7. Latch lock

4. Lock housing

8. Steel wire

Figure 12: Locking device of ammo tray

The ammunition compartment locking device is mounted in the middle of the protective housing.

(See Figure 11 and Figure 12) and receives commands to lock or unlock the ammunition storage shelf.

The ammunition chamber locking device (see Figure 12) has main components: an electromagnet (6), a lock pin (7), and a lock housing (4), etc. n

Electromagnet (6) consists of two electromagnet units (large and small) on the back of both electromagnetic units There will be touch switches K1 and K2 installed.

Part 4

Hoist for lifting ammunition storage compartment (HOISTER)

1. General _

The hoist for lifting the ammunition compartment (Hoister) is installed on the back of the cannon. The top of the pulley is fixed in place.

Turret support arm and the lower part is connected to the rotating base through a tension device. Main function of the pulley to lift the ammunition storage compartment is to raise and lower the ammunition compartment to the ammunition loading position.

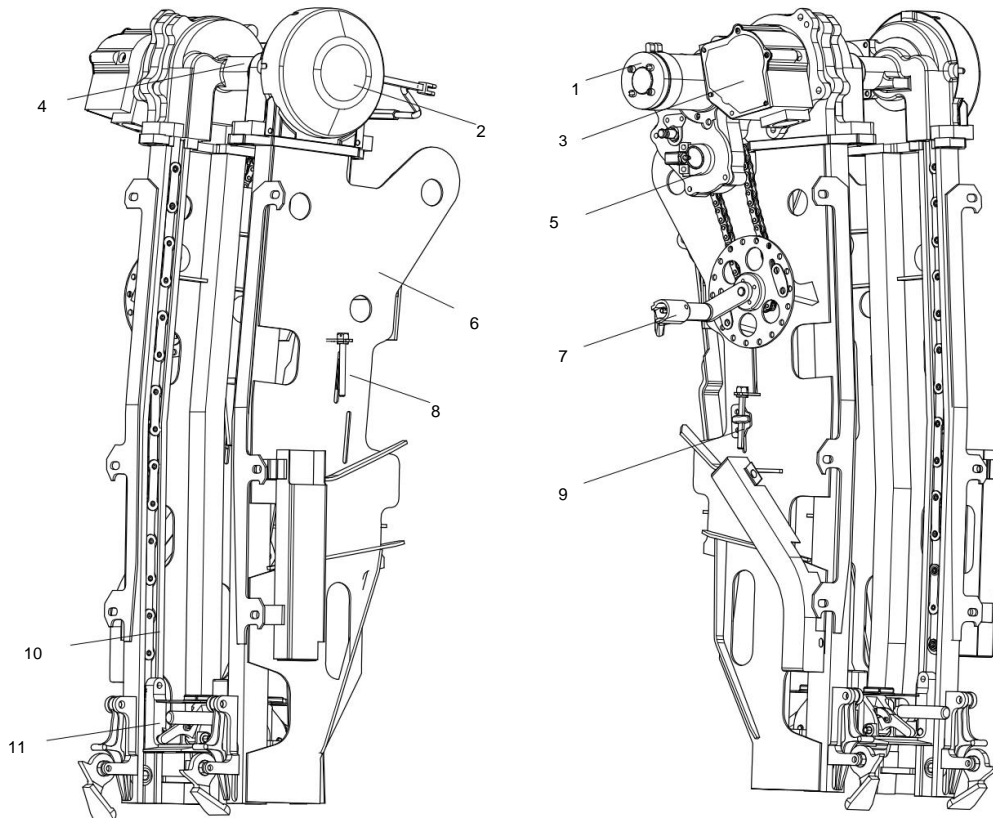
and unloading ammunition while loading ammunition and unloading ammunition that is in ammunition rail and lift the ammunition chamber to the loading line during automatic reloading.

After ejecting the bullet from the magazine chamber, The pulley lowers the ammunition chamber to Default normal position

2. System Composition and operation

principle)

The main components of the ammunition storage hoist are: Electromagnetic locking device (2), box Switch (3), manually operated pull arm (5), pulley wheel (7), pulley frame (6), storage compartment handle Bullet (11), two lifting chains (10), release stop plate, pulley lifting mechanism (4), etc.



1. Motor

2. Locking device

3. Switch box

4. Hoist lifting mechanism

5. Manual position change lever

6. Housing of the hoist that lifts the ammunition storage compartment.

7. Pulley dial 8.

Bullet release stop plate

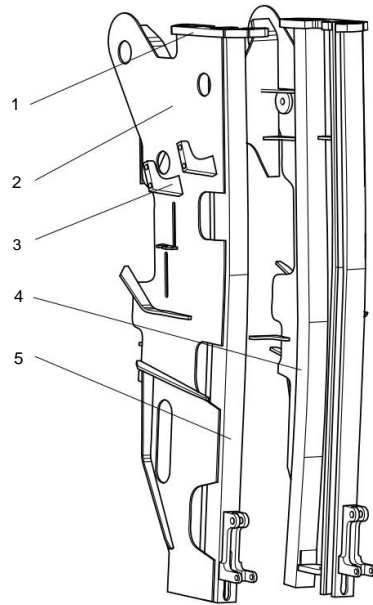
9. The ground release stop plate is delivered with a casing.

10. Chain lifts up the ammunition storage compartment.

11. Bullet storage holder

Figure 13. Hoist that lifts the ammunition storage compartment (Hoister).

1) Hoist frame for lifting the ammunition compartment.



1. Connection flange

4. Lead pipe

2. Left and right side cover plates

5. The chain guide rail lifts the ammunition storage compartment.

3. Hoist frame *is* the basic

structure for installing all the components of the hoist . The

pulley frame is made from welding of the left / right cover plates (2), 2 guide rails for the chain hoist to lift the ammunition storage compartment (5), guide pipes 2. Pipe (4), flange connecting the hoisting mechanism (1), rotating handle (3),

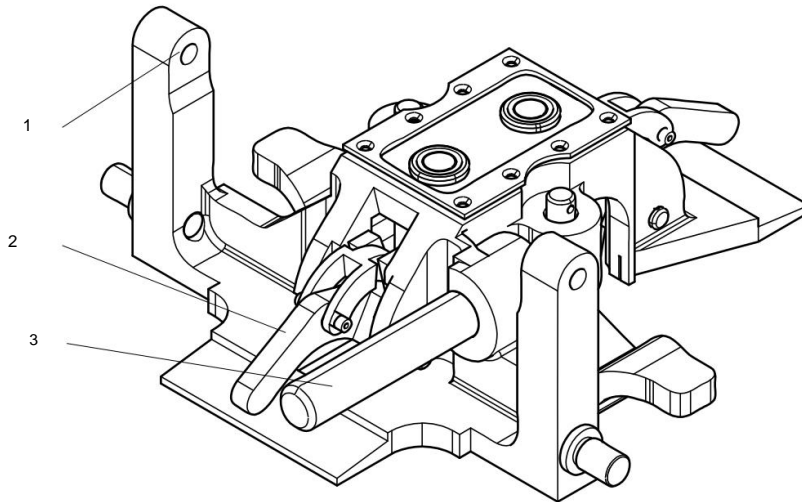
Support and support frame

The guide rail for the chain hoist to lift the ammunition storage compartment (5) is a guiding device for the chain hoist.

There is a chain inside to lift the handle of the ammunition storage compartment so that it moves up and down. The guide screen (4) has the main function of holding the end of the pulley chain. The connecting flange (1) is welded to the top of the pulley frame. The hoist lifting mechanism is connected to Pulley frame through connecting flange (1)

2) Ammunition storage compartment catcher (Catcher)

The function of the chamber catcher is to hold and lift the chamber. (using hook 2) from the ammunition rail and release the ammunition storage compartment when the ammunition storage compartment is inserted into the ammunition rail.



1. Connection

hole 2. Hook

3. The push rod to stop the ground

casing is **delivered empty. Figure 15 Hoist jaw.**

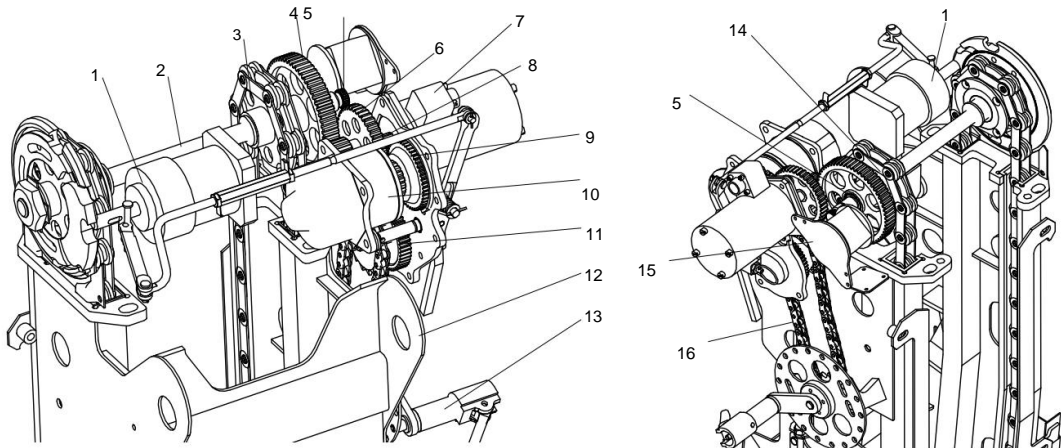
The magazine holder is connected to the lower ends of the two chains through the connection holes (1) on the holder housing. The push rod of the ground cover stopper (3) at the top of the holder moves up along the body.

Hold and push the Spent Case Stopper of the Spent Case Ejector.

(Case ejecting device) move to the side. This will leave enough space for lifting.

Ammo compartment

3) Pulley lifting mechanism (Drive device)



1. Electromagnetic lock pulley

2. Main shaft

3. Chain wheel

4. Drive gear

5. Angle sensor driving gear 6.

Power transmission gear

7. Motor

8. Motor gear

9. Gear

10. Buffer,

11. position change gear

12. Pulley frame

13. Pulley dial 14. Pulley

chain that lifts the ammunition storage

compartment 15. Sensor

16. Drive chain

Figure 16 Hoist lifting mechanism (Drive device)

The motor is driven by a 3-speed reduction gear. The function of the motor is to raise and lower the level. Electrical ammunition storage compartment The manual shift lever operates the manual hoist to manually raise and lower the magazine well. Changing

the operating mode between motorized hoisting and hoisting This can be done manually by moving the shift gear (11) with the manual shift lever. The pulley lift mechanism is in manual control mode. Electrically operated when the gear shifter (11) is in the inside position and the hoist driving mechanism is in manual mode when the gear is set. The position (11) must be changed to the outside position.

The motor driving the hoist and the mechanism for driving the hoist manually consists of a motor (7). Buffer (10), drive gear (4), chain wheel (3), pulley chain (16) and manual position change lever.

1) Lifting a pulley with a motor (Motor drive) Motor

(7) Motor drive gear (8) and Motor gear (8) Drive gear (9) to send

Power goes to the main shaft (2) through a buffer (10), drive gear (6) and drive gear (4), chain wheel 2.

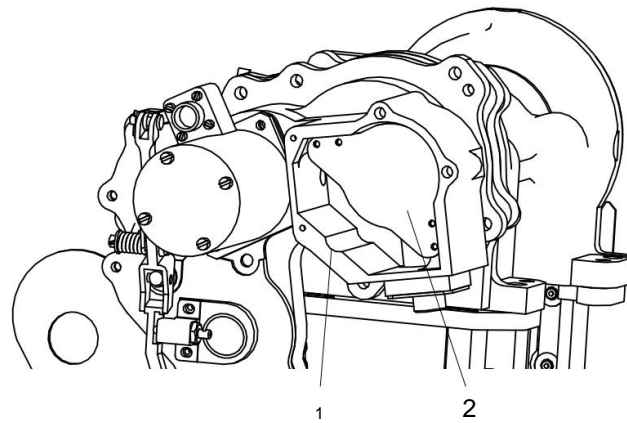
Set (3) is installed on main shaft (2), pulley chain (16) to move in a straight line. Ammunition storage holder installed at the lower end of the chain (16) will lift the ammunition chamber into vertical movement.

2) Lifting the hoist by hand (Manual drive)

The pulley dial (13), position change gear (11), passes through the pulley chain (16), and transfers power to the buffer (10) through the gear. Drive (9) The transmission of power by hand is the same as that of Transmit the power output of the motor.

3) Switch box

The switch box located on the housing of the hoist drive device (see Figure 16) contains an angle sensor. Mounted in the switch box, the gear (2) of the sensor (see Figure 16) is driven by a gear (5) located at the end. right side of the main shaft to allow connection and disconnection of the sensor.



1. switch box housing 2. Sensor

Figure 17 Switch box

Position signal of each sensor:

K1: Bullet pressure level switch Used to change the status.

Works the pulley and sends a signal to push the bullet.

K2: Dozer height switch delivered with casing. Used to change the status.

Work of the pulley and send signals to push the soil together with the casing.

K3: Load line elevation switch Used to change the status.

Work of the pulley in loading and unloading modes.

K4: Ammunition chamber default elevation switch. Used for changing

Hoist working status

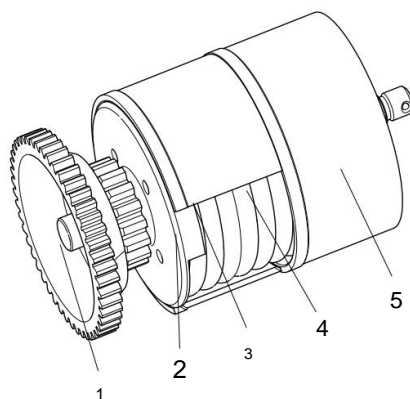
4) Buffer

The function of the buffer (Figure 18) is to protect various parts. of the hoist driving device Do not cause damage when working overload. and avoid excessive impact when starting work. Power input gear shaft (1) bottom cylinder (5) (connected together through gear tooth grooves) cylinder

The upper part (2) is connected to the lower cylinder (5) through a torque spring (4) and has a power transmission gear.

located at the top cylinder (2). Therefore, the torque receiving spring (4) is between the power input gear and the transmission gear.

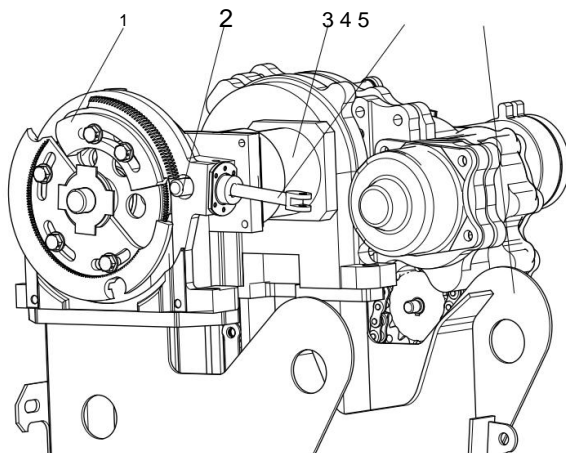
The output power therefore acts as a buffer.



- | | |
|---------------------|------------------------|
| 1. Power gear shaft | 4. Torque leaf springs |
| 2. Top cylinder | 5. Bottom cylinder |
| 3. Core sleeve | |

Figure 18 Buffer

5) Electromagnetic lock pulley (Electromagnet locking device)



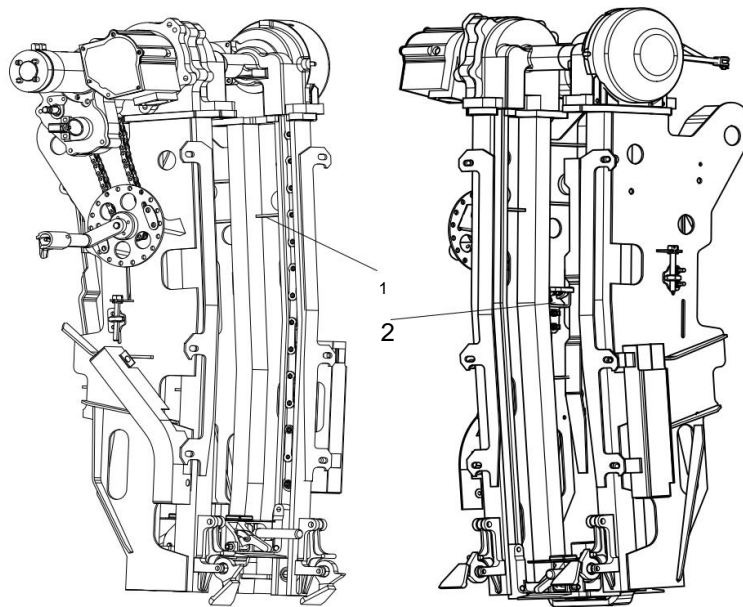
- | | |
|-----------------------------------|-------------------------|
| 1. Locking plate | 4. Manual release lever |
| 2. Latch lock | 5. Pulley frame |
| 3. Electromagnet used for locking | |

Figure 19: Electromagnetic lock pulley (Electromagnet locking device)

The electromagnetic pulley locks the ammunition chamber in the specified position. Consisting of an electromagnet (3), a locking latch (2), a locking plate (1) (including a lifting plate and pad in the default normal position) during the locking process. Contact switch mounted on the back of the

The electromagnet (3) sends control signals to create and remove electromagnetic energy.

6) Unlocking stop plate



1. Bullet release plate. 2. Bullet release plate delivered with casing.

Figure 20: Unlocking stop plate

The bullet release plate (1) and the shell release plate (2) are installed inside the pulley frame (see Figure 20). When the bullet is raised, to the packaging level body unlocking pad

The bullet (1) will release the clamp used to attach the bullet to the bullet chamber. When the soil is ready

The casing is raised to the loading line. The ground release plate delivered with sleeve (2) releases the clamp used to hold it.

The clay is delivered with a sheath and bullet storage compartment. To be able to push the bullet out of the bullet chamber.

Episode 5

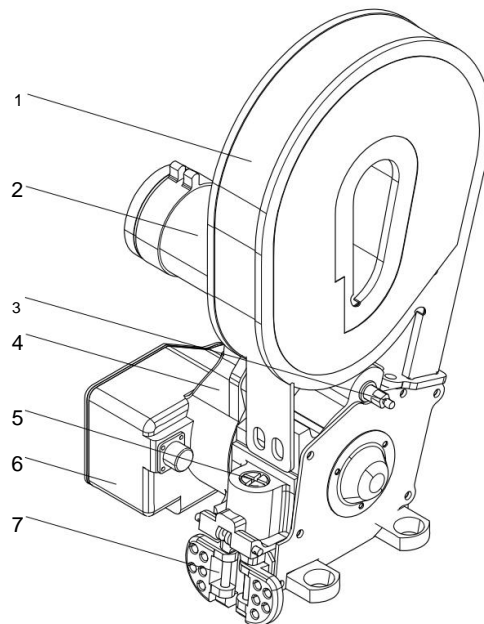
Bullet push chain (RAMMER)

1. General

The ammunition push chain is mounted behind the ammunition chamber hoist within the turret and is held Fixed on the turret floor. Used for pushing the bullet and the propellant along with the casing into the chamber as ordered. of the gunners

2. System composition and principle

Bullet push chain has main components: chain box, bullet push chain, adjustment shaft and equipment. Chain drive with motor and switch box



- | | |
|--------------------------|----------------------|
| 1. chain box | 5. Chain clamp |
| 2. Motor | 6. Switch box |
| 3. Adjustable shaft | 7. Bullet push chain |
| 4. Chain driving device, | |

Figure 21, Chain pushing bullets (Rammer)

1) Driving device of rammer

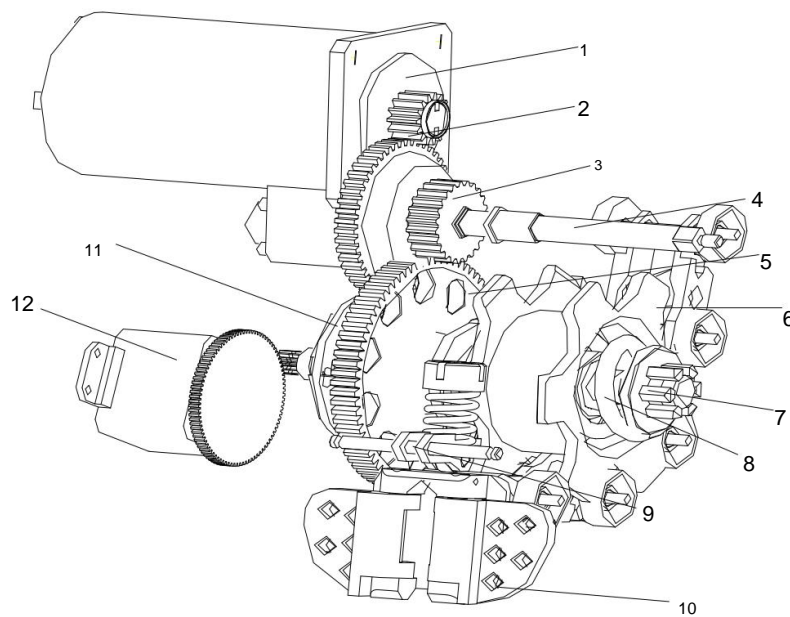
The chain driving device consists of a motor (1); Drive gear (5) with outer gear teeth Safety clutch plate (11) and bullet push chain (10), etc.

Motor (1), motor drive gear (2) to engage with the drive power transmission gear (3) and transmission gear

The driving power is connected to the driving gear (5) in order to send the power to the end of the grooved shaft of the driving gear (5) through

Safety clutch (11), the end of the grooved shaft drives the chain wheel (6) on the shaft and the chain wheel drives the bullet pusher chain.

(10) To make the chain move in a straight line. Meanwhile The other end of the drive shaft is driven through the Drive gear



- | | |
|----------------------------------|-------------------------|
| 1. Motor | 7. Adjustment screw nut |
| 2. Motor gear | 8. Tweezers |
| 3. Power transmission gear | 9. Chain clamp |
| 4. Power transmission gear shaft | 10. Bullet push chain |
| 5. Drive gear | 11. Safety clutch |
| 6. Chain drive wheel | 12. Measuring device |

Figure 22: Drive device

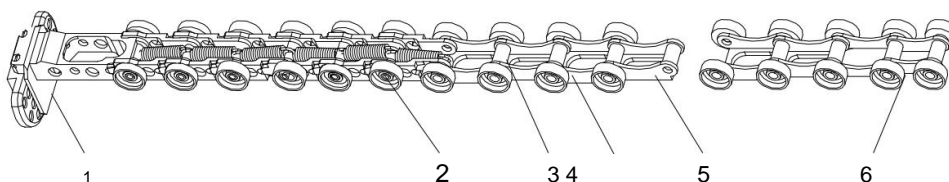
a) Safety clutch

The multi-disc safety clutch (11) is used to protect the gear parts/assemblies.

Prevent damage when overloaded. Clutch adjustment using the adjustment nut (7) to change the shape of the leaf springs (8) to change the torque transmission of the safety clutch (11).)

b) Rammer chain

The bullet pusher chain is a special chain that can be withdrawn into the spiral chain box. in one direction and can be extended to become a straight rod. The function of the chain is to push the bullet. and the clay was sent along with the casing into the chamber of the cannon.



- | | |
|---------------|---------------------|
| 1. chain head | 4. Outer chain link |
| 2. Roller | 5. Inner chain link |
| 3. Engraved | 6. Rear chain |

Figure 23 : Rammer chain

The bullet push chain has main components: chain head (1), inner chain (5), hinge joint, joint. Connect the outer chain (4), axle (3) and wheels (2).

The bullet push chain consists of a solid chain head (6 links) with tension springs which have Elastic pitch 45 mm. - 50 mm. middle section (26 joints) with pitch 50 mm. and The last loop (6) has a pitch size of 38 mm.

Working principle of the bullet push chain: When the first seven links of the chain protrude from the box, the chain, tongues and grooves of the two adjacent links will firmly connected to replace the chain becomes a solid rod. The first part of the chain is the one that keeps the middle part of the chain from being bent in the middle. While pushing the bullet. Therefore, the chain can overcome the resistance of the bullet to push the bullet into the chamber. The final chain, which has a joint pitch of 38 mm, can prevent the entire chain from falling out. The chain wheel due to inertia when the chain is fully extended. A rubber fin is mounted on the shaft of the first chain link. and has rubber grooves on the front. The bullet pusher chain is secured within the chain box using chain clamps (9).

c) Extended square shaft: The right end of the power transmission shaft. Drive (4) to form a square. This square shaft protrudes from the reduction gear body. The square shaft

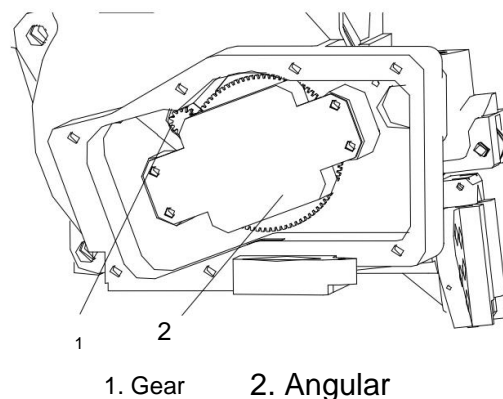
performs the following functions: It is used to receive the power input for manually driving the bullet pusher chain.

Use this axle wrench to Drive the chain to extend. Used to install the slipping moment testing wheel of the bullet push chain on this square shaft to check that the adjustment of the bullet push chain safety clutch is according to the terms of use or not?

d) Chain box: The chain box is

a snail-shaped box with a baffle inside. A place to arrange and store bullet pressure chains.

2) Switch box



1. Gear

2. Angular

sensor, **Figure 24, Switch box**

There is an angular sensor (2) installed in the switch box. The output gear is connected to the gear (1) on the chain wheel, which gives a signal indicating the position of the bullet push chain.

Sensor (2) is an angular sensor and a four-circuit switch.

Position signals of all switches:

K1: Signal for pushing the bullet to the specified position in the chamber. When pushing the child
The bullet has gone to the designated location. will send a signal to stop the movement of the bullet push chain and send
Signal to clear memory

K2: Initial normal position signal Return Give a signal to stop moving when the chain withdraws.
to the starting position.

K3: State change signal Before the chain pushes the soil and sends it with the sheath into the chamber.
Used to control the motor to rotate at a low speed so that the soil along with the casing can pass through the end capping machine.
and smoothly ramps the fire Avoid shock and soil damage. Send with casing.

which is flammable

K4: Breechblock closing zone signal

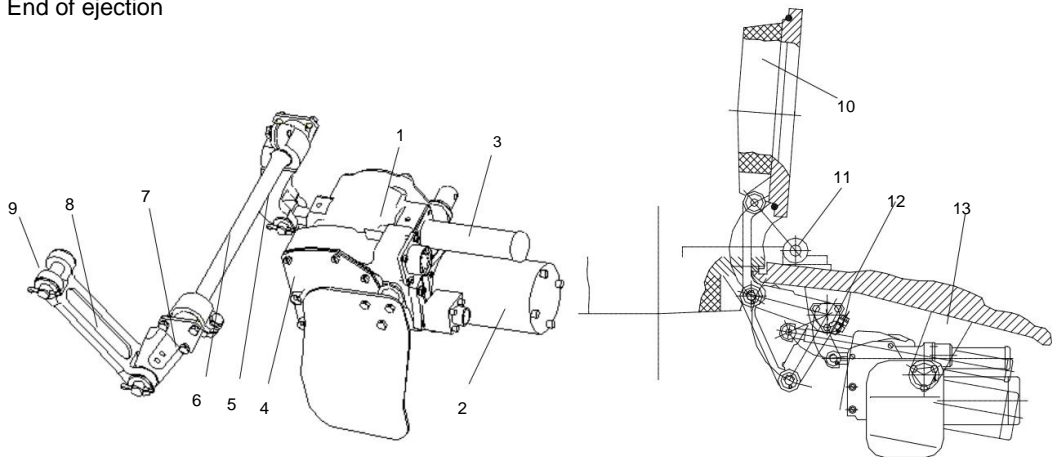
Chapter 6

WINDOW OPENING DEVICE

1. General

The device for opening the window to pick up the soil casing (see Figure 25) is a drive mechanism that consists of Reduction gears (worm gears and worm spurs) and linkage rods, window opening devices, etc., installed at Rear left side of the turret ceiling It serves to open the hinged window positioned at the top end of the the turret during ejection, empty the casing from the turret and close the window after completion.

End of ejection



- | | |
|-------------------------------------|--------------------------|
| 1. reduction gear | 8. Driven arm |
| 2. Motor | 9. Connection rod |
| 3. Shaft | 10. Sleeve window cover |
| 4. Switch box | |
| 5. Arm driving mechanism | 11. Window pick-up shaft |
| 6. The end of the shaft is grooved. | 12. Support base |
| 7. Baja Phla | 13. Support arm |

Figure 25: Window opening device

Insert the shaft (3) into the reduction gear (1) so that the reduction gear (1) rotates around the shaft (3); Both ends of the shaft (3) are connected to the hinge pivot point and the support arm (13) is welded. to the gun turret Both ends of the spline shaft (6) are connected to the support (12) which is welded.

Attached to the turret using the shaft shoulder (7).

Motor (2) transmits power in linear movement of the toothed rack.

through the reduction gear (1); The gear drives the mechanism drive arm (5), the grooved shaft end (6), the drive arm (8) and the connecting rod (9) to make the front cover. The window sheath (10) rotates around the window shaft. which is a mechanism for opening and closing the soil casing window (10)

2. System composition and principle

1) Switch box

Install the sensor inside the switch box. The PTO gear is connected to the gear of the drive shaft. worm (2) and sends a signal of the movement position of the window cover, sending the soil casing to the sensor (1), which is an angular sensor with Two-way switch value Each way switch position signal includes:

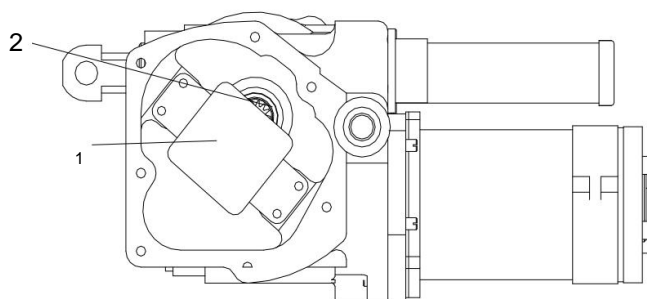
K1: Starting position: Gives a stop signal when the soil cutting window has closed to the position.

Given

K2: The signal for the window position has reached the specified position: Give a signal.

Stop when the soil casing window has opened to the specified position. (The copy window can be opened

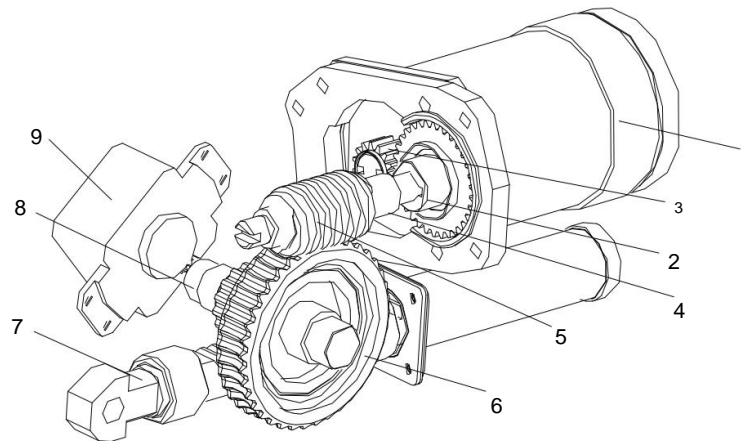
Out at an angle of 92° - 96°)



1. Sensor 2. Gear

Figure 26 Switch box

2) Reduction gear set



- | | |
|---------------|-----------------------|
| 1. Motor | 6. Drive gear |
| 2. Drive gear | 7. Gear rail |
| 3. Motor gear | 8. Power sharing gear |
| 4. Worm spur | 9. Sensor |
| 5. Worm gear | |

Figure 27: Reduction gear set

The motor (1) rotates the motor gear (3) to rotate the drive gear (2), which shares the same axis with the power sharing gear (8). The worm spur (4) then the worm spur (4) drives the worm gear (5) and the worm gear (5) drives the driving gear (6), the power sharing gear (8) are on the same axis as the driving gear (6) and the power sharing gear (8). Sensor output gear (9) to produce a change in signal – through the sensor (9).

The gear (6) is mounted on the worm gear (5) and the worm gear (6) drives the rail gear (7) to move in an extension-retraction motion.

There is a flat groove A at the end of the shaft of the worm shaft (4). It is used to drive the worm shaft (4) by hand in order to use the hand to tighten the gear to open and close the face. Different types of peeling

Chapter 7

CASE EJECTOR**1. Generally**

speaking, a soil shearing machine is a structure that combines mechanical and electrical mechanisms. The casing machine was mounted on the cannon's safety panel. and the duties of the soil peeling machine for delivery are

As follows:

A. Catch the clay casing and send it away empty after firing a cannon. and eject the casing from the turret.

B. Case stopper at the back of the casing holder. Ja

(Spent case) is installed as a barrier when the earthing sleeve holder has captured the earthing sleeve and sends a signal.

From the touch switch when holding the empty earth

cover, it acts as a counterweight. (Counter-weight) of artillery

After firing, the empty casing that is removed from the chamber is captured by the casing catch.

Soil will be sent in the next filling process. The gear motor is activated after the cannon is locked at an angle.

Once loaded, the rail gear moves and the connecting arm and connecting rod lift the earth sleeve frame up to the

Copy window location When the soil peeler frame is raised, (or moving up) packing system

The bullet will begin loading the next round. The Loading Soil Selection window will open while loading is complete.

Bullet The electromagnetic pull lever retracts to release the grounding cap holder. under force

of the leaf springs receive torque Torque tongs with sleeve holder rotate within the bracket to eject the soil sleeve.

Send it blank. at the same time It releases the connecting arm within the groove of the connecting rod to the threaded

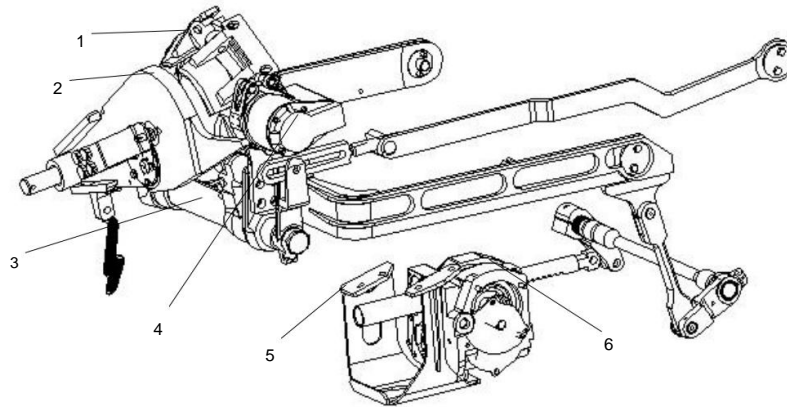
shaft. When the casing ejector frame is lowered under the action of the reduction gear motor, available connecting rod

The threaded shaft drives the connecting arm to rotate so that the torque with the sleeve holder is accumulated on the leaf spring barrel.

Power for ejecting the soil casing to deliver the next shot.

2. System composition and principle

The soil casing selector consists of a soil casing holder (1), an empty soil casing stopper (2), a torque-feeding cylinder (3), along with a soil casing holder. send electromagnet and driving equipment Soil peeling machine (see Figure 28)



1. Soil casing holding machine

4. Electromagnetism

2. The ground cover stopper is delivered empty.

5. Reduction gear cover

3. Torque leaf springs with handle

6. Device for driving the soil casing device.

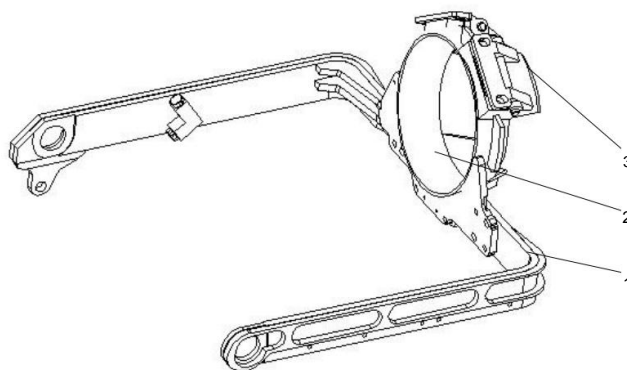
Figure 28: Case ejector

1) Case collector

Duties of the ground cover holder It is to hold the clay sheath and send it after firing the shot that was held back.

From the chamber of a cannon The casing catcher consists of a mobile rotating joint frame (1) mounted on the cannon safety panel, a casing holding pipe (2) brazed onto the frame. and a plate to hold the clay casing

Delivered empty (3) installed on the casing pipe (see Figure 29)



1. Frame

2. The pipe holding the soil casing is sent empty.

3. The clay cover plate will be sent empty.

Figure 29: Case collector

2) Collector drive device

Used for transmitting motor power. Lift the soil casing holder and send the soil casing holder.

Empty from the position of holding the soil cover to the position of ejecting the soil cover. And after peeling off the soil Once sent, the soil casing holder will be lowered from the soil casing eject position to the holding position.

The grounding sleeve is delivered. At the same time, the torque of the leaf spring cylinder with the sleeve holder can be accumulated.

Power for the next casing ejection The device for driving the soil casing machine consists of a reduction gear. round (2), connecting rod with threaded shaft (3), connecting arm (1), connecting rod (4), and torque beam (5), etc.

(See picture 30)

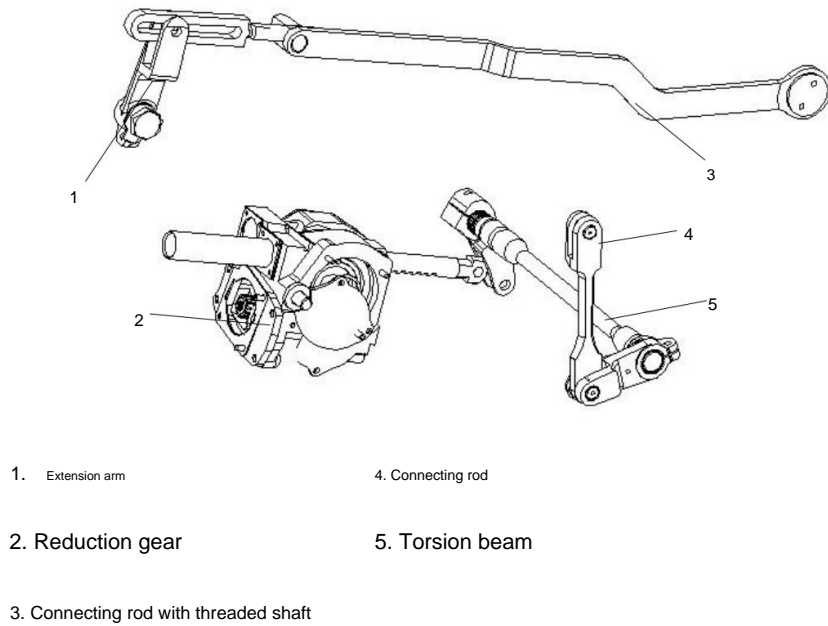
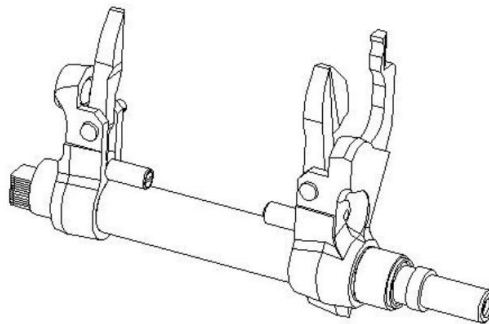


Figure 30: Collector drive device

3) Torsion spring tube with catcher

Torque leaf spring cylinder with gear teeth Its function is to release the power stored at the position.

Push the casing to eject the empty clay casing (see Figure 31).



**Figure 31 Torque leaf spring cylinder with sleeve holder
(Torsional spring tube with catcher)**

4) Spent case stopper

Used for holding empty casings that are removed from the cannon to the casing holder. A blank ground cover stop plate was mounted on the cannon safety panel (see Figure 32).

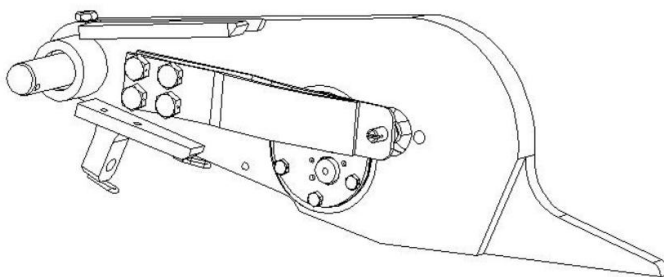


Figure 32: Case stopper

Chapter 8

Control system (CONTROL SYSTEM)

1. General

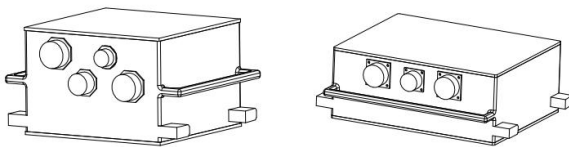
The control system is the main part of the automatic loading system that controls its operation. Automatic The control box of each system is installed in a position relative to the operation. on the turret and ammunition rail For convenience of use

The control system consists of a collection device, a driving device, a positioning device. Ammunition type, gun orientation device, gun orientation sensor, magazine loading controller, magazine loading switch box, gun control system components Relationship and line Connect

2. System composition and principle

1) Collecting device and driving box
device

The signal collection box and drive signal transmission box (see Figure 34) are mounted on the ring turret. Gun behind the driver's seat These boxes are the control center of the automatic loader. Receives position signals from key mechanical components. and send control orders and commands to work equipment



signal collection box Signal driving box, **Figure 33:**

Signal collection box and driving signal sending box.

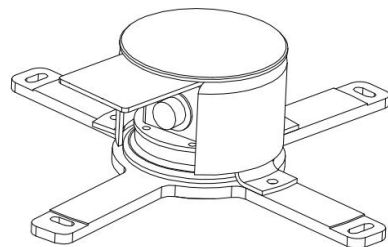


Figure 34: Bullet type positioning device.

2) Magazine identifier. The magazine identifier (see Figure

35) is mounted above the reduction gear of the magazine rail and It is driven by a small gear that protrudes from the reduction gear. Therefore, the optical coding disk in the bullet positioning device is driven to rotate simultaneously. Together with the ammunition rail that has 22 ammunition storage slots, the optical code plate in the type positioning device. The bullet works in conjunction with the monolithic control system's data memory to remember the type of bullet and its location. Bullet type positioning device and signal code of the control system. To control bi-directional bullet selection Braking and stopping the rail rotation Carrying bullets that

rotate in two directions. 3) Gun laying device.

Gun laying device. It is mounted on the support arm of the lifting mechanism. Sensor gear The loading angle was attached to the curve of the cannon's small cog to signal that the cannon had reached the loading angle. ($4^{\circ}30'$) and then send a signal to the automatic ammunition loader and send a signal of the artillery orientation to the stabilization system (stabilization)

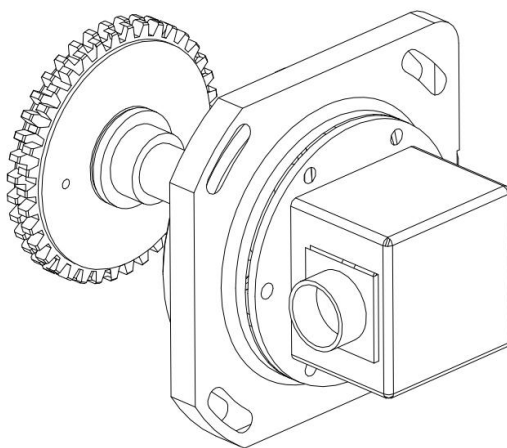
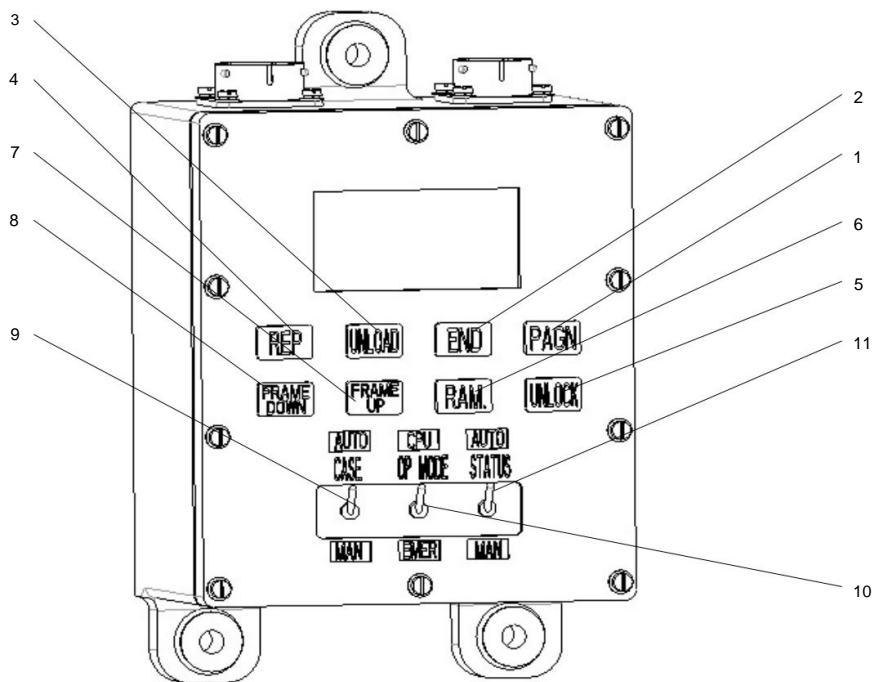


Figure 35: Loading laying device .

4) Loading console (Loading console)

The load control (see Figure 37) is mounted on the right wall of the turret. It is used to control the semi-automatic operation and display the automatic loader on the control panel. There are buttons and switches that are used to load bullets, unloading ammunition Ejecting the ground cover to deliver bullets and using a chain to push bullets, etc. (operated by the operator). The screen shows the operating mode, bullet type, number of bullets, and operating status information. The functions of push buttons and switches are as follows:



- | | |
|------------------|-------------------------------|
| 1. Page button | 7. FRA up button |
| 2. END button | 8. FRA down button |
| 3. UNLOAD button | 9. CASE AUTO-MAN switch |
| 4. REP button | 10. CONDITION CPU-EMER switch |
| 5. UNLOCK button | 11. STATUS AUTO-MAN switch |
| 6. Ram button | |

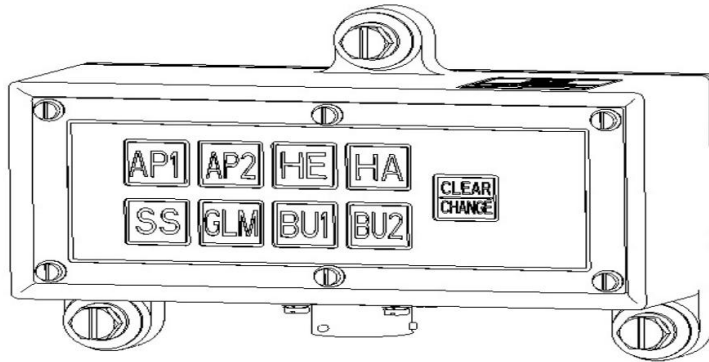
Figure 36 **Ammunition loading control device (Loading console)**

The functions of the reload control buttons and switches are as follows:

number	Device name	work
1	"UNLOAD" button	Used to cancel a load.
2	"REP" button	Used to carry new ammunition.
3	"END" button	Used to end loading or unloading ammunition.
4	"PAGN" button	Used to change display pages. (Used by repair personnel maintain)
5	"FRAME DOWN" button	When using a manual soil peeler Use this button to reduce the frame. The ground cover holder returns to its original position and unlocks the cannon.
6	"FEAME UP" button	When using a manual soil peeler Press this button to lock the device. Lock the gun. Lift the gun housing frame. Open the copy window. and threw out the clay casing and sent it empty.
7	"RAM" button	Press this button to release the chain to push the bullet out and when the button is released it will Withdraw the chain back
8	"UNLOCK" button	Press the button to unlock the cannon's locking mechanism at the reload angle.
9	"CASE" "AUTO—MAN" switch	When this switch is set to the AUTO position, the Soil Sheath Selection window will appear. Open it up and after lifting the casing catcher frame it will snap. Send out the soil casing. With this switch in the "MAN" position , when the sleeve holder frame is raised, But the soil selection window will not open. climb
10	Switch "OP MODE" "NORMAL-EMER"	It is a switch to change normal mode and mode. Emergency (Emergency mode)
11	Switch "STATUS" "AUTO-MAN"	When in ammunition loading mode Cessation of ammunition loading Pull out the soil cover and deliver it by hand. This switch must be set to the "MAN" position when automatic reloading is required. The switch must be set to the "AUTO"

5) Ammunition loading control switch button box (Replenishing button box)

When loading ammunition If you press the ammo button, the type of ammunition carried on this box
The system recognizes the type of ammunition loaded into the ammunition rail. When unloading ammunition,
pressing the (CLEAR/CHANGE) button on this box will cancel the memory of the unloaded ammunition type.



- 1. AP1: Armor-piercing ammunition loading button (APFDS) 1 6. BU1: Backup button 1
- 2. SS: Backup button 7. HA: Button for loading anti-tank grenades (HEAT) ammunition.
- 3. AP2: Armor-piercing ammunition loading button (APFDS) 2 8. BU2: Backup button 1 4. GLM: Guided missile loading button (Guided-missile) 9. Clear /CHANGE: button to cancel remembering the name of the bullet type.
- 5. HE: Explosive ammunition loading button (HE)

Figure 37: Ammunition loading control switch button box (Replenishing button box)

Chapter 5

Secondary weapons (AUXILIARY WEAPONS)

episode 1

CO-AXIAL MACHINE GUN

1. General

The vehicle's 7.62 mm machine gun (Type-86) is mounted on the right side of the gun cradle. Large, able to fire in short bursts. It is a long set. and continuous firing in order to Attacks moving targets at range. 1,000 m.

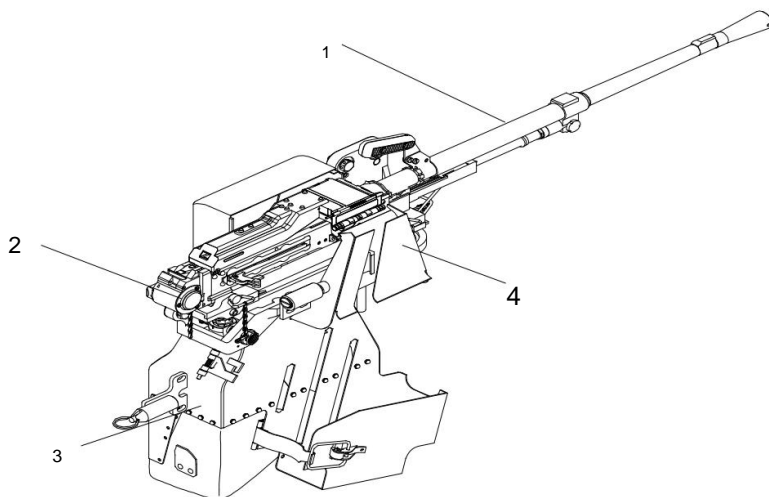
2. Main performance and parameters

Barrel width Length	7.62 mm.
of the entire gun	1097 mm.
effective shooting range	1,000 m.
Longest shooting	3,500 m.
distance Theoretical rate	750 - 850 shots/minute
of fire Rate of fire in battle	250 shots/minute
Initial velocity at the mouth of	865 meters/second
the barrel. Total weight	10.6 kg.
of the gun. Specified service life (for two barrels)	25,000 shots

3. System composition and principle

A. System Composition

The coaxial machine gun consists of a 7.62 mm vehicle machine gun (Type-86).
Mounting base: steel cable guide and a box for storing bullet casings, etc. (see Figure 1)



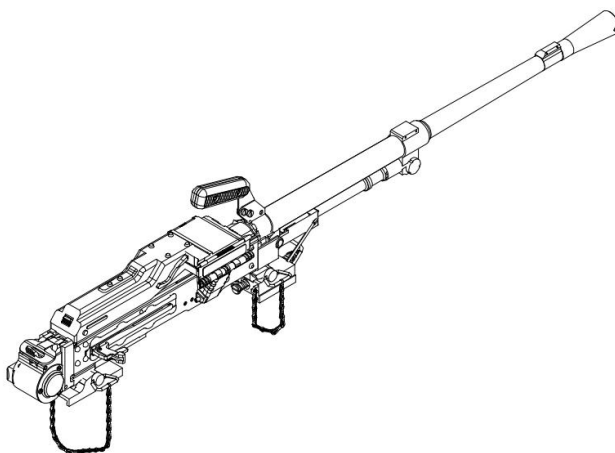
1. 7.62 mm vehicle machine gun 3. Bullet casing storage box
2. Co-axial machine gun mounting base 4. Steel guide wire for bullets

Picture 1: Co-axial machine gun

1) 7.62 mm vehicle machine gun (**Type-86**) (see Figure 2)

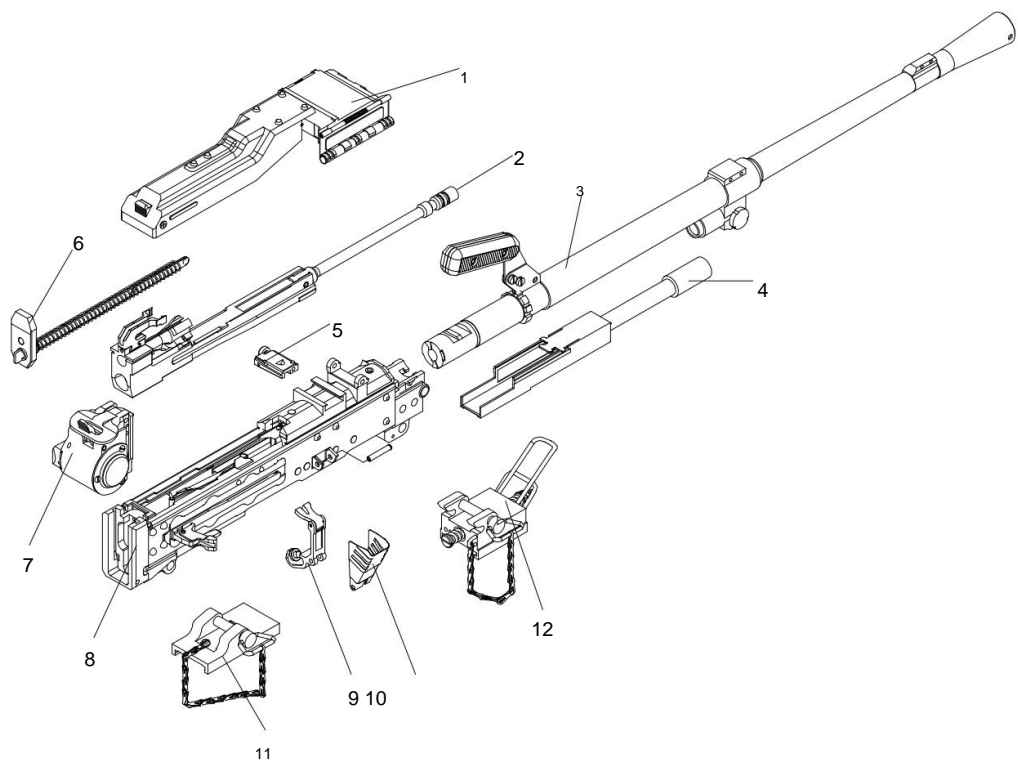
The vehicle's 7.62 mm machine gun (Type-86) is mounted on the right side of the vehicle.

The artillery cradle can be used to fire short bursts. It is a long set. and firing a series
Continuously to attack moving targets at a distance of 1,000 m.



Picture 2: 7.62 mm vehicle machine gun (Type-86)

Vehicle-mounted machine gun, size 7.62 mm, consisting of a barrel set, a chamber set slide and barrel mounting bolt set, etc., totaling 12 additional components and equipment (see Figure 3). This machine gun can be fired with both mechanical and electrical triggers.



- | | | |
|---|----|--|
| 1. Slide room cover | 2. | 7. Electric trigger |
| Slide and moving parts | | 8. Slide room |
| 3. Barrel | | 9. Steel for feeding the bullet |
| 4. Piston cylinder | | cable. 10. Steel cover for feeding the bullet cable. |
| 5. Barrel mounting bolt | | 11. Rear mounting base |
| 6. The leaf spring and the leaf spring propeller shaft. | | 12. Front mounting base |

Figure 3. The main components of the coaxial machine gun.

2) Ammunition cable storage

box The ammunition storage box is used for storing 7.62 mm bullets, in which one string The ammunition has 250 rounds of bullets.



Figure 4: Co-axial machine gun ammunition cable storage box

3) Bullet guide steel Bullet

guide steel is used for guiding and feeding 7.62 mm bullets and cables.

ammunition

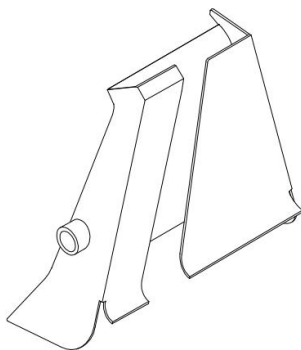


Figure 5: Bullet guide steel

4) Bullet casing storage box

The shell box is used to store shells after shooting to protect equipment from damage, and protect the rotating ammunition rail from abrasion that occurs from the explosion of the shell inside the turret. The shell storage box consists of a storage box. Upper shell casing and lower shell casing storage box

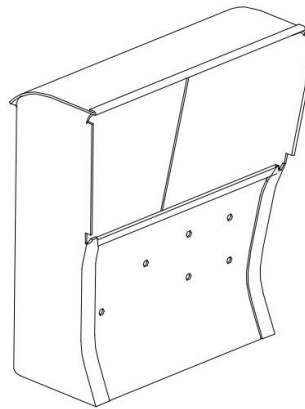


Figure 6. Upper part of the bullet casing storage box.

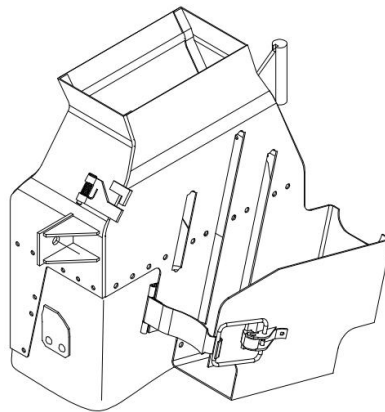


Figure 7: Lower shell case storage box with trigger control device.

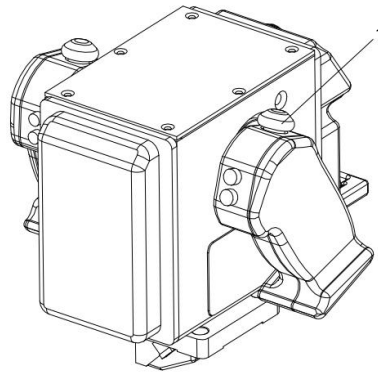
5) Trigger control device, consisting of an electric trigger device. and trigger

By hand

B. Electric firing control device Gunner's controller (see Figure 8) In IS mode and SFCS

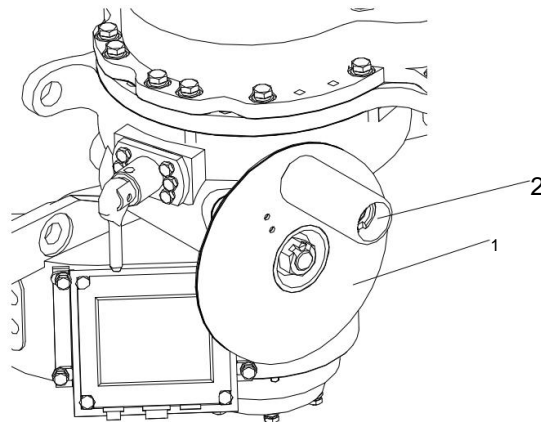
mode, the gunner can use the controller

to control aiming and firing. Fire the coaxial machine gun by pressing the trigger button (1) on the left control stick of the controller. to fire a machine gun Short combination of axes It is a long set. and is a continuous set



1. Coaxial machine gun trigger

button, *Figure 8. Gunner's controls.*



1. Turn the turret turning mechanism by hand. 2. Trigger button

Figure 9: The trigger button for the machine gun is combined with the shaft on the lever to rotate the turret by hand.

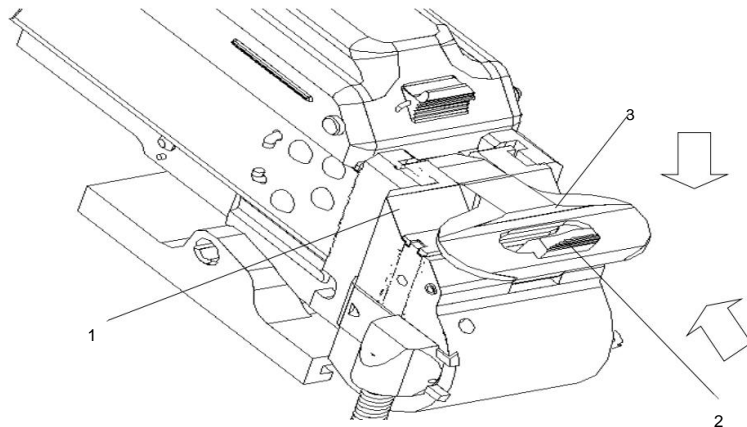
In RANGE SETTING mode, the gunner can use the altitude mechanism and directional mechanism.

To control the aiming and firing of the machine gun with the coaxial gun at the target by pressing the trigger button (see Figure 9). Pressing the machine gun trigger button Co-axial at the gunner's control unit, allowing for co-axial machine gun operation. When the controller

of The vehicle commander is in fire operation mode. The vehicle commander is above the gunner (COMMANDER OVERRIDE FIRING). The vehicle commander can use the vehicle commander's controller to control aiming, and shooting in operational shooting mode where the vehicle commander is above the gunner. By pressing the co-axial machine gun trigger button On the left

side is the commander's control stick (B), the manual firing device (see Figure 10).

In the event that the electric trigger circuit fails or the vehicle's electrical power supply fails, the first step is to aim at the target. target After that, push the manual trigger retaining hook (2) on the steel end of the slide chamber (1) towards the front, to keep it in the unlocked position, and press the trigger plate manually (3) to fire the coaxial machine gun.



1. Steel covering the end of the sliding chamber . 2. Hook for holding the manual trigger. 3. Manual trigger plate

Figure 10. Sketch of the manual trigger of a common machine gun. axis

C. Operating principle: The 7.62 mm vehicle-

mounted machine gun (Type-86) is an automatic weapon with long recoil and works with gas to control the direction of the piston. After the trigger When a bullet travels through a gas hole Some of the gas generated from the ground that propels the bullet enters the cylinder, passes through the gas hole and hits the gun. The piston and the slide guide are connected, which causes the piston and the slide guide to move backward. The force required for the backward movement of the slide guide depends on the with controlling the gas through the gas path The backward movement of the guide frame exerts pressure on the leaf springs and

shaft. Slide spring After the bullet exits the barrel of the gun, The sliding guide frame will guide the sliding ball. Move back to allow the slide to release the latch. After that, the guide frame and the sliding ball move back. back by inertia During the retreat period the bullet feed ends. Retracting the shell, screening the shell, etc. When recoiling, the loading surface on the slide guides the arm. The bullet feed rod rotates in the direction of bullet feeding. After the guide frame has

reached its initial position, If the trigger does not stop Slide guide frame The ball carrier is returned to its place by the action of the leaf spring and the ball spring shaft. The movement of the steel arm to feed the bullet, the locking action, and the firing of the bullet, etc., will end. A new cycle of shooting will begin.

Part 2

Weapon control station from inside the vehicle

(REMOTE-CONTROLLED WEAPON STATION)

1. General (General)

Weapon control station from inside the vehicle. It is a video and operational weapon system. Electrically powered To operate the control from inside the vehicle It is a combination of mechanical and electrical components. The remote weapons control station is mounted on top of the tank's turret. To be used to kill enemies who It's a group. and can be used to attack targets that are enemy light weapons within a distance of 1,600 m. The weapons control station from inside the vehicle can be fired through the enemy level. Protects light armored targets at a range of 1,000 m. Attacks enemy low-flying and high-flying armed helicopters and air targets. Inspect, aim and shoot, aim at moving targets, measure distance, and shoot at targets at the weapon control station from inside the vehicle.

2. Main performance and parameters A. Main capabilities and parameters of the system

Shooting angle in

direction: 360°; Altitude:

-4.5° to +70° Gun deployment speed (bi-directional): High speed 30°/sec; Low speed

0.05°/sec. Storage of 60 rounds of

ammunition/box. Total weight of weapon system 150 kg.

Ability to adapt to the environment

Operating temperature: -40°C to +65°C

Storage temperature -55°C to +70°C

Relative humidity 95% (temperature 35°C)

Average time between occurrence Error (MTBF) 200 hrs.

B. Main capabilities and parameters of the 12.7 mm anti-aircraft machine gun: Barrel width 12.7 mm.

Initial velocity at the mouth of the barrel: 800 meters/second for incendiary armor-piercing bullets, 1,150 meters/second for tungsten-core armor-piercing bullets.

Rate of fire: 650 rounds/minute to 750 rounds/minute.

Rate of fire in battle: 80 rounds/minute to 100 rounds/minute.

effective shooting range Air targets 1,600 m. Ground

targets 1,500 m. Light armor plates 800 m. Maximum firing range.

(Incendiary armor-piercing bullet) 7,000 m. Machine gun

weight. Machine 18 kg.

gun length 1,804 mm. Full service

life 7,000 rounds; Ammunition feeding

type Each bullet can be fed using only the bullet holder.

One item

How to fire: Fire with electricity.

Ambient temperature: -45°C to +50°C

Reliability failure rate 0.3% **C. Main capabilities and**

parameters of the camera Mixed Aim

The combination scope consists of a monochrome CCD scope with wide and narrow field of view, laser rangefinder. and condition calibration unit The scope can produce images. Wide and narrow video field of view to control weapon systems and has a laser distance finder which Can be used at both FIRST/LAST positions

1) Laser range finder system

a) Measuring distance: 50 m. to 2,500 m. (Target: person: 1.7 m. x 0.5 m.; Vehicle: 2.3 m.x4.6 m.; Visibility: >8 km.); b) Distance measurement accuracy:

±5 m. c) Distance measurement accuracy rate:

98%; d) Frequency of measuring distance: 6 times/

minute

2) Daytime scope viewing range system: a) Visible

range for distance measurement:

Not less than 1,500 m. (Target illumination: not less than 100 lux (lux) ; view

Visibility in the atmosphere: not less than 10 km. Small visibility range can recognize the shape. side of the vehicle)

b) Field of view (FOV) : Narrow field of view: $4^{\circ} \times 3^{\circ} (\pm 5\%)$ Wide field of view

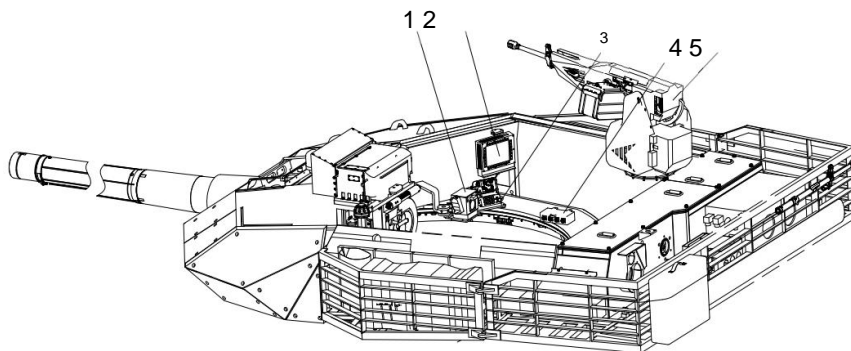
$18^{\circ} \times 13.5^{\circ} (\pm 10\%)$

3. System Composition and operation

principle)

A. Main structure of the system (Refer to pictures 11 and 12)

The weapons control station from inside the vehicle consists of the internal control elements and the gun. stationed at the outside fort Internal control elements include the commander's control unit, display Image and fire control of the vehicle commander, switch box, and position change box, which is used as The main station for controlling weapons from inside the vehicle. To carry out inspections, use and Communicate The external turret gun consists of a 12.7 mm anti-aircraft machine gun. Drive Locking mechanism Drive control box Combination control boxes, etc., which use It is the main weapon in propelling the weapon. and shooting operations



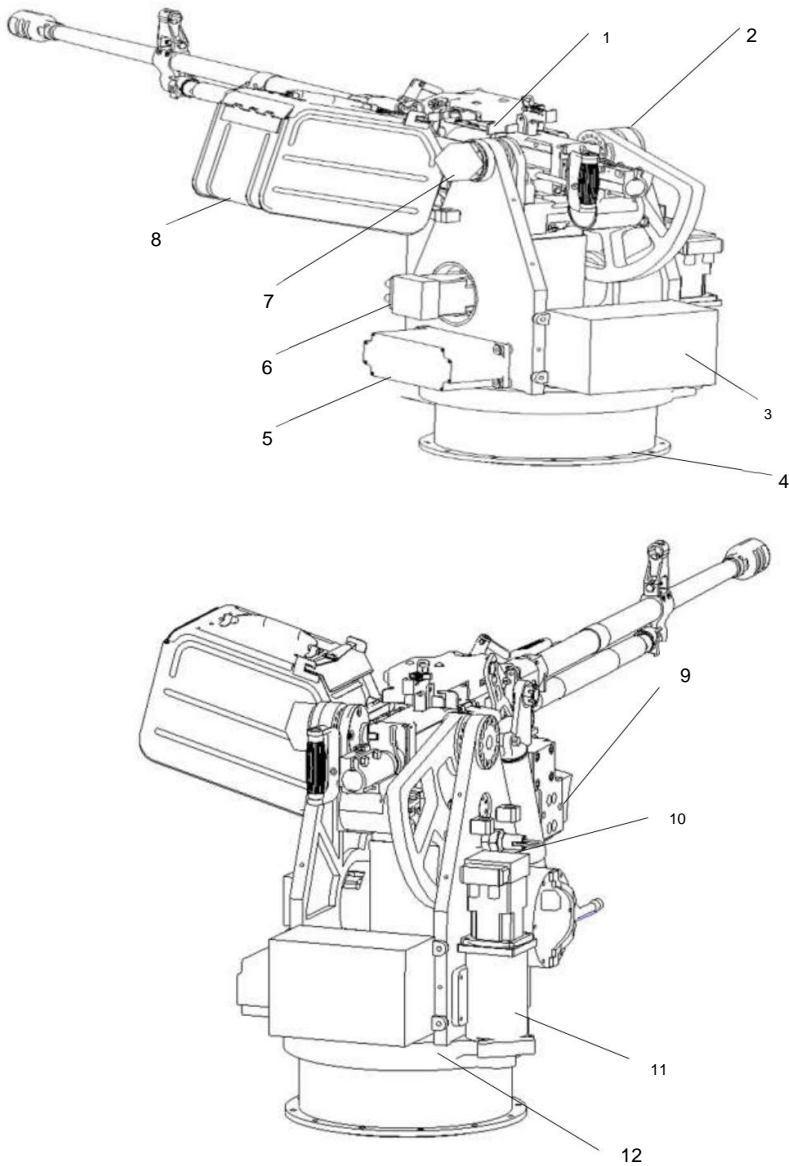
1. Vehicle commander's control

4. Box for changing use positions

device 2. Vehicle commander's image display and firing control screen 5. Weapon control station from inside the vehicle

3. Switch box (external component)

Figure 11: Installation of weapons control station equipment from inside the vehicle.



1. Protective cover, size 12.7 mm. 5. Propulsion control box 9. Scope

Gun receiver

6. Altitude drive mechanism 2.

10. travel gun lock

control box 4. Combination control box 7. Altitude measurement device 3. Combination

11. directional drive mechanism

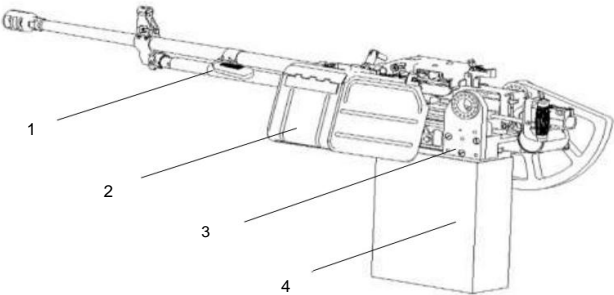
gear 8. Ammunition box Figure

12. Support platform

12 Weapon control station
from inside the vehicle

12.7 mm machine gun

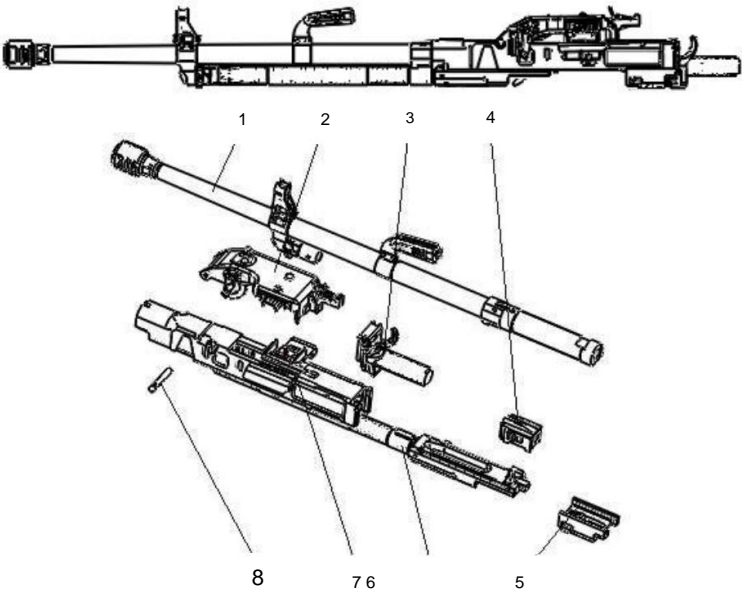
a) Components of a 12.7 mm machine gun.



- 1. 12.7 mm machine gun
- 2. Ammunition box
- 3. Gun Cradle
- 4. Bullet casing storage box
- 5. Electrically operated magnetic trigger.

Figure 13. Components of a 12.7 mm machine gun.

b) Barrel set for a 12.7 mm machine gun.

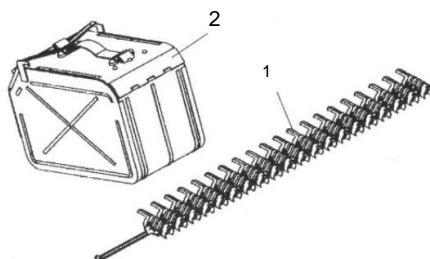


- 1. Barrel
- 2. Sliding chamber cover
- 3. Closing steel
- 4. The trigger
- 5. The slide guide frame
- 6. The slide
- 7. Slide room
- 8. Fastening bolt

Figure 14.

The barrel.

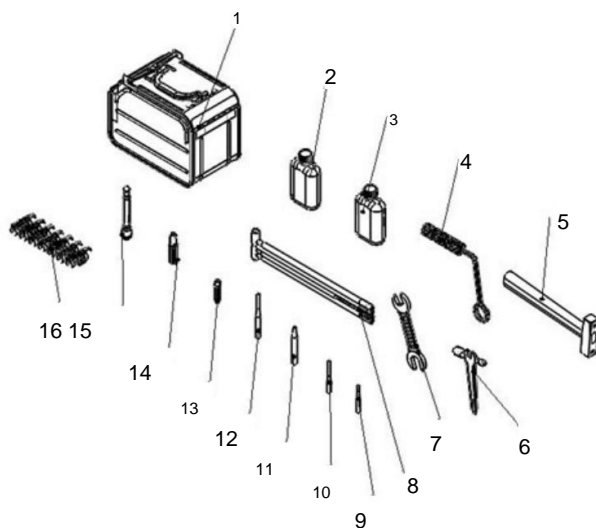
c) Ammunition cable and ammunition box.



1. Bullet cable , 2. Ammunition cord box

Figure 15. Bullet cable and bullet cable box.

d) Machine gun equipment (Refer to pictures 16 and 17)



1. Ammunition box 2.

Gasoline can

3. Sachet of alkali (Al kali) oil

4. cleaning brush

5. Hammer

6. Screwdriver-wrench 16. Bullet cable connector

7. Wrench for the recoil device and the joint.

8. Cleaning whip

9-12. Engraved steel

13. Tools for cleaning gas vent holes.

14. Tools for cleaning gas cylinders

15. Champa removed the shell casing.

Figure 16: Equipment that comes with the machine gun.

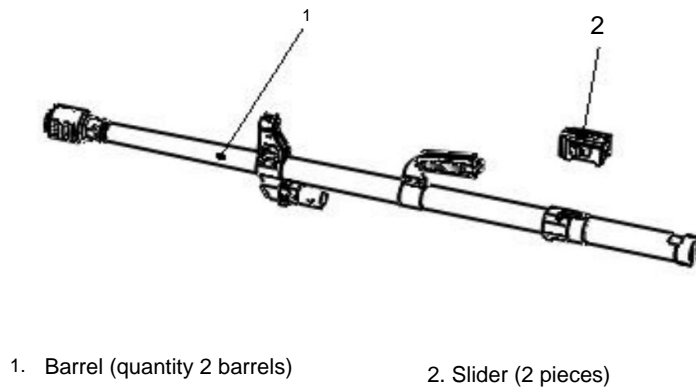


Figure 17: Machine gun equipment

e) The main structure of the compound sight.

The combination scope consists of a scope housing, a monochrome CCD scope, and Wide and narrow field of vision Laser rangefinder, calibration unit, and calibration board

Communicate The surveillance and targeting equipment uses visible light imaging technology to acquire information. Video of tanks and/or human targets on the battlefield via CCD PAL video signal for Sent to combination control box Distance is measured with a laser rangefinder module.

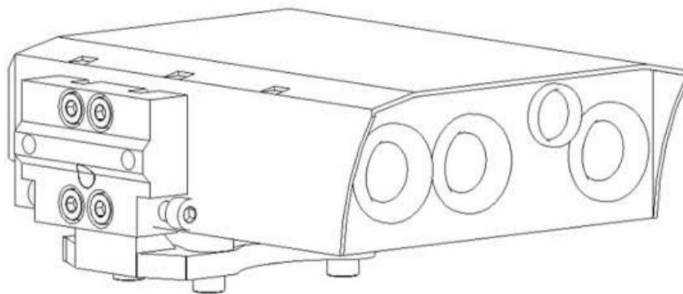
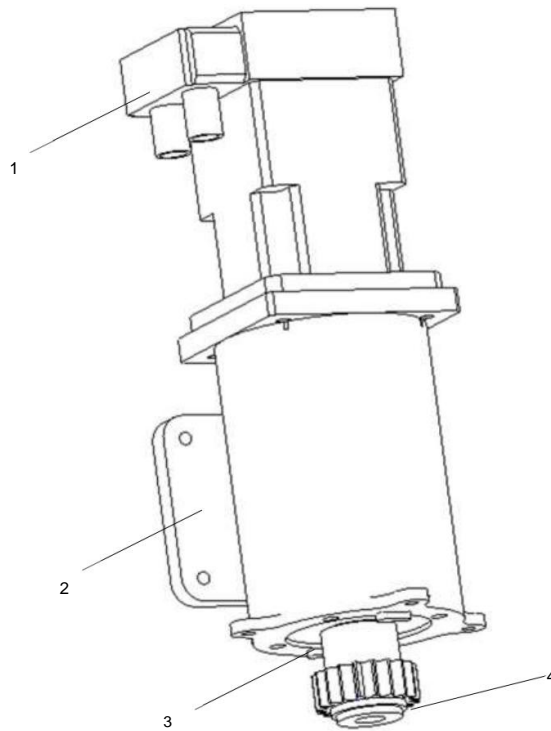


Figure 18: Combination scope

f) Directional drive mechanism

Installed on the right side of the 12.7 mm machine gun mount. The directional drive mechanism consists of a housing, a gear motor, output gears, etc. The motor and gear reducer are mounted on the housing of the drive mechanism in the direction Reduction motors and gears can be exported. It is connected as a fixed unit. The output gear of the directional drive mechanism engages the gear teeth, outside of the turret ring gear. The motor can drive the rotation of the weapon in relation to the gears. Turret ring in the direction



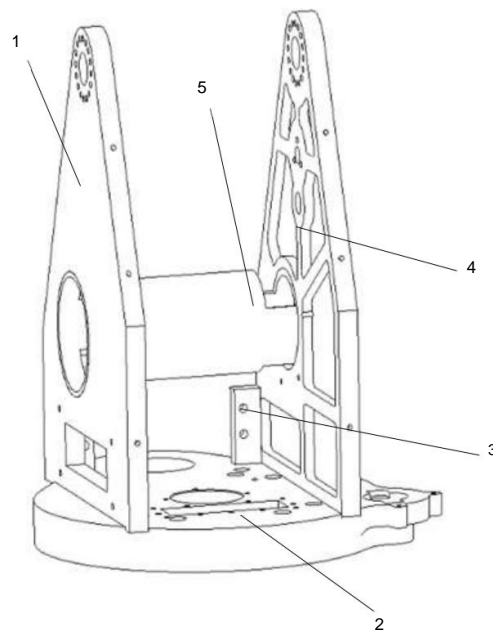
1. Motor

3. Reduction gear

2. Directional drive mechanism housing 4. Directional drive mechanism output gear **Figure 19*****Directional drive mechanism set***

g) 12.7 mm machine gun mounting stand set.

The 12.7 mm machine gun mount is the main support for the parts and Components of the station for controlling weapons from inside the vehicle It consists of a vertical support plate on the left side. Right vertical support plate The bottom support plate, etc., on the mounting stand kit has Connect multiple elements



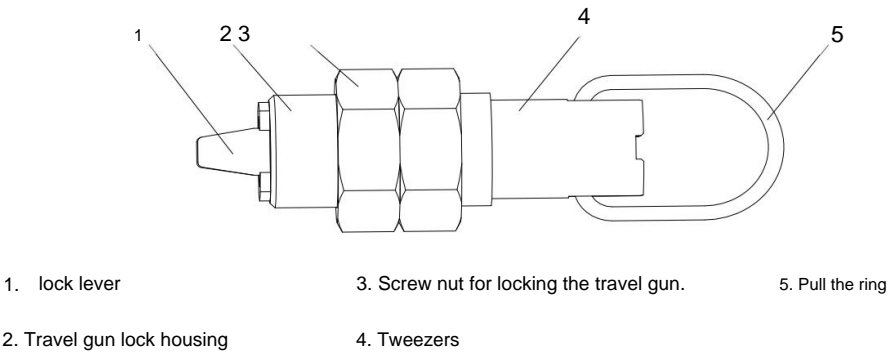
- | | |
|--|---------------------------------|
| 1. Vertical support plate on left side | 4. Right vertical support plate |
| 2. Bottom support plate 3. | 5. Mounting platform housing |

Electromagnetic brake unit mounting base

Figure 20: 12.7 mm machine gun mounting stand set.

h) Main structure of travel gun lock

The travel gun lock consists of a locking lever. Travel gun lock housing, tongs, pad Travel gun lock threads and pull ring The travel gun lock has a long-term locking mode. which can be locked There is a station to control weapons from inside the vehicle both in the direction and direction. by inserting the gun lock latch Travels into the lock hole of the curved plate lock. (locked in a high way) or into the lock hole of the ring gear. Outer turret (Lock in direction) The vehicle's weapon lock mode can be adjusted for the long term. This must be done from outside the vehicle.



Picture 21: Travel gun lock

i) Main structure of sliding ring connecting circuit

The sliding ring connecting the circuit consists of The sliding ring connects the circuit at the top. The sliding ring connects the circuit at the top. Connect the circuit below. Direction measuring sensor and rubber seal sheet The sliding ring connects the circuit at the top. Connect to the weapon station's machine gun mount from inside the vehicle. and sliding ring connecting the road circuit The bottom is connected to the internal operating equipment. It creates a circuit connection between devices. internal to external devices Direction measuring sensor The station's rotation angle can be verified. Control the weapon from inside the vehicle in relation to the gun turret in the direction To avoid deviation in during shooting

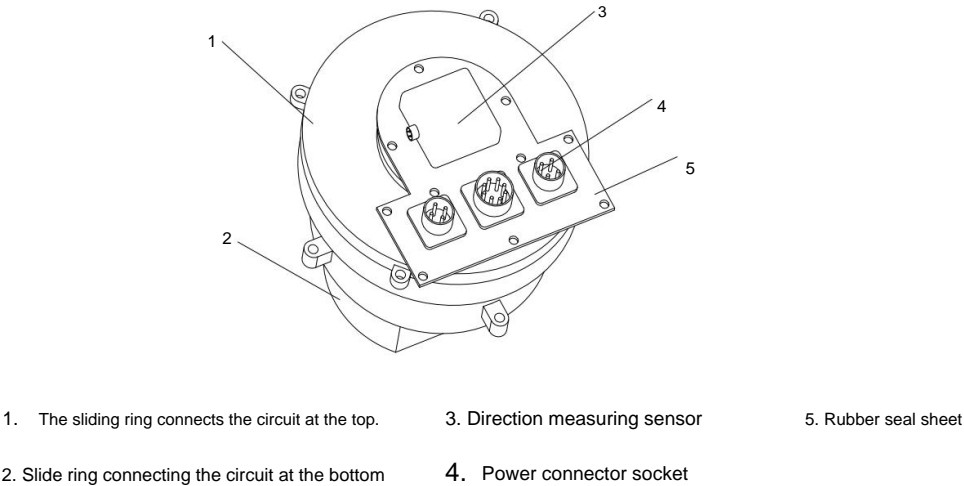


Figure 22: Slide ring connected to the circuit

j) Main structure of the turret ring gear.

The turret ring gear supports the full weight of the system. Turret ring gear

The gun has an inner gear, an outer gear, and a bearing to support the gun turret ring gear. to make scrolling more accurate The turret ring gear is designed with two ball bearings to support the turret ring gear.

The top housing and bottom housing rows are the components for the internal gear.

The relative position of the top and bottom of the inner gear can control the balance.

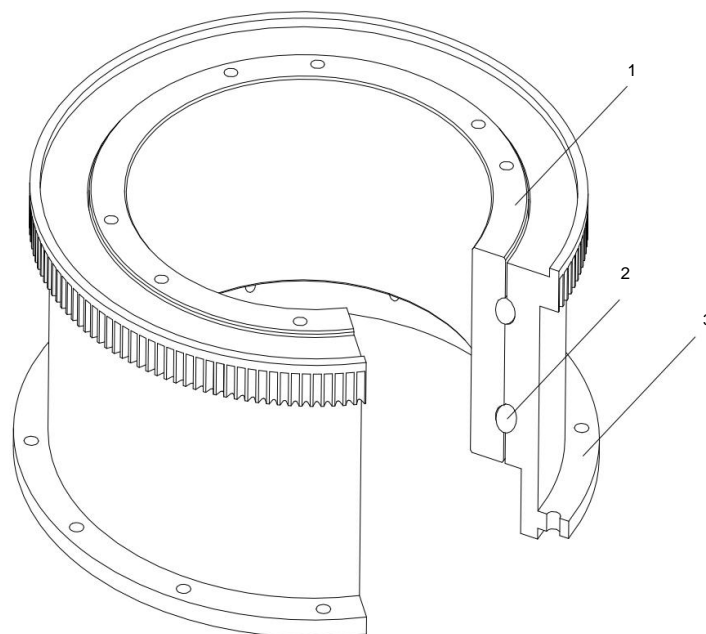
Between the turret ring gear supporting bearing and the turret ring gear supporting bearing and the path of the turret ring gear supporting bearing.

gun for the reason that the distance of the turret ring gear can be controlled and thus more accurate

The inner turret ring gear is connected to the bottom of the machine gun mount and the gear

The outer turret ring connects to the machine gun cradle at the bottom. Round turret ring gear

The inside and outside will rotate so that the movement of the weapon station controlled from inside the vehicle is related to the Turret rotation



1. inner gear

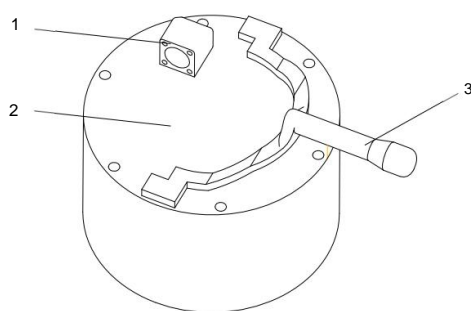
2. Ball

3. Outer gear

bearing, **Figure 23, turret ring gear**

k) Electromagnetic brake

The electromagnetic brake is a power-off brake with a torque of more than 50 newton meters (Nm.). The electromagnetic brake can be used for control weapons stations from inside the vehicle in a shooting-lockdown operation. and travel gun lock In firing operations, the electromagnetic brake can control the movement in height and direction. and limits jumping and Vibration of the muzzle of a machine gun To insure a stable firing rhythm and station firing. The weapons are controlled from inside the vehicle with precision. The electromagnetic brake can be used as a travel gun lock for a short period of time, changing the operating mode from a travel situation to a combat situation.



1. Electrical connector socket 2. Electromagnetic brake housing 3. Manual release lever

Figure 24 Electromagnetic brake

l) Driving mechanism box

The drive mechanism box consists of the main components: Box housing, drive chamber and drive module The drive module receives control commands and data from a combination control box. It uses a high response speed to drive the motor, receiving real-time position and speed information from the motor. Causes control of motor driving.

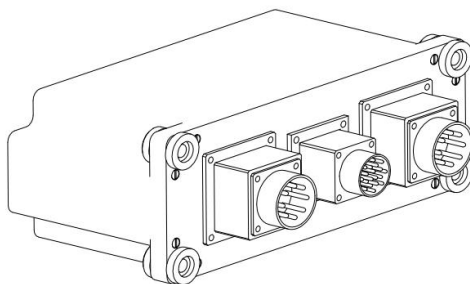


Figure 25: Driving mechanism box

m) Combination control box

The combination control box consists of main components: Box housing Control circuit board and driving force components The box housing is designed in the form of a drive chamber, control circuit board. and the driving power components are provided in the control room. propulsion

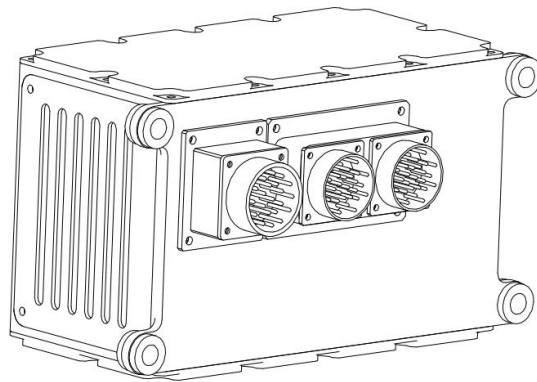


Figure 26: Mixed control box

n) Vehicle commander's image display and control screen

The commander's display and control unit is used in conjunction with the fire control system. It displays video signals of the weapon station controlled from within the vehicle.

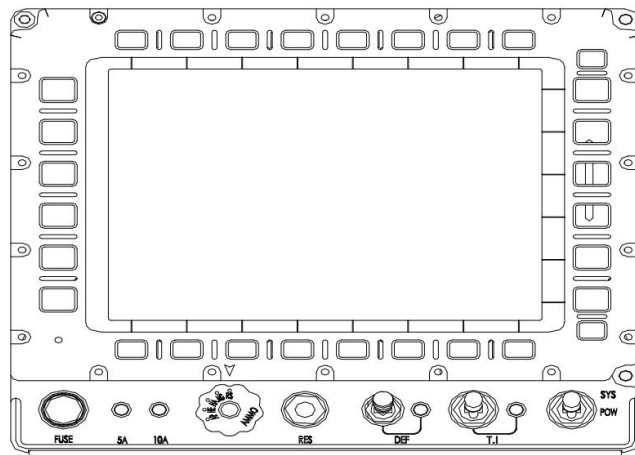


Figure 27: Vehicle commander's image display and control screen.

o) Commander's control device.

Vehicle commander's control device. The vehicle commander works with the fire control system and makes the weapon system work. It consists of turning, locating and firing, etc. Warning lamps are connected to switches in series to show control. Operate the commander's controls and turn both handlebars in height and direction. To control the aiming signal in height and direction On the switch panel there is an ELEVATION START switch, a FIRING button, and a LASER RANGE FINDING button. RELEASE button)

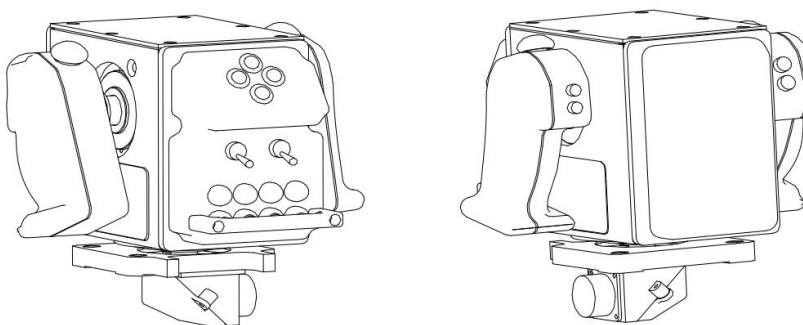


Figure 28: Vehicle commander's control device

at) Switch box

On the switch box there are switches and control buttons for the weapon station, controlled from inside the vehicle. which includes shooting safety and changing system modes Changing the operating state of the system Changing the visibility zone of the video image Changing the working mode to MANUAL/AUTO Selecting the gun's firing type as short burst/continuous fire, etc.

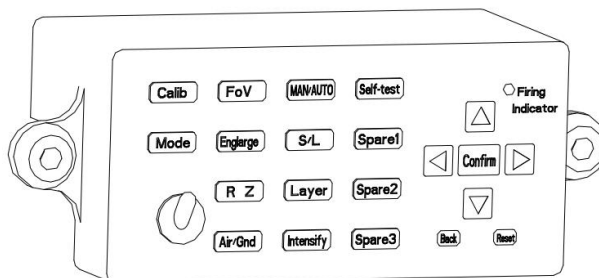


Figure 29 Switch box

j) Box for changing use positions

Receiving signals from buttons and switches on the switch box, the control signals of the vehicle commander's control unit can be converted into network transmission channel signals. control area (CAN bus signal), which is sent to the combination control box. Different video signals received from the box Mixed control can be converted to a single end video signal. (Single-ended video signal) to be sent to the fire control system computer.

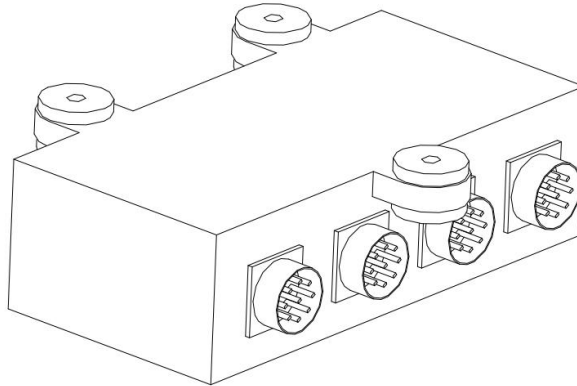


Figure 30: Use position change box

2) Working principles

The weapon control station from inside the vehicle is based on inspection and aiming instruments, monitors, control devices. and the vehicle commander's control device to inspect the surrounding area, aim at the target, measure distance, fire, adjust settings, and adjust data. and select the operating mode, etc. The crew uses the controller. Monitors and controls to control weapons Aim the weapon at the target, measure the distance and fire from inside the vehicle. The combination control box is the main body of the control system. Control signals, video signals The transmission channel information of the control area network, etc., is received and processed logically from the combination control box. cause control Integrated between combination control boxes Driving mechanism box Monitors and controls The transmission channel of the control area network (CAN bus net) will be used in the design to be able to Communicate with surveillance and aiming tools and angular velocity sensor (Angular sensor) through the transmission channel of the control area network RS422 in the form of c Serial communication

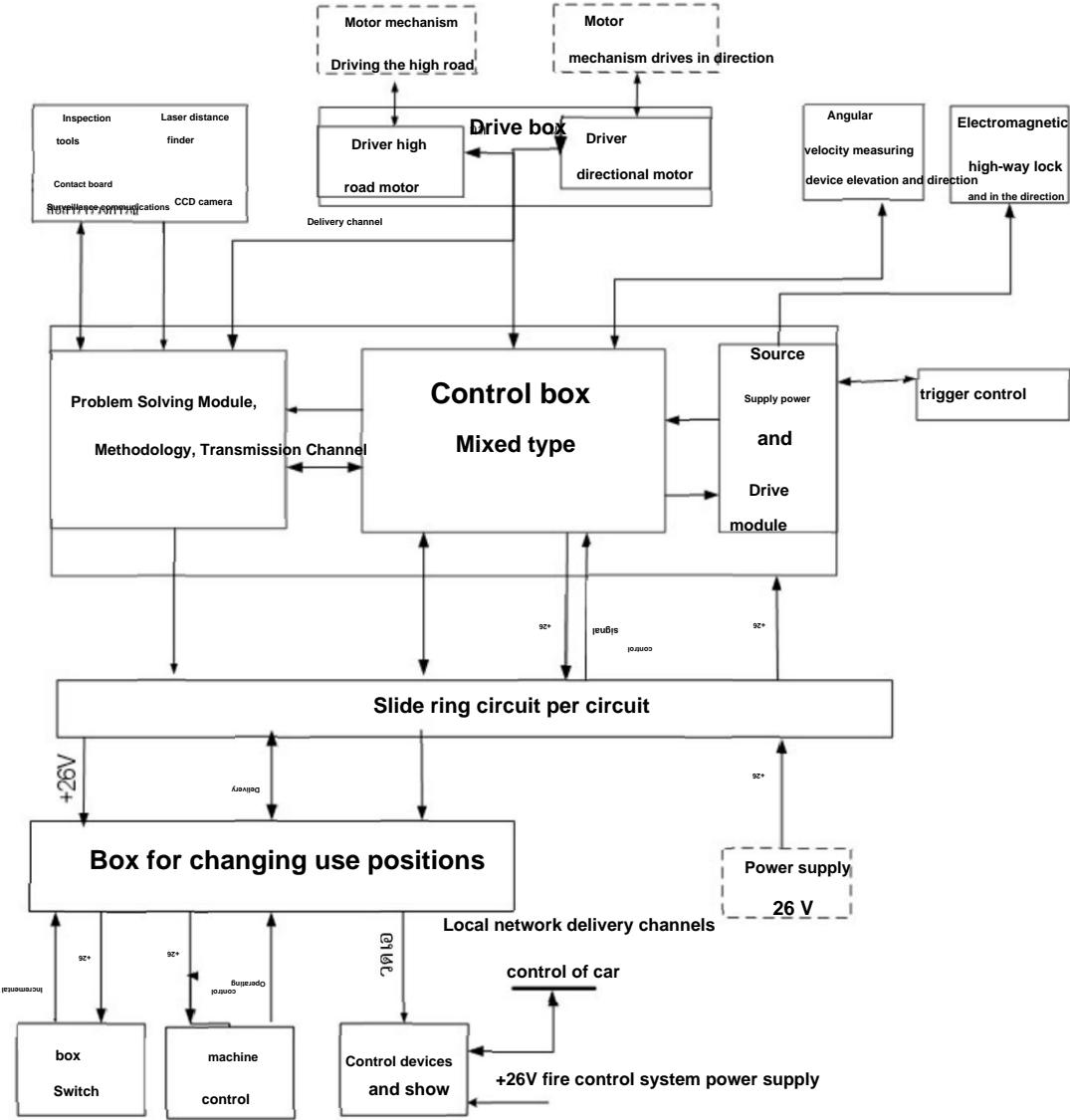


Figure 31: Working principle of the system

3) Working mode

The system has two modes of operation: calibration mode. (CALIBRATION) and WORKING (WORKING) modes. Calibration mode includes weapon line intersection.

(Line of weapon) with line of sight (Line of sight) and entering the correct values, the operating mode performs the tasks of search, reconnaissance, aiming and firing. towards the target Driver inspection Targeting with operating mode by changing viewing range And after setting the target, the system will be in the state of aiming and firing. There are three operating modes: AUTO mode, AUTO TRACK mode, and when the system The system is not working fully (DEGRADING) 4) The working steps of the system AUTO

mode is the default mode for

aiming and firing. The crew uses a controller to control the altitude and direction of the drive mechanism motors. In altitude and direction, the weapon can be rotated, using a wide field of view to locate the target, and after the target is detected, Switch to a narrow field of vision. Check the monitor and control equipment and aim the glass scale "+" at the target. Press the rangefinder button on the controller to measure the range. Finely align the "+" glass scale displayed in the monitor and control device with the target again. Turn on the switch. the firing safety switch and press the trigger button on the control unit. Electromagnetic braking unit It instantly locks in height and direction. At the same time, the machine gun's electromagnetic trigger also locks in height and direction. Start shooting

with precision. To shoot at a moving target The system has an automatic targeting function. (AUTO TRACING), which can analyze images of moving targets and provide technical feature matching, and can detect target positions and movement parameters, etc. Operate the controls to rotate the weapon. Use the wide field of vision to find the target, and after finding the target, switch to the narrow field of vision. Aim the glass scale "+" at the target. Press the range finder button on the controller to automatically drive the weapon towards the target. The system can measure Automatically ranges and determines the range and drives the weapon to the firing angle. Turn on the fire safety switch. Then press the FIRING button on the controller to fire at the target.

In the case of laser rangefinder (LASER RANGE FINDING) and problem solving

If BALLISTIC RESOLVING is defective, select the mode when the system is not fully operational.

(DEGRADING) using the video image distance scale to roughly measure the distance to the target. On the

basis of roughly measured distances Use the controller to aim at the target using the scale.

As for setting the distance of the glass scale to be consistent with the distance found, press the trigger button on the machine.

control to shoot

Chapter 6

Communication equipment (COMMUNICATION EQUIPMENTS)

Section 1

General Description (GENERAL DESCRIPTION)

The function of the communication system is complete communication within the vehicle and between vehicles.

Including work on voice communication and data communication.

Communication equipment consists of two parts: internal communication and communication.

Communicate between cars Internal communication is provided by the Chinese side. Including a set of internal communications

One digital VIC-2001H One network controller and one set of cables. Equipment

Communication between vehicles will be arranged by the Thai side. (This manual does not contain content in this section.)

Part 2

Communication within the vehicle (INTERNAL COMMUNICATION)

1. General description

Internal communications includes the VIC-2001H Digital Internal Communications Kit.

One set, one network controller and one cable

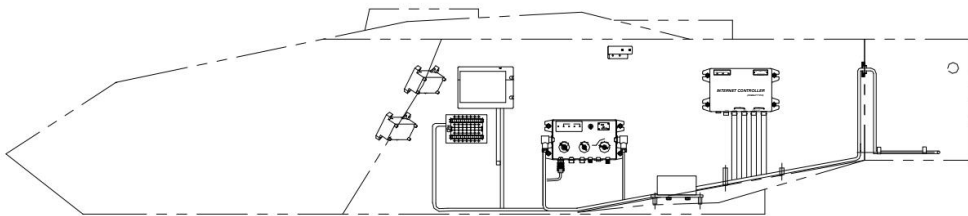


Figure 1: Position of communication equipment (Position of communication equipment)

2. Main performance parameters

A. Digital in-vehicle communication device **VIC-2001H**

- 1) There is work in a form that reduces noise that can increase efficiency.

Communicate

- 2) Use digital audio technology

- 3) Use a method of receiving and transmitting data via communication cables in two directions, alternating without

Must use timing cable.

- 4) Use the crew helmet to connect to communication.

- a) Input audio signal level: 7 millivolts (mV)/150 ohms (ȳ) b) Output

signal level: 7.35 volts (V)± 15%/600 ohms (ȳ)

- c) Output sound wave frequency range: in the region of 300-3000 Hz.

(Hz) , In the area of ±3 decibels (dB) using the standard criterion of 1 kilohertz (kHz).

- d) Change in the shape of the output sound wave: change value

(Distorsion) ȳ10%

e) Signal to noise ratio:

≥40 decibels

f) Noise reduction performance:

≥35 decibels

5) Radio interface parameters

a) Radio connection reception level: 220 millivolts \pm 15%/150 ohms (V)

b) Radio link transmission level: 220 millivolts \pm 15%/150 ohms.

B. Main network connection control unit (Commander's car) (Main interfaces of network controller) (command type)

1) Two-way digital signal connection set (RS-232C), 5 sets, rate

Speed of receiving and sending (Rate) 50 bits per second (bps) - 57,600 bits per second (bps)

2) Remote control signal connection (RS-232C), 3 sets, rate

Receiving and sending speed 2,400 bits per second - 57,600 bits per second

3) 6 sets of communication connections within the car with audio signals, a set of mouth-to-headphones (PTT), signal testing, usable at a low level.

4) 1 set of connected speakers, output rate 1.73 volts/600 ohms, output power after amplifying the signal is not less than 1 watt (W)

C. Main interfaces of network controller) (fight type)

1) Two-way digital signal connection set (RS-232C), 5 sets, rate

Receiving and sending speed (Rate) 50 bits per second - 57,600 bits per second

2) Remote control signal connection (RS-232C), 1 set, rate

Receiving and sending speed 2,400 bits per second - 57,600 bits per second

3) 6 sets of communication connections within the car with audio signals, a set of mouth-to-headphones (PTT), signal testing, usable at a low level.

3. **System composition and principles of operation (System composition and working principle)**

A. System composition

1) Fighting vehicle

The client consists of one internal contact box number 1, contact box Inside three No. 2 sets, three sets of chest switches, three crew helmets, a set of mouths. One speaker-headset, one network control unit (client), and one cable.

2) Commanding vehicle

The commander's vehicle consists of one internal communication box number 1, two internal communication boxes number 2, a chest switch unit. Three sets, three crew hats, One set of mouthpiece-headset, one set of network control set (commander's car), one set of speakers, and cables
One set of cable

B. Working principle

a) Fighting vehicle

Digital internal communication device VIC-2001H is used for Communication as a person inside the vehicle Each crew member can communicate with one another via Intercom box and can communicate via radio between vehicles. Intercom box number Can be ¹ assigned to communicate via radio with any crew member. When the vehicle commander allows Each crew member can use the radio independently via intercom box number 2. The operation of the network control unit (crew) is the pairing of the Thai Army's special short-wave radio set. with the audio signals of the Chinese intercom box and the mission control display data signals from China of The operator can control the vehicle. To combine equipment from both sides into a single communication system. The only one that works perfectly.

b) Commanding vehicle

The principle of operation and composition of the device is almost the same as that of the car.

Clients have only one difference: Network control unit (Command type) to be used

It is necessary to connect to three radio signals, which are ultra-short-wave radio audio and data signals.

Two units, that is, a shortwave radio set and a current channel amplifier loudspeaker.

C. Instructions for use (Function introduction)

1) Contact box within the number 1 (Intercom box 1) (Figure 2) 1 is

Contact box within the number 1 responsible for connecting to the radio and controlling

Operation of the internal contact device Up to three radio sets (clients) can be connected to each other.

One radio set connected, the commander's car connected to three radio sets) Internal communication box

No. 1 includes address signal lamp, power distribution switch, forwarding switch, adjustment switch.

Export and switch application control mode

Radio Unit A and Radio Unit B can be manually adjusted for forwarding. Outputting a signal

The radio set has the following operating modes: For example, in "Monitor" mode (boxes 1 and

2), the radio cannot be used to output audio signals. f), in mode

"Commander" (only number box 1A radio can be used to send out audio signals.

can) and in "Commander + Crew" mode (both boxes number 1 and number 2 can use the radio

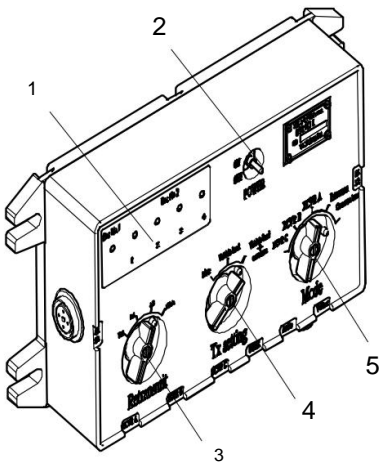
to output audio signals) and box number The signal cable connection 1 can control

condition of Box No. 2 is possible. Box No. In all Box No. 2 operations when 1 Still have duties

using the connection via "Radio A" box. The internal contact receives power from the radio set

and has protection capabilities.

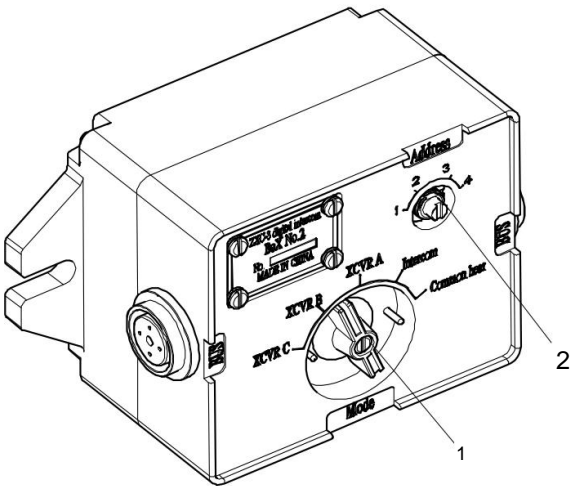
The power surge returned again.



- 1. Personal number light bulb
- 2. Power distribution switch
- 3. Forwarding switch
- 4. Export adjustment switch
- 5. Use mode switch

Figure 2: Intercom box number 1

2) Intercom box 2 (Figure 3)



- 1. Switch to select the mode of use.
- 2. Switch to adjust the personal number.

Figure 3: Intercom box number 2

Internal contact box number 2 can listen to the internal contact network and radio.

The crew can use the hotline. (Hotline refers to a method of sending speech without pressing buttons.

"Send" on the TR send/receive switch box) to send words to another crew member. How to control the switch button

(The button control method refers to the method by which the "Send" switch on the TR switch box must be pressed. to send speech) to use in

Sending Speech Using the Radio The crew can make other crew members in the vehicle listen to their voices.

You can make a call (mandatory call) by pressing the "Calling" switch button, but this will not interrupt the crew's radio transmission.

others who are listening

3) A set of talking mouth-headphones, internal communication box OSC-2A (Figure

4) A set of talking mouth-headphones, internal communication box OSC-2A, used for receiving – Send audio

signals Can connect to other internal communication boxes. The tank is equipped with a set of mouthpieces - headphones.

A box at the rear of the tank and used for communicating with personnel outside the vehicle.

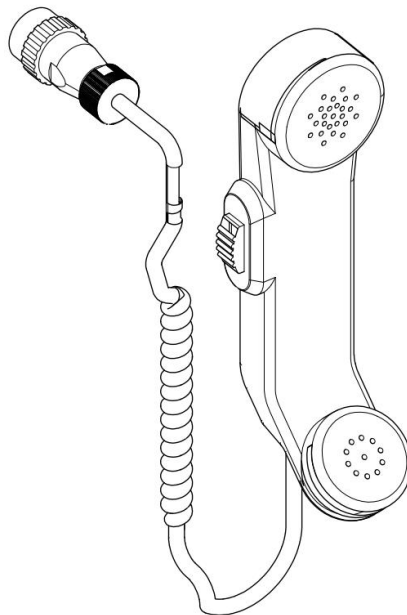


Figure 4: OSC-2A Handset (OSC-2A Handset)

4) Network controller box (client vehicle) (Figure 5)

The network control box (client) is used for pairing with shortwave radio signals.

Special features of the operator's vehicle, internal communication box and operator mission control display.

This control box does not require manual operation.

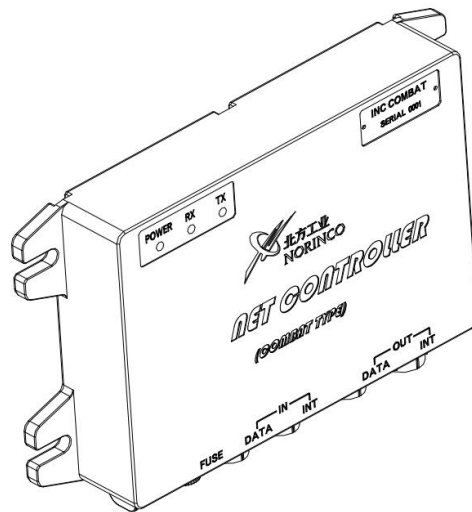
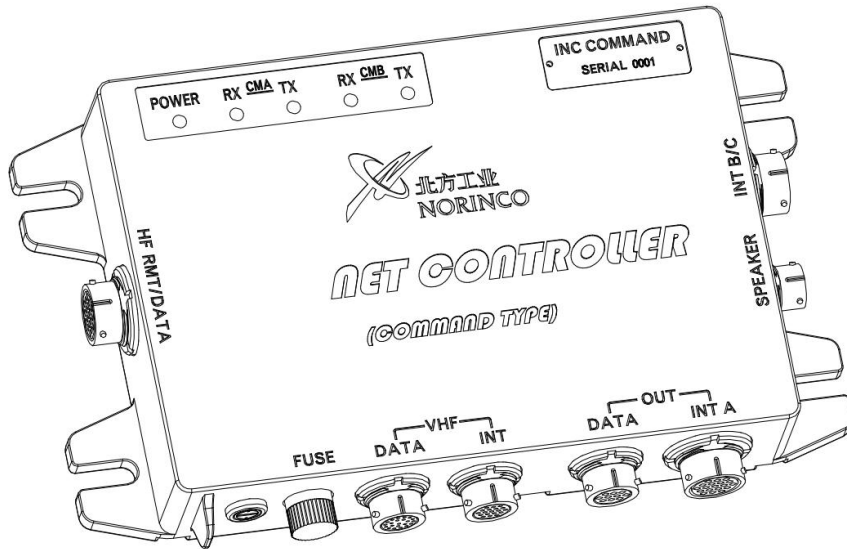


Figure 5 Network control box (Net-work controller (workstation))

5) Network control box (Commander's car) (Figure 6) Network control box (Commander's car) Used for pairing with radio signals.

Special shortwave dual ports in the commander's car, shortwave radio set, internal communication box and control display.

Commander's mission This control box does not require manual operation.



**Figure 6: Network control box (Net-work controller
(Commander's car)) 6) Loudspeaker (Figure 7)**

Loudspeakers (located in tanks provided by Chinese commanders) are used to amplify sound. of communication and share it with the crew inside the vehicle to hear.

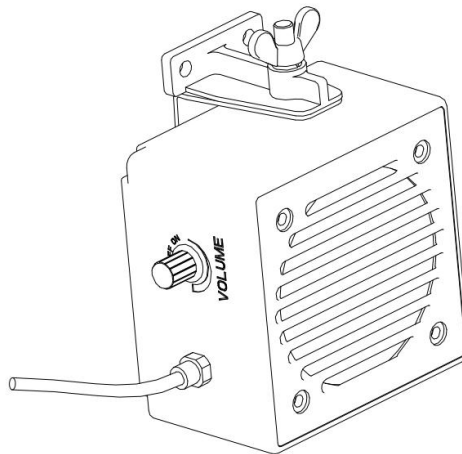
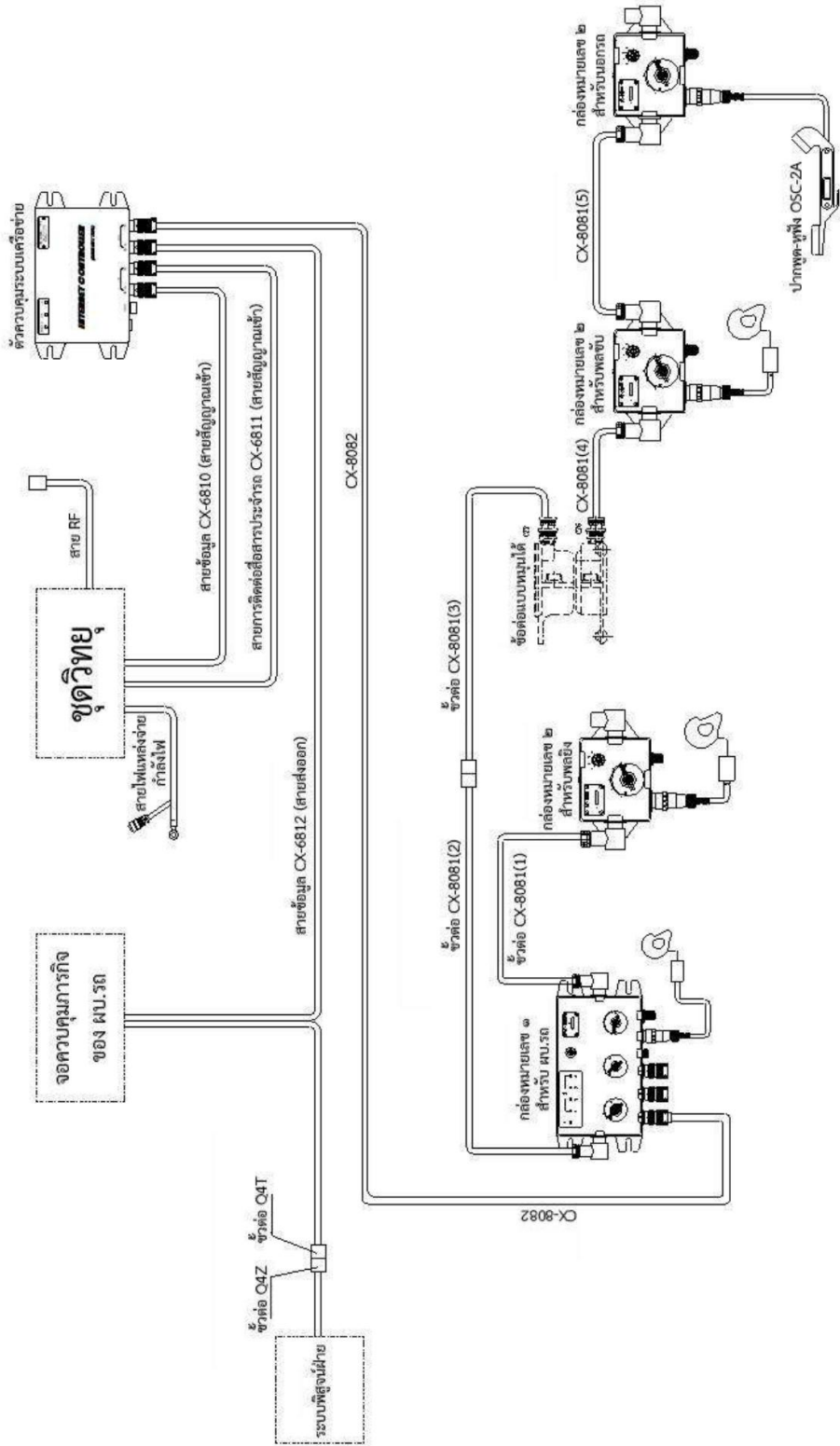
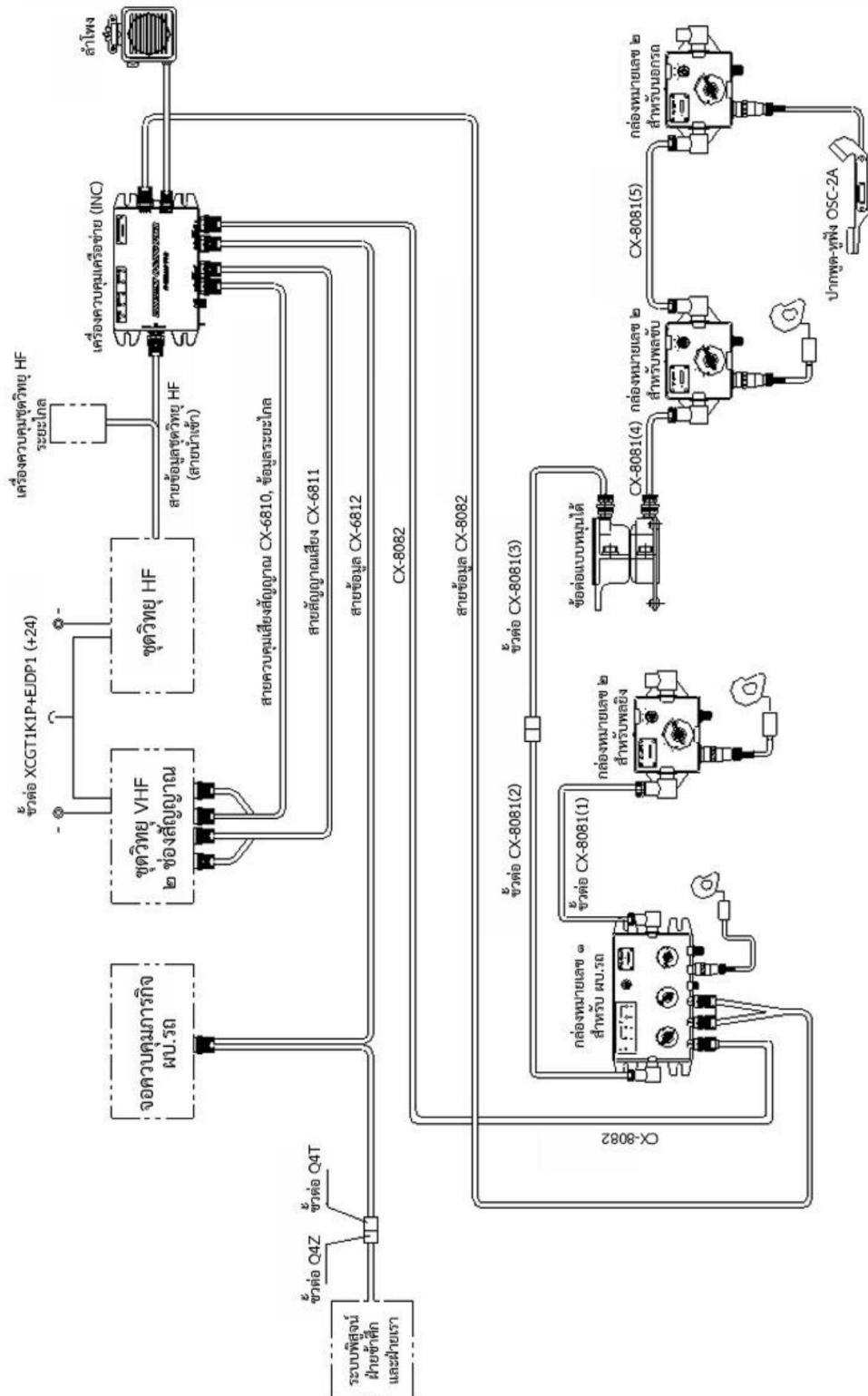


Figure 7 Loudspeaker





Chapter

7 Integrated Power Generators (INTEGRATED POWERPACK)

1

Section: General Introduction (GENERAL INTRODUCTION)

The hybrid generator can be removed and installed in the generator room and Make repairs quickly on the

battlefield. A combined power generator consists of an engine. Speed changer, power transmitter, power output coupler Cooling system, lubrication system, air supply system, oil cooler, speed changer Smoke screen generator with heat, electrical system, power generator Generator fuel pipe Brake fluid pipes, generators, etc.

Part 2

General characteristics and capabilities (GENERAL LAYOUT AND PERFORMANCE PARAMETERS)

1. General characteristics of the power generator

(Powerpack) The VT/E1 engine is placed transversely within the power compartment and the power is connected to the left side. The center of the power output of the Ch1000B speed converter is parallel to the center of the engine crankshaft. (The engine is placed in front and The VT/E1 engine and Ch1000B speed converter are mounted securely together via a transducer. A power conduit on the left side and three special connecting frames form the basic components of a combined power generator (see Figure 1).

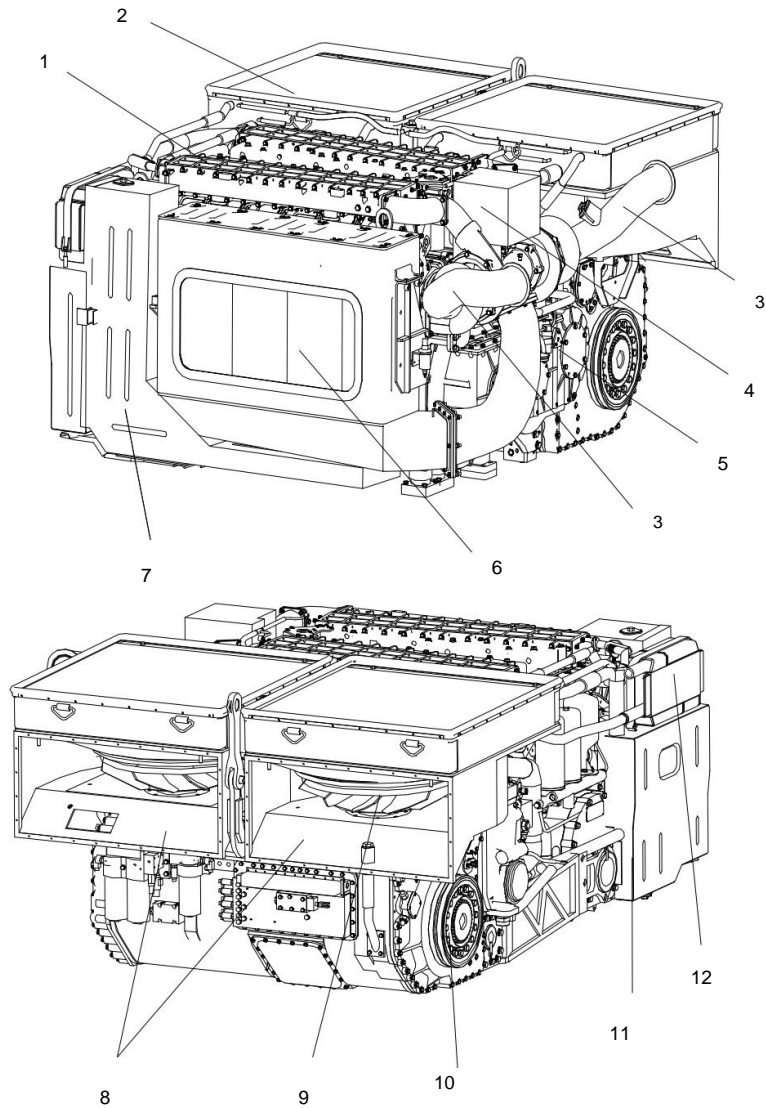
Secondary air filter and air intake pipe of the air filter Lubricant tank Steering oil tank The hose and associated wires are installed from left to right on the front of the engine. and a steering oil heat exchanger installed on the fuel tank. Steering the expansion water tank installed on top of the engine's flywheel housing.

(Engine flywheel housing) and the exhaust from the engine exits from the rear of the vehicle on the left side.

Top of speed changer (Transmission) has 2 mixed flow fans Ø 600 mm., 2 cooling fan housings and a honeycomb radiator. High temperature cooling and low temperature 2 housings. Transmission oil heat exchanger installed in the space between the ventilation fan housings. Heat and engines



Picture 1



- | | |
|--|---------------------------|
| 1. VT/E1 engine type | 7. Lubricant tank |
| 2. High temperature honeycomb radiator and low temperature | 8. Cooling fan housing |
| 3. Exhaust pipe | 9. Mixed flow cooling fan |
| 4. Overflowing water storage tank | 10. speed changer |
| 5. Power transmitter (by gear reduction) | 11. Steering oil tank |
| 6. Second stage air filter | 12. Steering oil cooler |

Figure 2. Components of a combined power generator.

2. Main performance and parameters

Ready weight	~ 52 tons
Weight-power ratio	~16.98 kilowatts per ton
maximum	70 km./hr.
speed average speed	35-45 km./hr.
Acceleration (0-32 km/hr.) Time	10-12 seconds
required to change the generator. Tank	~ hour
proportions: lengthxwidthxheight =2405 mm.x1960 mm.x1196 mm.	

Part 3

Structure and working principle of hybrid power generator. (STRUCTURE AND WORKING PRINCIPLE OF INTEGRATED POWERPACK)

1. Components of a combined power generator

A power generator consists of an engine. speed changer Broadcaster

Power, connecting parts Honeycomb radiator, high temperature cooling and low temperature ventilation fan

Heating, lubricating oil tank Secondary air filter, intake pipe, heat sink

engine oil change speed Steering oil cooler Fuel tank steering system

Thermal smoke scene Steering linkage, steering gear Engine exhaust pipes on both front

and behind the generator fuel pipe and the power cord of the generator

2. Description of the connection point between the generator and the vehicle.

A. Anchor points on the

vehicle floor. The generator is installed in the generator room at the rear of the vehicle.

The front engine is on the left side of the engine. (looking facing the flywheel housing) and the left side of

Front flywheel The rear supports are located on both sides of the speed converter. After

Lift the entire generator set and install it in the generator room. Use 2 M24 bolts to secure the engine rubber

feet at 2 points to the vehicle floor in sequence. and fasten the rear engine mount rubber at 2 points with

M20 bolts. There are also 2 bases on the right side of the engine which support

with the corresponding platform on the vehicle floor. These supports can absorb some of the impact.

When the generator is under strong shock, to prevent the equipment from connecting during

The engine and speed converter are subjected to excessive force.

B. On the wall of the generator room (Bulkhead) in front of the left side.

The fuel pipe remaining from the combustion of the injector flows back to the tank (Fuel overflow pipe) ÿ pipe is on the upper part of the wall of the generator room. Quick release connector for remaining fuel pipe From the oil supply of the high pressure fuel pump (Fuel return pipe quick joint) ÿ located on the central Joint part of the generator room wall. Quick release couplings, brake system fuel pipes, and couplings Electrical wires with 5 connectors are located at the bottom of the generator room wall.

C. On the left side of the power compartment.

There are 2 clamps for the exhaust pipe and the vehicle's exhaust pipe, 2 water pipe quick release connectors, and connection to compressed air pipe, 1 point, 1 point, and quick release connector for fuel supply pipe Quick release

D. On the right side of the generator room.

There are 3 electrical connectors and a connecting pin used for the rocker. Steering control lever on the right side of the generator.

E. At the end connection point of the generator.

There is a hook. 1 A piece at the end of the power generation room for pulling the rear lug. on the rear armor plate

3. Working principles refer to the systems involved.

See related systems

Chapter 8

Engine (ENGINE)

episode 1 GENERAL DESCRIPTION

The diesel engine is the heart of the tank. Its main function is to provide power to the tank.

Rotate the belt and drive the tank.

Important characteristics of the VT/E1 **diesel engine (Main characteristics)**

The engine uses rapid mixed combustion technology, fuel delivery technology.

High pressure 100 MPa, intake booster (Turbocharger), technology to increase pressure, pressure ratio

Height of turbine blade set Integrated electronic control technology of diesel engines

Diesel engine type VT/E1, water cooled, 4 strokes, 12 cylinders, pump type

Placed in a V shape at an angle of 60°. Turbocharged diesel engine with vented intercooler.

Heating air with water (Water-to-air intercooler turbocharged) with direct injection system into

Combustion chamber (Direct injection) Engine power 883 kilowatts at 2300 rpm, maximum torque 4400

newton meters at a speed of 1400-1500 rpm. sense

Excellent maneuverability guarantees the performance of the VT4 tank.

Fuel consumption does not exceed 225 grams per kilowatt hour. at medium speed with

Full load The lubricant consumption rate is not more than 2.5 grams per kilowatt hour, which has

saving efficiency that the use strictly complies with the specified requirements. Hours guaranteed

The use of the engine is not less than 500 hours. The engine is highly reliable.

Diesel engine VT / E1 controlled electronically. Provides stable power

Continuous and precise speed adjustment There is a self-protection system and a fault diagnosis system. It

has diesel engine revolution data memory and communication capabilities.

Sending/changing data with the vehicle can be done via CAN bus, which meets the needs of

Data platform

Part 2

Main capability parameters

(MAIN PERFORMANCE PARAMETER)

1. Main performance parameter

Maximum power (Rated power)	883 kilowatts
Rated speed that produces maximum power (Rated speed)	2300 rpm
Maximum rotational speed when there is no burden. (Max rotation speed at idling state)	2450 rpm
Lowest speed - idle (Min rotation speed at idling state)	~800 rpm
General operating speed (Common working speed)	1700~2000 rpm
The rotational speed that produces the highest torque. (Max torque rotation speed)	1400~1500 rpm
Maximum torque (Max torque) Fuel consumption rate (Fuel consumption rate)	~4400 newton meters
Rate of consumption of lubricant. (Oil consumption rate)	~225 grams per kilowatt hour
Weight, overall	2250 kg.
dimensions, engine	1461×980×1085 mm.
operating hours before major repairs.	500 hours

2. Main composition and technical parameters

Table 1 Main components and technical data

list	details
Model	VT/E1 diesel engine, water-
type	cooled, 4-stroke, turbocharged, self-cooling intercooler. Swimming
Number of cylinders	12
Cylinder placement	The pump is V-shaped and tilted at an angle of 60°.
Direction of crankshaft rotation	Turn counterclockwise. (from the power output side)
Cylinder sequence numbers	From the front: Left row: 1-2-3-4-5-6 Right row: 1-2-3-4-5-6
Ignition sequence	Left 1 - Right 6 - Left 5 - Right 2 - Left 3 - Right 4 - Left 6 - Right 1 - Left 2 - Right 5 - Left 4 - Right 3
Cylinder width Stroke	150 millimeters
	160 millimeters
Maximum cylinder volume	33.93 liters
Cylinder volume Average	14.25 liters
piston movement speed Maximum	12.26 meters/second
compressive strength obtained from	13.5 MPa
combustion The pressure is still average. (Mean effective pressure)	1.35 MPa
Power per liter (Power per liter) Weight-	26 kilowatts per liter
to-power ratio (Mass density) Maximum	2.55 kilowatts per liter
dimensions Length	1821×980×1085 millimeters
Maximum volume (Max volume)	1.94 cubic meters
Power to volume ratio (Unit volume power)	456 (kilowatts/cubic meter)

Table 1 Main components and technical data (continued)

list	details
Main structure type:	
Engine housing structure	The upper cylinder block is made of cast aluminum, the lower cylinder block is from cast iron and a dry engine oil pan
Cylinder head structure	The cylinder head is cast in one piece (Casted monoblock).
Crank shaft structure	Made from alloy steel with a balanced counterweight. (Balance weight) and vibration relief device Gaslinger
Connecting rod structure, Piston	Tangent cut in-line point
structure, Engine support	Molded in one piece, the piston head retains the rotation of the piston. air flow, 3 piston ring grooves
type	Engine mount rubber at 2 points (on the vehicle). All engine mounts. 4 points in the engine room
Air distribution mechanism:	
Valve opening-closing	Twin camshafts on the cylinder head, direct drive
mechanism. Air intake valve opens.	Before reaching death center on 40°
Air intake valve close. Intake valve	Behind the lower death center 40°
distance. Intake	13 mm.
camshaft gear working distance	0.68±0.03 millimeters
Exhaust valve opens. Exhaust valve	Before reaching lower death center 60°
closes. Maximum exhaust valve lift	After death center on 40°±10°
distance. Exhaust	13 mm.
camshaft gear working distance	0.68±0.03 millimeters

Table 1 Main components and technical data (continued)

list	details
Fuel supply system:	
Fuel delivery pump, fuel delivery pump	Gear type
speed ratio and Crankshaft speed Fuel	1: 2 rounds
pump pressure Fuel	0.25~0.55 Mpa
pump flow rate	900 (liters/hour)
Fuel filter type, quantity	Paper filter type RYL13A-100
Change and maintenance intervals (hours)	1 200
The numbers show the order of the fuel injection pumps.	From the power connection side 1-2-3-4-5-6-7-8-9-10-11-12
Direction of rotation of the fuel injector	Counterclockwise from the pump gear
pump Fuel injection advance	side. First cylinder on the left, compression stroke, top dead center 23°
angle Sequence of operation of the plunger group.	12-1-4-9-8-5-2-11-10-3-6-7
Mechanism used to control speed (Speed	Electronic speed controller Multi-
regulator). Injector type.	hole fuel injector, low inertia
Number of injector holes × diameter of the	8×0.435 mm.
injector holes. Initial nozzle pin pressure (Pin valve starting pressure) (MPa)	28+1

Table 1 Main components and technical data (continued)

list	details
Cooling lubricating system:	
Cooling method, water pump type,	Water-cooled closed dual cycle
water pump speed ratio to crankshaft speed.	Centrifugal type 1.6667:1
Centrifugal water pump flow rate (liters/minute)	1200 liters/minute (Lift: 0.36MPa)
How to lubricate	Pressure-fed lubrication is the primary method, splash lubrication is the secondary method.
Engine oil pump	The three-way engine oil pump uses gears to operate.
type Ratio of oil pump speed to engine speed shaft Crank	1.6129:1
oil pump flow rate Time	~21000 liters/hour
period for maintenance of the oil filter Machine uses centrifugal force (Centrifugal	200 hours
Oil filter). Type and model of	Pin-on filter (JLX-12K)
engine oil filter. Number	2
of engine oil filters Period of use of	120 hours
the engine oil filter Main oil passage pressure pressure)	At constant rotational speed: 0.5-0.8 Mpa ; at rotational speed Others within the range 1400 - 2200 rpm: 0.4 MPa-0.8MPa;
Engine oil pressure at low idle.	~0.25 MPa
Alarm oil pressure	0.25 Mpa

Table 1 Main components and technical data (continued)

list	details
Air inlet and exhaust system:	
Compressed air cooler (Inter cooler)	Water-air cooling type inter cooler
Exhaust system type Starting system:	Exhaust wave conversion type (Pulse conversion) type)
Starting method	Starting the engine with air and starting the engine with Electricity
Main starting device device)	Starting the engine with electricity
Equipment to help start the engine (Spare starting device)	Installing the engine with air
Minimum pressure required for starting a pneumatic engine	Summer: 5; Winter: 7 megapascals (Mpa)
Maximum pressure of air distributor (Air distributor)	13 megapascals (Mpa)
Air supply timing	Air is forced into the combustion chamber before the piston reaches the combustion chamber. Upper death center 7°±1°
Speed changer system (Transmission system) :	
Speed changer structure model	Operation type cross-drive speed changer Mixed style

Table 1 Main components and technical data (continued)

Turbocharger (Turbocharger) :	
ID adding machine type (Turbocharger type)	Uses exhaust gas to drive turbine blades.
Intake booster model (Turbocharger model)	J128
Number of intake boosters (Turbocharger quantity)	2
Air flow rate	0.84×2 kg./sec
Air compression ratio of the intake booster	3.3
Exhaust temperature before entering the intake booster. (Exhaust temperature before turbo)	~750 °C
Exhaust temperature after leaving the intake booster (Exhaust temperature after turbo)	~650 °C
The operating speed of the turbocharger turbine. (Calibration point turbocharger rotation speed)	~ 75000 rpm

Part 3

System components (SYSTEM COMPOSITION)

Diesel engine housing made of high strength die-cast aluminum, cover
Cast iron bearing frame, cast aluminum oil pan, cast cylinder head, rolled steel
crankshaft, connecting rods, valves Integrated casting with cooling oil chamber
Vibrating type, direct injection combustion chamber and camshaft mechanism at the top. There is a water inlet pipe.

Between the V-shaped cylinder housings, the exhaust pipe is located on the outside of the engine.

Engine oil filter Centrifugal oil filter

and a machine that helps ventilate engine oil vapor in the crankshaft room (Respirator) installed at the front of
Engine, main lubrication channel pressure gauge and pre lubrication pump
installed on the oil filter base. Fuel pump

(Delivery pump) Air distributor (Air distributor) Booster

Intake (Turbocharger) installed at the back of the engine.

Oil pump, water pump and cooling device

The oil heat exchanger is installed on the left side of the engine.

The generator, starter motor, and two engine stands for mounting to
the vehicle are on the side. right side of engine

Fuel injector, fuel filter, base

Get the filter

The fuel filter seat and thermal smoke interface are located between
the V-shaped pump housing.

Two water-air intercoolers mounted on top of the engine.

,

Water drain valve and oil drain valve installed at the front of the oil tank.

The flywheel on the back of the engine has a M14×1.5 bolt hole.

Number of 16 holes (hole spacing 25 mm.) which are used to connect to the speed changer housing. (Transmission box housing)

The crankshaft power output connection has 16 bolt holes size M16×1.5.

Connect to

speed changer housing (transmission box) through power connection from

Geislinger coupling for power output A sketch of the VT/E1 diesel engine is shown in

Picture 9 - 13

Part 4

Working principles of diesel engines (WORKING PRINCIPLE OF DIESEL ENGINE)

1. Working principle description

The function of a diesel engine is to convert the chemical energy of the fuel into mechanical energy. Completing the energy conversion requires one cycle such as 4 strokes (see Figure 1) including the air suction stroke. Explosive stroke or power stroke Including the timing of engine exhaust. Diesel that uses 4 strokes (the crankshaft rotates 720°) to complete one work cycle is called Four-stroke diesel engine Therefore, the VT/E1 diesel engine is a four-stroke engine.

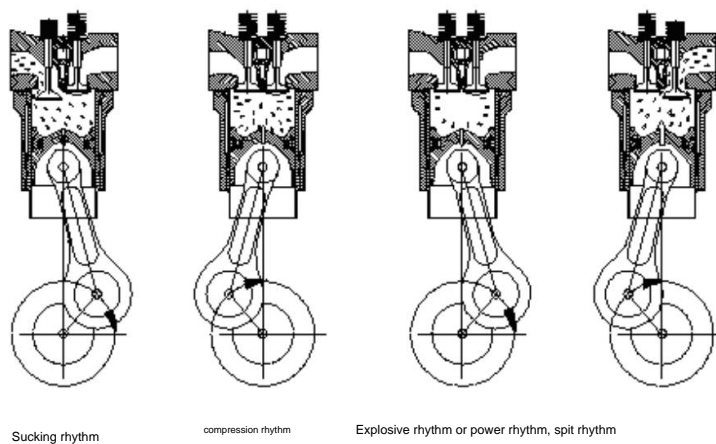


Figure 1: Working principle of a diesel engine.

A. Intake stroke

The suction stroke refers to the moment when the cylinder sucks fresh air into the cylinder. When this rhythm begins The piston is now at top dead center (TDC).

The waste will close and the intake valve will open. With the rotation of the crankshaft, the piston gradually moves downward. The pressure inside the cylinder will decrease. The air then enters the cylinder through the intake pipe. When the piston Moves down to bottom dead center (Bottom dead center, abbreviated BDC), the intake valve closes. At the same time the cylinder is filled with fresh air. which represents the end of the suction stroke.

B. Compression stroke

The function of the compression stroke is to increase the pressure and temperature of the fresh air in order to ignite the fuel/air mixture spontaneously in the cylinder. After the sucking stroke ends, the piston moves from top dead center to lower dead center along with the constant rotation of the crankshaft continuously during the process. The intake and exhaust valves are closed. The air in the cylinder is compressed. By means of the piston, the pressure and temperature are continuously increased. When the piston reaches top dead center, the air is compressed in a very small volume combustion chamber, which indicates that the compression stroke ends when the recording is about to end. Diesel fuel is injected into the combustion chamber in the vapor state through the injector under the working of the fuel injection pump. This is to ensure that the injected diesel fuel can ignite spontaneously. The temperature of the compressed air must be higher than the self-ignition temperature of the diesel fuel. In this way, the diesel fuel that is combined with the high temperature vapor and air forms a fuel/air mixture using a short time, then the fuel-air mixture will spontaneously ignite.

C. Expansion stroke

The explosion timing refers to the timing of the combustion and expansion of combustion gas. Power comes out. At this moment, the intake and exhaust valves close. After diesel fuel and air temperature rise, high levels of fuel combine to form a mixture of fuel and air in the combustion chamber. This mixture will burn violently and with high heat to cause the pressure and temperature of the combustion gas to increase sharply. Quickly, the high temperature / high pressure gas expands, propelling the piston from top dead center to lower dead center. The engine then outputs power through a crankshaft driven by connecting rods. When the piston moves down, the cylinder volume increases gradually, resulting in a gradual decrease in combustion, and the pressure and temperature of the gas will gradually decrease. The explosion stroke ends when the piston moves downward to bottom dead center.

D. Exhaust stroke

The expulsion stroke refers to the moment in which the combustion fuel-air mixture is expelled. When the piston returns from bottom dead center to top dead center Under the action of the crankshaft, the exhaust valve opens and the exhaust stroke begins. The exhaust gases in the cylinder are expelled through the exhaust valve. Under the thrust of the piston When the piston reaches top dead center The exhaust valve closes, indicating that the exhaust stroke has ended. One cycle is completed through four strokes, including the suction stroke, compression stroke, explosion stroke or power stroke. When the piston moves back and forth twice, the intake and exhaust valves open and close once, respectively. The injector will spray oil one time. and the engine will send leaving once When the cycle ends The next cycle starts with the suction stroke. Repeat This process is repeated to convert the chemical energy of the diesel fuel into mechanical energy by rotating the crankshaft. Swing to send out power.

2. Lubrication system principle and function

The lubrication system uses a splash lubrication system combined with pressure (Pressure lubrication supplemented by splash lubrication) and a dry-type oil pan.), whose main components are Oil pump (consisting of a single layer pressure oil pump and two layers of return oil pump : One layer of pressure oil pump and two layers of return oil pump, oil heat exchanger, engine oil filter (Oil filter, oil pipe (Pipeline), pressure control valve (Pressure control valve), shortcut valve (Bypass valve), One-way valve including a lubrication system set which is a part of Auxiliary system of the tank. Engine oil from the

engine oil tank flows into the engine oil cooling pot by pressure. From the oil pump to cool the engine. Then it passes through the oil filter and enters the main passage of the diesel engine and flows through the oil pipe to the main point. Various smooth screens and the position of the engine that needs cooling. Then flows back to the engine oil pan. and return to the oil tank With the return pump of the engine oil pump, in addition, 600 liters of engine oil per hour is filtered from the engine oil filter and passed through the engine oil pump. The engine oil filter is seriously damaged. The centrifugal oil filter flows directly back to the engine oil pan.

The engine oil pump and main oil passage are equipped with a pressure regulating valve. The pressure regulating valve controls the flow and maintains the lubricant pressure of the passage. Run the main engine oil while the engine is running. When the temperature Engine oil too low The pressure at the main oil passage is not too high. When the engine oil temperature is too high, the pressure at the main oil passage will not drop too much. The oil cooler and oil filter are equipped with a cut-off valve. The function of the cut-off valve is to protect the coolant assembly. Engine oil, filter, engine oil and engines When the resistance of the system is too much The shortcut valve prevents Parts of the engine oil cooler and engine oil filter are damaged, and a shortcut valve will supply engine oil to the engine in an emergency.

The oil filter base is equipped with a one-way valve and pre-connected lubrication pump. (Pre-lubricating pump) of the auxiliary system through a one-way valve. With this method, Oil does not flow back to the engine oil tank through the pre-lubrication pump while in operation. A diagram of the lubrication system is shown in Figure 2.

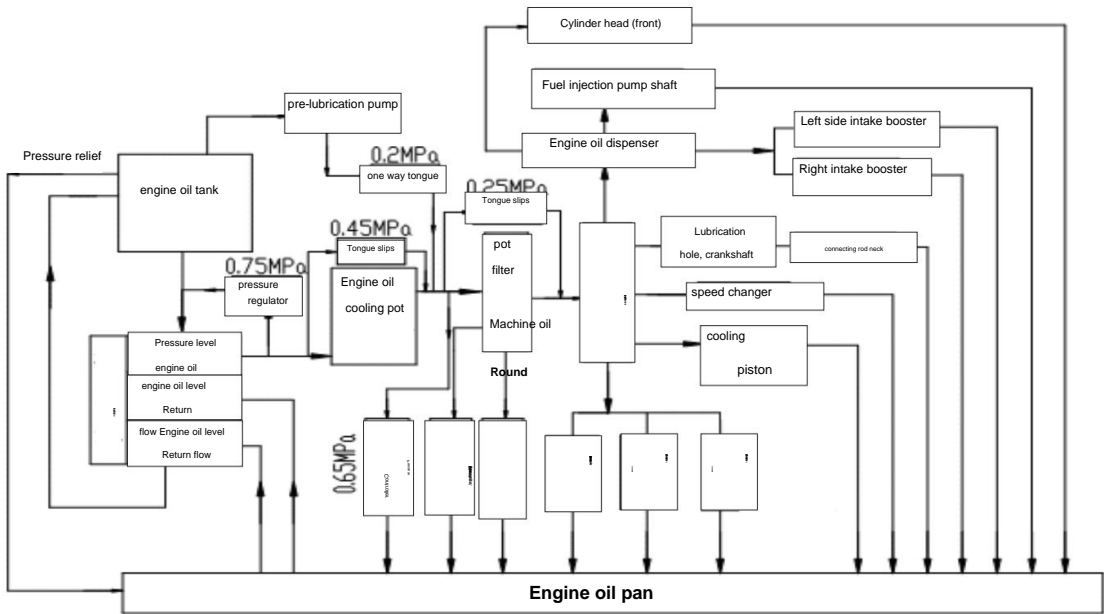


Figure 2: Diagram of the lubrication system.

3. Fuel supply system principle and function

The fuel delivery system of the VT / E1 diesel engine is a fuel pump system. Fuel through a line through an injector which has the following main components: fuel pump (Fuel delivery pump), fuel filter (Fuel filter) and fuel injection pump (Electronically controlled in-line fuel injection pump (FIP), High pressure fuel pipe, Injector nozzle, Assembly equipment The fuel system kit is part of the fuel tank auxiliary system.

Fuel from the the fuel tank is pressurized to flow into the fuel filter.

Enters the injector pump, causing the fuel to have high pressure and inject it into the cylinder. The return fuel from the injector passes through the fuel radiator and

Returning to the fuel delivery pump, the return fuel flows through a valve.

One way (Float valve) to Expansion fuel tank. System diagram.

Fuel is shown in Figure 3.

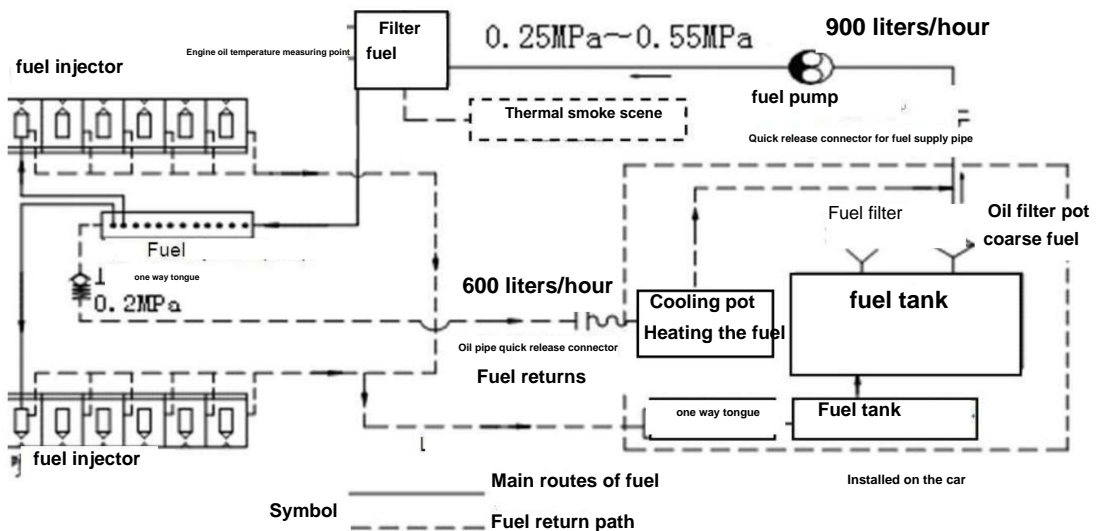


Figure 3: Diagram of the fuel system.

4. Cooling system principle and function function)

The cooling system is a single water pump with 2 circulating circuits. It is a closed system. The main components are a water pump and a cooling pot. Oil heat exchanger, air temperature reducer (Inter cooler), cylinder block, cooling water channels on the cylinder head (Cylinder block water jacket) water inlet pipe and water return pipe Assembly system of The cooling system is also a secondary system of the tank.

The main flow of the cooling system has two circulation circuits and the principle of operation.

Refer to Figure

2, Circuit 1: Water pump → Engine oil cooling radiator. → Water passage in the engine block → Cylinder head → High temperature water

radiator → Water pump; Circuit 2: Water pump → Low temperature boiler → Air temperature

reducer → Water pump The water pump dispenses water in two parts. Part of the water goes to

cool the engine oil. It passes through the oil cooler (Oil exchanger) and then enters the water passage in the cylinder block. Then flows to the return pipe. The return pipes of the left and right rows are connected.

It is connected to the high temperature radiator through interfaces at the front and rear of the engine. The

water is cooled through The water enters the high temperature boiler and returns to the water pump and

completes the high temperature circulation cycle. Another portion of water enters the low temperature

boiler. Serves to reduce the temperature of the air passing through the machine. The water-air intercooler

cools the compressed air and flows back to the water pump and completes the low temperature circulation

cycle. Steam inside the engine and water vapor Inside the intercooler, it enters the expansion tank through

the system's steam pipe. Cooling The diagram of the cooling system is shown in Figure 4.

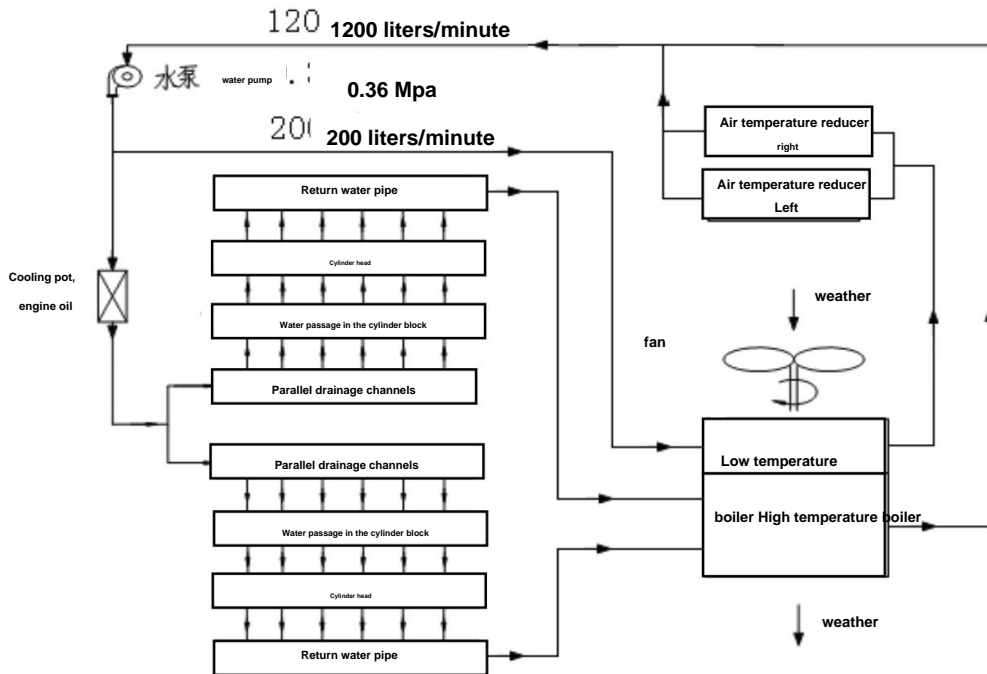
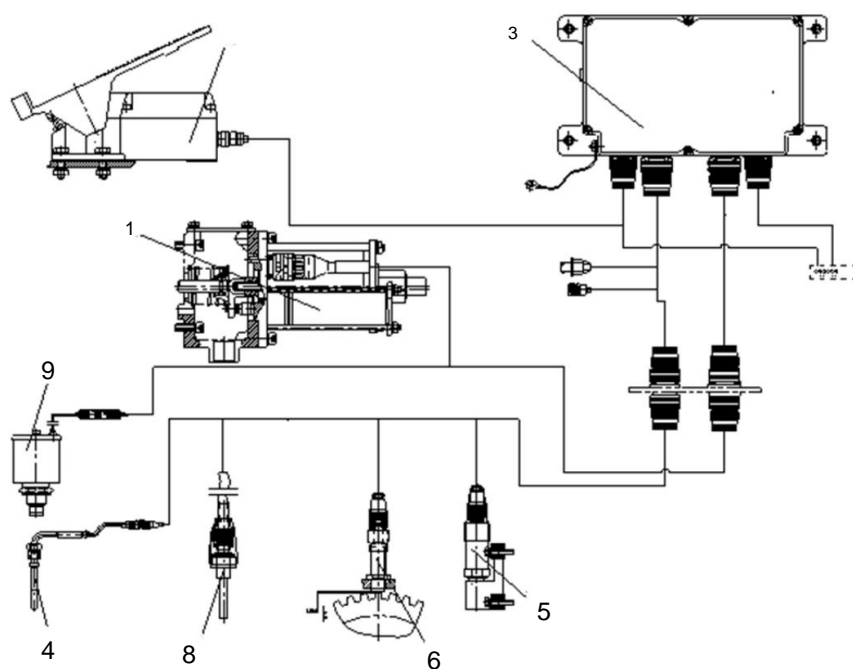


Figure 4. Diagram of the cooling system (Cooling

system) 5. Working principle of the electronic control unit and its functions (ECU system principle and function)

A. Electronic control system components

The electronic control system is a microcomputer control system in which the main components are the electronic device control unit (Controller), the valve controller (Actuator, accelerator pedal (Pedal), measuring device, and CAN bus, etc.



1. Tongue control device (Actuator)

2. Accelerator pedal (Pedal)

3. Electronic device control unit (Controller) 4.

Exhaust air temp. sensor 5. Oil pressure sensor 6. Rotation

speed sensor 8. Water temperature sensor 9. Fuel cut off

solenoid valve

Figure 5. Components of the electronic control system.

B. Control principle

The system adopts PID calculation control in parallel to use. It is the basis for calculation and control. The outer ring gear is a speed ring. speed comparison that is adjusted by the accelerator pedal and the engine speed that is transmitted from the speedometer. The difference value and signal value are received. Comes out of the outer ring gear by calculating PID. Compare the signal value coming out of the outer ring gear with the value that comes out, such as the power limit. Operation of auxiliary equipment (cooling water temperature protection, exhaust gas temperature protection) and obtain the desired position of the pump fuel supply valve lever. Oil Fuel The inner ring gear is the positioning ring. The operating value of the actuator is calculated. Through calculating the PID value of the value obtained by comparing the input position of the position ring (the outer ring requires position of the tongue stem) to determine the actual tongue stem position of Pump the fuel for output by the fuel quantity measuring device. The position of the fuel valve lever and the control of the rotational speed of the Diesel engine by controlling the power of the fuel valve actuator. For the principle The control system of the electronic system is shown in Figure 6.

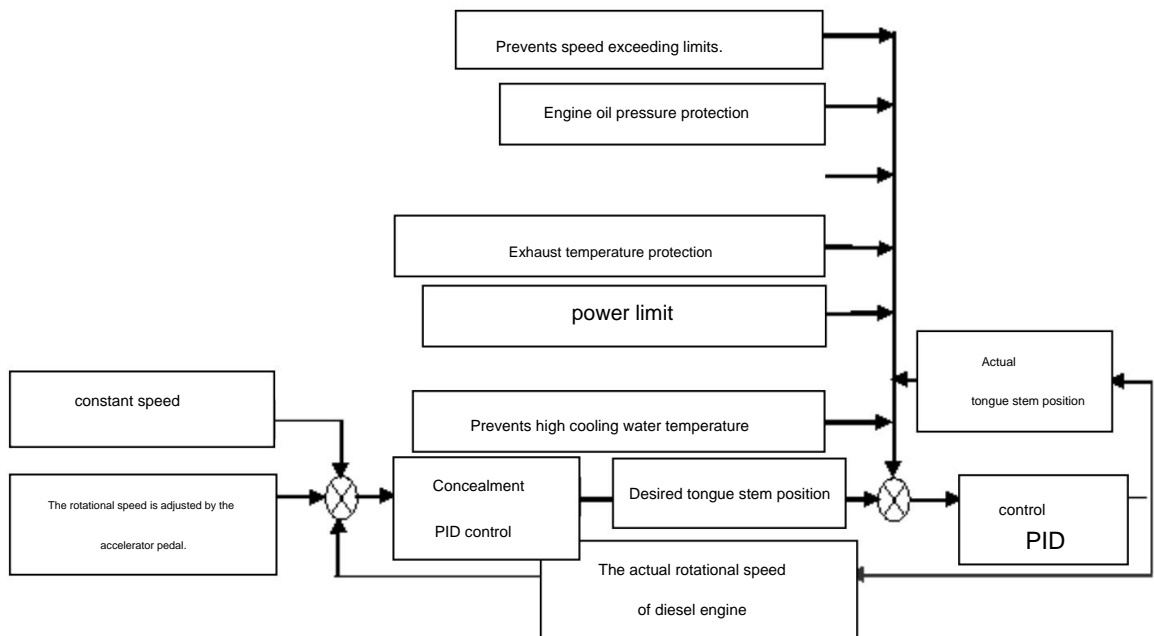


Figure 6: Control principles of electronic systems.

C. Duties of the ECU

1) Rotation speed control : The electronic control system

of the VT/E1 diesel engine controls the engine's rotational speed at all speeds. speed control mode 2) Control to protect engine oil

pressure (Oil pressure protection) Engine oil pressure

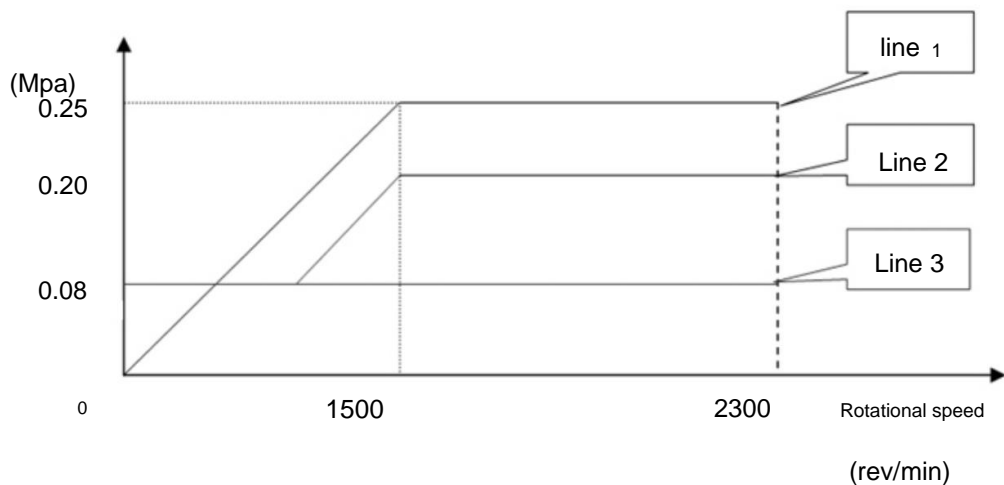


Figure 7: Control diagram to prevent engine oil pressure (Oil pressure protection).

When the diesel engine is running The system measures pressure changes.

engine oil all the time In the case where low engine oil pressure is detected due to a blockage in the engine passage. Lubricating oil or engine oil leaks The electronic control system

provides protection by warning, cutting off at idle. or turn off the engine that is related to

engine oil pressure. Figure 7 is a control diagram to protect engine oil pressure. Line 1 is the alarm limit. Line 2 is the protection limit. (Lower than the alarm limit of 0.05 MPa) Line 3 is the engine shutdown limit when the oil pressure is lower than the alarm limit (**0.25 MPa**. I)

The electronic control system will send an alarm signal. When the engine oil pressure is lower than the protection limit (**0.2 MPa**), it will reduce the engine speed to idle speed. When

the engine oil pressure is lower than From the stopping limit (**0.08 MPa**), the electronic control system will Automatically turn off the engine. You can use an ECU programmer to set the

engine oil pressure at Warning limits and engine shutdown limits

3) Control to prevent cooling water temperature (Coolant temperature protection)

The electronic system measures the engine's coolant temperature at all times.

When the diesel engine is running The electronic control system sends an alarm signal and reduces the charge fuel and reduce the power output of the diesel engine in the current mode of the engine.

To guarantee that the engine will operate reliably when the coolant temperature exceeds the limit

Protection 107 °C. and if the cooling water temperature is lower than 104 °C. control system

The electronics automatically restore normal engine operation. Diagram

Controls to protect the cooling water temperature are shown in Figure 8.

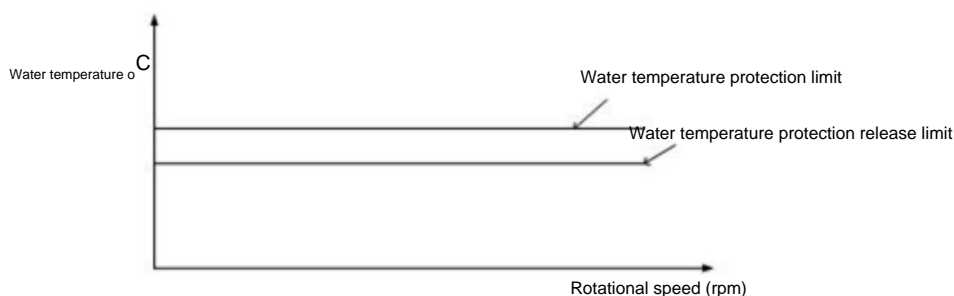


Figure 8: Control diagram to protect cooling water temperature.

4) Control to prevent exhaust temperature (Exhaust temperature protection)

The ECU system measures the exhaust temperature of turbo diesel engine turbines.

all the time while the diesel engine is running. When the temperature of the exhaust gas at the back of the turbo engine turbine is up to 650 fuel °H. The electronic control system will send an alarm signal and reduce fuel supply.

and reduce the power output in the engine's current operating mode to guarantee that the engine remains

Can continue to work When the exhaust gas temperature is lower than 630 C., the electronic control system will restore Automatically determines the normal engine operating status.

- 5) Accelerator pedal protection: Normally, do not press the accelerator pedal while starting the engine. otherwise

The electronic control system will not allow the engine to start. In combat condition mode, if you step on the accelerator pedal, you can still start. engine But the electronic control system controls the maximum engine speed at 1800.

revolutions per minute

- 6) Removing automatic protection in battle mode (Overriding control) function in combat condition)

In training and normal use The Combat switch should be in the "OFF" position to maintain the engine's operating parameters. normal area and Prevents engine damage due to abnormal conditions. In battle mode

To make the engine ready for use and turn it off. Automatic protection system affecting the continuous operation of the engine. The combat state switch on the switch box can be set to the "ON" position to disengage protection. automatic control of the electronic system regarding engine oil pressure Cooling water temperature Exhaust temperature Over speed and accelerator pedal and serves to automatically release protection (Overriding function)

- 7) Finding the cause of stuck (Fault diagnosing

function) when the diesel engine is running. The electronic control system monitors and Monitor all detectors and actuator components. (Executive device) continuously monitors for abnormalities or errors. For serious failures that cause damage to the engine The electronic control system sends Warning signal and engine stop For general errors The electronic control system sends alarm signal and allow the engine to operate normally.

8) Fuel cut-off electromagnet valve

Turn on and off the "main switch of the electronic control system" to open and close the valve.

Turn off the fuel. In an emergency, the fuel supply of the fuel system can be cut off by turning it off.

D. Functions of the electronic control system switch (Electronic control system) 1) The

main switch of the electronic control system. The

main switch of the electronic control system controls the power distribution. to the electronic control system When the engine is turned off The switch must be set to the "Close" when The system works abnormally. This switch can be used to stop the vehicle in an emergency by cutting off power. Power to the system

2) Engine shut down button

In normal conditions, the driver presses the engine stop button to control the engine shutdown. To

control turning off the engine 3) Combat condition switch

In general, the Situation Switch should be set to the "OFF" position (not in combat situation), the system decides the engine protection function according to the engine operating condition.

4) Fixed speed switch: Fixed speed switch is used

to accelerate the engine speed to a predetermined value without You must step on the accelerator. In general, the speed position is constant. 1 is 1200 rpm which is used for heating.

Machine automatically in winter and cause the temperature of the cooling water to decrease first and then turn off. The engine in constant speed position 2 is 1600 rpm, which is the operating speed for Generator to produce electricity

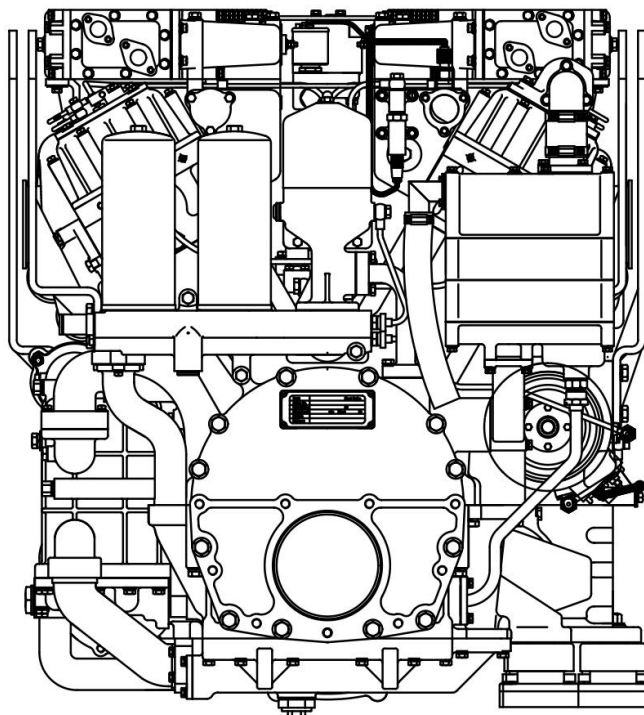


Figure 9: Front view of the VT/E1 diesel engine.

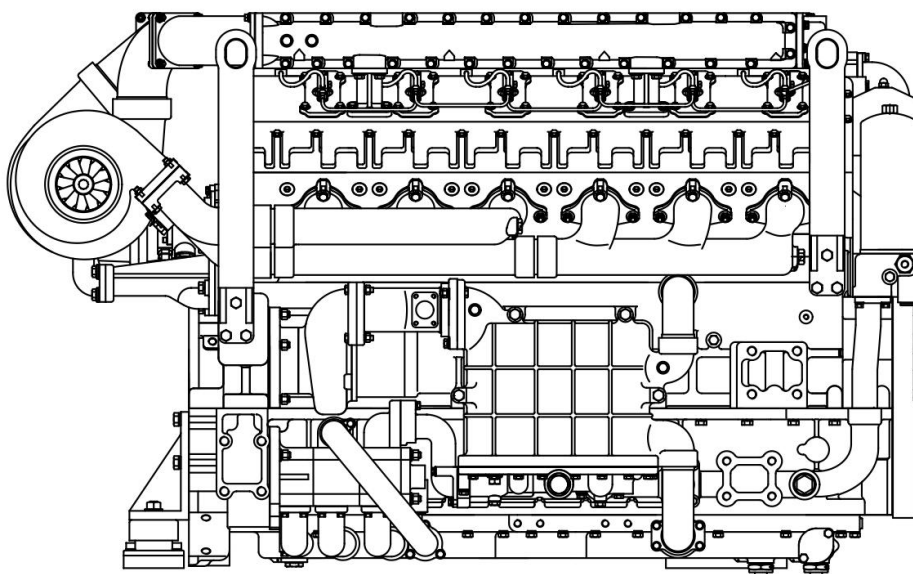


Figure 10: Picture of the left side of the VT/E1 diesel engine.

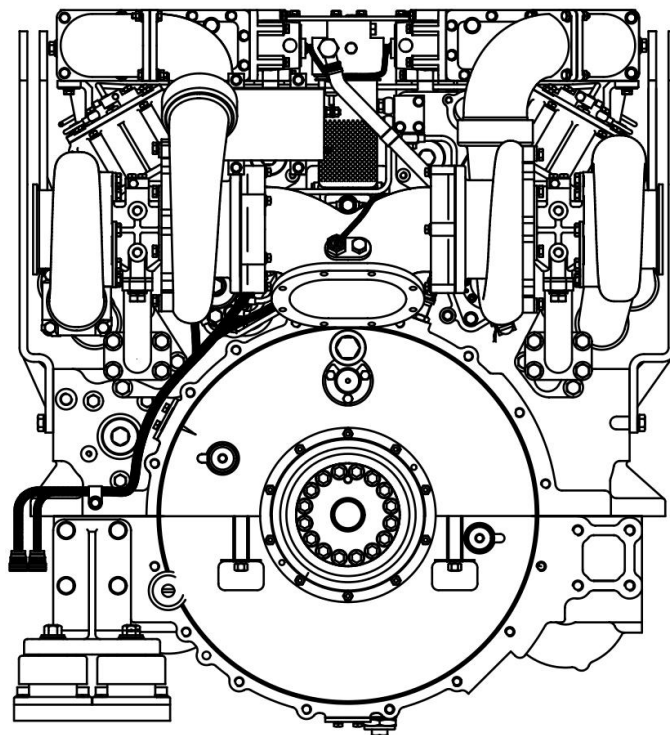


Figure 11: Rear view of the VT/E1 diesel engine.

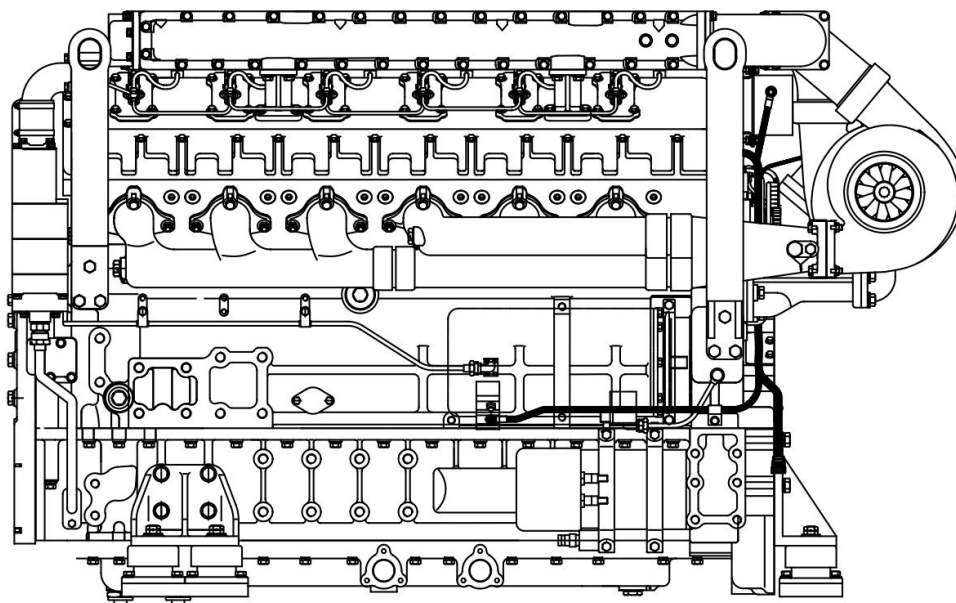


Figure 12: Right side picture of VT/E1 diesel engine.

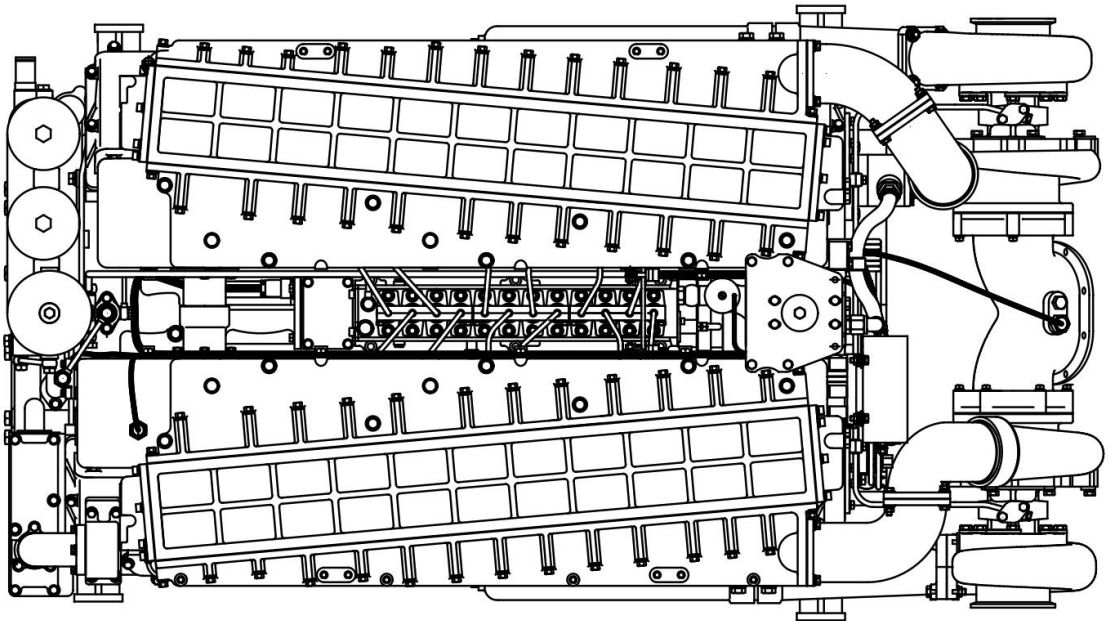


Figure 13: Top view of a VT/E1 diesel engine.

Chapter 9

speed changer

(INTEGRATED TRANSMISSION)

Section 1

General Description (GENERAL DESCRIPTION)

The main purpose of the Ch1000B speed changer is to transfer power to engine to the gear box, changing vehicle speed and belt drive traction. The speed changer includes gear changing functionality. Steering and braking and cutting

Engine power while changing automatic gear Steady turning and emergency braking

The Ch1000B speed changer uses the technology of hydraulic torque conversion. (Hydraulic torque converting) satellite gear group, speed changing mechanism (Planetary gear-shifting), automatic control by electric-hydraulic hydraulic steering and Hydraulic mechanical combined brake A speed changer is a set of mechanical and electrical devices that Large complexes that integrate with machinery, electrical equipment and fluids have the following main features:

- A. Using a hydraulic torque converter with a locking clutch increases the ability to Transmission and acceleration on difficult roads Including extending the life of the changer. speed
 - B. The use of a gear group speed changing mechanism with 3 degrees of freedom ensures good dynamic performance and compact structure. Recognize the change in power and automation
 - C. Using hydraulic composite steepless steering technology, the steering wheel can be adjusted smoothly.
- This allows for agile use of the tank's steering wheel on complex terrain. and more light

D. Use electrical and liquid automatic control technology. (Electro-liquid automatic control technology) allows automatic gear shifting and gear shifting as well.

The hand is easier and more convenient. The tank can perform extremely well in all terrains. and increasing Tactical mobility increases the tank's combat capabilities.

E. Using hydraulic and mechanical braking technology, the braking torque is constant.

This will help increase the efficiency of the tank's wheel braking. and significantly extends the life of the brake system.
significant

F. Use high speed internal engaged gear pump technology, which has a small size and high displacement, making the system

The fuel dispenser is compact. Strong and reliable

G. The speed changer housing is made of thin-walled aluminum alloy and has a tank.

Engine oil is inside the housing. has light weight and high strength;

H. Use a fan drive set together with a liquid viscous clutch, resulting in high efficiency. and automatically adjusts fan speed with high precision

I. With the concept of serialization. Modularization and international design

Makes changing modules easier and more convenient.

Part 2

MAIN PERFORMANCE PARAMETER

1. Specific characteristics of the speed changer

A. Model	Hydraulic mechanism combined speed changer
B. Gear position	6 gears forward and 2 reverse gears (gear position Emergency 1 gear and reverse 1 gear)
C. How to use	Forward Priority automatic transmission available Both manual gear shifting and emergency gear shifting. Manual
D. Steering type	Hydraulic composite stepless steering (with turning by rotating in place)
Mon. Highest temperature	
engine oil change	135 °C
speed	
Steering oil F.	125 °C
Net weight	2450 kg (weight of the machine, not including the power transmitter)
G. Major repairs	10000 km.
(Overhaul) for the	
first time when the distance has been completed.	

2. Characteristics of the tank :

A. Combat weight	52 tons
B. Center distance of the belt	2790 mm.
C. Maximum	70 km./hr.
speed D. Average speed in the terrain	35 km./hr. - 40 km./hr.

E. Time taken to accelerate. 0 – 32 km./hr.	12 seconds
F. Time spent turning while stationary 1 round	18 seconds
G. Engine power/rotational speed engine	883 kilowatts/2300 cycles per minute
H. Maximum straight slope (Max grade ability)	32°
I. Maximum slope (Max slope) J. Belt press wheel pitch circle radius	25° 0.318 m.
(Radius of road wheel pitch circle)	
K. Final drive gear ratio	4.42

Part 3

System components and working principles

(SYSTEM COMPOSITION AND WORKING PRINCIPLE)

1. System composition

A. Composition: The Ch1000B

speed changer consists of 21 large modules and other parts as shown in Figure 1.

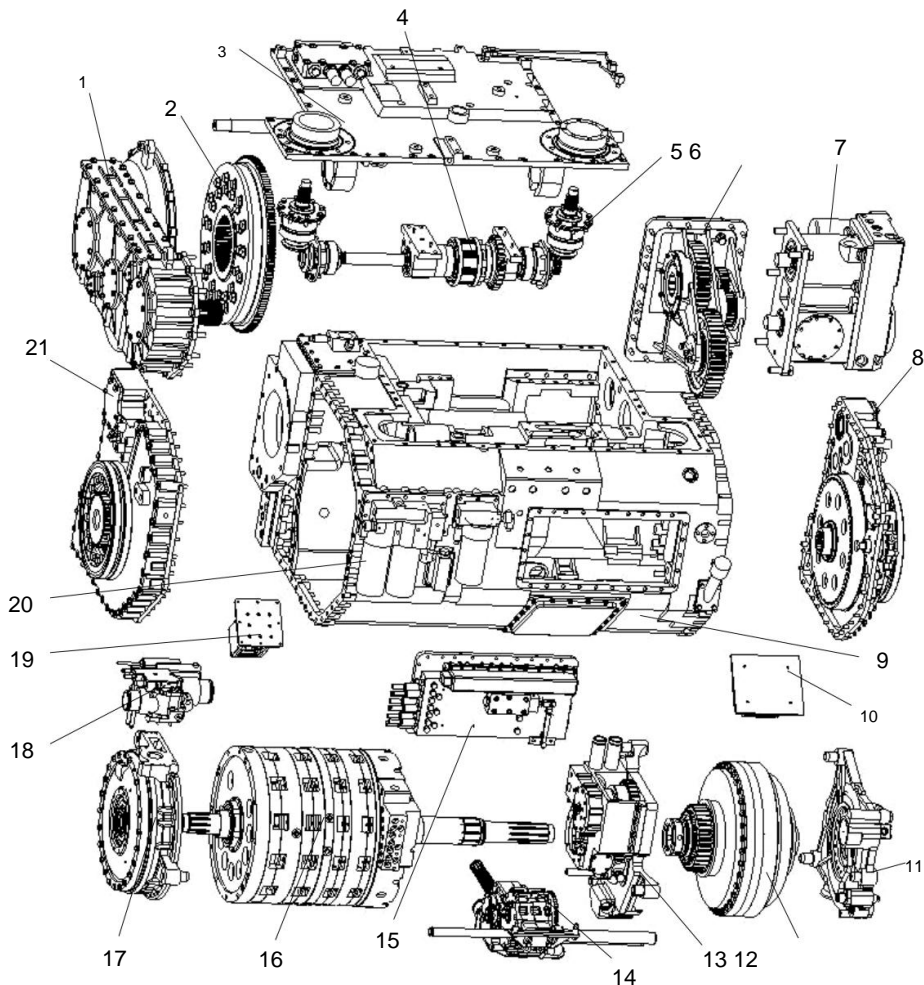
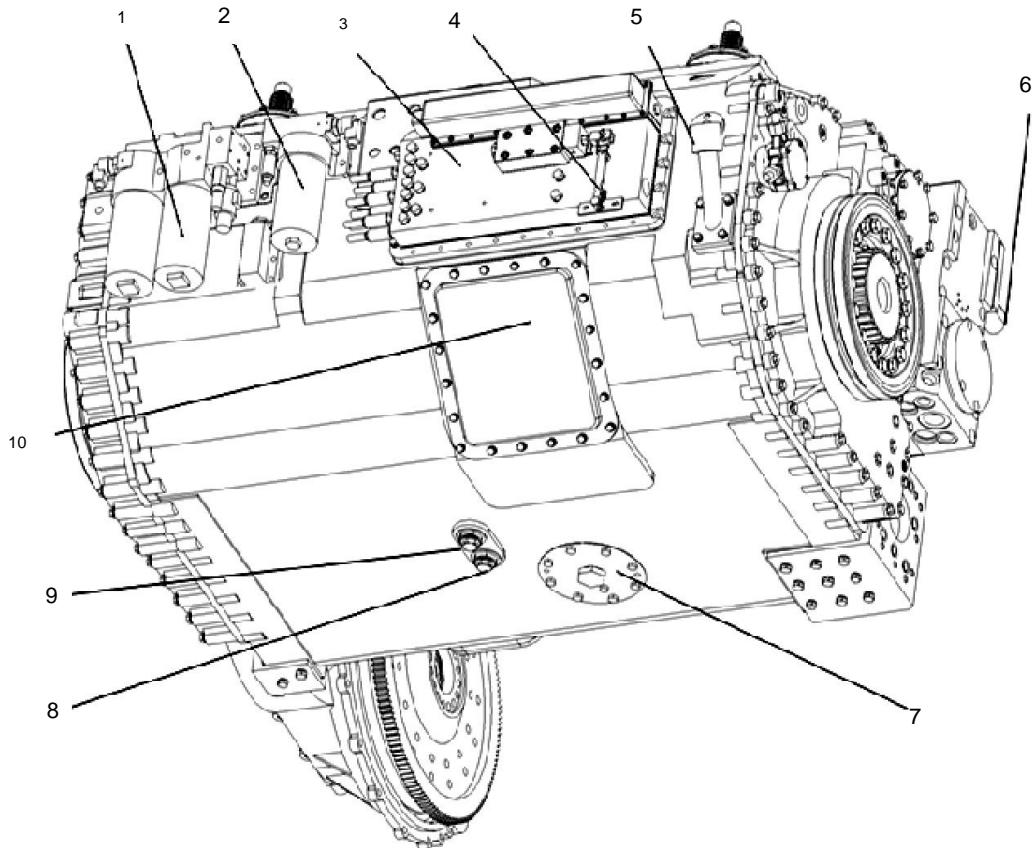


Figure 1: Picture of components of the Ch1000B speed changer.

-
- | | |
|---|---|
| 1. Power transmitter (Transmission gearbox) | 12. Hydraulic torque converter |
| 2. Gelslinger coupler | (Torque converter) |
| 3. Steering mechanism assembly | 13. Middle bracket |
| (Steering mechanism assembly) | 14. Oil pump assembly |
| 4. Clutch assembly machine | 15. Hydraulic control system |
| (Liquid viscous clutch assembly) | (Hydraulic control system) |
| 5. Fan drive assembly machine | 16. Set of gears, satellite mechanism, speed change mechanism |
| (Fan drive assembly) | (Planetary gear-shifting mechanism) |
| 6. Front drive gear assembly machine | 17. Hydraulic damper |
| (Front transmission assembly) | (Hydraulic retarder) |
| 7. Hydraulic steering set | 18. Hydraulic damper control valve |
| (Hydraulic steering unit) | (Control valve of hydraulic retarder) |
| 8. Right confluence mechanism and side | 19. Electronic control and diagnose system |
| Cover) | system) |
| 9. Housing and accessories | 20. Oil supply system |
| (Case and component assembly) | 21. Left-side combination speed reduction gear set and cover |
| 10. Testing system (Health management | (Left confluence mechanism and side |
| System) | Cover) |
| 11. Torque converter support kit with rear pump | |
| (Torque converter bracket with rear | |
| pump) | |

Structure of the Ch1000B speed changer, see Figure 2.



1. Engine oil filter (double filter)

(Control twin filter)

2. Fine filter for power connector

(Coupler filter)

3. Hydraulic control valve

(Hydraulic control valve)

4. Emergency control mechanism

(Emergency control mechanism)

5. Engine oil filler

plug (with oil level measuring rod)

6. Fine filter of the pump motor.

(Fine filter of pump motor)

7. Fine filter for oil return circuit.

(Fine filter for oil returning)

8. Oil drain hole of the oil pan

(Oil drain 1 (sump))

9. Oil drain port of engine oil tank

(Oil drain 2 (oil tank))

10. Pump cover

Figure 2: Structure of the Ch1000B speed changer.

B. Hydraulic system composition

The Ch1000B hydraulic system consists of an oil pump group, constant pressure valve (Constant pressure valve) Pressure oil tank (Pressure oil tank) Pipes and oil passages Its main function is to supply lubricant for parts and assemblies. Lubricating oil for Steering and changing gears Engine oil for the operation of the thrust converter. (Torque converter) and create a circulation circuit for cooling the engine oil.

The oil return pump (P1) in the pump unit distributes oil from the oil pan. To the oil pressure pot, main pump (P2) and engine oil supply pump. (Compensating oil pump-P3) Serves to distribute oil from the oil pressure cooker. Supply control signal (Pilot oil) Supply oil to Propulsion converter and steering boosting coupler. P4 pump is installed on the central mount and serves to supply control signals (Pilot oil) together with P2 hydraulic pump set Click the steering wheel. (HSU-Hydraulic steering unit) uses oil from the steering oil tank.

The engine oil for lubricating the various parts comes from the adjacent lubricant tank. Pressure ejection method: Pressurized engine oil lubricates the contact surfaces of the gears. and bearings

The operating principle of the hydraulic system of the oil distribution system is based on Figure 3.

(Hydraulic working principle of oil supply system)

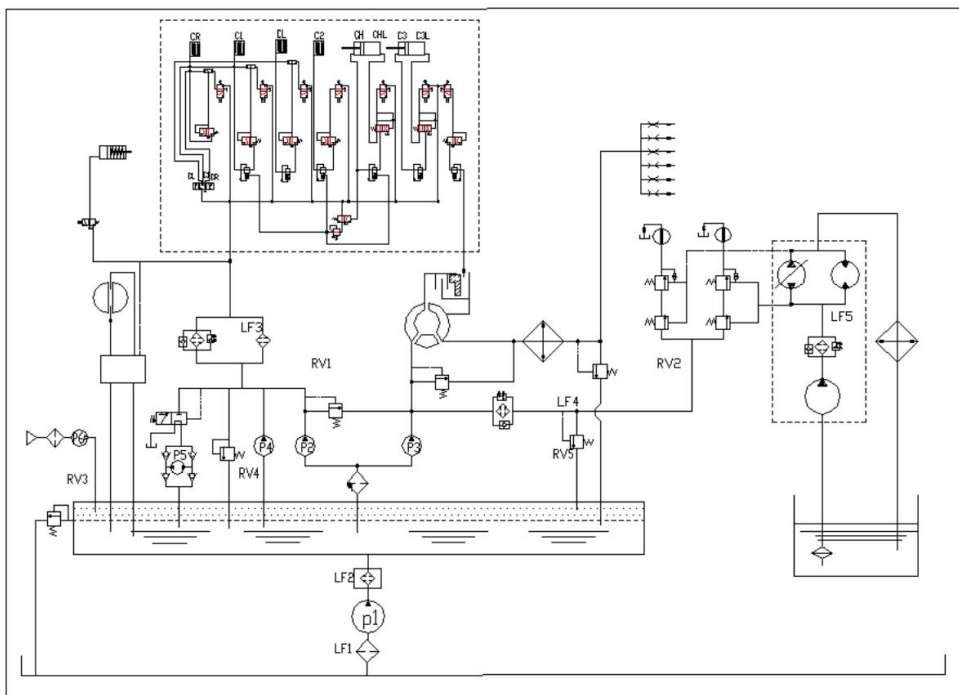


Figure 3: Hydraulic principle of the Ch1000B combination speed changer.
(Principle of integrated transmission Ch1000B hydraulic system)

2. Working principle

A. Basic principle

For the Ch1000B speed changer, gear changes are made via the shift mechanism.

Servant gear set Steering is carried out via a hydraulic steering unit combined with a mechanism.

Steering wheel braking is done through a hydraulic retarder installed inside the housing. Automatic fan speed adjustment is done via a fluid coupling device.

(Liquid viscous clutch)

B. Power transfer route

Power from the engine is output to a flexible coupler (Flexible coupler), a power transmitter. (Transmission gearbox) and front drive gear set (Front drive) power transmission The direct drive (direct drive) passes to a hydraulic torque converter which sends power through the turbine shaft to the gear group. mechanical servant change speed (Planetary gear-shifting mechanism) and then transmit power through The main shaft goes to the ring gear of the speed reduction gear set on both sides. As for the other way of transmitting power, (steering power) The steering shaft transmits power through The steering gear goes to the center gear (Sun gear) of the speed reduction gear set on both sides (called Double power flow zero difference transmission), while drive straight steering shaft The gear (which is connected to the center gear) is locked. Power from the main shaft is sent to the Retarders and drive gears on both sides through a combination of speed reduction gears, while For steering, the center gear (sun gear) rotates under the action of the steering shaft. (Zero axes) cause different speeds or rotational directions between the speed reducers. and drive gears on both sides Therefore, the tank can be controlled to make turns. The structure is shown in Figure 4.

A hydraulic retarder is connected to the power shaft.

out and housing the gear group, satellite gear-shifting mechanism (Planetary gear-shifting mechanism), and wheel braking. The hydraulic system works when oil flows into the chamber. Hydraulic damper

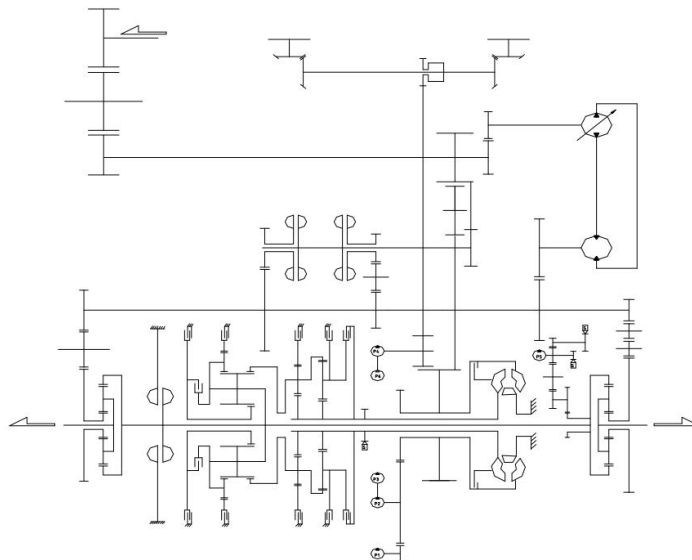


Figure 4. Mechanical system diagram of the Ch1000B combination speed changer.

Part 4

Electronic control system and troubleshooting system
(ELECTRONIC CONTROL AND FAULT DIAGNOSIS SYSTEM)

1. General description

Corresponds to signals received from the driver and the control procedures established by the system.

Electronic controls and jam detection work to keep the tank in the best condition by Gear position control Hydraulic torque converter lock/unlock status and fan speed. Including sending tank driving information (such as speed, temperature Gear oil, engine oil pressure and fault information) via cable to the control unit for Record driving status and information

2. Main performance parameters

Input power supply: DC22-30V@10A

Data transmission rate (CAN bus baud rate) : 250kbps

Working temperature range: -43 to 150° Celsius

Gear position: 6 forward gears, 2 reverse gears, stationary steering gear

1 Gear and neutral 1 gear

Controlling the locking/unlocking of the hydraulic thrust converter: Locking/unlocking Automatic, manual locking and unlocking

Fan speed control: automatic control, high speed Control the fan working at and low speed by hand.

Table 1 Speed range table for manual gear shifting

gear position	1	2	3	4	5
Minimum speed to shift into a higher gear. (km/h) (lock state torque converter)	8.26	11.82	17.05	25.68	36.78
gear position	2	3	4	5	6
Maximum speed at which you can downshift (km/hr)	11.17	16.1	24.26	34.73	50.09

Table 2: Fan clutch oil pressure table at 3: Fan speed range.

(Fan speed low, medium and high speed)

Fan speed	Ratio	Fan driving oil pressure (MPa)
low speed	0	0
medium speed	0.4~0.8	0.55
automatic high speed	1	0.9
Set the high speed manually.		Unlimited oil pressure

3. Composition and working principle

A. System composition

The main components of the system include: Gear change controller (Gear-shifting controller), control switch panel (Panel switch), steering angle measuring device. Steering wheel angular displacement sensor, emergency brake switch (Emergency braking switch), speed changer processing unit (Transmission information unit), electronic speed changer control unit (Transmission electronic control unit), wires, electromagnets (Electromagnet), and others. Figure 5 shows Connecting the system components, Figure 6 shows the system components. In Figure 5, CAN nodes 3 and 4 are the bus connection points of the CAN bus, responsible for exchanging data. Dung between the cars

Electronic control & fault diagnosis system

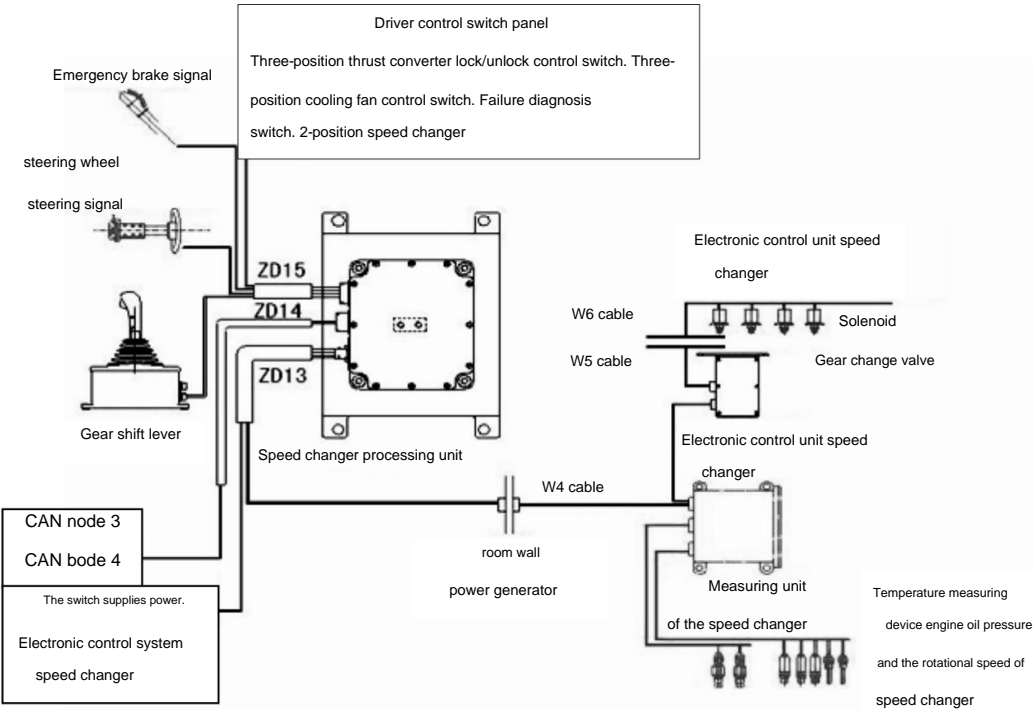


Figure 5: Connection of system components

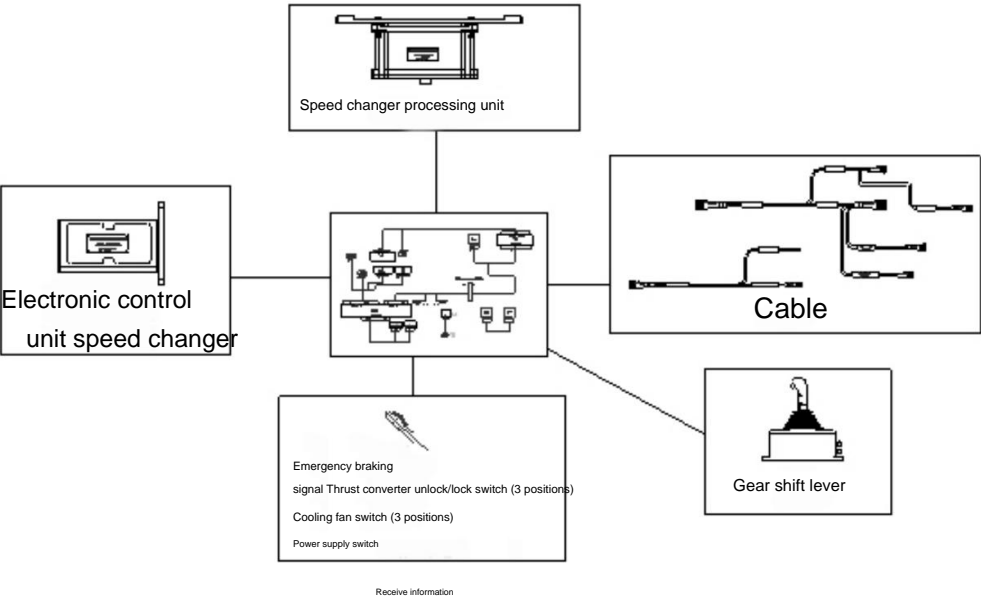


Figure 6 shows the components of the system.

1) Gear shift lever Gear-shifting controller

a) Gear shift lever

The shift lever receives gear change signals from the driver. These include manual and automatic gear shifting. Position selection switch

1st gear start, 2nd gear, and (2nd gear start) is responsible for selecting the start of the vehicle in gear. 1 or the mode selector switch for the automatic transmission to select the driving mode on sand roads (Sand mode) or the mode to increase the engine's power and torque. Nat (Power mode)

The gear shift lever receives on-off input signals of the gear positions and The road condition mode selection switch, the shift lever, receives the input signal and sends the signal to the unit. Processing speed changer The gear shift lever has 8 gear positions, which are the functions of

The various gear positions are as follows.

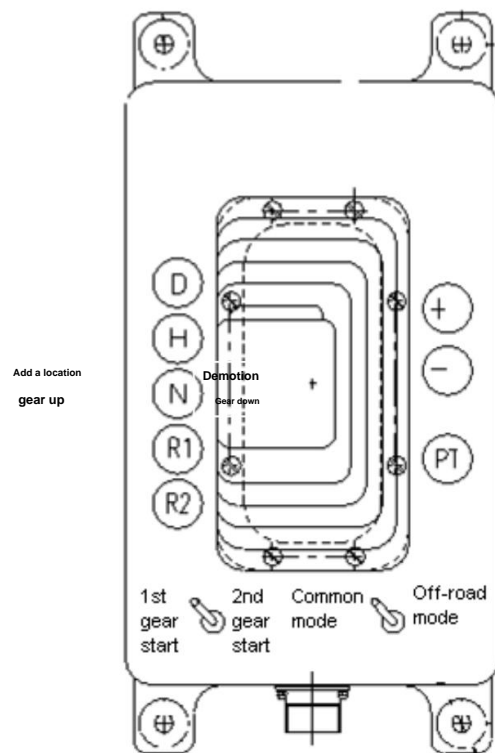


Figure 7: Gear shift lever (Gear-shifting controller)

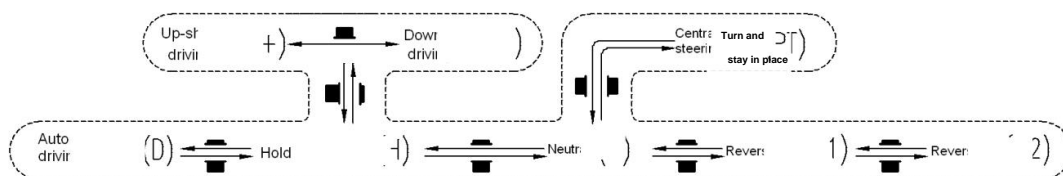


Figure 8: Operation of gear-shifting controller

“D” position

Automatic transmission position When the gear shift lever is moved to the D position, automatic transmission The system automatically selects the gear position without the driver having to manually shift gears and controls the opening and closing of the electromagnetic valve. to keep the moving tank in proper gear position;

“N” position

The neutral position when the shift lever is moved to the “N” position will be neutral position

Position “H”

Lock position (Hold) The current gear position can be locked by setting the shift lever to Position “H”

“+” position

Manually shift to a higher gear position. To shift into a higher gear position, move the shift lever from the “H” position to the “+” position and then move the shift lever back. Come to

Position “H”

Position “-”

Manually shift into a lower gear position. To shift into a lower gear position, move the shift lever from the “H” position to the “-” position, and then return the shift lever to the “-” position.

Position “H” ;

Position "R1"

Reverse gear position 1 To use the reverse gear position 1 Move the shift lever.
shift into the "R1" position.

"R2" position

Reverse gear position 2 To use the reverse gear position 2, move the shift lever.
shift into the "R2" position.

Position "PT"

The turning position is fixed. To keep the tank turning in place Move the shift lever.
Shift into the "PT" position.

b) Switch to select the gear position to start

Select gear position 1 the car or 2nd gear to start the car using the switch.

Select the 1/2 shift position on the shift lever. This switch is available only when in
Changing gears manually (Electro-liquid manual gear-shifting mode)

c) Road mode selection switch.

This switch has 2 positions. Installed on the gear shift lever, this switch can be used.

Only when the gear shift lever is set to

automatic. Locking and unlocking the top of the shift lever Normal position of the rod

Shift into the locked position. To unlock Move the red circle in the direction of the colored arrow.

Red as shown in the picture below



Figure 9: Unlocking the gear shift lever

2) Panel switch

The switch panel contains the power switch, lock/unlock control switch.

Propulsion converter, and fan speed mode control switch

a) Power switch (Power switch)

This switch controls the power supply to electronic systems and diagnoses failures.

b) Locking and unlocking control switch for the thrust converter (Locking and unlocking control switch of torque converter)

Thrust converter lock/unlock control switch This switch controls the ON-OFF Power supply from the thrust converter to the speed converter unit. Switch.

There are 3 positions (normal, hydraulic and mechanical) mounted on the driver's control panel.

Switch to the "Hydraulic" or "FORCED UNLOCKING" position to Unlock the thrust converter manually.

Switch to the "Mechanical" or "FORCED LOCKING" position to lock.

Manual thrust converter

Switch in the "automatic" position to provide control over locking and unlocking. chest automatically

c) Fan mode control switch

The cooling fan control switch turns the signal fed to it on-off. to the processing unit to change the speed The fan control switch has 3 positions (automatic, speed high rpm and low rpm) mounted on the driver's control panel When the switch is set to the "OFF" position, the fan will rotate with the knob. High speed, low position, the switch is set to the "HIGH" rpm, when the fan will rotate at maximum speed with the engine speed at that time. When the switch is set to "AUTO" position to control the fan speed automatically.

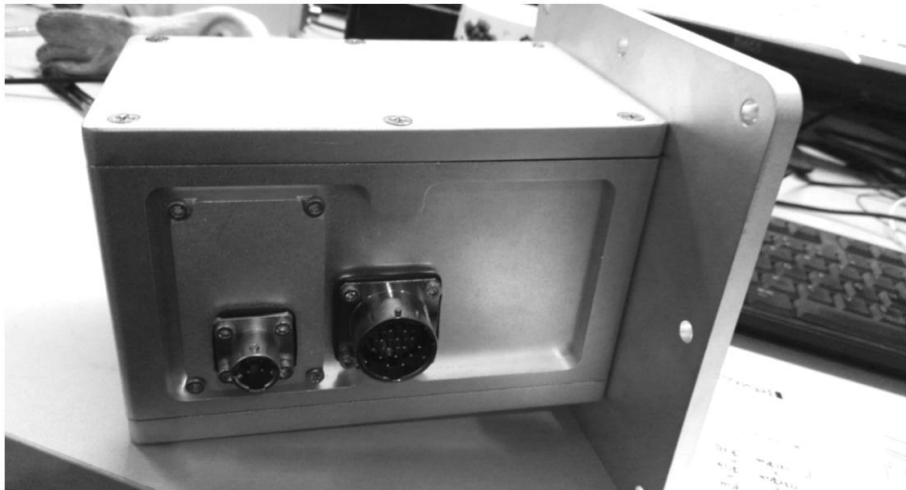
3) Speed changer processing unit Transmission information unit The speed changer processing unit's main function is to collect and Processes the shift lever position signal. Lock/unlock switch Cooling fan switch Emergency brake switch and the gear selector switch to start the car Receives and sends data on the CAN bus (inner CAN, whole vehicle CAN), including performing data recording duties, and others. Figure 10 shows an image of the changer processing unit. speed



Figure 10: Speed changer processing unit (Transmission information unit)

4) Electronic control unit for speed changer (Transmission electronic control unit)

The electronic control unit of the speed changer is responsible for sending and receiving data. Between the vehicle system devices (inner CAN bus), control signals are output to the valves. electromagnet, collects electromagnetic feedback signal and controls gear shifting, controls locking/unlocking of hydraulic drive converter, controls rotational speed of cooling fans, etc. Figure 11 shows a picture of the electronic control unit of the changer. speed



**Figure 11 Electronic control unit for speed changer
(Transmission electronic control unit)**

B. Working principle

The working principle of the electronic control and jamming system is as follows:

gear shift lever, thrust converter lock/unlock control switch, control switch.

Fan speed mode, steering angle sensor and brake switch

Emergency Connect by cable to the speed converter processing unit to input the signal.

from the gear shift lever and signals from switches;

The vehicle's CAN bus connection is connected to the speed converter processing unit. They exchange data between the electronic control system and the diagnostic system. Error;

The speed changer processing unit is connected to the power supply and to the partition wall.

Cable powered generator, supplies power to electronic controls and systems.

Diagnose faults and exchange internal CAN bus data. Vehicle system (Inner CAN bus);

The electronic control unit transmits the gear-shifting electromagnetic drive signal. electromagnet), electromagnetic locking and unlocking (Electromagnet) and valve of the fan (Fan proportional valve), driving signal (Driving signal) acting on the electromagnet Gear shifting, electromagnetic locking and unlocking and fan valves

Working principle of electronic control system and jamming cause finding system. Shown as shown in Figure 12 :

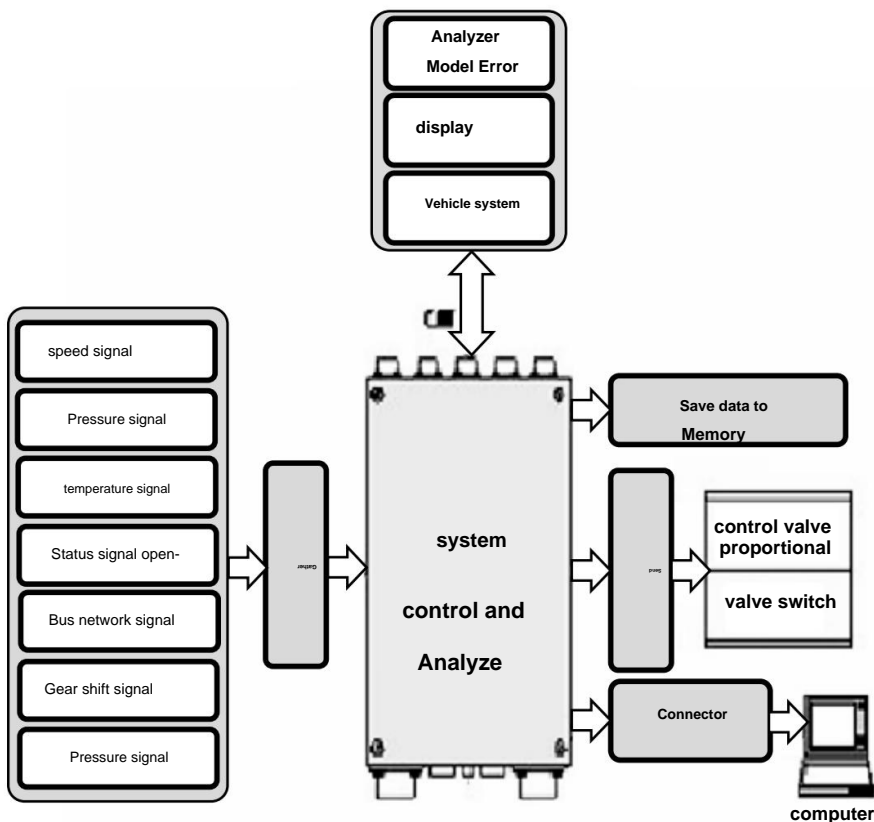


Figure 12. Working principle of the electronic control system and jamming cause finding system.

Gear shift lever (Gear-shifting controller), steering angle sensor

Steering wheel angular displacement sensor, switch panel, brake switch

Emergency braking switch input the handle code and the switch sends a signal to

Speed changer processing unit (Transmission information unit)

The working steps and principles of the speed changer processing unit are: Gear shift lever code Receives signals from switches and adjusts the signals and sends data to the CAN bus system of the vehicle such as engine speed, acceleration rate, engine coolant temperature. The distance of the gear rack displacement and brakes which the CAN bus of the vehicle system receives. This information at the same time Make adjustments and send signals such as gear position. Notification information Gear shift start/end signal Gear oil temperature Oil pressure, control signal (Pilot oil pressure), engine oil pressure, etc., these data are received from the internal CAN bus and then send these data to the CAN bus. of the vehicle system and record the data into memory

Divide the working steps and working principles of the machine's electronic control system. Changing speed is divided into 3 parts, including gear shifting control. Locking and unlocking the engine, hydraulic torque converter, and fan control. 1) Gear-shifting control while the

system is turned on. The gear shift lever must be set to the N position or the electronic control system and fault diagnosis system cannot be started.

According to the signal received from the gear shift lever, the gear selector switch

signal for vehicle 1/2, the road mode selector switch signal and the accelerator pedal signal, the speed signal. vehicle, engine speed, error signals, lock and unlock signals, emergency brake signals, transmission oil temperature signals, etc., which are received from the CAN bus system of the vehicle. The system will Calculate the optimum gear position based on the defined control strategy. The system calculates the valve control logic. The electromagnet is related according to the gear position, which sends an output signal to the electromagnetic valve. to change gear Therefore, it can satisfy the driver's need to control vehicle speed. a) Manual gear-shifting after starting the engine. If the system receives a signal to shift manually from Gear shift lever The system calculates

the gear position based on the manual gear shifting procedure. During shifting, If the engine speed is higher than 2600 rpm, then brake the vehicle. Emergency in which the gear position is higher than 3rd gear or an incorrect signal has been received. Calculated gear position will be the neutral position Manual gear shifting diagram refer to Figure 13.

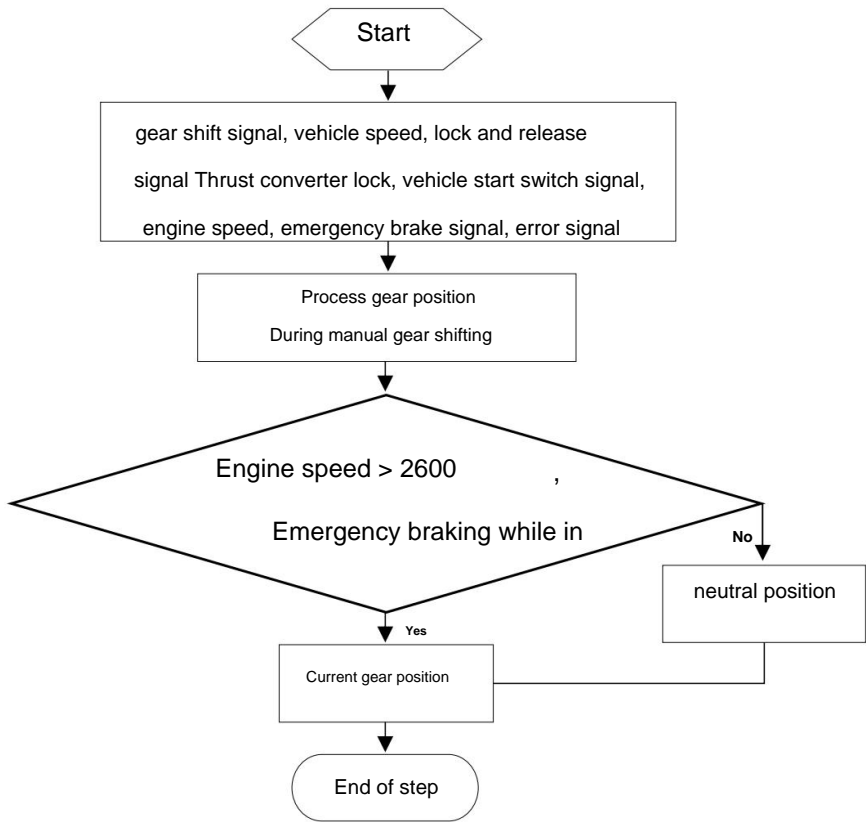


Figure 13: Flowchart for changing gears manually (Manual

gear-shifting) b) Changing gears automatically (Automatic gear-

shifting) after starting the engine The system will automatically shift gears when a signal is received. shift position “D” from the shift lever During automatic gear shifting If the rotational speed The engine is higher than 2600 rpm and performs emergency braking in a gear position higher than 3rd gear or an incorrect signal is received. The processed gear position is the neutral position. at neutral position If the vehicle speed is lower than 4 km./hr. and the gear shift lever Send a signal from position "N" to position "D" and automatic gear shifting can be initiated. The calculated gear position is gear position 2. The flowchart of automatic gear shifting is based on Figure 14.

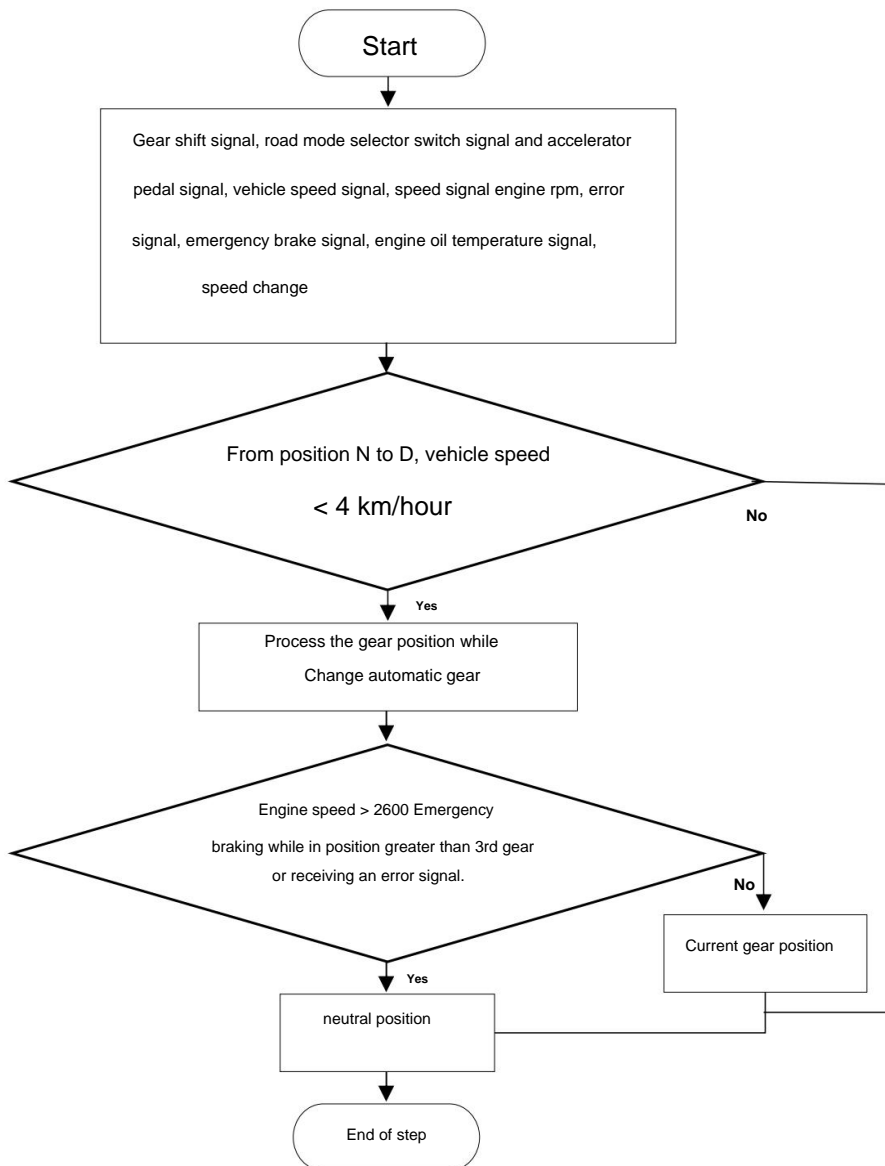


Figure 14: Flowchart of automatic transmission changing (Automatic gear-shifting)

c) Output signal of gear change electromagnetic valve (Output signal of gear-shifting electromagnet valve)

according to the calculated gear position The system calculates the valve output signal. Corresponding electromagnetic which drives an electromagnetic valve to achieve position control. can shift

2) Locking and unlocking control

according to lock and unlock status The system will send a lock signal for driving. Electromagnetic valve to achieve locking and

unlocking control. 3) Fan rotating speed control. Calculate

the pressure required to drive the fan to the desired rotational speed. set Control the fan speed by adjusting according to the fan feedback pressure. and feedback signal from proportional control valve (Proportional valve signal) The relationship between the target rotating speed of the fan and the driving target pressure of the fan. Refer to the table. 2nd place

Episode 5

Hydraulic control system (HYDRAULIC CONTROL SYSTEM)

1. Duties (Function)

Functions of the hydraulic gear-shifting valve block: A. Recognize the operation of the gear-shifting mechanism. At the same time it controls the replacement process. gear of speed changer For the most efficient gear shifting;

B. Controls the operation of the clutch lock;

C. In case of emergency Can shift into gear ¹ forward and gear ¹ Can go backwards.

2. Technical data (Technical performance index)

Oil pressure (Supplied oil pressure): 1.4 - 2.5 megapascals (MPa)

Rated operating oil temperature: 100° C.

Maximum oil temperature while working (Max. operating oil temperature): 135°C.

Minimum oil temperature while working (Min. operating oil temperature): -25°C.

3. Composition and working principle

A. System composition

The gear-shifting hydraulic valve block is installed. at the rear of the speed shifter housing and connected to a gear set within the speed shifter housing. Speed with coupling The main components of the tongue housing include: Shock valve, oil valve Return flow and emergency valve

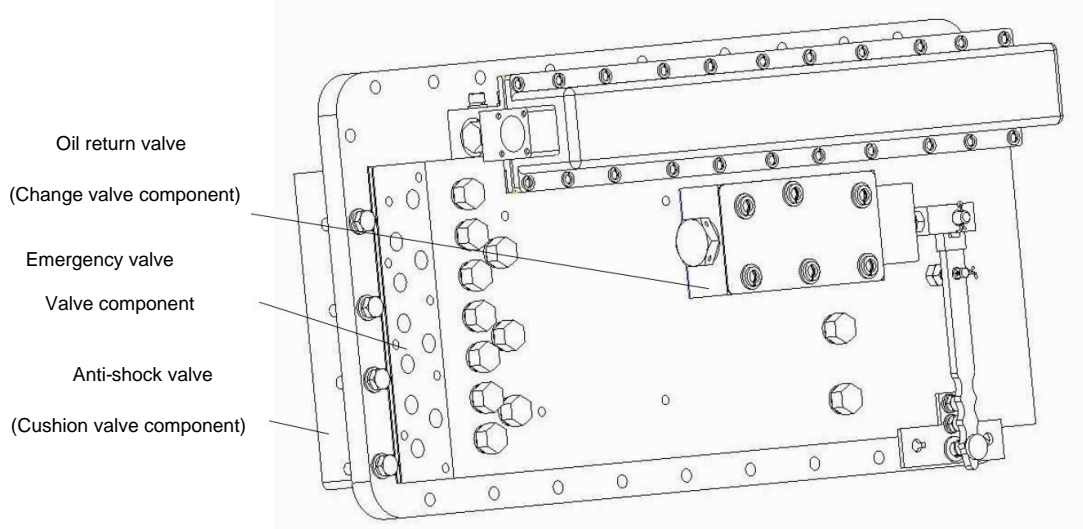


Figure 15: Components of the hydraulic control system .

B. Working principle

According to the signal received, the gear shift lever vehicle speed and accelerator control system. Electronic speed converters control the operation of the return valve and shock valve by sending open/close commands. also various electromagnetic valves (Electromagnet valves) of the gear-shifting valve block. Therefore, the clutch or brake associated with the The gear shifting mechanism must be engaged or disengaged. To effect change of gear position, the gear shifter housing is connected to the gear shifting mechanism within the speed changer housing by a coupling. (intubation) The oil pressure used for the gearshift hydraulic valve body is provided by the engine pump assembly. change speed (These pumps are also used to supply fuel for the steering system. hydraulic thrust converter and lubrication system). The pressure for gear shifting is determined by a constant pressure valve on the pump unit, usually 1.4. -2.5 megapascals (MPa)

The electronic speed changer control system sends valve locking commands. Electromagnet of gear shift valve housing To control the operation of the lockup clutch.

Chapter 6

Testing system (TESTING SYSTEM)

1. General description The fault

diagnosis system is the main component of the Ch1000B speed changer for data digitization and information provision. Provides working status and Real-time speed converter fault signals and send data to the bus as needed. Therefore, the speed changer's processing unit can record the data. Can install memory and statistical data.

2. Composition and working principle

Components of the speed changer fault diagnosis system As shown in the picture below Consists of a group of sensors. Error diagnosis collection unit and connection cable The system monitors the status of the speed changer and can communicate with the control system. Electronic speed changer and communication system of the entire vehicle.

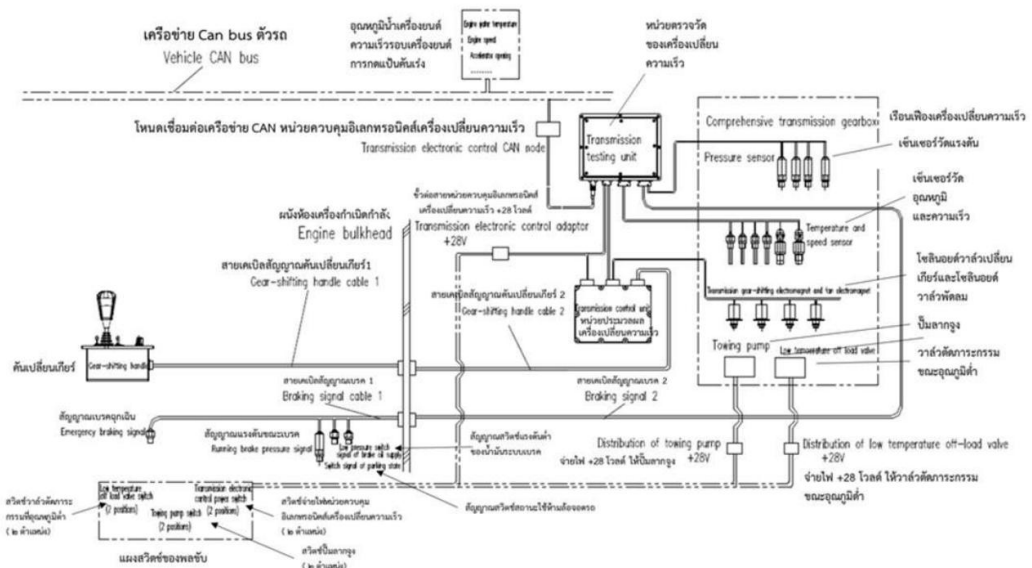


Figure 16: Components of the speed changer fault diagnosis system.
(Composition of transmission fault diagnosis system)

3. Fault code description

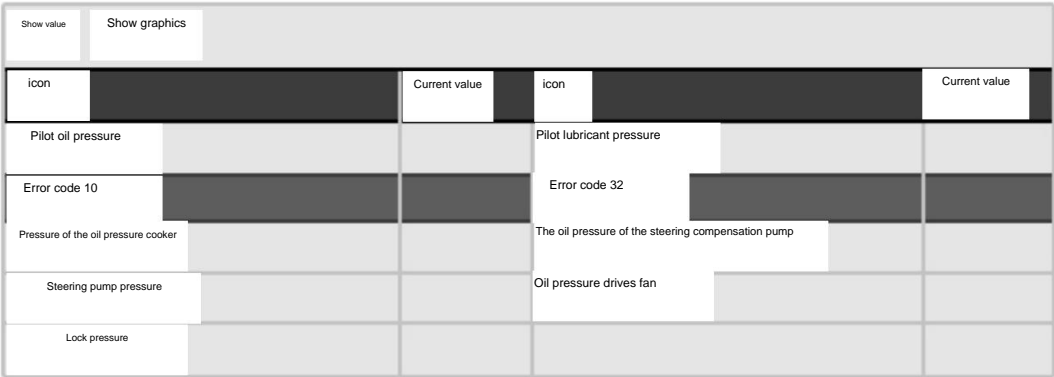


Figure 17: Data checking connection window of the speed changer (internal) fault diagnosis system.

Table 3: Meaning of speed converter error codes. (Transmission faulty code)

Order	Error name	Error code		type Error	Display mode	Recommended message
		Hexadecimal numbers, binary numbers				
1	There are no errors.	0X0000~0x0 OFF		No error, not displayed.		There is no message.
2	change machine Speed has pressure low control principle	0x0101	100000001	Serious	Warning window appears on the screen. main	Stop the car and inspect the car.
3	change machine Speed has pressure Low lubricant	0x0102	100000010	Serious	Warning window appears on the screen. main	Stop the car and inspect the car.
4	change machine Speed has lock pressure Low bust(Locking pressure)	0x0103	100000011	Serious	Not displayed	Stop the car and inspect the car. ; In case of emergency, adjust the TORQUE switch. CONVERTER Go to location "FORCED UNLOCKING"

Table 3: Meaning of speed converter error codes. (transmission faulty code) (continued)

number	Error name	Error code		type Error	Display mode	Recommended message
		Hexadecimal numbers	binary numbers			
5	Force compensation pump Turn the machine around. Speed has pressure low oil	0x0104	100000100	Serious	Not displayed	Stop the car and check. car
6	Gear control cylinder Land shortage	0x0110	100010000	Serious	Not displayed	Stop the car and check. car
7	The 1st gear control cylinder is defective.	0x0111	100010001	Serious	Not displayed	Stop the car and inspect the car.
8	The 2nd gear control cylinder is defective.	0x0112	100010010	Serious	Not displayed	Stop the car and inspect the car.
9	The 3rd gear control cylinder is defective.	0x0113	100010011	Serious	Not displayed	Stop the car and inspect the car.
10	Gear control cylinder 4 Bad luck	0x0114	100010100	Serious	Not displayed	Stop the car and inspect the car.
11	Gear control cylinder 5 Bad luck	0x0115	100010101	Serious	Not displayed	Stop the car and inspect the car.
12	The 6th gear control cylinder is defective.	0x0116	100010110	Serious	Not displayed	Stop the car and inspect the car.
13	Gear control cylinder Reverse 1 (R1 gear) Bad luck	0x0117	100010111	Serious	Not displayed	Stop the car and inspect the car.
14	Gear control cylinder Reverse 2 (R2 gear) is defective.	0x0118	100011000	Serious	Not displayed	Stop the car and inspect the car.
15	Gear control cylinder Stationary turning (PT gear) defective	0x0119	100011001	Serious	Not displayed	Stop the car and inspect the car.

Table 3: Meaning of speed converter error codes. (transmission faulty code) (continued)

number	Error name	Error code		type Error	Display mode	Recommended message
		Hexadecimal numbers	binary numbers			
16	The electromagnetic circuit of gear 1 Bad luck	0x0121	100100001	Serious	A warning window appears. On the home screen	Stop the vehicle and inspect the vehicle, in case of emergency select Emergency gear mechanism
17	The electromagnetic circuit of 2nd gear is defective	0x0122	100100010	Serious	A warning window appears. On the home screen	Stop the vehicle and inspect the vehicle, in case of emergency select Emergency gear mechanism
18	The electromagnetic circuit of 3rd gear is defective	0x0123	100100011	Serious	A warning window appears. On the home screen	Stop the vehicle and inspect the vehicle, in case of emergency select Emergency gear mechanism
19	The electromagnetic circuit of 4th gear is defective	0x0124	100100100	Serious	A warning window appears. On the home screen	Stop the vehicle and inspect the vehicle, in case of emergency select Emergency gear mechanism
20	The electromagnetic circuit of 5th gear is defective	0x0125	100100101	Serious	A warning window appears. On the home screen	Stop the vehicle and inspect the vehicle, in case of emergency select Emergency gear mechanism
21	The electromagnetic circuit of 6th gear is defective	0x0126	100100110	Serious	A warning window appears. On the home screen	Stop the vehicle and inspect the vehicle, in case of emergency select Emergency gear mechanism
22	The electromagnetic circuit of Reverse gear 1 (R1 gear) defective	0x0127	100100111	Serious	A warning window appears. On the home screen	Stop the vehicle and inspect the vehicle, in case of emergency select Emergency gear mechanism
23	The electromagnetic circuit of Reverse gear 2 (R2 gear) defective	0x0128	100101000	Serious	A warning window appears. On the home screen	Stop the vehicle and inspect the vehicle, in case of emergency select Emergency gear mechanism

Table 3: Meaning of speed converter error codes. (transmission faulty code) (continued)

number	Error name	Error code		type Error	Display mode	Recommended message
		Hexadecimal numbers	binary numbers			
24	The electromagnetic circuit of The gear turns in place. (PT gear) defective	0x0129	100101001	Serious	A warning window appears. On the home screen	Stop the vehicle and inspect the vehicle, in case of emergency select Emergency gear mechanism
25	electromagnetic circuit (Electromagnet circuit) defective	0x012a	100101010	Serious	A warning window appears. On the home screen	Stop the car and inspect the car. ; In case of emergency Adjust the TORQUE switch. CONVERTER to Position "FORCED UNLOCKING"
26	engine oil change Speed has high temperature over	0x0201	1000000001	general	Error icon speed changer Flashing on the screen Display main results	Lower the gear position or stop. The car is in neutral to ventilate. heat
27	engine oil change speed has low temperature	0x0202	1000000010	general	Not displayed	Turn up the heat or drive. with the low gear position
28	There is steering fluid. The temperature is too high.	0x0203	1000000011	general	Error icon speed changer Flashing on the screen Display main results	Lower the gear position or stop. The car is in neutral to ventilate. heat
29	Filter notification control signal oil (pilot oil filter) machine change speed	0x0211	1000010001	general	Error icon speed changer Flashing on the screen Display main results	clean filter control signal oil (pilot oil filter)

Table 3: Meaning of speed converter error codes. (Transmission faulty code) (continued)

number	Error name	Error code		type Error	Display mode	Recommended message
		Hexadecimal numbers, binary numbers				
30	Filter notification Detailed steering pump (steering pump fine filter)	0x0212 1000010010		general	Error icon speed changer Flashing on the screen Display main results	perform filtering service Detailed steering pump (steering pump fine filter)
31	Filter notification Details of the power connector of the steering system (steering coupler fine filter)	0x0213 1000010011		general	Error icon speed changer Flashing on the screen Display main results	perform filtering service Details of the power connector of the steering system (steering coupler fine filter)
32	The fan also spins. abnormal speed	0x0213 1000010011		general	Not displayed	Check the fan, just in case. Emergency, set aside the fan switch. at the HIGH position (high speed)
33	The rotational speed is too high. (Input rotating speed is too high)	0x0213 1000010011		general	Error icon speed changer Flashing on the screen Display main results	Pull off the accelerator.

Part 7:**Set of gears for the speed changer.
(PLANETARY TRANSMISSION)****1. General description :** The

planetary transmission consists of many working parts, such as the planetary gear set.), controls (clutch and brakes), axles, outer hubs, and motive seals are responsible for transmitting power while the vehicle is driving in a straight line and Acceleration and affect the overall movement performance of the vehicle.

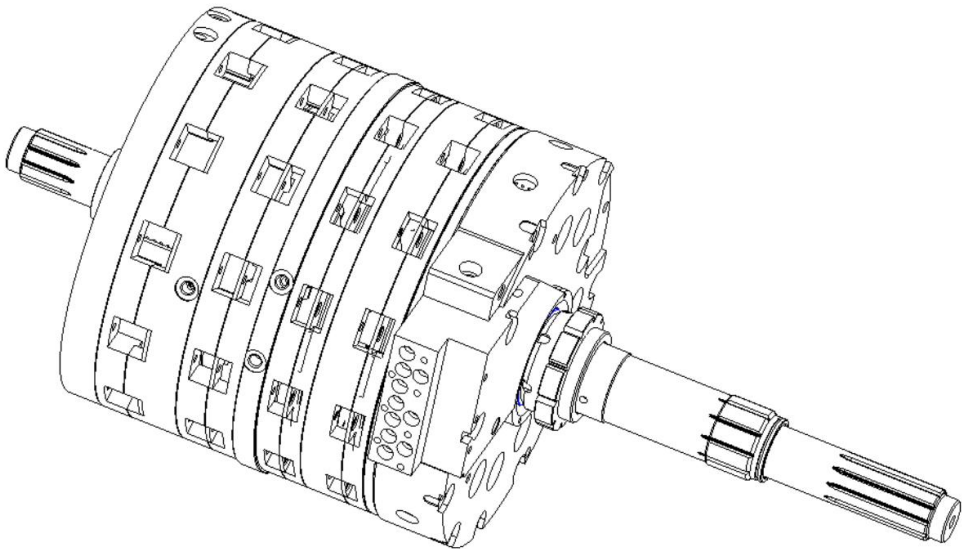


Figure 18: ***Planetary transmission gear set***

2. Composition and working principle

A. System composition

The Ch1000B speed changer satellite gear assembly consists of 1 composite gear, 2 manual gears, and 6 control parts. The connections between the gears satellite gear Occurs with the grip and release of various control parts. Therefore, the gear ratio can be changed. in each gear position and can transmit power. Within the satellite gear set there are components. The main ones are the sun gear, ring gear, planet pinion set, and planet carrier; Controls (clutch and brake) have The main components are friction plate, oil cylinder, inner wheel hub, outer wheel hub and piston. The system also includes some working parts such as power shaft, power transmission shaft. Seal parts, housings, bearings, etc., used for power transmission Pilot oil seating and rotating part support

B. Working principle

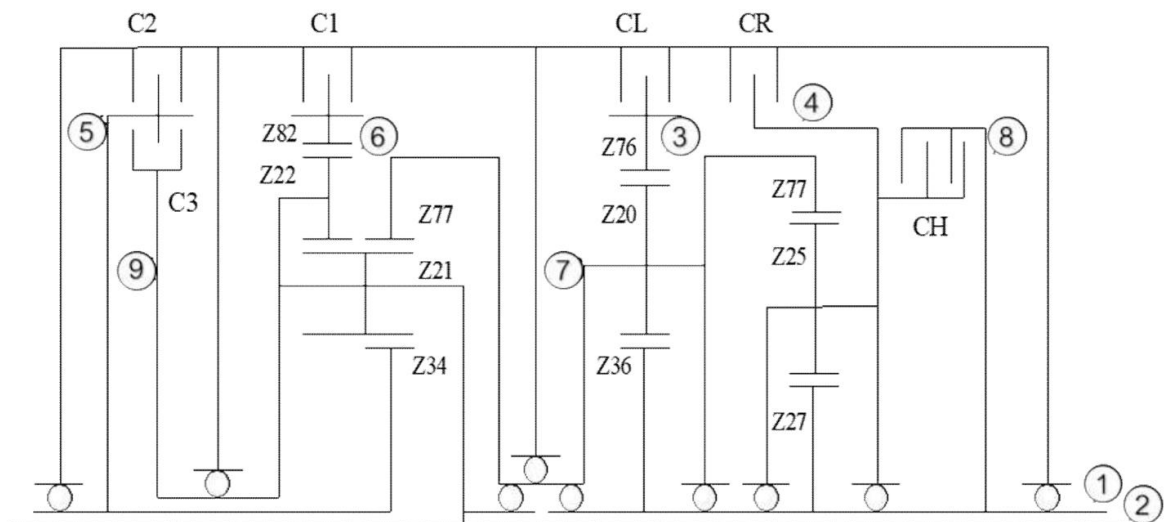


Figure 19 shows the gear set of the speed changer.

(Diagram of planetary transmission)

The gear set for the speed changer is a gearbox with 3 degrees of freedom as shown in the figure above. Power is entering from the section and power is leaving section 2. Gear 1 can work when the 2 control sections are working. All gear changes are gears. 6 forward gears and 2 reverse gears. Basic parameters refer to the following table, while C1 works together with C2 section. The second one will be the brake, so the car can be controlled to turn and stay in place. Stably

Table 4 Basic parameters of the speed changer satellite gear set.

gear	parts that hold together Engaged parts	Formula for calculating the broadcast rate Formula of transmission ratio	Broadcast rate Transmission ratio	Gear ratio Gearshift ratio	efficiency Efficiency
I	CLC1	$(1+K2)(1+K4)$	6.424		0.932
II	CLC2	$(1+K2)(1+K3)/K3$	4.485	1.432	0.952
III	CLC3	$1+K2$	3.111	1.442	0.966
IV	CHC1	$1+K4$	2.065	1.507	0.965
V	CHC2	$(1+K3)/K3$	1.442	1.432	0.985
VI	CHC3		1	1.442	1
-I	CRC1	$-K1(1+K4)$	-5.889		0.917
-II	CRC2	$-K1(1+K3)/K3$	-4.111	1.432	0.936
Null	CL				
Note 1: Select two reverse gear positions -I and -II;					
Note 2: $\eta_{outer}=0.97, \eta_{inner}=0.98$;					
Note 3: Parts $\ddot{y}\ddot{y}\ddot{y}$ are gear groups.					

$K4 = 1.065 \quad K3 = 2.265 \quad K2 = 2.111 \quad K1 = 2.852$

Chapter 8

Steering mechanism and fan drive unit

(STEERING MECHANISM AND FAN DRIVE ASSEMBLY)

1. General description

The steering unit and fan drive unit consist of 3 parts. The combined steering unit
Composite steering unit, liquid viscous clutch and fan drive

(Fan drive) The steering control valve receives the high voltage signal sent from the steering pump motor.
turn (Conjoined pump motor), then open the steering valve (Guiding valve) to apply pressure.

Oil enters the hydraulic coupler to transmit power to help with steering. Clutch

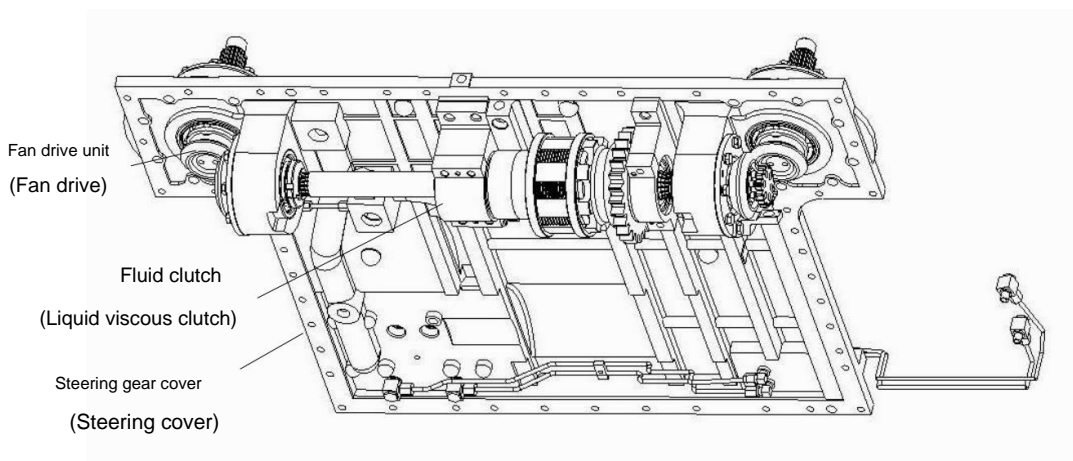
The liquid type controls the rotational speed of the fan through the pressure of the signal oil
(Liquid viscous pilot oil). The fan drive transmits power through a bevel gear.

The main function of a composite steering unit is to transmit power
to a pump motor.

B. To control the output power of the steering coupler (Coupler).

C. To assemble the power of the pump motor and steering power coupler.

(Coupler)



**Figure 20 Steering cover and fan drive assembly,
liquid viscous clutch assembly**

2. Composition and working principle

A. System composition

The combination steering unit has main components consisting of a Steering cover set rotating shaft base (Rotor, hydraulic control system) and (Steering cover) Cover set

The steering wheel serves to support the liquid viscous transmission.

The steering gear cover is made of high-strength aluminum alloy material ZL101A. Responsible for installing the fan drive system and the pipe for filling hydraulic oil into the power coupler. Turn and install internal connecting fuel pipes for the steering and drive systems. of the fan, as well as its connection and clamping to the speed converter housing.

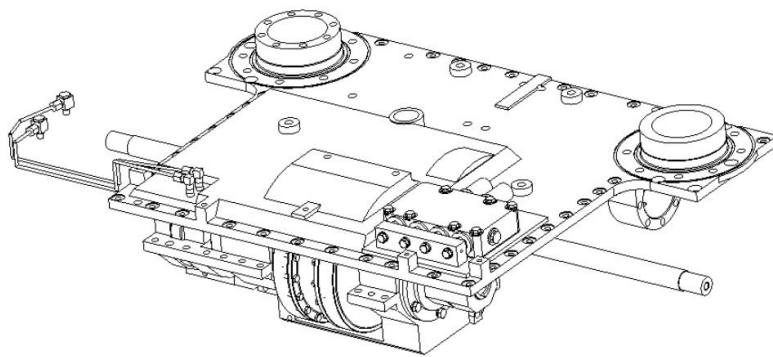


Figure 21 Steering unit assembly

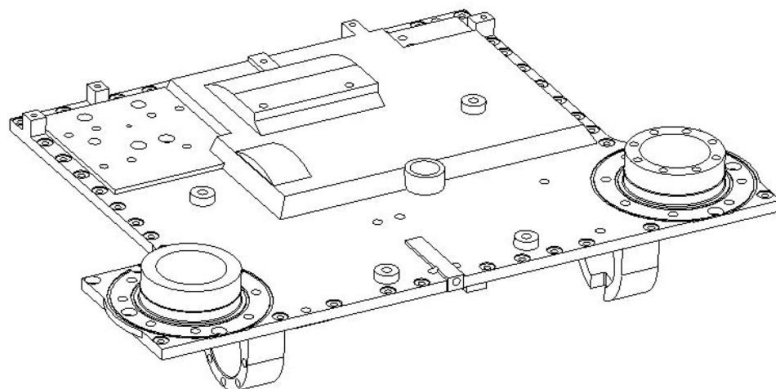


Figure 22 Steering cover

Coupler oil-filling hydraulic control system consists of a valve block controlling the oil supply and

Delivery Pipe The valve housing collects pressure on the high pressure side of the pump motor and controls the process.

Increase the driving power (Boosting) of the steering power coupler (Coupler).

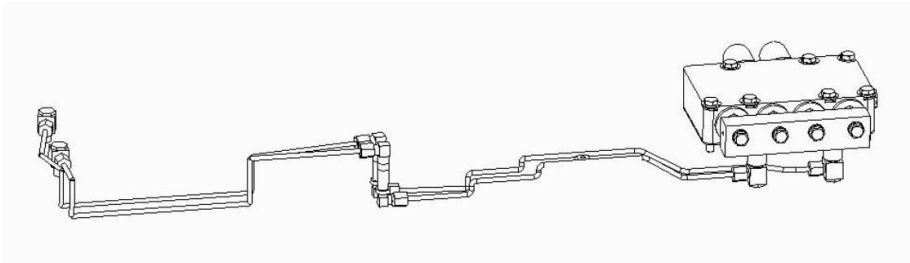


Figure 23: Engine oil distribution valve housing for steering power and oil delivery pipe.

(Coupler oil-filling valve and pipeline)

Rotor base has main components consisting of a pair of motor output gears.

The pump, the steering coupler (coupler) and the input and output gear pairs and oil delivery pipes,

as well as the steering shaft (Zero shaft), are used. To output the steering power of the pump motor and

The steering power is connected to the final drive system to achieve

Steer by making the left and right drive wheels have different speeds. (Differential steering)

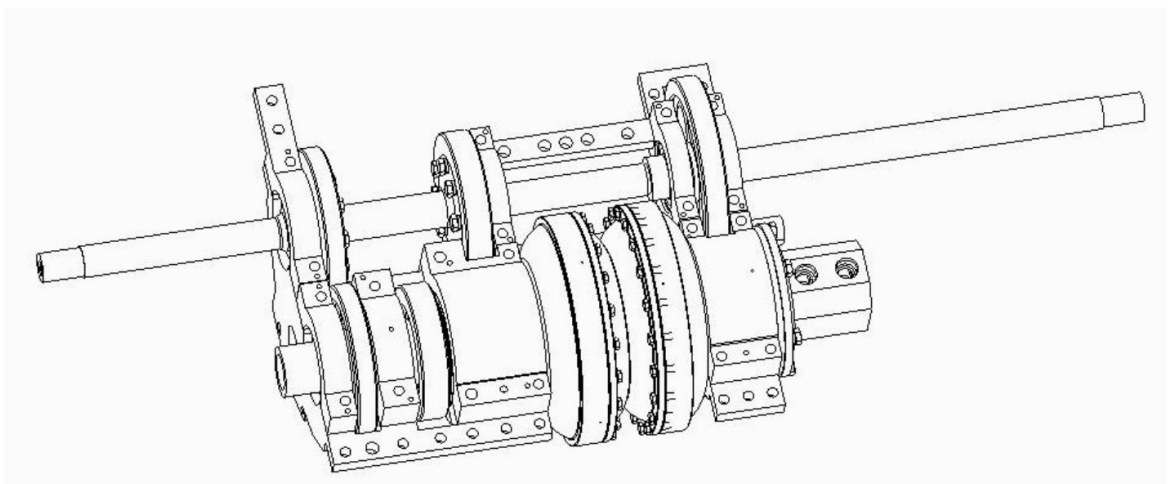


Figure 24 Rotor base subassembly

The main component of the fan drive consists of two pairs of curve toothed bevel gears mounted on the combination steering cover. There is a speedometer gear. (Tacho gear) is installed on the bevel gear on the power output side of the fan to measure speed.

Fan rotation cycle

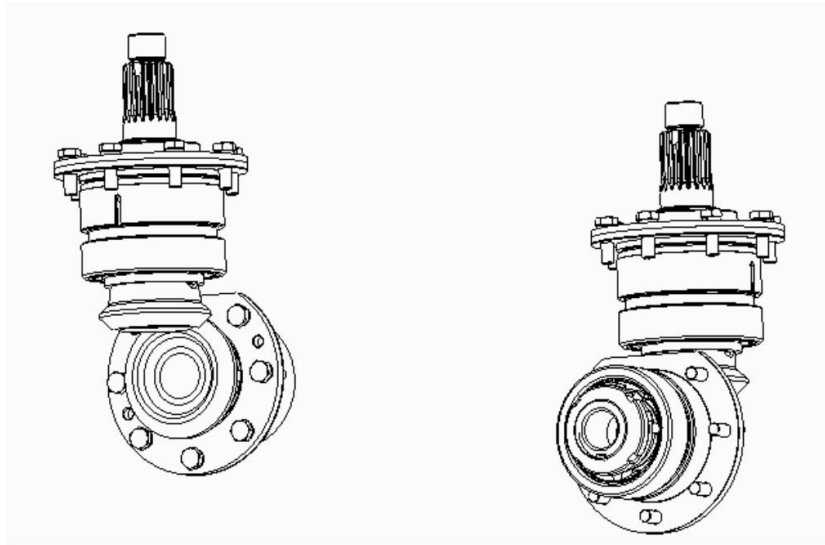


Figure 25 Fan drive set

Liquid viscous clutch and fan drive system are mechanisms for adjusting fan speed and power transmission of the commutator.

Speed (Integrated transmission) A fluid clutch has main components consisting of a shaft.

Main body, oil cylinder, friction plate, outer hub, input gear, piston etc. receives input power from the PTO gear and

It is transmitted to the main shaft through a pair of friction face plates mounted on the outer hub and main shaft.

Then the power is divided into 2 routes and the power is transferred to the gears driving the fan on both sides.

to drive the fan adjust rotation speed and cooling the speed changer

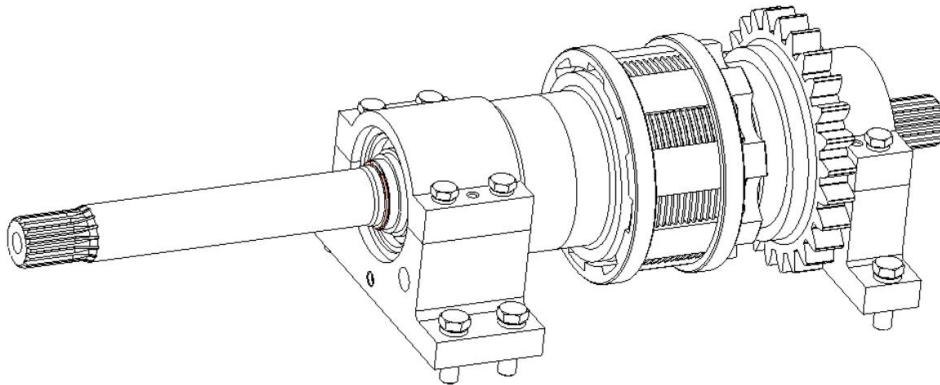


Figure 26: Liquid viscous clutch

B. Working principle

The principle of operation of the combined steering unit is as follows: the driver turns the steering wheel, which will pull the sloping plate of the pump motor. There are two signal collection points on the motor. The pump is used as a pressure signal source and controls the fuel valve housing of the steering coupler. One of the two points is the high pressure point. When the pump motor pressure exceeds the specified value. Fuel distribution valve housing. The power coupler will begin to supply oil to one side of the power coupler, then the steering coupler (Coupler) together with the Boosting pump motor will send torque to the steering shaft (Zero shaft). See the following figure.

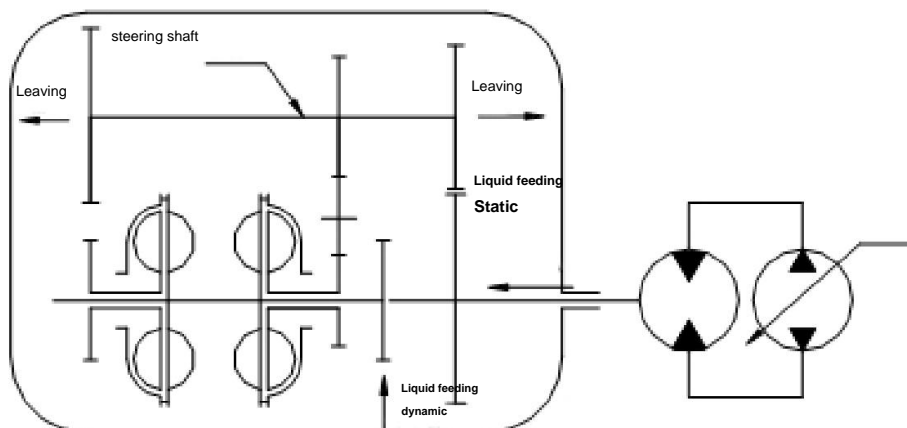


Figure 27: Working principle of a composite steering unit.

The working principle of a fluid clutch is: Torque is transmitted through the shear force of the film. oil between the friction pairs on the structure. Changing the clutch grip level, the friction surface plate will Changed by controlling the operating oil pressure of the clutch cylinder. Therefore, it causes Difference between driving friction plate and driving friction plate along (Driven friction plate) and will change the rotational speed of the PTO shaft if the pressure oil rise The distance between the pairs of friction surface plates is reduced. If the oil film is thin Film shear strength oil will increase and the rotational speed of the drive shaft is high. On the other hand, if the oil film is Thick, the shear force of the oil film is reduced. and the rotational speed of the drive shaft is low. Therefore it can Can control the speed adjustment. For this reason, a transmission efficiency of 100% will occur when The clutch engages perfectly. This, in turn, protects the equipment from overload by slipping. (Overloaded slipping) to protect parts and other components on the fan drive system.

Chapter

9 Other components (OTHER COMPONENTS)

1. Speed changer gear housing (Transmission gearbox)

The speed changer receives power through the connection of the Geislinger and the engine, the power system and the speed changer system. (Transmission system) connected together to form a strong structure with a power train bracket.

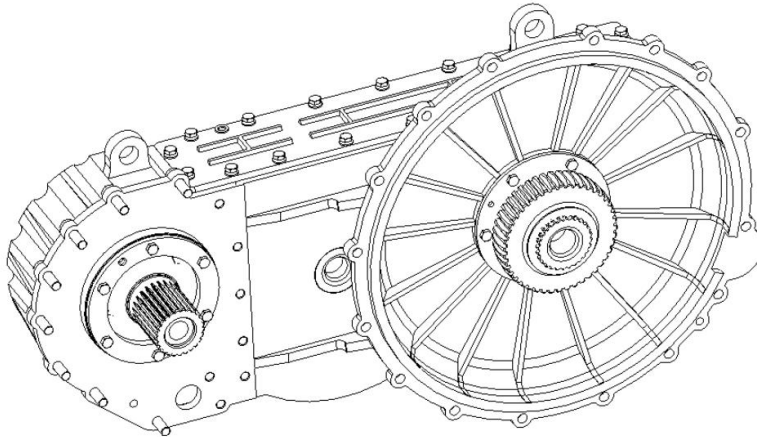


Figure 28: Speed changer gear housing (Transmission gearbox) 2. Composition of case body

The components of the speed changer housing kit are the main housing, auxiliary cover plate, oil drain plug, etc. The main housing is made of high-strength aluminum alloy. ZL101A is made of The main ones are connection and clamping. As well as being an internally connected oil delivery pipe and a pressure oil tank for the system.

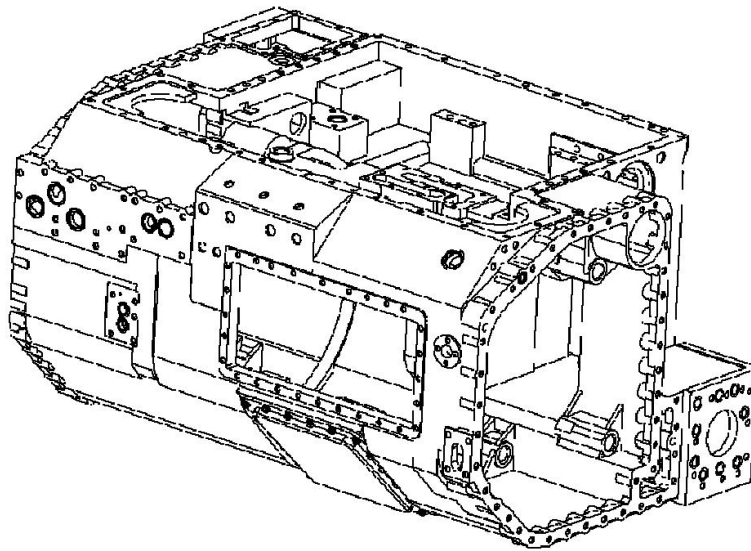


Figure 29 Components of the speed changer housing (Case body)

3. Middle bracket Middle bracket,

the outer ring of the bearing mount on the middle support unit has the function of supporting the torque converter. P4 pump set serves to drive Oil supply for the steering gear, fan drive, power from the gear train, lubrication, locking and oil supply for the thrust converter is achieved through the casing. Valve sleeve and connecting pipe of the thrust converter

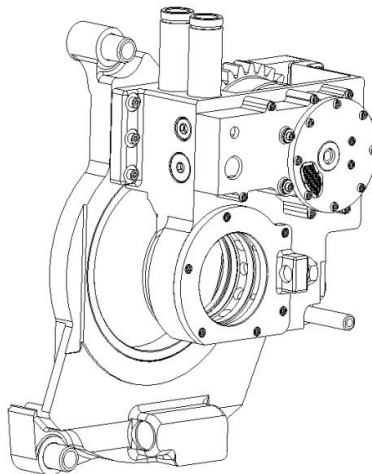


Figure 30: Middle bracket

4. Torque converter bracket with rear pump.

The hydraulic torque converter support unit is used to connect the torque converter and
Meanwhile It is also where the oil pump (P5), various oils and oil control valves are installed.

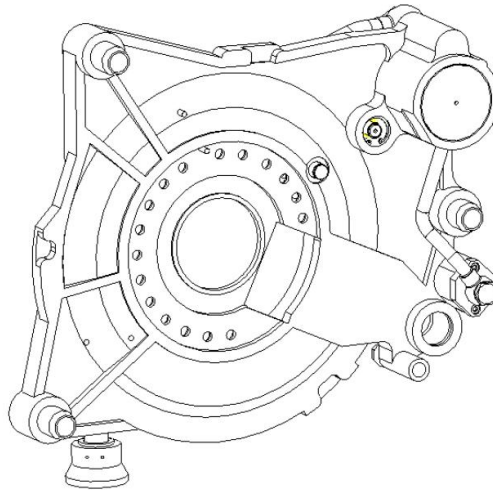


Figure 31: Hydraulic torque converter bracket

5. Front transmission assembly

The front transmission module consists of a housing, steering gear, and center
Input shaft, (Intermediate gear), gear.
etc., serve to divide and transmit the received power. The power received will be divided.
Divided into 2 parts, one will transmit the driving power while the vehicle is driving straight (Straight
driving power flow) of the hydraulic torque converter (Hydraulic torque converter) and the other circle
One is to transmit the steering power flow of the steering element.
(Steering components)

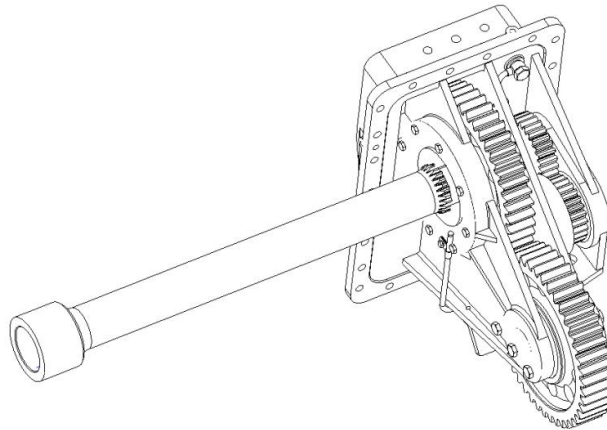


Figure 32 Front transmission assembly

6. Hydraulic torque converter

The hydraulic drive converter is equipped with a lockout clutch. Can work in 2 ways: hydraulic and mechanical. Its main function is to increase torque while reducing speed and reducing shock, for example when conveying high torque under heavy loads. Reduces shock and provides support. Impacts inside the machine change its speed. The thrust transducer is supported by a transducer mounting bracket. Drive and middle support unit (Middle bracket) which is fixed to the speed changer housing with a bracket. Main unit with mounting bracket

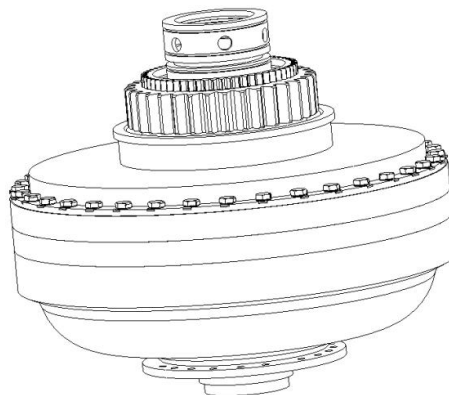


Figure 33 Hydraulic torque converter

Lockable hydraulic torque converter

Helps increase the ability to move and accelerate the car on routes in difficult terrain.

difficult difficulties very well and extend the life of the speed changer.

7. Hydraulic retarder and control valve.

The hydraulic damper is mounted inside the speed changer housing and is connected with the PTO shaft of the planetary gear-shifting mechanism after the driver's brake pedal signal is received.

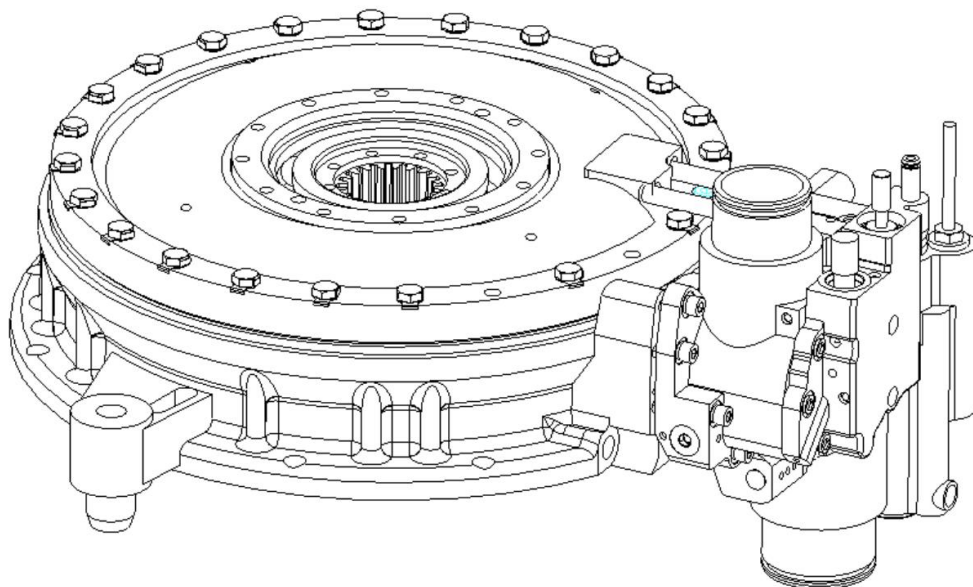
Transferred to the hydraulic damper control valve by means of oil pressure. There will be oil flowing.

Enter the damper to delay the rotation of the PTO shaft of the speed change mechanism.

(Gear-shifting mechanism) hydraulic dampers and control valves and mechanical brakes.

The vehicle's mechanical brakes work together as a combined brake system.

braking system)



**Figure 34: Hydraulic damper and control valve
(Hydraulic retarder and control valve)**

The control valve acts to brake the wheel with constant torque through control. Hydraulic servo control, which improves the braking efficiency of tank clearly Therefore, the tank can move at a better average speed and extend its life.

Main braking system (Mechanical brake)

8. Left/right combination speed reduction gear set and cover

(Left & right confluence mechanism and side cover)

The Ch1000B speed changer uses a speed change mechanism to transmit dual drive power. Zero differential type double-flow transmission which has a group of satellite gears. It is a driving mechanism. Ring gear is used for inputting driving force while driving a tank in direct movement and the center gear (Sun gear) is used for inputting steering power. satellite gear frame (Planetary frame) used to send out the power output by the satellite gear frame receiving the output power from the output power. While the vehicle is moving straight ahead and while steering the tank. Power output end The output end of the satellite gear frame is connected to the final drive gear through the output gears.

Therefore, The main functions of the combined speed reduction gear mechanism are:

A. To transmit propulsion power while the tank is moving straight ahead and transmit propulsion power.

When steering the car to turn to the left (turn to the right) through the frame of the satellite gear;

B. to transfer the increase in steering power to the high speed side while steering; C.

Acts as a speed reduction gear set. (Differential performance) of the gear group entourage on both sides while steering

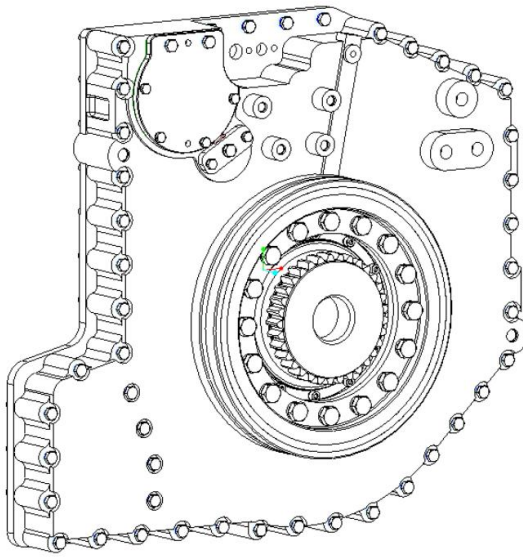


Figure 35. Left-side combination speed reduction gear set.

and cover

(Left confluence mechanism and side cover)

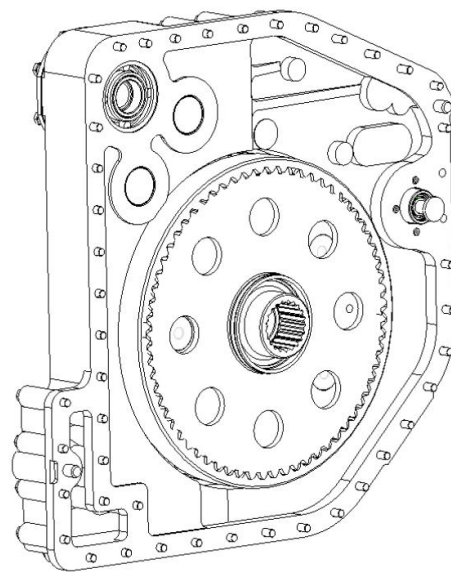


Figure 36. Right-hand combination speed reduction gear set.

and cover

(Right confluence mechanism and side cove)

9. Pump group

The pump unit is the main oil supply of the speed changer. (Transmission) is the heart of the speed changer

The pump set consists of 3 pumps: P1, P2, and P3. Pump P1 is a hydraulic steering unit. The pump unit uses high-speed internal gear drive technology that is characterized by small volume and high flow rate, so the pump unit has a compact structure.

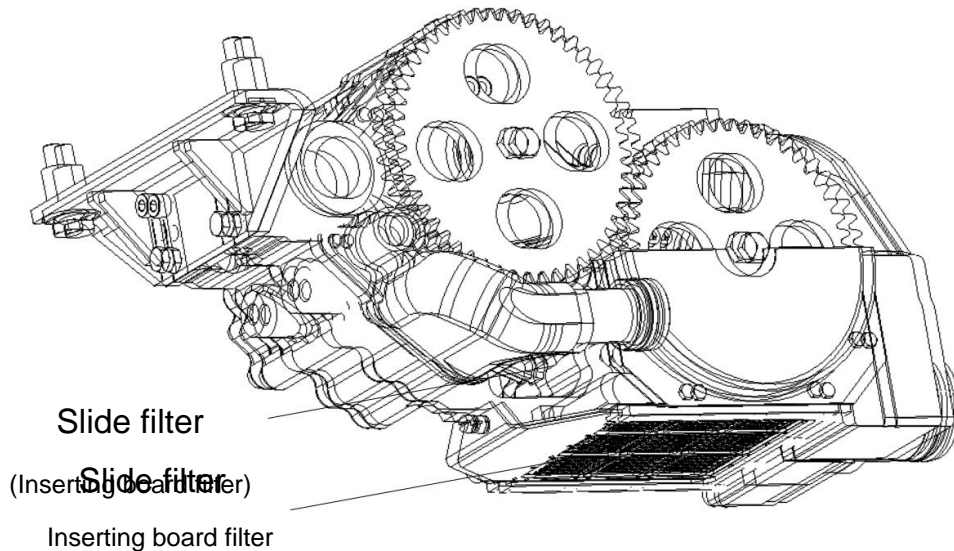


Figure 37 Pump group

10. Hydraulic steering unit (HSU) Hydraulic steering

unit (HSU) Consists of an axial piston plunger pump and a steering motor. The hydraulic steering unit works together with the steering unit to deliver steering power. Servo mode of the steering pump. The

turns are mechanical. Can be controlled by The connection between the Mechanism pull arm and the Steering wheel allows for smooth turning and steering. This makes the tank's maneuvering on difficult terrain more agile and convenient, increasing the tank's average speed of movement and reducing driver fatigue.

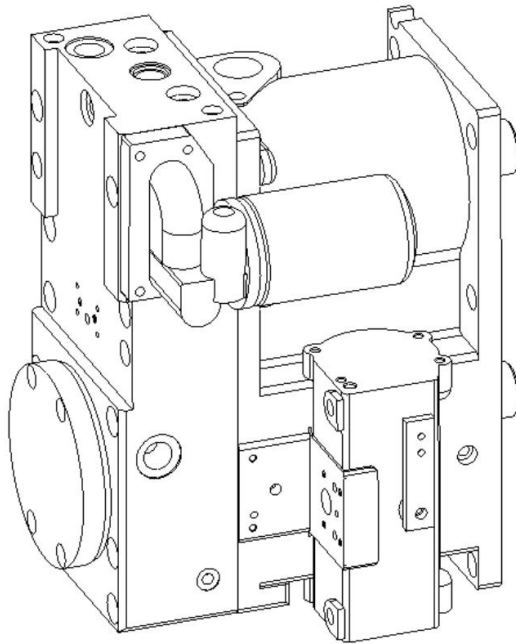


Figure 38 Hydraulic steering unit (HSU)

11. Oil supply system

The oil supply system consists of a constant pressure valve of the pressure oil tank, a main filter, and an engine oil filter. -Double filter (Pilot oil filter/ operating filter), pipes and valves. The oil supply system serves to adjust the oil pressure. Push the oil flow rate and control cleanliness. Hydraulic control valve for controlling Automatic fan speed is integrated into the fuel supply system.

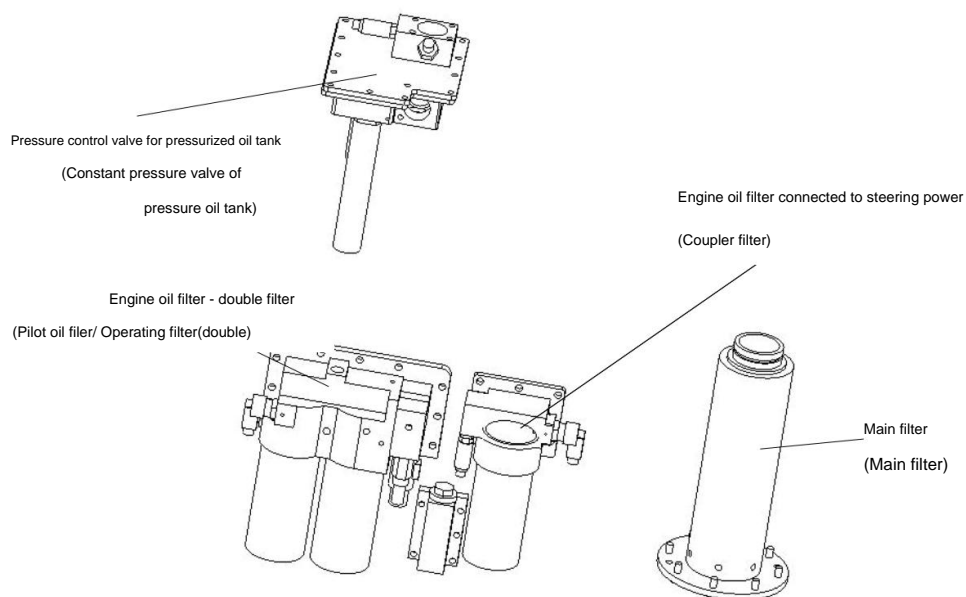


Figure 39 Oil supply system

10

Chapter: Other power transmitters
(OTHER TRANSMISSION DEVICE)

Section 1

General Description (GENERAL DESCRIPTION)

Other power transmitters are power transmitters excluding speed converters.
which consists of

Disc brake set and final drive gear

Part 2

Disc brake set (COMPLETE DISC BRAKE)

1. General description

The disc brake assembly is the final critical component of a tank's wheel braking system. car on sloping ground Slowing down the car, stopping the car, etc. The disc brake unit works with torque. Output brake torque

2. Main technical parameters

Brake the wheels at vehicle speeds from 32 to 0 km./ 10 meters
hr. at the maximum parking angle on slope of 60%.

3. Components of the wheel braking system and principles of operation.

A. Working principle

When the driver steps on the brake pedal The brake system will begin to work. The brake cylinder will drive the ball disc to rotate, sending force to the brake rollers. (Rotatable ball) rolls up the ramp on the brake ramp ring. The roller pushes the ring to rotate. (Rotatable ball disc) and the brake ramp ring (Moveable ball disc) separated from together, it will push the friction disc set (Friction pair), both pairs, transmitting torque to force the brakes, so the brakes Thus, the tank can brake through transmitting braking torque to the power shaft of the final drive gear. By connecting the brake to the final drive gear

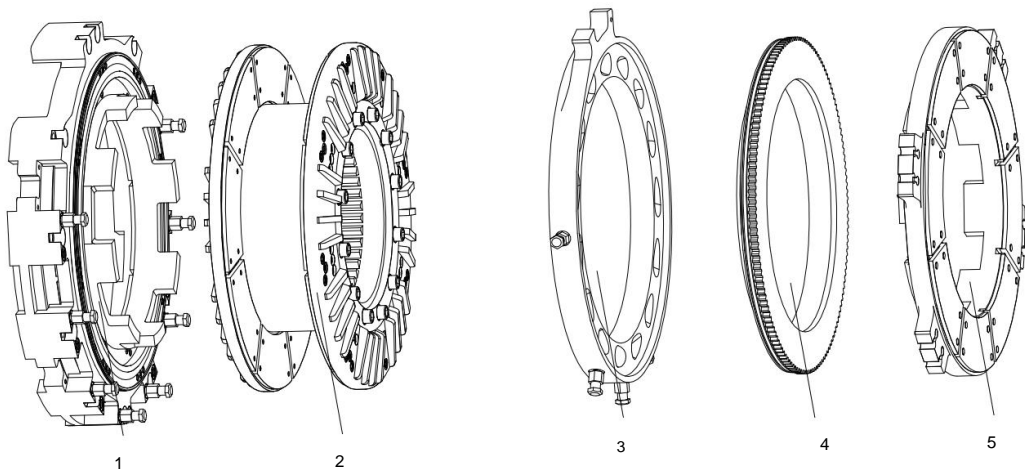
B. Components:

See Figure 1 , the brake set consists of the brake anchor, friction disc brake set, rotating ring, ring. Brake ring and brake ring assembly Each tank is equipped with a brake kit. 1 set of left disc brake and 1 set of right disc brake set, the difference between the left disc brake set And the right front brake set is the direction of the ball slot on the control ring. Brake (Ball disc)

1) Brake anchor, friction disc brake set and brake force ring was assembled together using rivets that connect the friction plate and structural parts. When braking, the brake torque is exported by compression and binding of friction plates.

2) The brake anchor is connected to the final drive gear with a bolt. The brake anchor serves to mount all brake components.

3) Friction disc brake set It is connected to the final drive input shaft with an inner gear. Brake torque can be transmitted to the final drive gear to achieve wheel braking. can be adjusted Distance by adding or reducing shims (Adjusting shims) Cooling frame on the ring. The brake pads act to accelerate the air flow around the brakes to remove heat from the brakes.

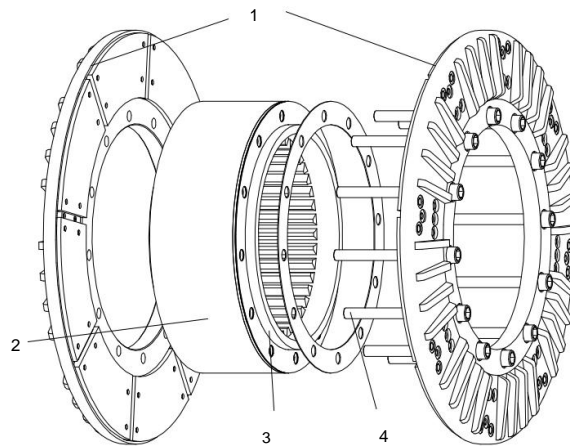


1. Coupling disc assembly
2. Brake disc assembly
3. Rotatable ball disc
4. Brake control ring (Movable ball disc)
5. Movable disc assembly

Figure 1: Picture of components of the brake set (Complete disc brake)

4) While braking, the braking ring and the turning ring are separated from together and drive the friction plates together. Therefore,

the brake catches 5) Brake ramp ring assembly. and the brake disc set can move in axial direction through the coupling of the inner gear teeth The picture shows the components referred to in Figure 2.



1. Brake disc assembly 2.

Coupling tooth

3. Adjusting shim

4. Fixing bolt

Figure 2: Picture of the components of the brake assembly (Brake disc assembly).

Part 3

FINAL DRIVE

1. General description

The final drive gear installed outside the vehicle is the final power transmission.

The tank, which consists of a left final drive gear and a right final drive gear, can be increased. Braking torque from speed converter then transmits torque to the drive wheels.

The final drive gear can also be installed or disconnected from outside the vehicle. which allows the use of a crane to lift The generator can power out of the tank.

Characteristics of the final drive gear, see Figure 3. Installation location on the vehicle, see Figure 4. First, install the final drive gear and brake. Let's talk together The final drive gear assembly is then fitted to the upper brake. The car is installed from outside.

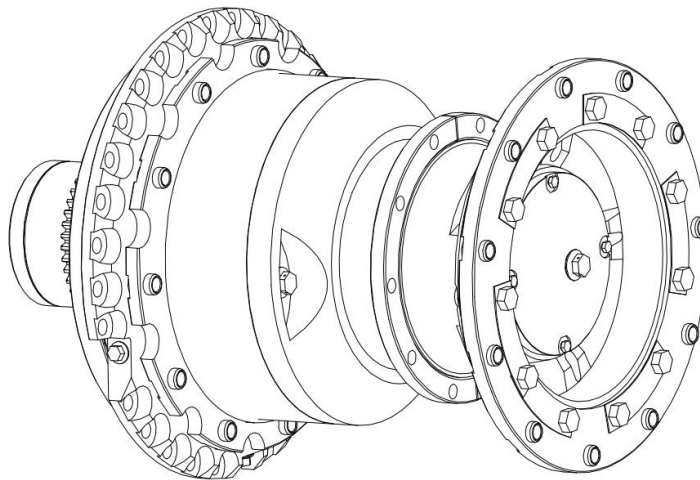
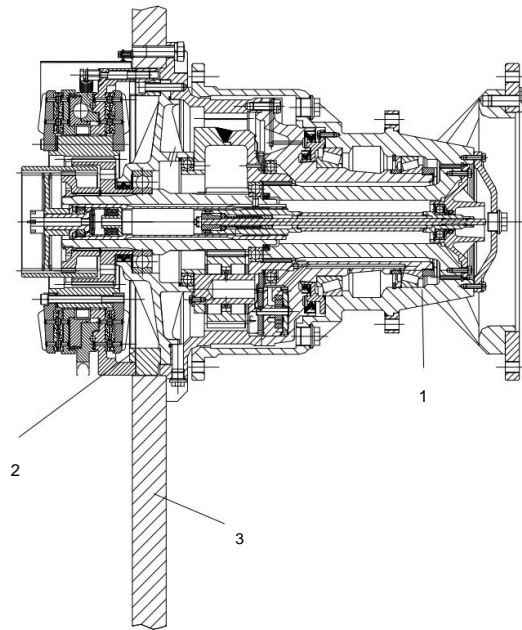


Figure 3: Final drive gear set (Final drive)



1. Final drive gear set (Final drive)

2. Brake (Brake)

3. Hull side armor plate

Figure 4: Mounting position of final drive .

Main performance parameter

Ready weight 52 tons

energy 1200 horsepower

Maximum 70 kilometers/hour

speed Gear ratio (Transmission ratio) 4.42

type Planetary gear set

Lubrication With a lubricating oil pump

How to unlock Release from outside the vehicle.

2. Working principle

Diagram of the final drive gear set, see Figure 5.

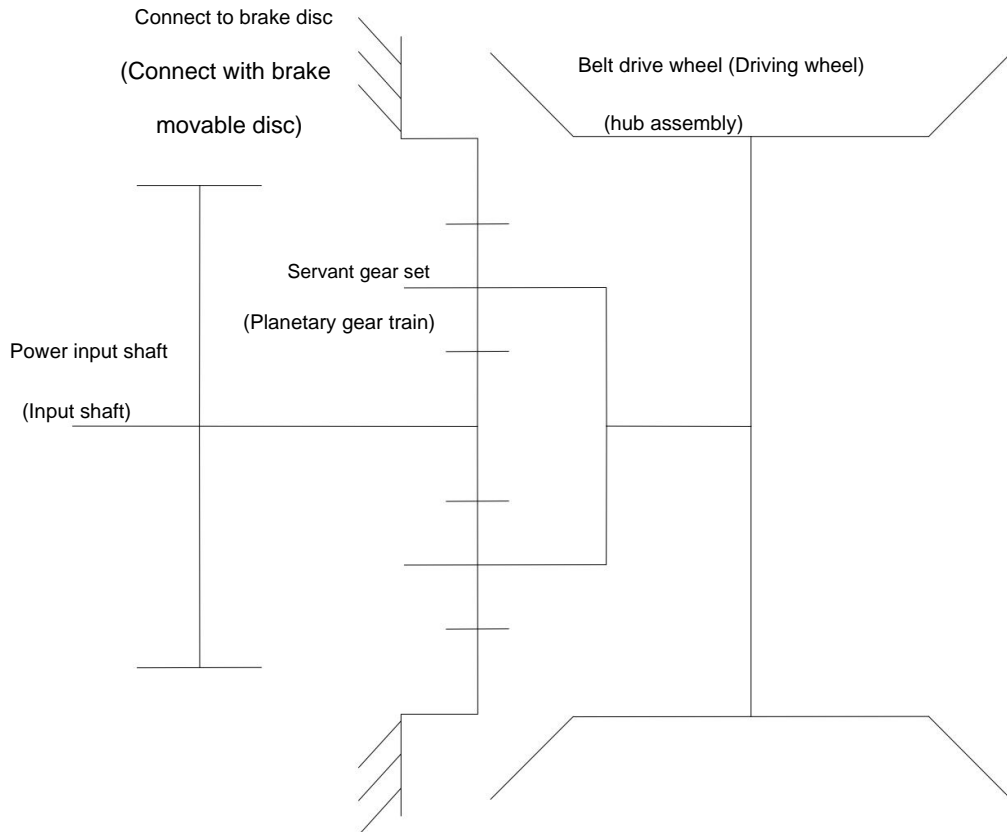


Figure 5: Diagram of final drive

Drive power is transferred from the speed converter's PTO gear to the shaft.

Receives the power input of the final drive gear. In this case, the power input shaft is the center gear (Sun gear) of the speed reduction mechanism of the slave gear of the drive gear. Finally, the ring gear of the satellite gear is combined with the final drive gear housing, that is, the ring gear is fixed. provided

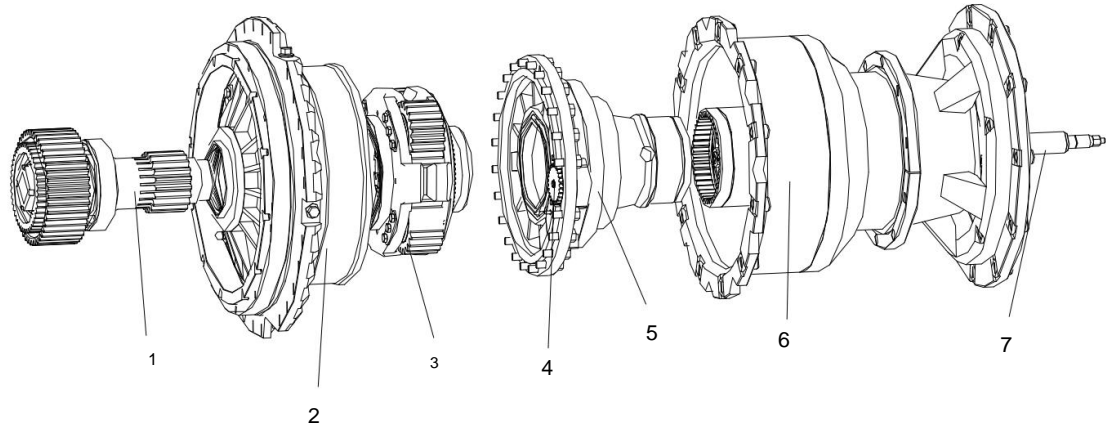
Therefore, the gear frame transmits power to the driving wheels (hub assembly) to drive the vehicle. The ramp ring

The brake force is connected to the final drive gear with a gear. When the brakes are applied, the shaft receives the power input.

The final drive gear is locked for stopping.

3. Composition of final drive

The final drive assembly consists of a drive shaft. Cover and ring gear, frame
Belt drive gear housing Lubricant pump Drive hub housing Wheel hubs drive belts, adjustment
units, etc. while driving the tank. The drive power from the speed changer is transferred to the step gear.
Finally, through the gear shaft receives the drive power. and send it to the satellite gear set to reduce the speed. Steps
Finally, power will be transferred to drive the vehicle and belt through the belt drive wheel hub, see Figure 6.



1. gear shaft receives driving power

(Input shaft with sun gear)

2. Cover and ring gear

(Final drive cover and tooth ring)

3. Belt drive gear housing frame

(Frame assembly) **Figure**

4. Lubricating pump

5. The housing accepts the drive hub.

(Support body assembly)

6. Belt drive hub (Hub assembly) 7.

Adjuster assembly

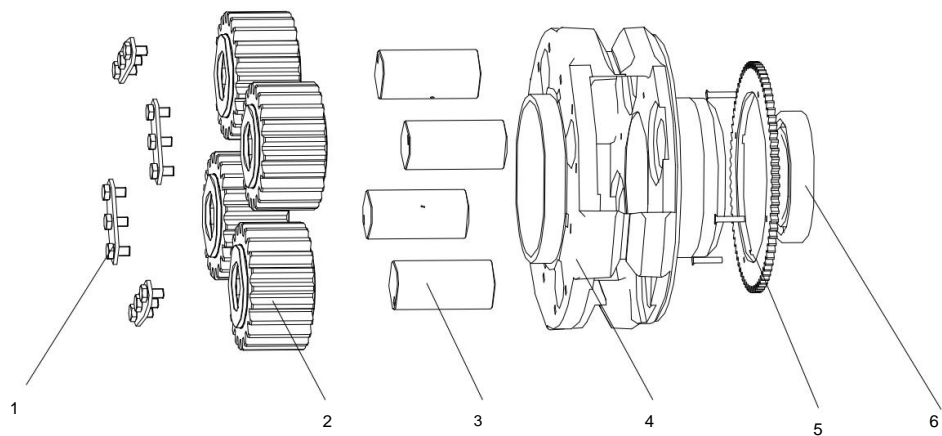
6 Picture of components of the final drive gear assembly.
(Breakdown drawing of final retarder)

A. Belt drive gear housing frame (Frame assembly)

Belt drive gear housing It is the satellite gear and the frame that holds the gear group. Speed, which is the main component in reducing rotational speed.

The belt drive gear housing consists of a frame and 4 satellite gears, a gear shaft. Servants, etc., receive driving power from the central gear (Sun gear) and send the driving force out of the frame. satellite gear and have a gear ratio of 4.42

Components of the satellite gear frame, see Figure 7.



- | | |
|---|----------------------|
| 1. Bolt securing the satellite gear set | 4. Frame (Frame) |
| (Tightening part of planetary gear) | 5. Pump driving gear |
| 2. Planetary gear | 6. Bearing (Bearing) |
| 3. Planetary gear shaft | |

**Figure 7. Components of the belt drive gear housing.
(Breakdown drawing of frame assembly)**

B. Cover for final drive gear, ring gear and drive hub housing.

Final drive cover, tooth ring and

The support body assembly is the main component of the final drive gear assembly.

The final drive cover is the housing of the final drive gear, serving as a support.

Mechanism of the satellite gear set

The ring gear is part of the final drive housing, and is also used as a part.

One of the satellite gear mechanisms The brake ring gear is used to transfer drive power from the drive gear frame.

Final drive frame The drive hub

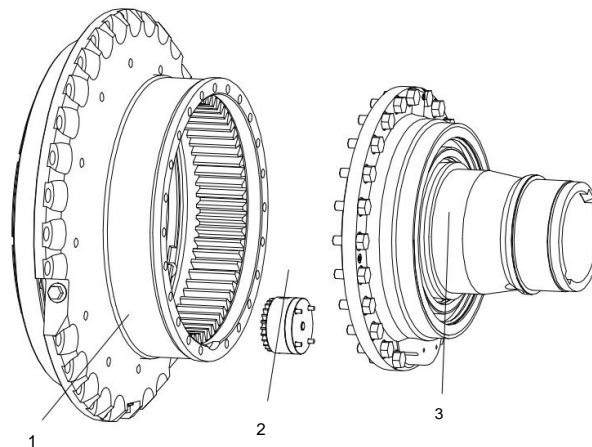
housing is used to support the slave gear mechanism and hub assembly. Use the oil seal on the body.

Hub housing to seal the lubricant inside the final drive gear. Built-in lubricant pump attached

Located within the drive hub housing to lubricate the bearings and gear mechanism.

Components of the final drive cover, ring gear and drive hub housing.

See picture 8.



1. Final drive cover and tooth ring 2. Pump 3. Support body assembly

**Figure 8. Cover of final drive gear, ring gear, and drive hub housing.
(Final drive cover, tooth ring and support body assembly)**

C. Belt drive hub (Hub assembly)

The drive ring gear and limit plate are mounted on the belt drive hub assembly. Used to transfer drive power from the final drive frame to the drive wheels.

Belt drive hub Consists of the left side of the wheel hub. The right side of the wheel hub and half ring which are connected by electron beam welding. For the components of the belt drive hub assembly, see Figure 9.

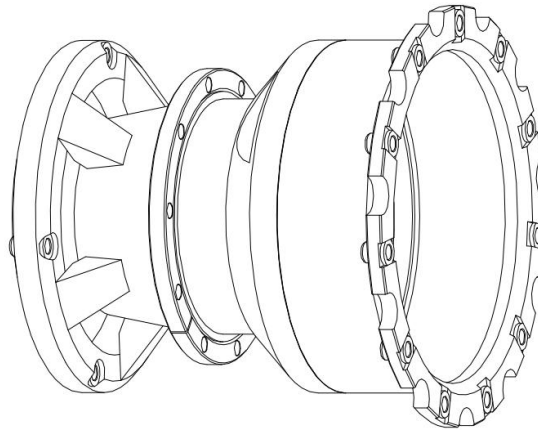
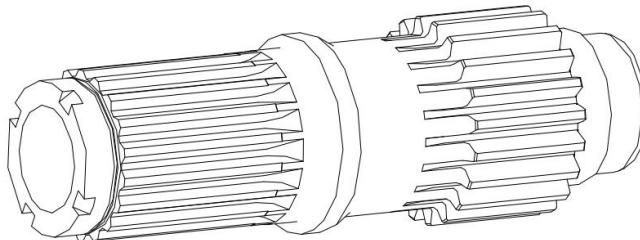


Figure 9: Belt drive hub assembly (Hub assembly)

D. Input shaft with sun gear

The driving power comes from the speed changer through the drive shaft and Transmitted to the satellite gear mechanism through the central gear (Sun gear) to reduce the rotational speed.

Structure of the gear shaft to receive the power drive, see Figure 10.



**Figure 10: Gear shaft receiving power drive
(Input shaft with sun gear)**

E. Adjuster assembly

The function of the adjustment housing Used to disconnect the drive power or connect the drive power to the power connector sleeve.

Gear type of the final drive gear and coupling gear of the commutator.

Speed The structure of the housing is adjusted according to with support between structures

Figure 11. The shaft shaft is positioned. Alignment gear sleeves, main shafts, etc., facilitate transition between

State without power (Moving state) and state with power output (Locking state) Rotate the casing.

Alignment sleeve to de-energized state to move the alignment ring. and the movement of the band

The alignment ring causes the geared power connector to move forward or backward. The

structure of the housing is adjustable. Refer to Figure 11.

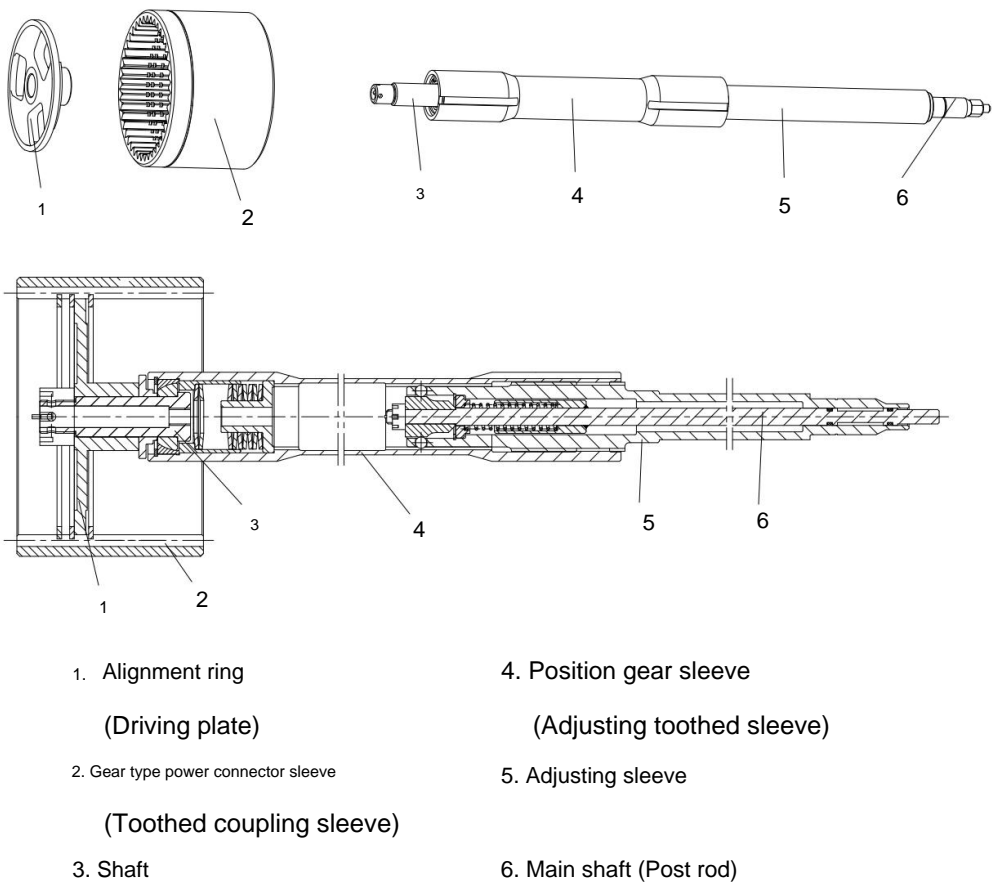


Figure 11 Adjuster assembly

F. Method of using the operation of adjuster as shown in

Figure 11. Connection steps of the gear-type power coupling sleeve (2) of the ultimate drive gear. Projection and power transmission gear (Not shown in photo): Unscrew the final drive gear cover and insert the special tool into the screw hole. Press the main shaft (6) until the hexagonal hole of A special tool is inserted into the outer hex of the alignment sleeve (5) and pressed down until it stops. The alignment sleeve now disengages from the alignment gear sleeve (4). Rotate the special tool clockwise, the alignment ring (1) and gear coupling sleeve (2) will move inside the vehicle. Under the action of the shaft (3), if the gear coupling sleeve cannot move, rotate the special tool counterclockwise approximately 2.5 revolutions. At this time, the mark line Address outside the casing The gear coupling (2) is covered by a mounting seat on the outside of the speed converter. The special tool is removed and the main shaft returns to its position under the action of the springs. Inside the housing, adjust and the alignment sleeve and the alignment gear sleeve are in a locked state. Therefore, the power connection between the toothed coupling sleeve of the gear unit final drives and power transmission gears of the speed changer, then the power is connected successfully. The release procedure is the same as the locking, but differs in the direction of rotation of the special tool.

Chapter CONTROL DEVICE

The control device consists of a brake control system. Gear change control device
Steering wheel controls and throttle control equipment The driver uses a control device to control the tank.

episode 1

Brake control device (BRAKING CONTROL DEVICE)

1. General introduction

The driver can control the brakes and retarder with a hydraulic retarder.
Through the braking control system while driving the tank to slow down, parking, using
Parking brakes and emergency braking The braking system uses a combination of hydraulic and mechanical braking modes.
(Hydro-mechanical combined braking mode)

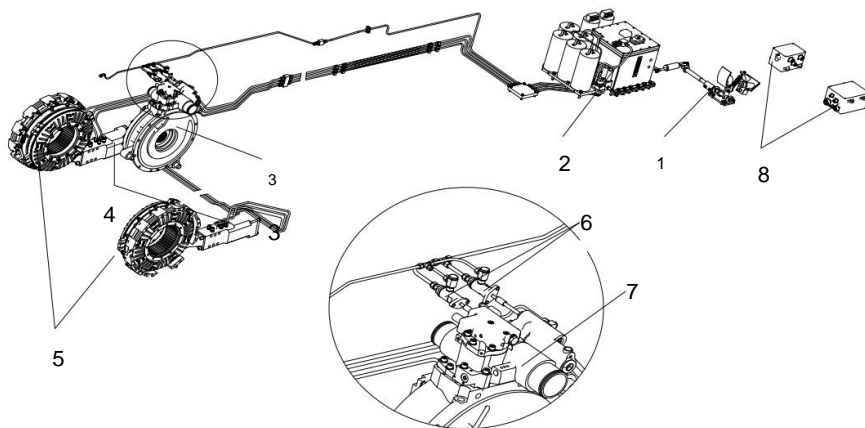
2. Main performance and parameters

System pressure	11 - 16 megapascals
Pressure in the booster (Accumulator)	10 - 12 megapascals
Motor	700 watts x2
power, DC voltage	24 volts
Hydraulic oil tank capacity	18 liters

3. System composition and principle

A. System Composition

The brake control system consists of an electrical control system (8), brake pedal
mechanism (1), hydraulic station (2), brake cylinder (4), brake (5) cylinder. Hydraulic servo oil (6) Valve
Control the hydraulic damper (7), hydraulic damper (3) and connecting oil pipes.



1. Pedal mechanism
2. Hydraulic center 3. Hydraulic retarder
4. Brake cylinder
5. Do not brake.
6. Servo hydraulic oil cylinder
7. Hydraulic retarder control valve
8. Electrical control system

Figure 1: Components of the brake control system.
(Composition of braking control system)

B. Working principle

The brake system uses a hydraulic brake mode combined with a mechanism. In other words, it is a damper.

With hydraulic (Hydraulic retarder) serves to brake the wheels when the tank runs at high speed and to prevent Mechanical wheels and hydraulic dampers work together when the tank is running at low speeds.

While the tank is being driven The driver steps on the brake pedal. And the instruction valve in the hydraulic center receives commands from the brake pedal. The force in the mechanical operation of the brake pedal. can be changed to hydraulic pressure and distributes high oil pressure Apply hydraulic pressure to the brake cylinder and push the brake piston in the brake cylinder to move. brake piston Move the push rod of the brake cylinder to create braking force. Therefore, the friction plates of the brakes are pressed together to perform the function of slowing down the speed and stopping the wheels of the tank. When the driver steps on the brake pedal The mechanical working force of the pedal can be converted into hydraulic pressure. Click through the hydraulic station. To push the servo hydraulic oil cylinder on the gear box of the speed changer. Hydraulic servo oil cylinder pushes the mounting shaft of the Hydraulic retarder control valve (Hydraulic retarder control valve) so that the valve The hydraulic damper is opened to supply hydraulic oil to the hydraulic damper. A hydraulic damper serves to slow down the speed and brake the tank's wheels. Hydraulic retarder contributes to slowing down the speed. and the tank's wheel braking is complete. To protect the brake system If the vehicle speed is higher than 32 km/h, the

mechanical brakes will not work. But only hydraulic dampers work.

Emergency brake function: Used to stop the vehicle immediately when the vehicle and the crew is at risk or in an emergency. In this case, wear and tear on the vehicle may not be taken into account. Prohibit the wheels and bumps of the vehicle. Both mechanical brakes and hydraulic dampers function. Combination braking at any vehicle speed with maximum brake torque and at the same time There is a signal sent to the generator system to reduce the engine throttle (Engine throttle) and change the gear to neutral position, etc. I

Using the brake system when parking for a long time The driver can use the parking brake lever. Cars on the hydraulic station The hydraulic station will not supply hydraulic fluid to the wheel brake circuit. Brake cylinder Therefore, the leaf spring plate in the brake cylinder pushes on the piston of the brake cylinder. As a result, the push rod protrudes and the push rod pushes the brake cylinder. Follow the wheel to make the parking brake work.

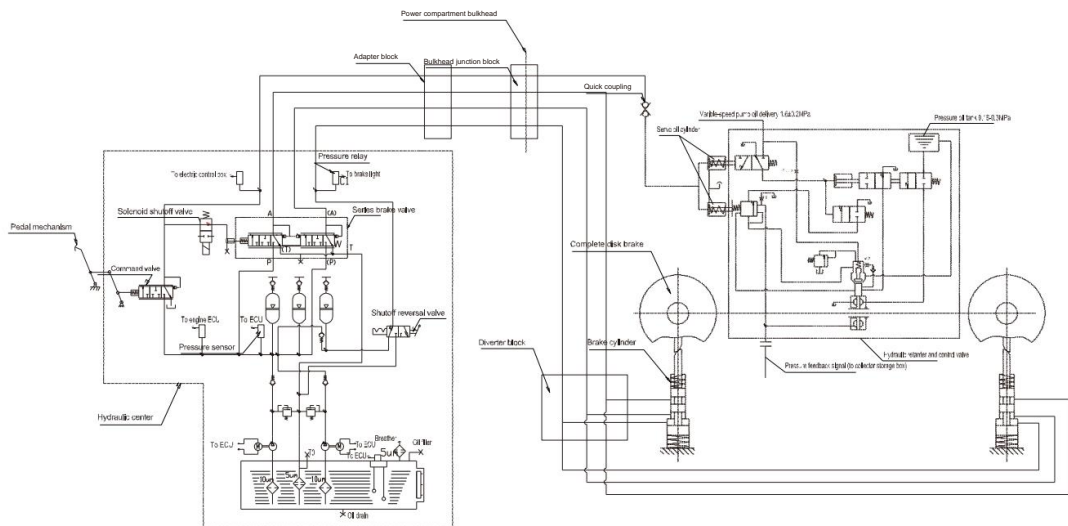


Figure 2: Working diagram of the brake control system.

(Hydraulic schematic diagram of braking control system)

4. Pedal mechanism

A. The function of the brake pedal.

The brake pedal mechanism is installed in the driver's compartment (see Figure 3). The brake pedal (5) receives mechanical force from the driver. The mechanical force from the brake pedal is transmitted to the hydraulic station. Through the pull rod, the mechanical force is changed to hydraulic pressure through the hydraulic station when the latch Pedal limit screw of the brake pedal is pressed on the travel switch. The tank will be in emergency brake mode.)

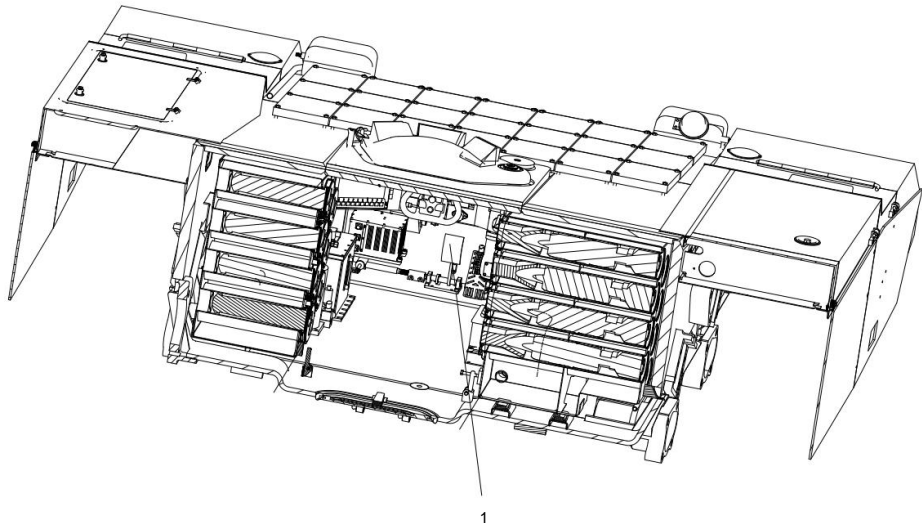


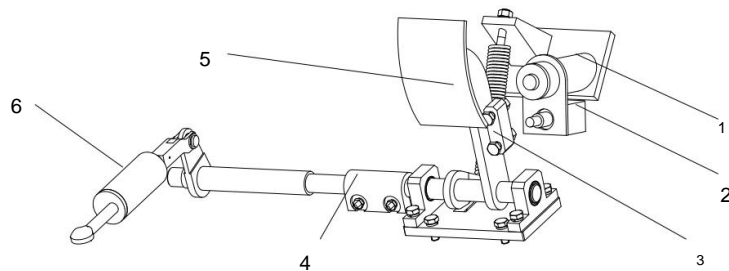
Figure 3: Diagram of installation locations for brake pedal mechanism.

(installation position of pedal mechanism)

B. Composition of pedal mechanism

The brake pedal mechanism has the main components: Distance limiting seat (1), switch emergency (2), limit bolt (3), grooved axle end cap (4), brake pedal (5), pull rod set (6) and parts

Another loop



1. Limited support seat

2. Emergency switch (Travel switch)

3. Limit screw

4. Splined sleeve

5. Pedal to brake the wheel (Pedal)

6. Pull rod assembly

Figure 4: Diagram of components of the brake pedal mechanism (Pedal mechanism).

5. Electrical control system

A. Functions of the electrical control

system 1) Control functions: The combined braking control box signals the start command. and stop of the accelerator motor according to the value of the pressure signal of the accelerator pressure measuring device. Power controls the hydraulic oil pressure in the hydraulic station's power booster to be within the specified range. The open-close command of the electromagnetic valve is output according to the value of the pressure detector signal and The value of the speedometer signal at a speed of 32 km/hr controls the connection and Cutting off the hydraulic fluid circuit of the brake cylinder.

2) Page showing fault code **and** pressure: control box

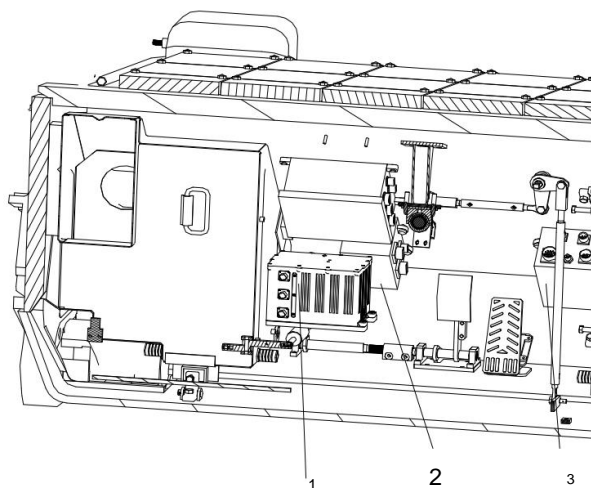
(Control box) Generates a fault code that corresponds to the sensor input signal. Fault code Abnormalities will be displayed on the display screen. Fault codes and their meanings Shown in Table 1 The display screen can show the booster pressure and output pressure.

Table 1: Fault code meaning

code	Meaning of fault code
2	No brake failure
3	The hydraulic oil tank has a low hydraulic oil level.
4	The motor has been running for too long.
5	The brake cannot return to its original position.

B. Composition of electric control **system**

The electrical brake control system consists of a brake control box (see Figure 6). Brake system operation warning (see Figure 7) and connecting cables. The brake control box is installed in the driver's cab. Area at the front of the vehicle (see Figure 5). The main function is to receive the measuring signal sent back from the station. Hydraulics and brakes Send control commands to relevant parts and generate error alarms. The brake system warning box is installed in the driver's compartment at the front of the vehicle. The main duty is to Drive the motor of the hydraulic station according to the commands of the brake control box.



1. Inertial navigation device
2. Braking drive alarm box
3. Braking bus control box

Figure 5: Diagram showing the location of the brake control box and the brake system operation warning box.

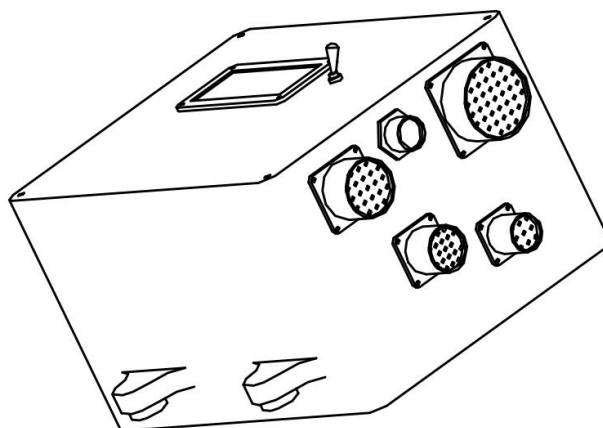


Figure 6: Brake control box

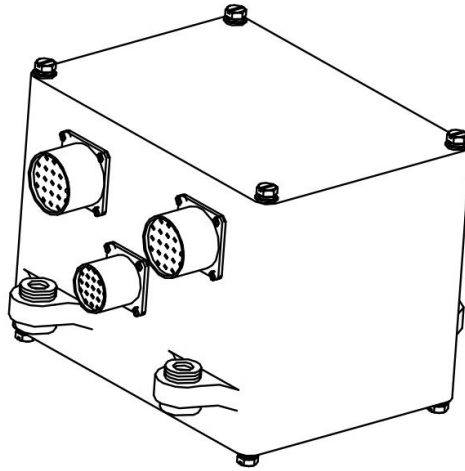


Figure 7: Braking bus control box drive alarm box

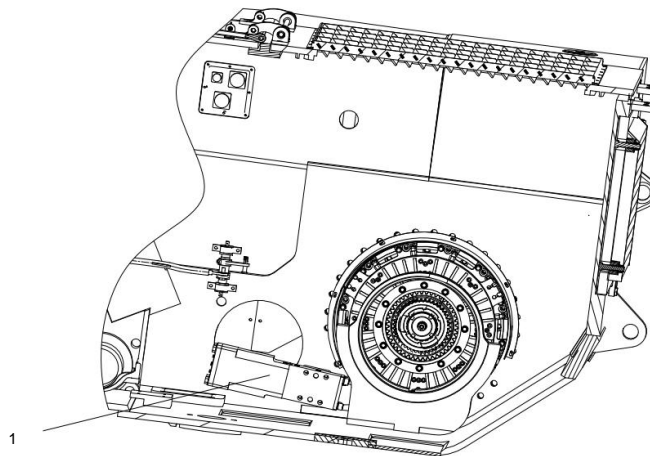
6. Braking cylinder

A. Function of braking cylinder

The brake cylinder is installed in the power generation room. and is fixed at the end of the machine.

Change speed on both sides (As shown in the figure) The brake cylinder is operated by hydraulic pressure generated by Received from hydraulic station and the hydraulic pressure is changed to the mechanical pressure of the cylinder.

The wheel is used to push a lever to push the brake unit, which is the operation of the mechanical brake mode.

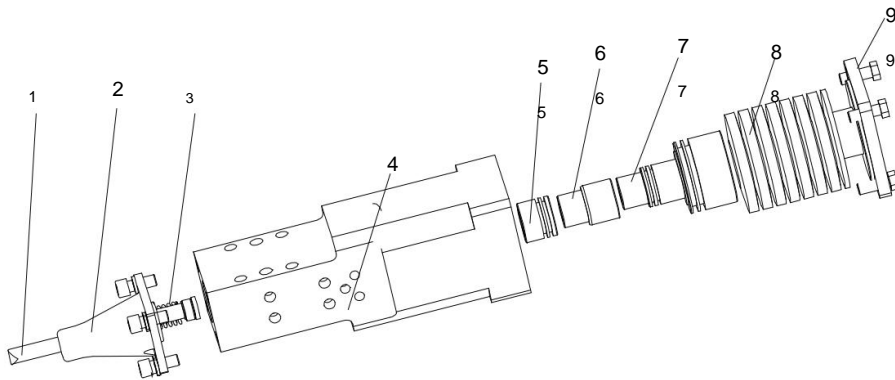


1. Braking cylinder

Figure 8: Diagram of the installation location of the brake cylinder.

B. Composition of braking cylinder

A brake cylinder has main components: cylinder rod (1), front cover (2), leaf spring (3), cylinder housing (4), piston or Wheel brake 1 (5), wheel brake piston 2 (6), brake piston Parking wheel (7), leaf spring plate (8), rear cover (9) and other parts. ...



- 1. Push rod 2. Front end cover
- 3. Return spring 4. Cylinder body
- 5. Braking piston 1 6. Braking piston 2
- 7. Parking piston 8. Belleville-type spring 9. Rear end cover

Figure 9: Braking cylinder

7. Hydraulic station (Hydraulic center)

A. Duties of the hydraulic station

The hydraulic station is located on the left side of the driver in the crew cab. (As shown in Figure 10) The hydraulic station is the power source for the brake control system. and change the mechanical working force The action of the brake pedal provides hydraulic pressure to the hydraulic fluid lines of the brake system.

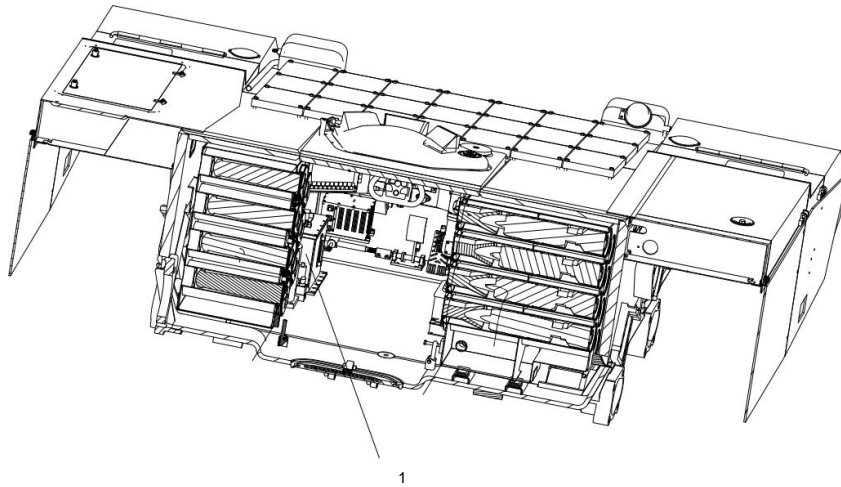
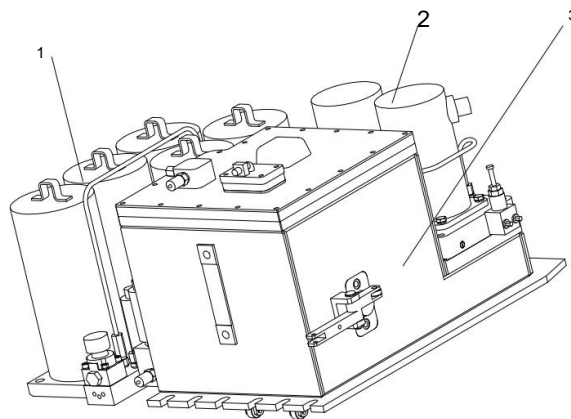


Figure 10: Installation location diagram of the hydraulic station.

B. Composition of hydraulic center

A hydraulic station has main components: Fuel booster valve housing (1), pump motor set (2) Hydraulic oil tank (3), other hydraulic components and measuring devices.



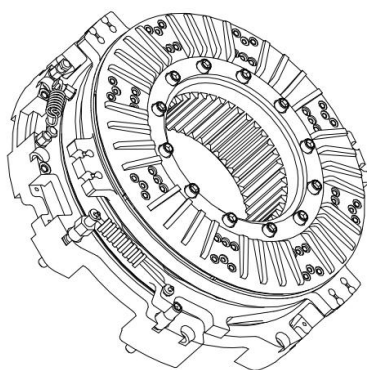
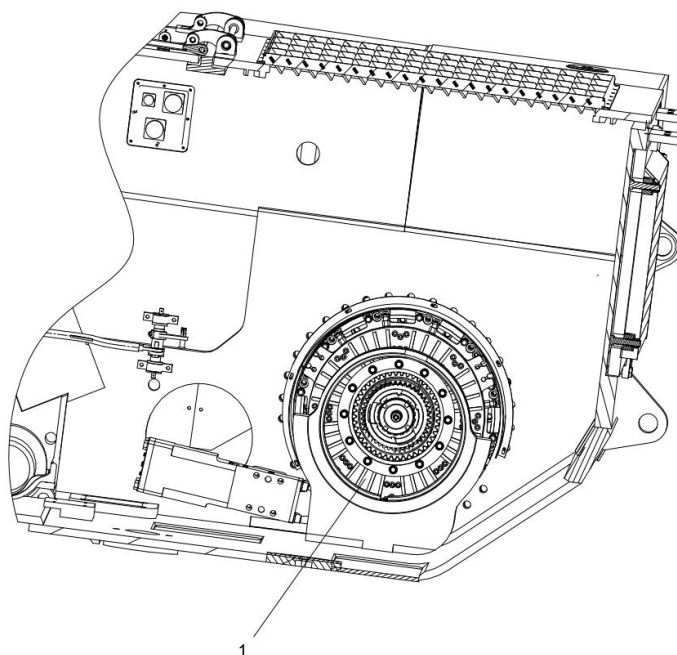
1. Accumulator
pump set

2. Motor
welding body assembly)

3. Hydraulic oil tank

Figure 11 Hydraulic station (Hydraulic center)

8. Stop the wheel (Brake).



1. Brake

Figure 12: Diagram of the wheel brake installation location and picture of the wheel brake set.

A. Function of brake:

The brake wheel should not be located between the PTO shaft of the speed converter in the chamber. Power generator and power receiving shaft of the final drive gear set, wheel brake is a component. The final operation of the brake system is performed. The brakes can transfer braking torque to the power axle. of the final drive gear which is to stop the wheel at the input shaft of the final drive gear. As a result Ensure slowing down, braking, and parking on ramps at an angle less than 32° .

B. Composition of brake

Refer to part 2 in the chapter. 10

9. Servo hydraulic oil cylinder

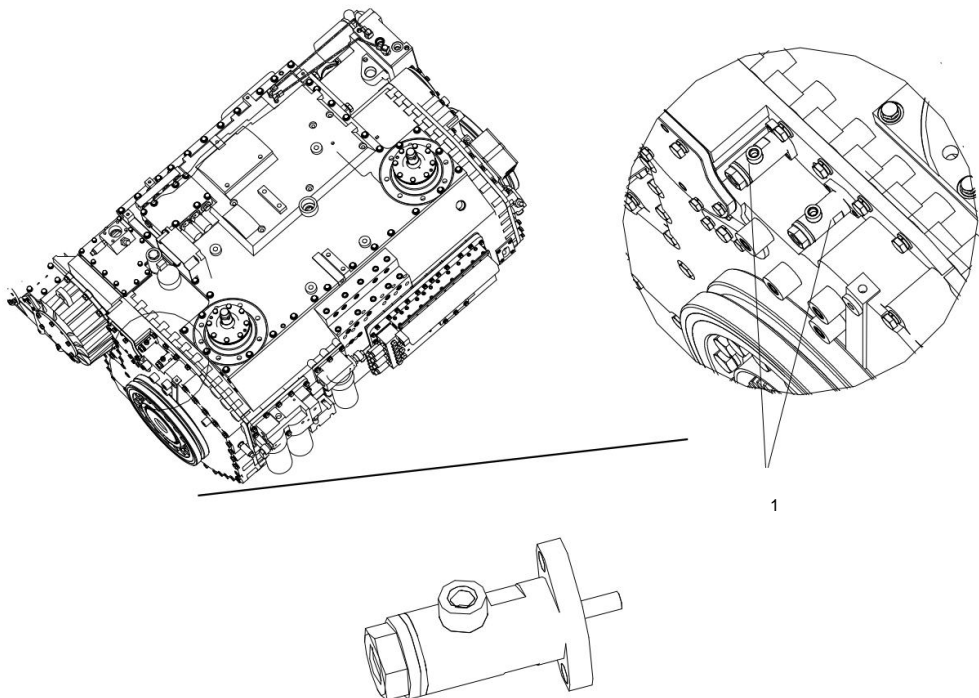


Figure 13 : Installation location diagram of the servo hydraulic oil cylinder and picture.

Function of servo hydraulic oil cylinder The servo hydraulic oil cylinder is mounted on the outside of the machine to change speed when the driver.

By stepping on the brake pedal, force is applied through the brake pedal mechanism, resulting in hydraulic pressure. changes through a hydraulic station and pushes the servo hydraulic oil cylinder, and the servo hydraulic oil cylinder pushes the carrier rod. of the hydraulic retarder control valve. Open the hydraulic retarder control valve to allow The speed changing engine oil flows into the hydraulic retarder. **10. Control valve of hydraulic retarder.**

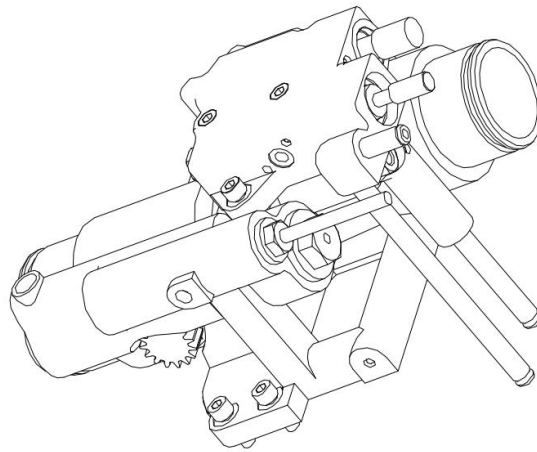


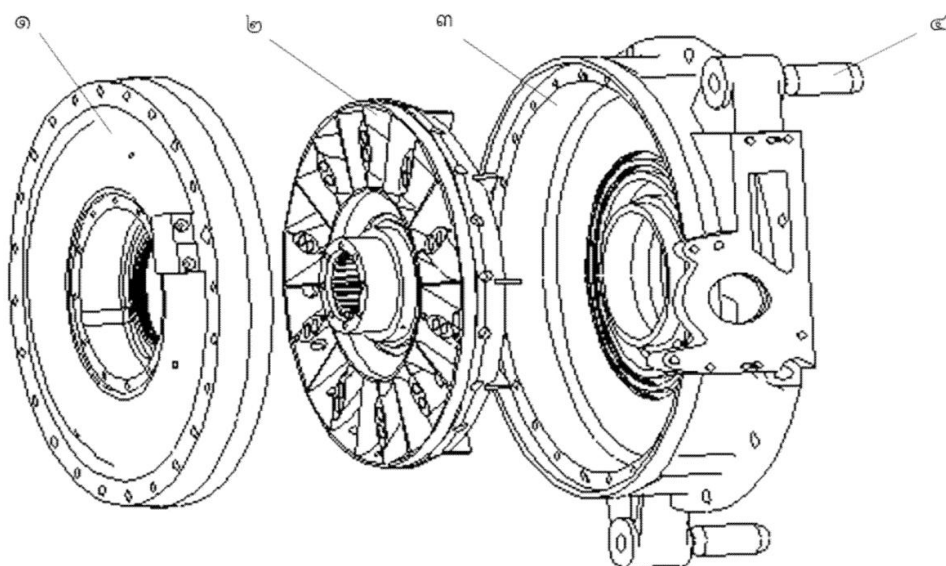
Figure 14 Control valve of hydraulic retarder.

Function of control valve of hydraulic retarder. of

hydraulic retarder) :

The control valve of the hydraulic damper is mounted on the hydraulic damper and is installed inside the speed changer housing together with the damper. hydraulic snatch after opening the tongue Control of the hydraulic damper The hydraulic damper works in the presence of engine oil. The speed changer flows into the hydraulic damper.

11. Hydraulic retarder



1. Fixed propeller (Fixed wheel)
2. Driven wheel
3. Housing of hydraulic retarder
4. Locating pin

Figure 15: Picture of components of a hydraulic damper.

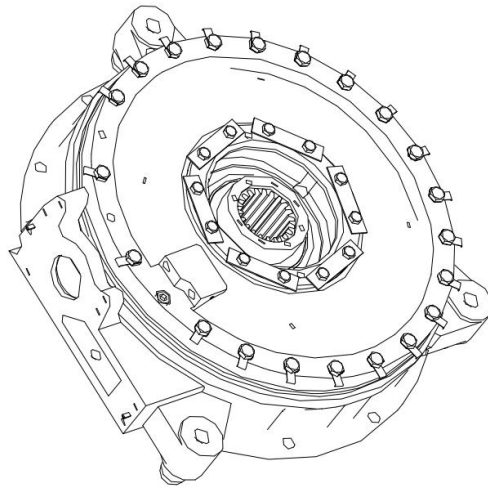


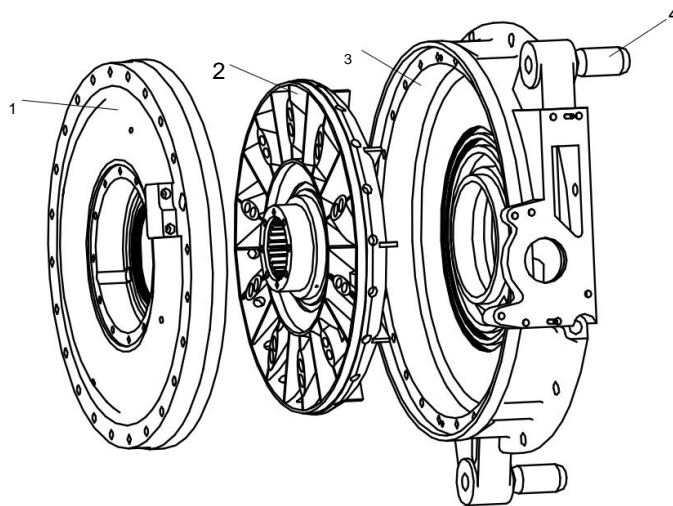
Figure 16 Hydraulic retarder

A hydraulic damper is a hydraulic brake component that reduces the speed of the vehicle. The drive propeller is mounted on the PTO shaft of the gear shifting mechanism. Hydraulic damper housing Fixed on the speed changer housing. When braking the wheels while the tank is running at high speed, the hydraulic damper converts the tank's kinetic energy into heat energy. Spread the fries to Hydraulic oil of speed changer and the hot hydraulic oil will also be cooled. Heat transfer system From the above, which is the operation of the hydraulic damper in

Braking the wheels and reducing vehicle speed

In the process of reducing vehicle speed or braking the wheels The main function of a hydraulic damper is to assist the brake system in absorbing the primary energy generated by reducing speed or stopping a wheel. of the tank and to help effectively prevent damage to the wheel brakes.

A. Composition of hydraulic retarder



1. Fixed propeller (Fixed wheel)
2. Driven wheel
3. Housing of hydraulic retarder
4. Locating pin

Figure 17: Composition of hydraulic retarder

A hydraulic damper has the main components: Fixed propeller (1), driving propeller (2), hydraulic damper housing (3), mounting bolts and various components and parts. _

Part 2

GEARSHIFT CONTROL DEVICE

1. General introduction

The gearshift controller performs automatic and manual gearshifts.

Manual Selection of gear position and Pivot turn. The shift lever has a position.

Total of 8 positions and by changing the gear lever in different positions. Can change position

Can use all 10 Gears such as 6 forward gears (gear 1, 2, 3, 4, 5 and 6), neutral gear 1

gears, 2 reverse gears and 1 stationary turning gear. There gear

is also an emergency gear, which is a forward gear. Gear Neutral 1 gear and reverse gear

behind 1 gear

2. Main performance and parameters

Gearbox: 6 forward gears / 2 reverse gears and stationary turning gear.

Emergency gear forward gear 1 Gear / Reverse gear 1 gear

3. System composition and principle

A. System components

The system consists of a speed converter processing unit, shift lever, speed converter electronic control unit, solenoid valve, detector. various temples and Cable

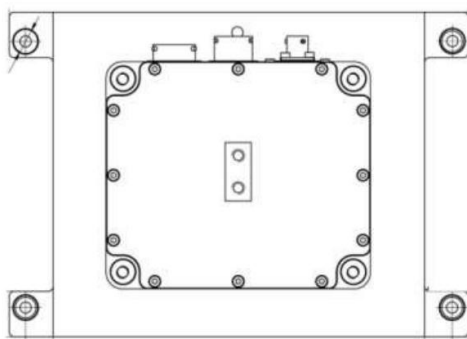
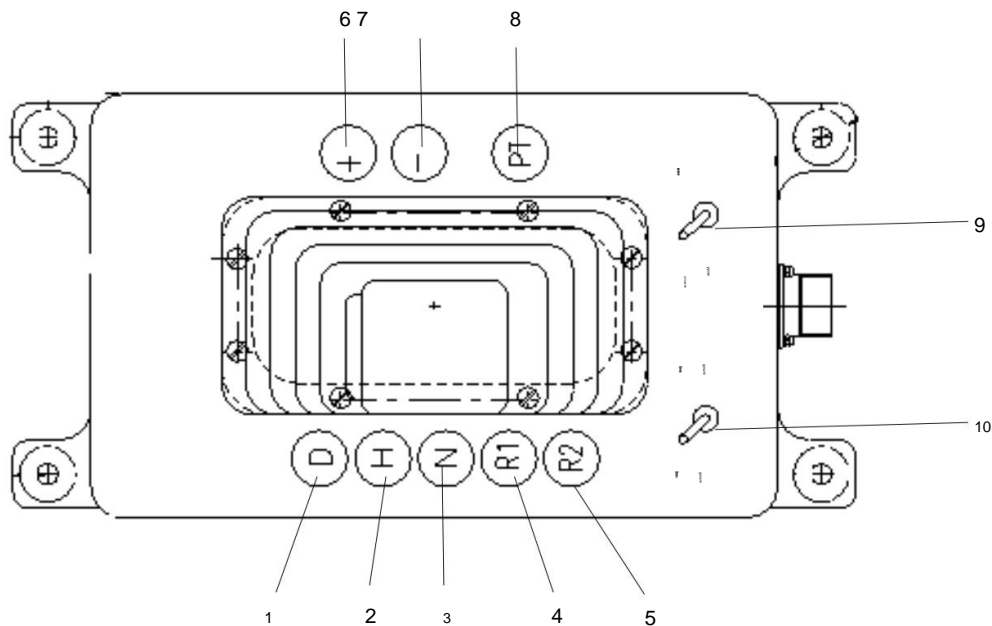


Figure 18 Speed changer processing unit (Transmission information unit)



- | | |
|------------------------------------|--|
| 1. automatic transmission position | 6. Change the gear position to a higher position by |
| 2. Manual gear shifting position | hand. 7. Shift the gear position to a lower position |
| 3. Vacant positions | by hand. 8. The turning position is with at |
| 4. Reverse position 1 | 9. Switch to select the type of use on the road. |
| 5. Reverse position 2 | 10. Switch to select the gear position to start the car. |

Figure 19 Gearshift controller

B. Working principle

The gearshift control computer receives external input signals which include Signals reflecting the driver's drive mode preferences. Speed signal that reflects the speed of the vehicle. The throttle opening signal sent from the drive system (MIC bus) and the error code of the speed changer, etc., are compared and calculated with MicroPro. The sensor, under the command of intelligent software, sets the tank to drive under manual or automatic gearshift mode and at the same time transmits signal data. such as gear range and speed, etc., to the driver's display for Displays the current operating status of the vehicle.

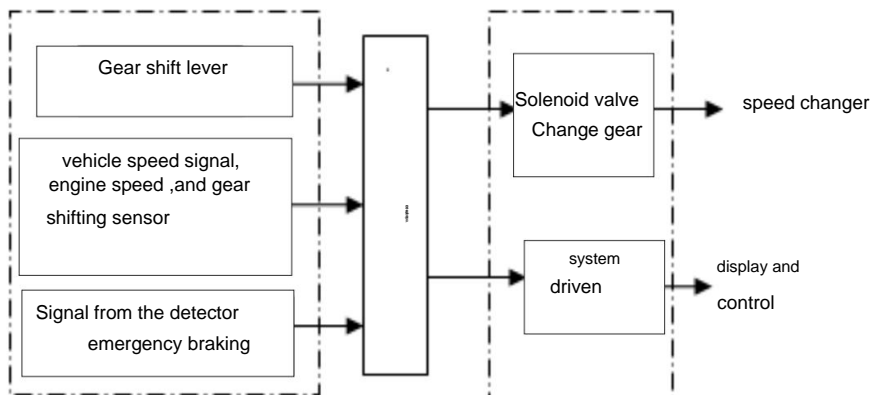


Figure 20 Electric control system diagram for changing gears

(Electric control system diagram) 1) Speed change controlling

The hydraulic control system's gearshift solenoid valve controls the shift. Change gears in relation to the

speed. 2) Pivot turn control. Solenoid valve for changing

gears of the hydraulic control system. Click to control Turning in place.

3) Selecting the

gear position to start the vehicle.

By using the "gear selector switch to start the car" on the control panel, you can select gear position 1 or 2nd gear to start the car.

4) Torque converter lock-up clutch control

clutch controlling)

The torque converter lock control switch is located on the driver's control panel.

The torque converter clutch control has 3 modes: "AUTO" " FOURCED UNLOCKING " and " FORCED LOCKING "

Setting the switch to "FOURCED UNLOCKING" mode will unlock the device.

hydraulic torque converter

Setting the switch to "FORCED LOCKING" mode will lock the torque converter.

hydraulic

Set the switch to "AUTO" mode to control the locking and unlocking manually.

automatic

Part 3

Steering (STEERING CONTROL)

1. General introduction

The purpose of this group is to familiarize the operator with basic functions. of the steering system This section describes the main functions and principles of the steering system.

2. Main performance **and parameters** when turning the steering wheel left and right

The maximum limiting angle of the steering wheel is 40 degrees.

The steering wheel adjustment range is 80 mm.

3. System components and working principles

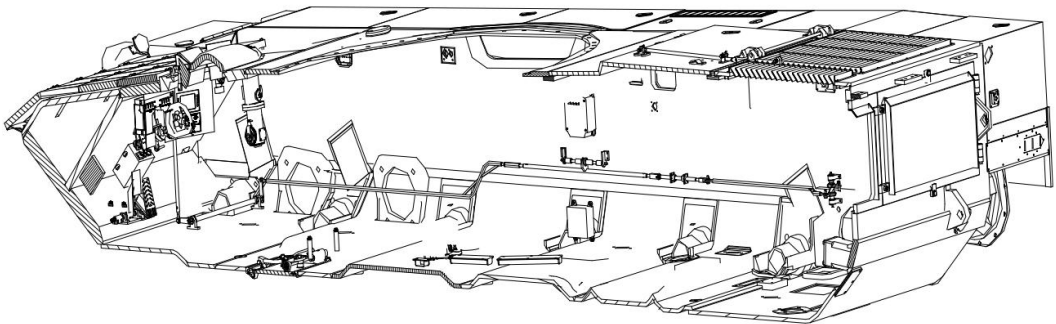
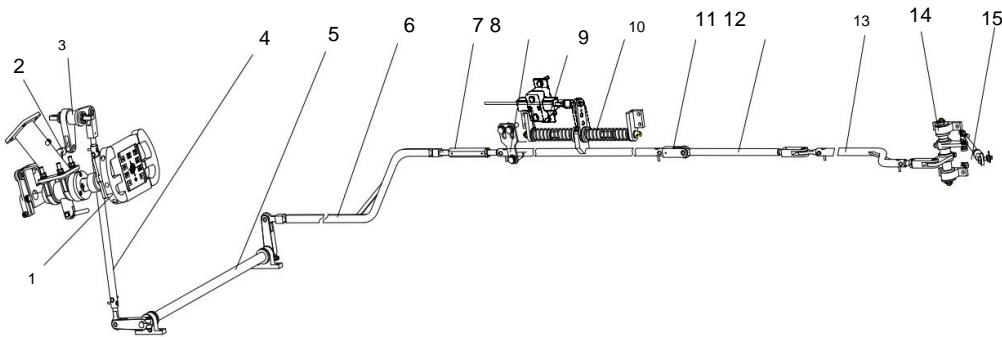


Figure 21: Installation location diagram of tank steering

control equipment A. System composition

Steering control device Consisting of the steering gear set (1), front transmission rod set (2), upper longitudinal shaft set (3), front vertical tie rod set (4), front transverse axle set (5), front longitudinal pull rod set (6), adjustment pull rod (7), rod set Center horizontal return (8), distance sensor set (9), return spring set (10), sliding sleeve set (11), horizontal stem set (12)) and the rear pull rod set (13), etc., are horizontal rod sets.



1. Steering wheel assembly
2. Front tie rod assembly
3. Top longitudinal shaft assembly
4. Vertical tie rod assembly
- Front vertical pull rod assembly
5. Front cross shaft assembly
6. Front longitudinal pull rod assembly
- Front longitudinal pull rod assembly
7. Adjusting pull rod
8. Middle longitudinal tie rod assembly
9. Distance measuring sensor set (Displacement sensor assembly)
10. Return spring assembly
11. Slide sleeve assembly
12. Horizontal shaft assembly (Longitudinal guide rod assembly)
13. Rear (Longitudinal pull rod assembly)
14. Rear vertical shaft assembly
15. Steering tie rod

Figure 22: Components of a steering control device.
(Composition of steering control device)

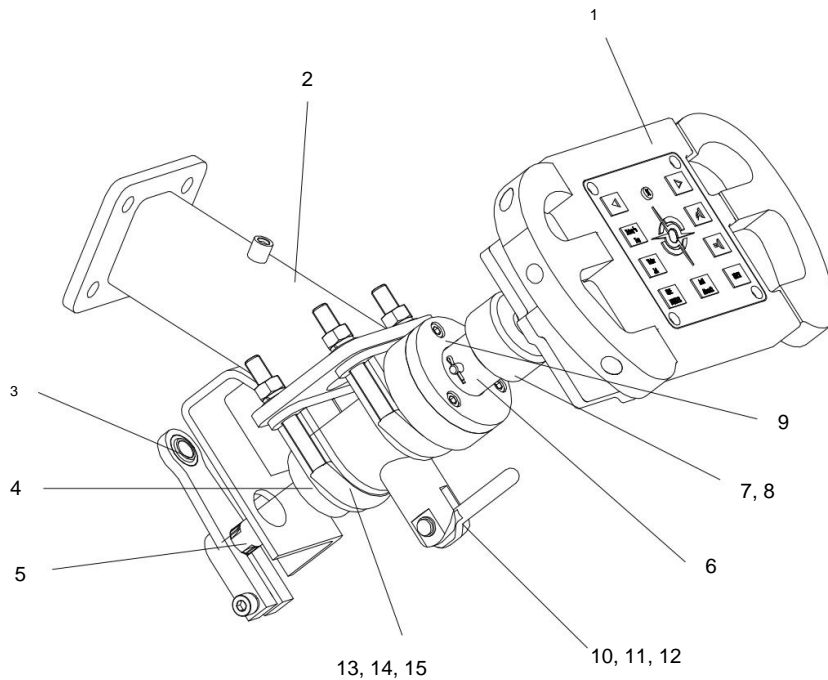
B. Working principle

Steering system principle: Steering wheel movements are conveyed through the elements. Links to the servo lever of the pump motor unit. and the rotation of the servo lever makes The pump's displacement has changed. The result is the speed of the steering mechanism output to the gear train. So the family changed. Therefore, the left and right belt drive gears have different speeds. together, resulting in the steering of the vehicle.

C. Steering wheel assembly 1) Function: Supports

steering control from the driver in order to steer the vehicle.

2) Main components:



1. Steering wheel (Adjusting mechanism of steering wheel)

2. Steering wheel mounting bracket (Bracket assembly)

3. Pull arm assembly

4. Shaft seat assembly

5. Shaft sleeve

6. Steering wheel shaft

7. Rotary handle sleeve

8. Ring (Elastic ring)

9. Upper bearing cover, locking handle

10.

11. Leaf spring (Spring)

12. Lock pin, fixing

13. sleeve

14. Rubber sleeve

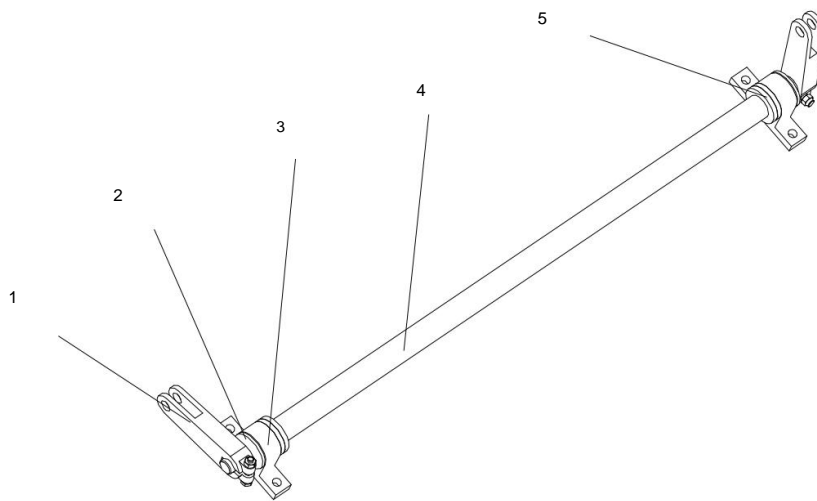
15. Shim

Figure 23 Steering wheel assembly

D. Front cross shaft assembly

1) Function : Connect the front vertical pull rod assembly and the pull rod assembly.
front length to transmit torque

2) Main components :



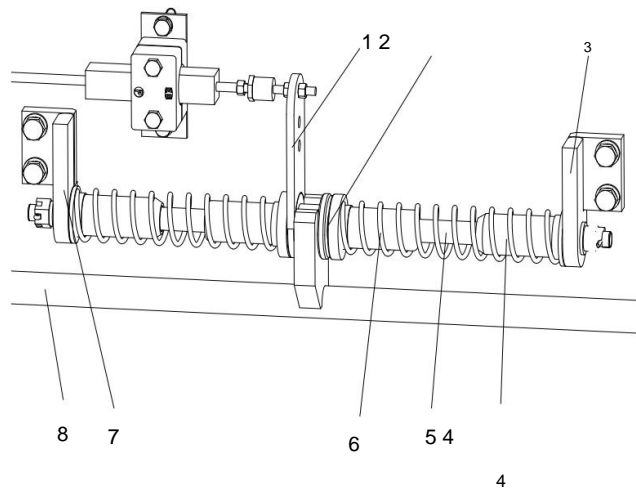
1. Front pull arm
2. Spacer sleeve
3. Bracket
4. Front cross shaft
5. Copper sleeve

Figure 24 Front cross shaft assembly

E. Return spring assembly

1) Function : The function of the leaf spring return unit is to enhance steering feel. and returns the steering wheel to its precise center position.

2) The latter component :



1. Limit sleeve assembly

2. Spring seat

3. Fixing plate assembly

4. Limit body

5. Leaf spring control shaft (Guide shaft)

6. Leaf springs (Spring)

7. Bottom plate

8. Middle longitudinal tie rod assembly

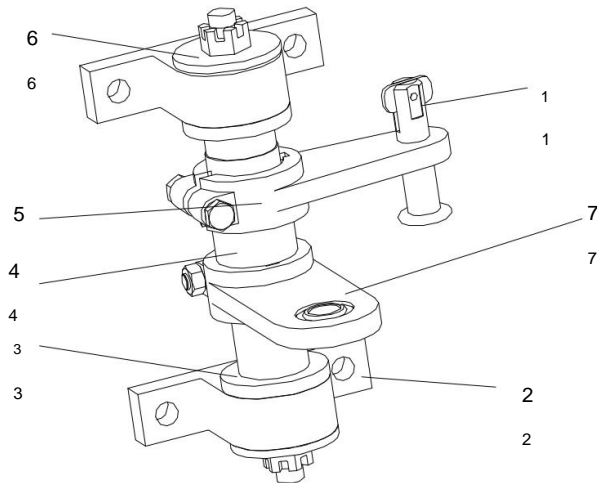
Figure 25 Return spring assembly

F. Rear vertical shaft assembly

1) Function : Connect to the rear pull rod set and servo rod of the pump motor.

Speed changer to transmit torque

2) Main components :



1. Combined pin 2.

Bracket

3. Retaining ring, rear

4. vertical shaft

5. Rear pull arm

6. Shim

7. Rear pull arm I

Figure 26 Rear vertical shaft assembly

Part 4

ACCELERATOR CONTROL

1. General introduction

The accelerator pedal of the electric control system of the VT/E1 diesel engine is a type of accelerator pedal.

Electronics The driver can control the speed of the diesel engine by pressing the accelerator pedal. to increase the acceleration rate deceleration or driving the vehicle at a constant speed

2. System composition and working principles

principle)

Acceleration control system Contains engine throttle control box. (Electronic control box), accelerator pedal, and other parts for installation.

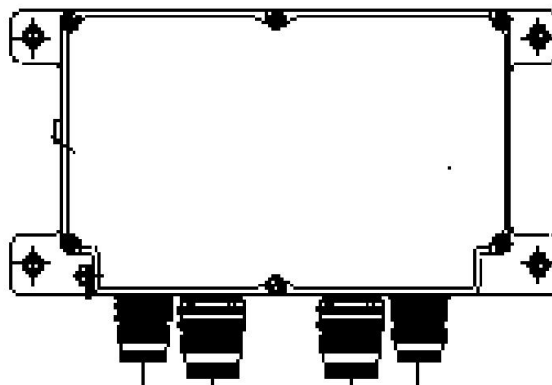


Figure 27: Electronic control box

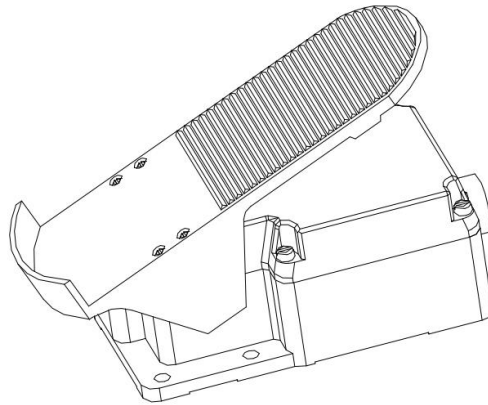


Figure 28 Accelerator pedal

Controlling the operating status of diesel engines Control unit of the control system
The electronics calculate and adjust the fuel injection rate of the fuel delivery system under
Full-range governor control mode according to the speed signal
demands from the accelerator pedal and the duties of a diesel engine.

Chapter 12

System to help improve engine efficiency

(POWER TRANSMISSION AUXILIARY SYSTEM)

1

Section General INTRODUCTION

Engine performance enhancing systems include a cooling system, a lubrication system, an air supply system, a fuel supply system, a high-pressure air system. , heater and a thermal smoke screen generator, including a secondary air filter of the air supply system. Fuel , delivery pipe of the fuel distribution system and the engine's exhaust pipe is installed on the machine. generator, and the entire powertrain can be removed from the vehicle along with the generator. The left side of the speed changer is mounted on the vehicle.

Part 2

COOLING SYSTEM

1. General

The cooling system is responsible for transferring the heat of the coolant that is heated. From the engine and speed converter to transfer heat to the air through the radiator. To maintain the temperature of the water and oil within an acceptable range and to ensure normal system operation. It is a necessary cooling system. The cooling system is characterized by a high pressure, cyclic type. Closed single water pump And there are two heat transfer circuits: high temperature circuit and low temperature circuit.

2. Main performance and parameters

A. Cooling system

Cooling capacity	812 kilowatts
Capacity of cooling liquid B.	110 liter

Cooling fan

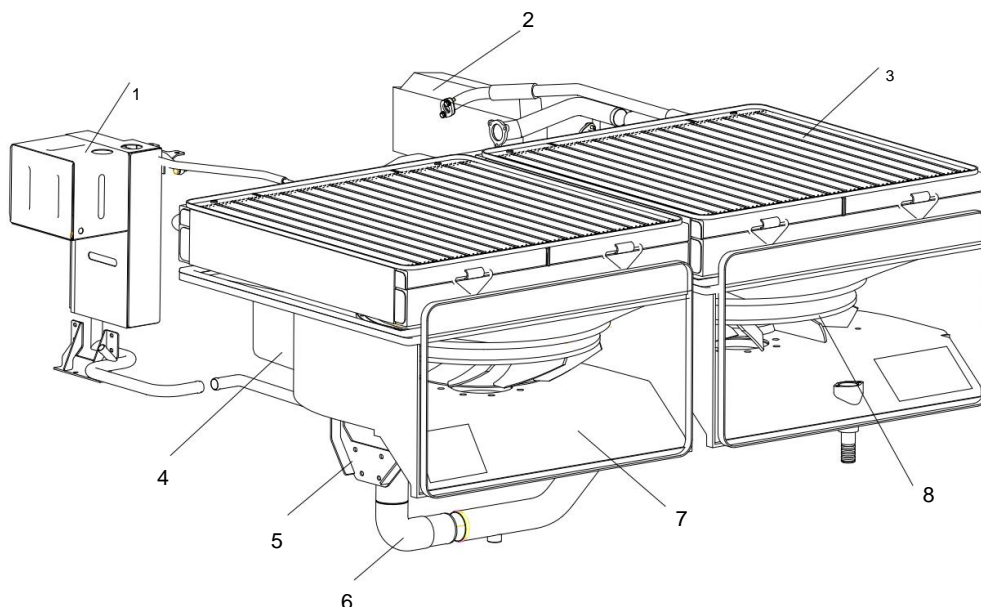
Maximum fan speed	5000 rpm
Number of fans	2
Fan diameter Air	600 millimeters
flow rate per 1 fan	8 cubic meters/second
Pressure (Fan static	4400 pascals
pressure) Power per fan	58 kilowatts

3. Components and operating principles of the cooling system

A. System Composition

The cooling system consists of a high temperature radiator and a low temperature radiator. Water cooled intercooler (attached to engine) oil cooler Gear, steering oil cooler, overflow tank, vents and ventilation fan

Heat, bracket and pipe (see Figure 1)



1. Expansion tank 2. Steering
oil cooler
(Steering oil exchanger)

3. High temperature boiler and low temperature boiler.
(High-temperature radiator and
low-temperature radiator)

4. Gear oil cooler
(Transmission oil exchanger)

5. Mounting bracket 6. Pipe
accessory 7. Fan volute

8. Fan (Fan)

Figure 1. Main components of the cooling system.

B. Main components

1) High and low temperature boiler
radiator)

A radiator is used to store the coolant and transfer heat to the coolant.

Absorbed and released into the air. Maintain the coolant temperature at a normal temperature.

The high-temperature and low-temperature radiators use an aluminum plate-wing style. The two main components are designed as an integrated structure, which is separated by

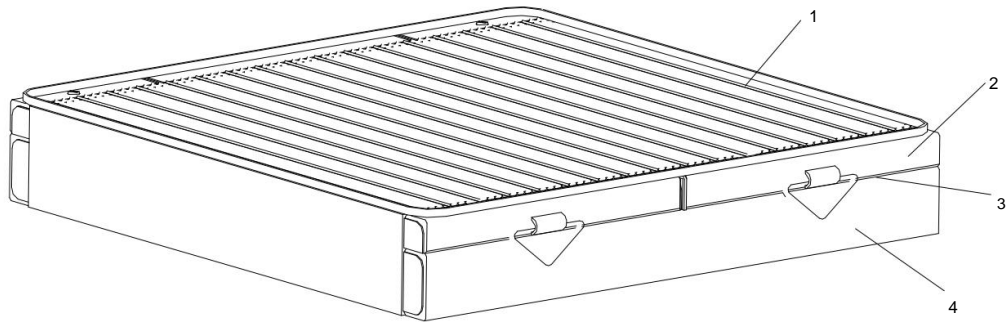
A barrier between the upper water storage compartment and the lower water storage compartment. The low temperature radiator is above the radiator.

high temperature

Low temperature radiators are used for cooling vented intercoolers.

Water heating and steering oil cooler while the boiler temperature is high

It serves to cool the engine.



1. High temperature boiler and water boiler

Low temperature (High-temperature and
low-temperature radiators)

2. Upper water storage compartment (Upper water-
collected chamber)

3. Wall separating the generator room
(Bulkhead)

4. Lower water storage compartment (Lower water-
collected chamber)

Figure 2: High temperature boiler and low temperature boiler.

2) Water-air intercooler

The water-cooled intercooler lowers the air temperature.

clean air that is compressed with the engine's turbocharger To ensure that the temperature of the incoming air into the engine has an appropriate temperature for engine operation.

3) Expansion tank

The main functions of the overflow tank are: It provides free space to accommodate the expansion of substances.

Cools down the cooling system and causes cool condensation of the steam. Adjust

The cooling system pressure has a pressure maintenance mechanism to prevent the water in the radiator from reaching the point.

Do not boil too quickly for the system to work reliably. Make sure that the cooling system is still intact.

Works even when the vehicle is on a slope. The overflow tank works together with a vapor-air valve to prevent the

maximum temperature of the system from exceeding the designed value and to prevent it from overflowing. Let the system reach

Boiling point too fast This is for the safety of the system.

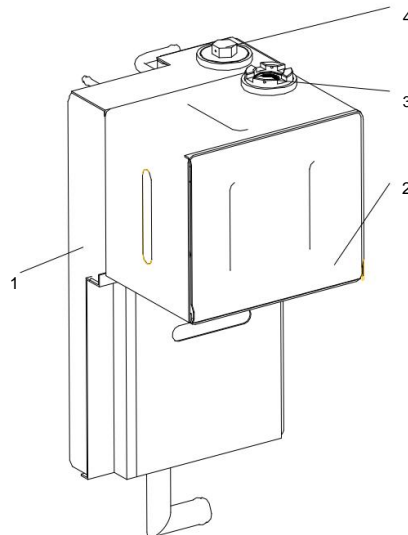
The overflow tank has two separate chamber structures, divided into a water chamber and an air chamber. The overflow tank is made from stamping and welding.

Steel plate The overflow reservoir is mounted on the top of the engine's turbocharger. Water filling cap

Installed in the upper water storage compartment. Used for adding cooling fluid for cooling systems. A pressure

relief valve is installed in the upper air chamber. Used for adjusting the operating pressure in the ventilation system.

Heat.



1. Bathroom (Water chamber) 3. Vapor-air valve
2. Air chamber **Figure 3** 4. Water inlet cover

Expansion tank

4) Cooling fan. The function of the

cooling fan is to cause cool air to circulate in a way. Run cold air to cool down the generator. There are two mixed

flow cooling fans with a diameter of 600 mm and rotating blades in opposite directions. The fan uses a liquid viscous clutch drive. The operating speed of the fan will vary. according to the engine water temperature The fan speed control modes are automatic

mode and manual mode. Automatic mode consists of three conditions: neutral gear, low gear, and high gear. The revolution speed of high gear is 5000. rpm The low gear speed is $3000 \text{ rpm} \pm 100 \text{ rpm}$. Manual mode is a special operating mode. Only the 5000 rpm high speed gear is used in special demand mode. or when unable to control in automatic mode

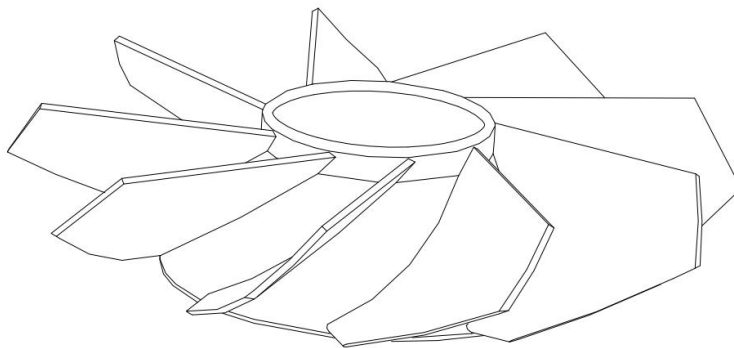
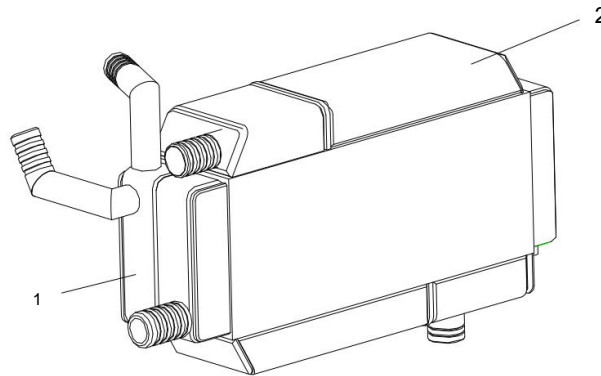


Figure 4 Cooling fan

5) Steering oil exchanger

The steering oil cooler has an aluminum plate and fin construction. Cooling Installed on the top of the steering oil tank (Steering oil tank) to help Cooling of oil Steering system hydraulic oil

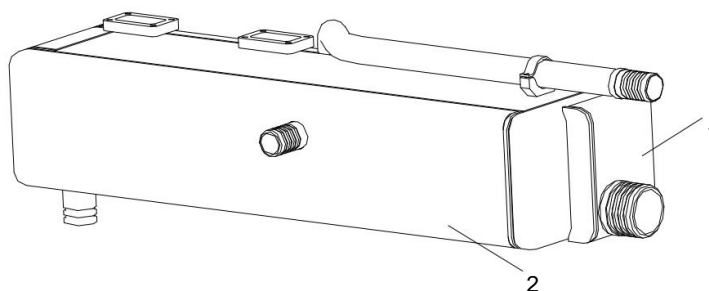


1. Bathroom (Water chamber) 2. Oil chamber (Oil chamber)

Figure 5 Steering oil exchanger

6) Speed changing engine oil cooler. (Transmission oil exchanger)

The speed changer oil cooler has a plate structure. Aluminum and cooling fins Installed on the front of the high temperature/low temperature radiator. and in the upper part of the speed changer To help cool down the hydraulic oil of speed changer



1. Bathroom (Water chamber) 2. Oil chamber (Oil chamber)

Figure 6: Speed changing engine oil cooler. (Transmission oil exchanger)

C. Working principle

When the engine is running The engine's water pump circulates the coolant.

(Coolant) After the coolant circulates through the water pump, it is divided into two.

Part: One part flows through the engine's oil cooler to enter the engine's water jacket and Cylinder head to help with heat dissipation Coolant that has absorbed heat from the engine flows out of the left water inlet.

and right side enter the left and right high temperature radiator respectively. and finally will enter the machine Cooling the engine oil, changing speed The other part of the cooling fluid is divided into two.

route by flowing into the left and right low temperature radiators to cool down for the first time.

Second, the coolant cooled by the left and right low temperature radiators flows into the

Intercooler air intake pipes on the left and right sides of the engine. Then it will enter the machine pump.

The steering oil cooler is used for cooling the steering oil and finally

Flows into the oil cooler, changing speed. Coolant enters the machine.

Cool the engine oil, change the speed and return to the engine water pump to complete the cycle.

further circulation

High temperature steam enters the water collector. (Water-collectors) of high temperature boiler

The left and right sides pass through the engine water inlet and the intercooler water inlet. Matte card

The incoming air then passes through the air pipe above the water collector to the air chamber of the

overflow tank. After cooling down The steam returns to the engine's water pump. which is a balanced network to cool the steam and stabilize the cooling fluid circulation.

When the pressure inside the air chamber of the expansion tank is higher than 0.22 MPa

- 0.24 Mpa (absolute pressure), the high-pressure vapor will be exhausted through the relief valve. cough

(Vapor valve) at the top of the overflow tank. When the vacuum level of the air chamber of the water tank exceeds

to 0.005 MPa - 0.015 MPa. Outside air will enter the system through the air valve of the overflow tank.

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Part 3

Lubrication system (LUBRICATION SYSTEM)

1. General

The lubrication system stores and distributes clean lubricating fluid for the engine to keep it running.

The engine works normally. The lubrication system is inside the generator. and can be lifted out From the car with the generator

2. Main performance and parameters

Theoretical lubricant tank	147 liters
capacity Electrical force of the pre-lubricant pump	27 ±2.7 volts
(Rated voltage of pre-lubricating pump)	(D.C)
Electrical current of pre-lubricating oil pump	6.5 - 7 amperes
(Working current of pre-lubricating pump)	
lubricant pump flow rate in advance	2100 liters per
(Rated flow volume of pre-lubricating pump)	hour

3. System components and working principles

A. System Composition

The lubrication system consists of a lubricant tank with oil inlet filter and an oil pre-lubricating pump. pump) and mounting brackets and accessories

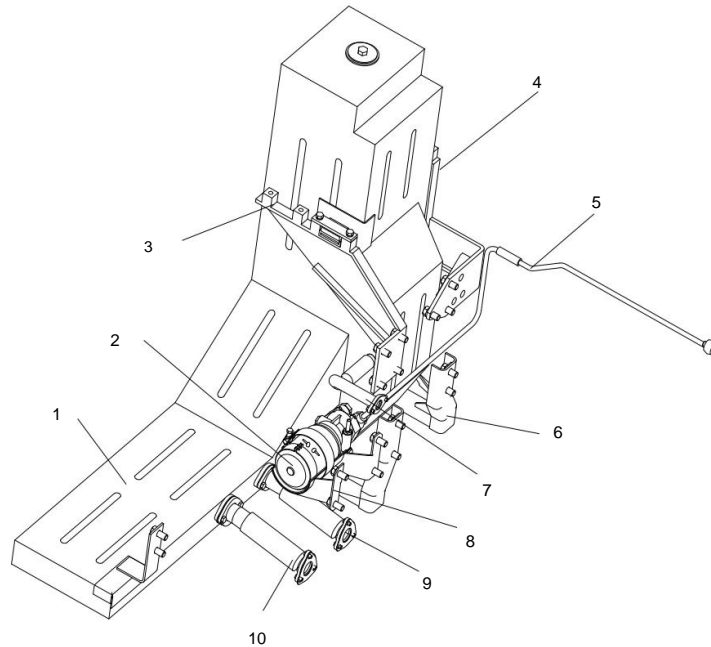
(See picture 8)

B. Main components

1) Oil tank (Oil tank)

Install a lubricant tank at the front of the generator room. between the engines and the partition wall of the generator room The lubricant tank is mounted on the engine with support and Can be lifted together with a power generator (Powerpack). There is an air bubble trap inside the tank. A lubricant used to remove air bubbles created by the circulation of lubricating oil in engines. At the bottom of the tank is a sedimentation tank that is used to capture and remove dirt. at the top of the tank

The oil is a lubricant filling port with a lubricant level dipstick. Lubricant supply valve (Oil outlet valve) located at the bottom of the lubricant tank.



1. Oil tank (Oil tank)

2. Pump lubricating oil in advance.

(Oil pre-lubricating pump)

3. Right side tank mounting bracket

(Right support)

4. Left support for
the tank.

5. Lubricant distribution pipe of the lubricant pump.
advance (paid to engine)

6. Bracket

7. Foam pipe

8. Pre-lubricated oil pump base.
(Oil pre-lubricating support)

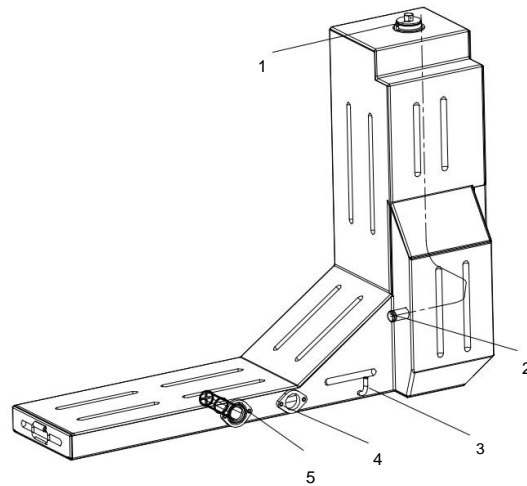
9. Lubricant receiving pipe (from engine)

(Oil tank's oil inlet pipe (from engine)

10. Lubricant distribution pipe (Pay to engine)

(Oil tank's oil outlet pipe (into engine)

Figure 8 Lubrication system



1. Oil inlet

2. Foam pipe

3. The oil receiving pipe of the pump is pre-lubricated.

(Oil inlet pipe of oil
pre-lubricating pump)

4. Oil intake port of the lubricant tank

(Oil inlet of oil tank)

5. Oil distribution port of the lubricant

tank. (Filter is installed inside)

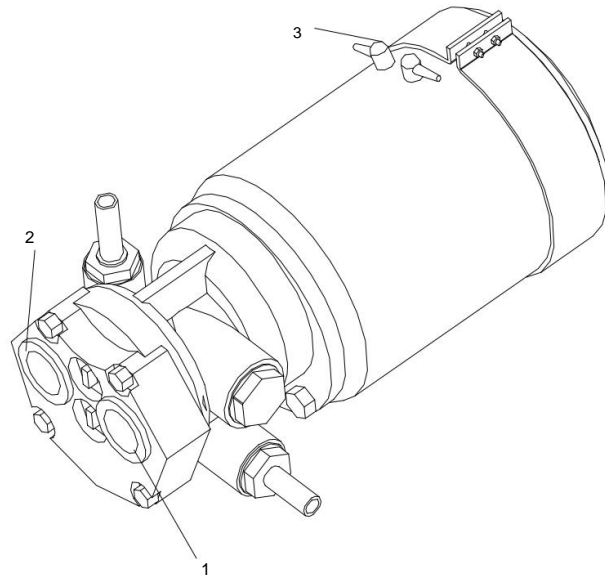
(Oil outlet of oil tank (Filter net is
installed inside)

Figure 9: Lubricant tank (Oil tank)

2) Oil pre-lubricating pump

A pre-lubrication pump is installed on the engine. Serves to distribute lubricant from the tank.

Lubricating oil to the engine lubrication point before starting the engine.



1. Oil inlet

3. Wiring terminal

2. Oil outlet

Figure 10 Oil pre-lubricating pump

C. Working principle

Before starting the engine, the oil inside the lubricant tank is pressurized by a pump. It is pre-lubricated and flows through the oil filter and enters all lubrication points in the engine. to lubricate in

advance After starting the engine, the scavenger pumps suck up the lubricant. (Passed through the oil filter basket) inside the lubricant tank enters the cooling machine for cooling. Oil that has passed through the oil filter pan It enters the lubrication point of the engine. Then return to rest. Engine oil (Oil sump) of the engine Finally, it will be sucked back into the lubricant tank as well. Oil return pump of lubricant

pump Ventilation is through the air pipe at the top of the lubricant tank. Then it will return to Engine ventilation plug Lubricating oil is drained from the engine and tank. Lubricating oil passes through the lower engine crankshaft chamber and the engine's lower oil drain port. Lubricant tank

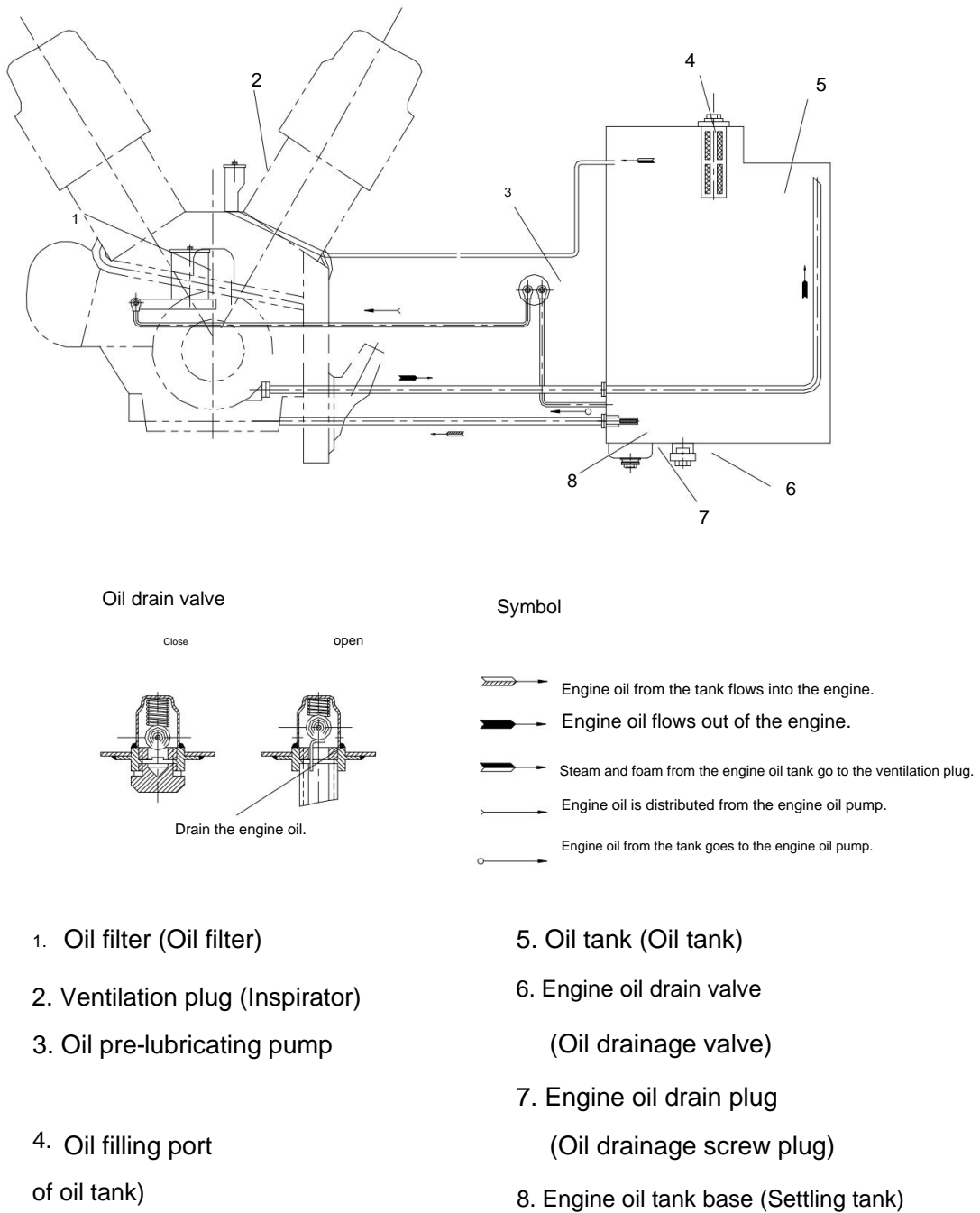


Figure 11 Lubrication system principle

Part 4

Air supply system (AIR SUPPLY SYSTEM)

1. General introduction

The job of the air supply system is to supply clean air to the engine. Disposal of dust divided into two levels The primary air filtration is through a cyclone tube and a draft tube, and the secondary air filtration is through a fine air filter.

(Heavy load nano filter element) The primary and secondary air filtration structures are Modular structure The left and right primary air filters are installed on the left and Right side of the vehicle The secondary air filter is mounted on the generator and can be removed. Equipped with the engine, a second stage air filter is connected to the turbocharger air intake.

Engine gear There is a middle air passage between the primary air filters. and a secondary air filter located in the tower partition wall. Quick sealing and release between The central air channel and primary and secondary air filters are achieved through inflation and Release the air of the pneumatic sealing device.

2. Main performance and parameters

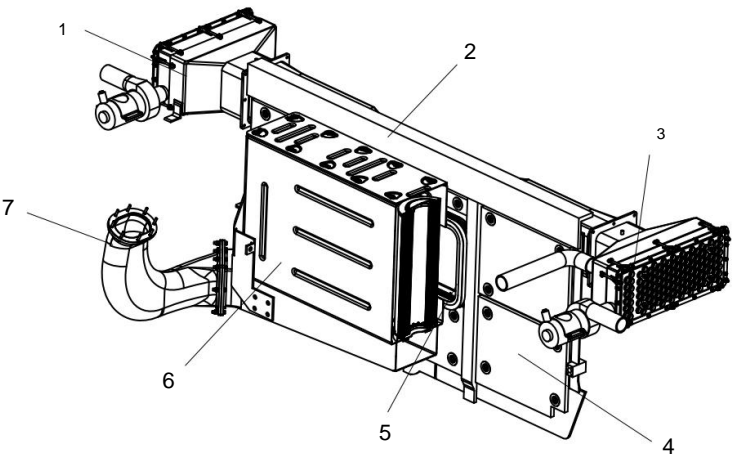
Air intake volume of engine, filter clogged warning pressure value	1.68 kg./sec 12 kilopascals
(Air filter alarm resistance value)	
Filtration efficiency of primary air filters	90%
(Primary filter)	
Total filtration efficiency , number of cyclone pipes and air suction pipes	99.95% 232 sets
(Cyclone tube and draft tube)	
Number of air filter elements (Paper filtration elements)	4
Air pressure for rubber seal strips	0.05 megapascal
(pneumatic sealing band)	

Notification of air pressure, rubber strip (Alarming pressure),	0.02 megapascal
number of dust ventilation fans.	2
(Dust scavenging pump assembly)	
Dust ventilation fan motor power	1.2-1.3 kilowatts
(Dust scavenging pump's motor power)	
Dust ventilation fan motor type	AC variable
(Dust scavenging pump's motor pattern)	frequency
Maximum speed of the dust extraction fan (Max. running speed)	17600 rpm

3. System components and working principles

A. System components

The air supply system consists of four subsystems: a left pre-air filter; Right primary air filter Rubber strips to prevent leaks of the air filter and inflator nozzle, as well as Secondary air filter and connection to engine



- 1. Left primary filter installation sub-system
- 2. Middle air passage
- 3. Right primary filter installation sub-system
- 4. Bulkhead of power compartment

5. Leak-proof rubber strip and air filling head

(Pneumatic sealing band and its air charging pipe installation)

6. Secondary air filter and its connection to the engine.

(Secondary filter installation and connection with engine)

7. Air intake pipe (connected to the intake booster)

[Air inlet pipe (connected with engine's pressure booster)]

Figure 12 Air supply system components

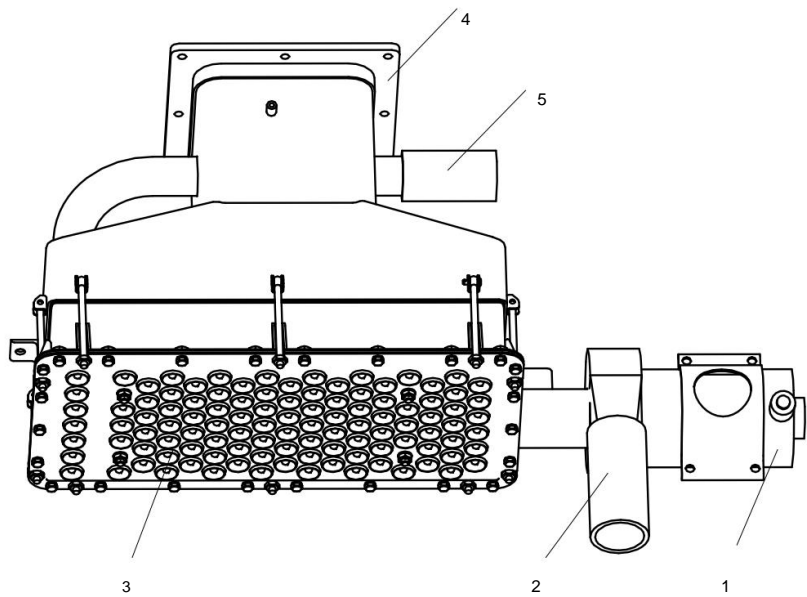
B. Main components 1) Left primary air filter. The

left primary air filter consists of With primary air filter set, left side,

left air storage room Left-hand dust extractor fan assembly (including dust blower motor)

and left air intake cover The left-side primary air filter and dust pump are installed at Top left side of the vehicle which can initially filter half the amount of air before entering the engine Separate dust particles using the principle of centrifugal force. Dust particles are exhausted by a dust extractor fan. The left air intake grille is located on the upper left side of the vehicle. A rain cover is attached above the grille. Air inlet to prevent rain from entering the filter chamber. Basic weather conditions on a rainy day

The left filter assembly consists of 106 cyclone and suction pipes, of which 12 cyclone pipes and suction pipes will be used. 7 sets for ventilation Cooling and provide fresh air for the power generation room These seven sets of cyclone pipes and air suction pipes are separated from the other sets of cyclone pipes and air suction pipes by the walls of the generator room (Bulkhead).



1. Left side dust ventilation fan and motor

(Left dust scavenging pump and motor)

2. Dust vent (Dust-removal pipe of dust scavenging pump)

3. Cyclone pipe and air suction pipe (Cyclone tube and draft tube sets)

4. Flange connecting the air channel

Central (Flange connected with middle air passage)

5. Generator room ventilation pipe (Ventilation hose of power compartment)

Figure 13 Left primary air filter installation

2) Right primary air filter (Right primary filter)

The right side primary air filter system consists of the air filter unit.

right side step Right air chamber Right dust extractor fan assembly (including fan motor dust vent) and the right air intake cover. Right-hand primary air filter and fan

The right dust extractor is installed on the top right side of the vehicle. which can filter half the amount of air in

The first step is before entering the engine and separating large dust particles using the principle of centrifugal force.

Central, large dust particles are exhausted by the dust exhaust fan from the vehicle. Compartment grille

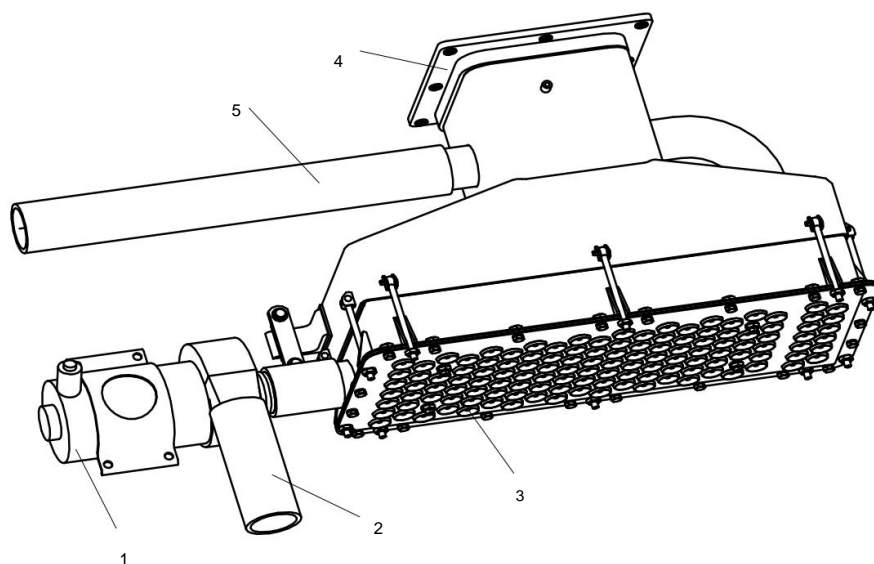
The right side air intake is located on the upper right side of the vehicle. There is a rain cover over the air intake grille.

To prevent large amounts of rainwater from flowing into the primary air filter chamber.

The right-hand primary air filter unit consists of a cyclone pipe and an air intake pipe.

Quantity: 126 sets, of which 13 sets use cyclone pipes and air suction pipes for ventilation.

Air cooling and provide fresh air for the power generation room The cyclone pipe and 13 air pipes are separated from the other cyclone pipes and air intake pipes. without any connection



1. Right side dust ventilation fan and motor
(Right dust scavenging pump and motor)

2. Dust vent (Dust-removal pipe
of dust scavenging pump)

3. Cyclone pipe and air suction pipe
(Cyclone tube and draft tube sets)

4. Flange connecting the central air vent.
(Flange connected with the middle
air passage)

5. Generator room ventilation pipe
(Ventilation hose of power
compartment)

Figure 15. Right primary air filter. (Installation of right primary filter)

3) Air filter pneumatic sealing belt and its

charging pipeline)

The rubber seal and the inflator include a rubber seal. Leak-proof rubber frame

Air filling head and air pipe When the engine is running The sealing rubber strip is in the inflated state to seal the machine.

Secondary air filter and generator room walls and sealed between the air filter

Primary and secondary air filters When removing the generator from the vehicle, it must

Make the rubber seal strip in the deflated state, which will cause the rubber seal strip to shrink back to its position.

Leak-proof rubber frame As a result, a gap is created between the secondary air filter and the engine compartment wall.

generator, which makes it convenient to remove the generator from the vehicle

Inflate the rubber seal with a manual pump. By controlling the shape of the rubber strip

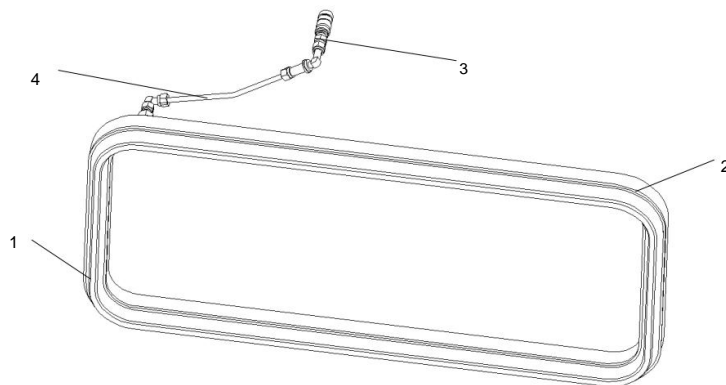
Sealing The rubber sealing strip can be inflated in a straight line until it contacts the assembly.

Secondary air filter head and sealed When removing the generator from

On the vehicle, manually deflate the rubber seal. and the rubber seal strip will shrink back into the

rubber seal frame. Leave a gap between the rubber seal and the front of the secondary air filter to ensure

that the generator was successfully removed from the vehicle without damaging the rubber seal.



1. Pneumatic sealing belt

2. Frame of pneumatic sealing belt 3. Connector head and tongue

(connected with air compressor) [Joint (connected with valve cock)]

4. Air pipe (Connecting pipe)

Figure 15: Components of a leak-proof device. (Installation of pneumatic sealing device)

4) Secondary air filter (secondary filter)

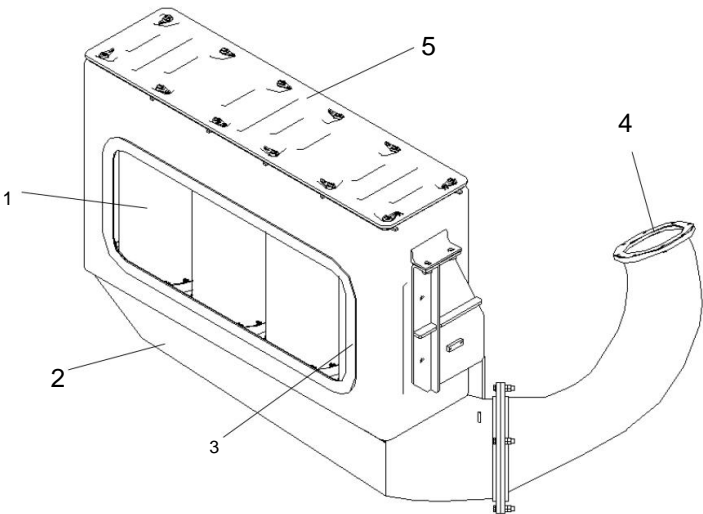
Secondary air filter and secondary engine connection system

Includes a secondary air filter. Air inlet set and mounting bracket set inside the filter.

The second stage air consists of four paper filter elements, a filter

The secondary air filter can filter air in addition to the primary air filter. and provide clean air for the engine A second stage air filter is installed inside the generator room. and connect to The air intake of the engine's turbocharger This second stage air filter can lift

Can be used together with a generator to power the entire system.



- | | |
|--|--|
| 1. 4 sets of air filters
(Four paper filter elements) 2.
Air-collected chamber 3. Part sealed with
leak-proof rubber strip
(Sealing part connected with
pneumatic sealing belt) | 4. Flange connecting the turbo air inlet of
Engine (Flange connected with
engine's pressure booster)
5. Secondary air filter cover
(Cover of secondary filter chamber) |
|--|--|

Figure 16 Secondary air filter (Secondary filter)

C. Working principle

Engine air intake Dusty outside air enters the cyclone pipe and The air intake pipes of the left and right pre-air filter pass through the left and right rain covers. Dust particles Large dust particles are removed into the space between the top and bottom grid plates, and the dust is then exhausted by a fan. It will blow out dust outside the car. Then the air is clean. It enters the secondary filter through the central air inlet. After the air has been filtered with the paper filter of the secondary air filter. Fresh air enters the turbocharger. of the engine The air distribution system has the working principle as shown in the following figure.

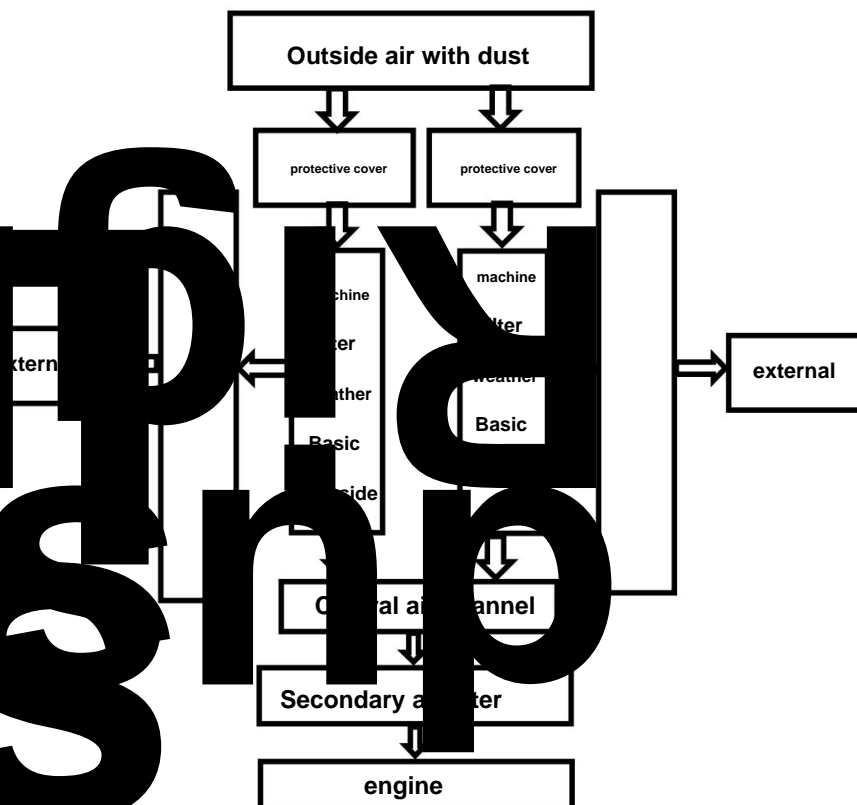


Figure 17: Schematic diagram of air supply system

Part 5

Fuel Supply System (FUEL SUPPLY SYSTEM)

1. General

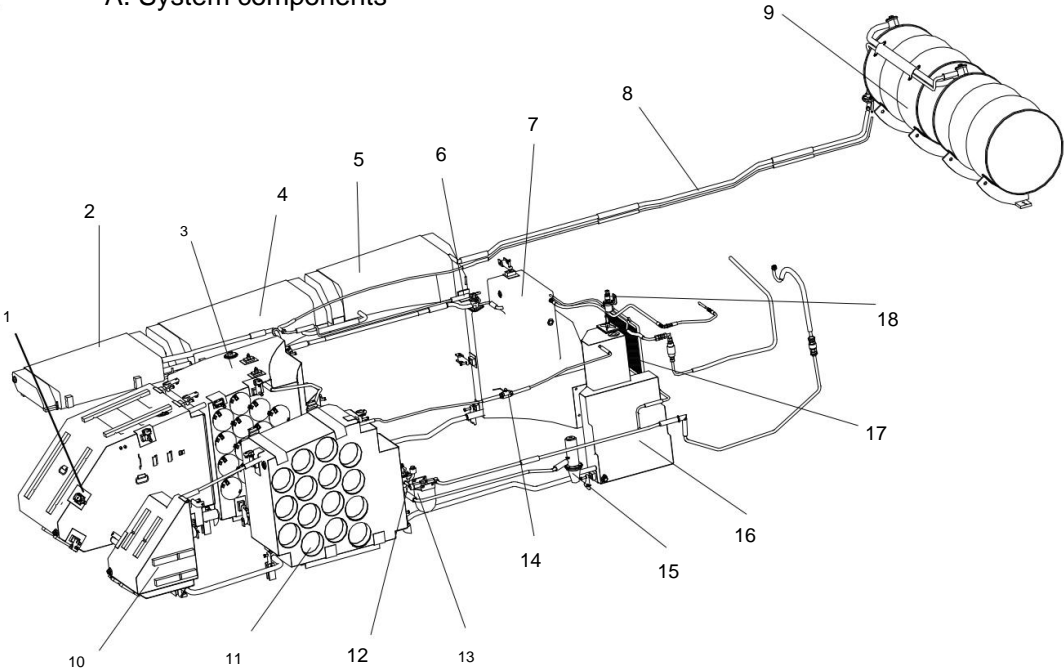
The fuel supply system stores, filters, and distributes enough fuel for Engines and heaters So that the tank can be driven to the maximum distance.

2. Main performance and parameters

Total fuel capacity (including fuel tank	1888 liters
Spare	
parts): Front left fuel tank	84 liters
Right front fuel tank Fuel	430 liters
tank and artillery ammunition rack, front left,	174 liters
Fuel tank and artillery ammunition rack, front right,	260 liters
Left center fuel tank	140 liters
Right center fuel tank	165 liters
External fuel tank number 1	65 liters
External fuel tank No. 2 External	105 liters
fuel tank No. 3 Spare fuel tank	105 liters
	2x180 liters

3. System components and working principles

A. System components



- | | |
|---|---|
| 1. Right front fuel tank
(Right front fuel tank) | 10. Left front fuel tank
(Left front fuel tank) |
| 2. External fuel tank no. 1
(First exterior fuel tank) | 11. Fuel tanks and artillery ammunition racks
Front left (Left shell rack fuel tank) |
| 3. Fuel tank and ammunition rack
Large front right
(Right shell rack fuel tank) | 12. Fuel distribution valve
(Fuel distribution switch) |
| 4. External fuel tank number 2
(Second exterior fuel tank) | 13. Fuel coarse filter
(Fuel coarse filter) |
| 5. External fuel tank number 3
(Third exterior fuel tank) | 14. Ball valve |

- | | |
|--------------------------------------|---------------------------|
| 6. Fuel valve of the fuel tank. | 15. Fuel pump |
| Outside group fuel (Turn-off switch) | (Centrifugal fuel pump) |
| 7. Right middle fuel tank (Right | 16. Left center fuel tank |
| middle fuel tank) | (Left middle fuel tank) |
| 8. Fuel pipe (Pipeline), fuel | 17. Fuel cooler |
| 9. tank, spare parts | (Fuel radiator) |
| (Spare fuel | 18. Float valve |
| tank) | |
- Figure 18 Fuel supply system**

The fuel supply system consists of an internal fuel tank. External fuel tank, connecting pipes and accessories Fuel cooler and fuel tank Spare fuel (The user supplies the spare fuel tank.)

B. Main components

1) Vehicle interior fuel tanks

The internal fuel tank consists of 6 fuel tanks, one fuel tank

The left front fuel tank is located on the left side of the vehicle's nose. The right front fuel tank is located on the right side of the vehicle.

Car nose, fuel tank and left front artillery shell rack Located at the back of the station. hydraulics located at the rear of the front left fuel tank; Fuel tank and storage rack

The right front artillery shell is located behind the right front fuel tank; Left center fuel tank Installed in the middle of the vehicle on the front left side of the generator room partition wall. ;Middle right fuel tank Installed in the middle of the vehicle on the right front of the generator room partition wall.

2) Exterior fuel tanks

There are three external fuel tanks on the right side of the vehicle. Fuel tanks External fuel number External fuel tank number 2 and fuel tank

Outside number 3, where the fuel tanks are in order from the nose of the car to the rear of the car.

- 3) Spare fuel tanks: There are two spare fuel tanks at the rear of the vehicle. It looks like a steel tank.

Two small cylindrical tanks with a volume of 180 liters (can be installed according to need)

- 4) Fuel pipes and accessories (Pipelines and accessories)

On the inside - left wall of the vehicle and the rear of the fuel tank and storage rail.

Artillery shell, front - left, with coarse fuel filter and fuel distribution valve. The fuel pump is located at the front of the center-left fuel tank. The ball valve set is on the upper wall. Under the turret ring gear, the fuel cooler is mounted within the air intake of the air supply system, which is mounted on the part. In the middle of the power generator room partition wall, the float valve is at the upper part of the power generator room partition wall. 5) Coarse filter

The coarse filter serves to pre-filter the fuel and remove mechanical impurities. and water removed from the fuel

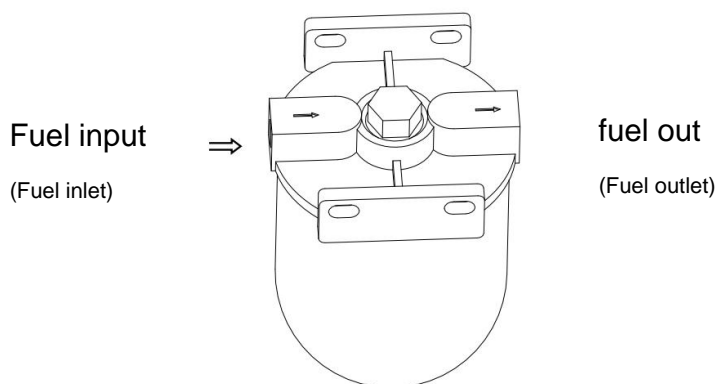


Figure 19: Fuel coarse filter

6) Centrifugal fuel pump. The duty of the fuel pump is to supply fuel to the fuel distribution pipe. Before starting the engine and vent air from the fuel supply pipe before starting the engine.

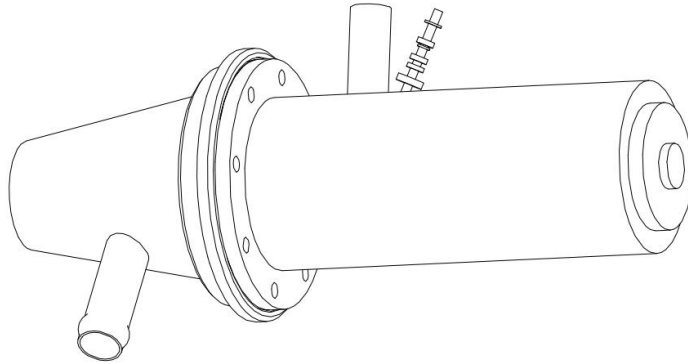


Figure 20 Centrifugal fuel pump 7) Fuel

distribution switch When the valve shaft is rotated to the open position (OPEN), it will deliver fuel. Enter the system for normal operation. When servicing the coarse fuel filter, turn the valve shaft to the closed position (OFF) and when you want to drain it. To remove fuel from the system, turn the valve shaft to External location (OUTER)

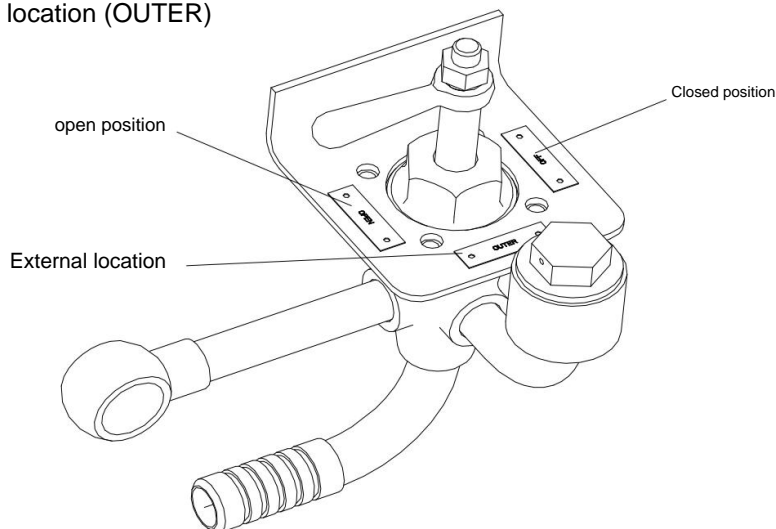


Figure 21 Fuel distribution switch

8) Float valve

The float valve is used to prevent fuel from flowing out when the fuel expands.

In normal conditions, the engine works. Open the float valve. and the fuel system is connected to the air. through the float valve When the fuel is full, the room supports the expansion of the right center fuel tank. The float will rise to close the air hole. To prevent fuel from flowing out of the system.

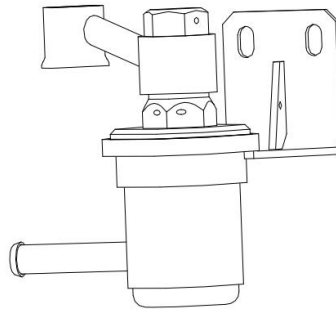


Figure 22 Float valve

9) Fuel cut-off switch

The fuel shut-off valve is installed on the middle-right fuel tank. End a is connected to the pipe.

Fuel of external fuel tank No. Connect to the air pipe of the fuel tank.

spare part. End b is connected to the expansion chamber of the right middle fuel tank. End d is connected to

Right middle fuel tank The fuel flap is used to control the closing or opening between the fuel tanks.

external or spare fuel tank and internal fuel tank Fuel distribution of the oil system

Fuel is divided into two modes: fuel supply from the internal fuel tank and fuel supply from

Fuel from both internal and external fuel tanks When the fuel valve is in the position

Turn "ON", the external fuel tank and the spare fuel tank will be connected to the internal fuel tank, then

The internal fuel tank and external fuel tank share the fuel supply. When the valve closes the oil

The fuel is in the "OFF" position. The external fuel tank and spare fuel tank are not connected to the tank. internal fuel Only the internal fuel tank supplies fuel.

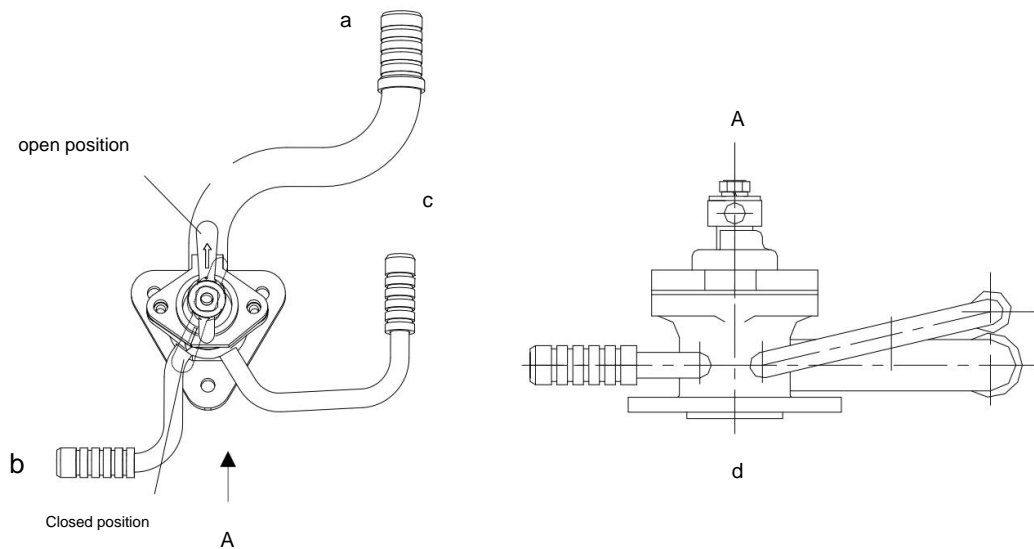


Figure 23 Fuel cut-off switch

a) When the fuel valve is in the **"ON"** position, end **a** and end **d** are connected. End **b** and end **c** are connected. End of pipe (**b** and **c**) of the oil valve The fuel is connected to the expansion chamber of the right center fuel tank. and the pipe of the oil tank Spare fuel in order and also connects to the air pipe of the entire fuel system. At the same time, the fuel delivery pipes (**a** and **d**) of the fuel valve are connected to the delivery pipe. Fuel of external fuel tank No. and right middle fuel tank Then the external fuel tank and the spare fuel tank are connected to the fuel tank. Internally, the internal and external fuel tanks will jointly distribute fuel.

b) When the fuel valve is in the **"OFF"** position, pipe ends **b** and end **c** are not connected (**b** and **c**) are disconnected. connected to the expansion chamber of the fuel tank middle - right and the pipes of the spare fuel tank respectively External fuel tank air pipe and the spare fuel tank is completely disconnected from the fuel system. Air pipes **b** and **d** are connected, and the external fuel tank and spare fuel tank do not supply fuel. fuel Only the internal fuel tank supplies fuel.

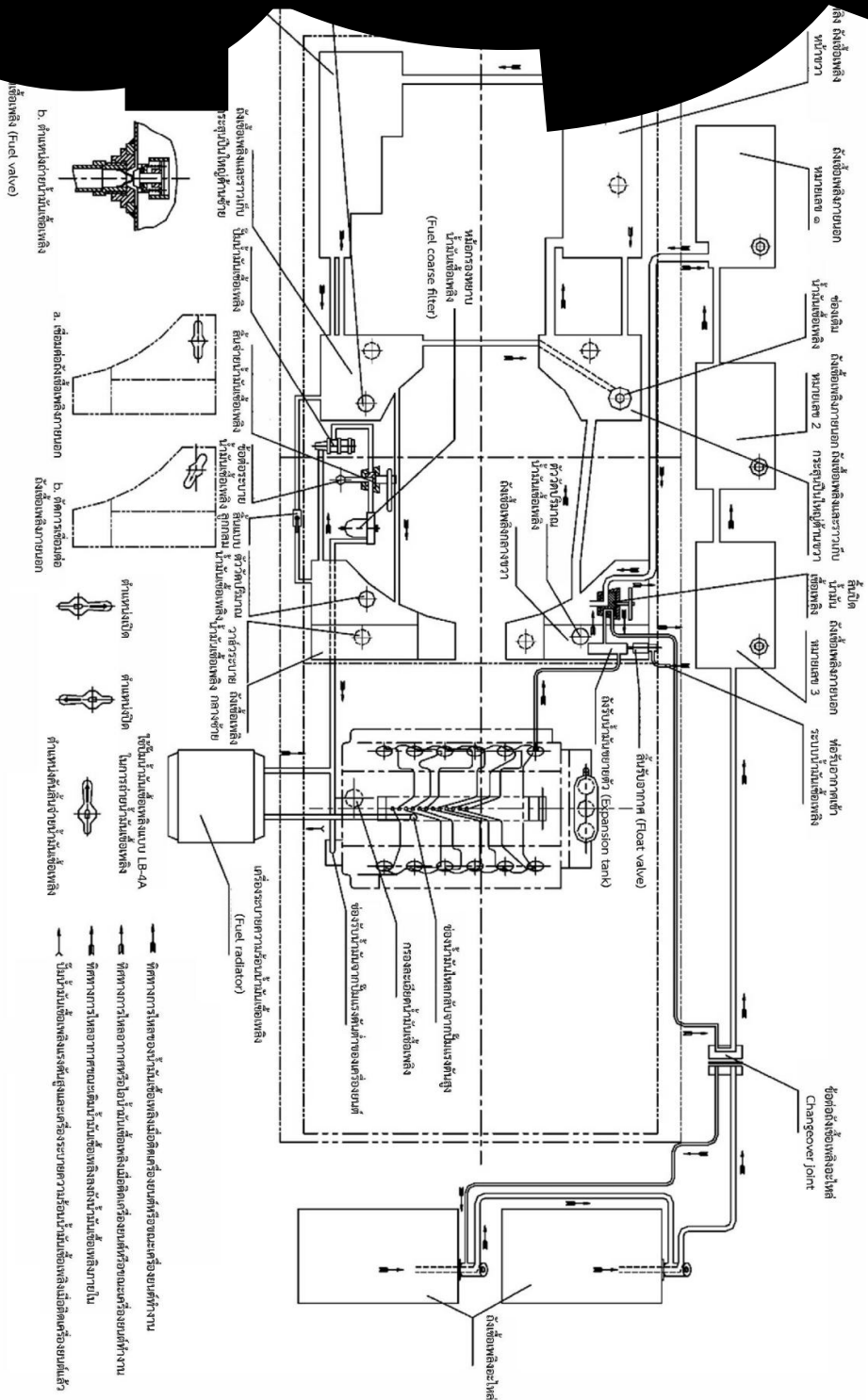
10) Fuel radiator: Fuel radiator is used to cool down the oil. Fuel returns from the engine's high-pressure pump to keep the fuel temperature within normal range. The cooler intake pipe is connected to the radiator. Pump fuel return screen High pressure of the engine The outlet pipe is connected to the fuel system and the intake pipe. Engine low pressure fuel pump

C. Working principle

The fuel system is in parallel (Tandem type). Fuel connection. The fuel is as follows. The external fuel tank and spare fuel tank are connected in series and connected to the right center fuel tank in series by a fuel flap. Internal connection is Mixed connection Middle-right fuel tank Connects to fuel tank and cannon rack. Serial right front The right front fuel tank and the left front fuel tank are connected in series. The left front fuel tank and artillery shell rack and the left central fuel tank are connected in series. The projector is connected in one and way. Left center fuel tank fuel pump fuel distribution valve Series oil coarse filter, fuel engine connected to the fuel pipe. The left front fuel tank is connected to the tank. The fuel and artillery ammunition racks are on the left side respectively. The right front fuel tank is connected to the tank. The fuel and artillery ammunition rack are on the right side respectively. There are two fuel distribution modes.

which controls the fuel flap. First mode: The fuel flap is in the open position (Normal mode), the engine receives Fuel from the external fuel tanks in order of tank number, external fuel tank No. 3 to external fuel tank No. 1, right center fuel tank, right front fuel tank, and the fuel tank and artillery shell rack. right side, left front fuel tank and fuel tanks and storage racks Left cannon shell, make sure the engine works normally. oil shut-off valve The fuel controls the outside air that enters the spare fuel tank at the rear of the vehicle and the fuel tank through the intake chamber. Expansion of right center fuel tank

Second mode: The fuel flap is in the closed position. (Not normal mode, use in conditions where external fuel tank damaged) The engine receives fuel from the right center fuel tank, right front fuel tank and right fuel tank and artillery rail, left front fuel tank. Projection and left fuel tank and artillery shell rack, and left center fuel tank Make sure that The engine works normally. The fuel valve controls outside air entering the fuel tank. inside through float valve and the expansion chamber of the right center fuel tank.



when

Chapter

6 Exhaust system (AIR EXHAUST SYSTEM)

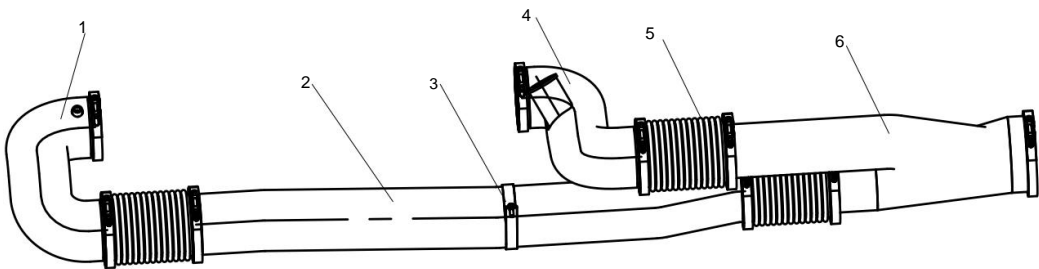
1. General

The job of the exhaust system is to remove exhaust gases generated from combustion inside the cylinder. of the engine out of the vehicle.

2. Components of the system

A. System Composition

The exhaust system consists of the front exhaust pipe of the engine, the rear exhaust pipe of Engines, front exhaust pipes, rear exhaust pipes, corrugated pipes and exhaust pipe clamps.



1. Front exhaust pipe of the engine

(Front smoke exhaust pipe of engine)

2. The front exhaust pipe of the vehicle.

(Front smoke pipe of hull)

3. Fixing strips

4. The exhaust pipe at the back of the engine.

(Rear smoke exhaust pipe of engine)

5. Corrugated tube 6. Exhaust pipe at the back of the vehicle

(Rear exhaust pipe of hull)

Figure 25: Components of the exhaust system (Air exhaust system installation)

B. Main component

The front exhaust pipe of the engine and the rear exhaust pipe of the engine

The front exhaust pipe of the engine and the rear exhaust pipe of the engine are mounted. in power generator It is connected to the turbine blade exhaust vent of the engine with a clamp, see Figure 25.

Front exhaust pipe of the vehicle and the exhaust pipe at the back of the vehicle

Front exhaust pipe of the vehicle and the rear exhaust pipe of the vehicle is installed on the starboard side of the vehicle. After the generator is placed in the generator room, Use corrugated pipe to connect. front exhaust pipe and rear exhaust pipe of the vehicle To the front exhaust pipe and exhaust pipe. the back of the engine together Then use a clamp to tighten it, see picture 25.

Chapter 7

Compressed air system (AIR COMPRESSED SYSTEM)

1. General

The function of the compressed air system is to store high pressure air for the starting system. Air engine and air tank The air starting system is used when the motor starts the engine. The electrical system is not in normal operation. The air start system is in "Pneumatic Start" mode. Help start

2. Main performance and parameters

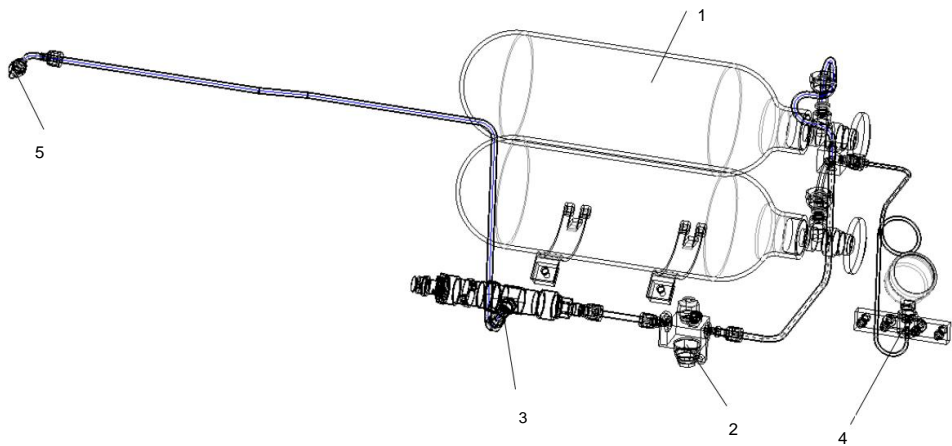
Air tank	2x5 liters
capacity. Minimum air pressure	13 MPa
of the air tank. Air pressure from the reducing valve (Reducing valve)	9 MPa

3. System composition and principle

A. System components

The compressed air system consists of an air tank. pressure reducing valve Pneumatic valves – Electrical gauges

Air pressure, exchange joints and air pipes are shown in Figure 26.



- | | |
|---|-----------------------------|
| 1. Pressure-air bottle | 4. Air pressure gauge |
| 2. Pressure reducing valve (Reducing valve) | (Air pressure indicator) 5. |
| 3. Pneumatic valve - electric | Switch joints |
| (Pneumatic-electric valve) | (Changeover joint) |

Figure 26: Compressed air system components (Pressure-air system components)

B. Main components

- 1) Air tank: used for storing compressed air. It is an alternative method of starting the engine. The system

The air start system opens and closes the air tank.

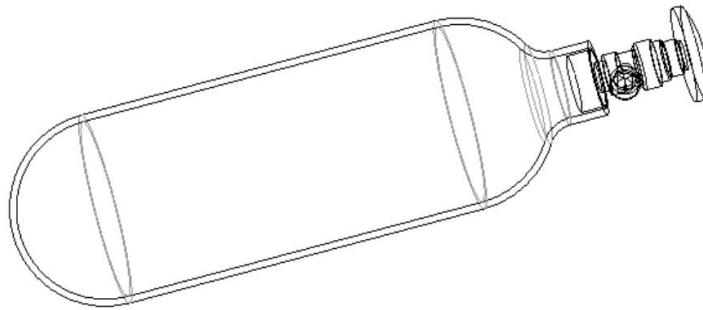


Figure 27: Pressure-air bottle

- 2) Pressure reducing valve: reduces the air pressure from the air tank to (9 ± 0.5) megapascals (MPa).

To be suitable for starting the engine with air.

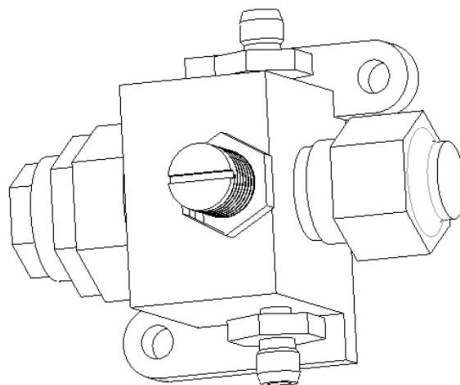


Figure 28 Air reducing valve

3) Pneumatic - electric valve: used for opening the air pressure delivery pipe used to start the engine with air, which is attached Located on the instrument panel.

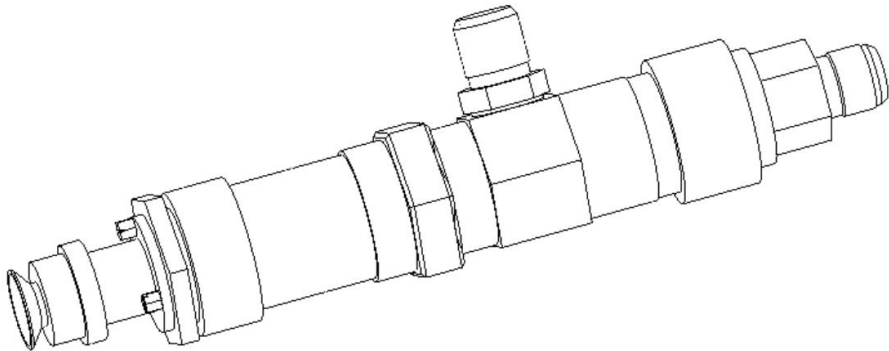


Figure 29 Pneumatic – electric valve

4) Air pressure gauge: used to measure the air pressure in the air tank.

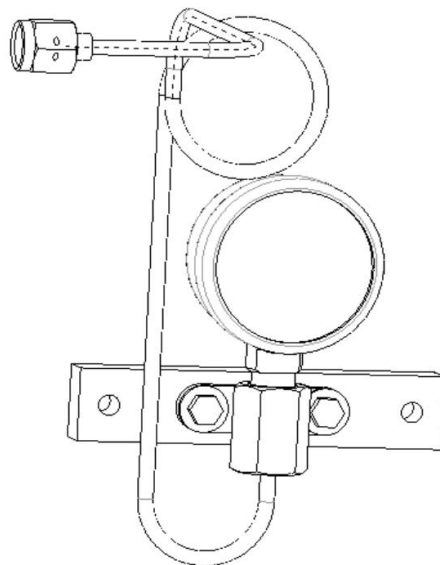


Figure 30: Air pressure indicator.

C. Working principle

Press the air starting button, which is located above the left side.

of the driver, then compressed air from the air tank flows into the pressure reducing valve. Through the pneumatic valve - Electricity through the body

Distribute air and then pass through the air starting valve and enter the engine cylinder.

Engines in order of cylinder operation Pressure from compressed air will flow in to compress the pistons. and drives the crankshaft to rotate until the engine can be started.

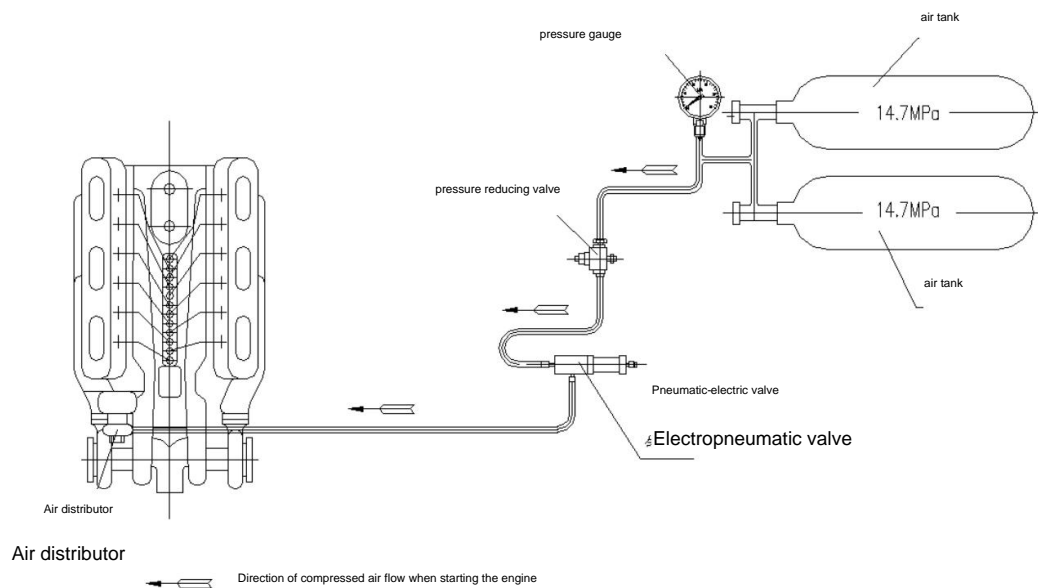


Figure 31 System working principle

Chapter 8

Heating system (HEATING SYSTEM)

1. General

The heating system is the part of the cooling system that provides heat. with the coolant of the cooling system before starting the engine in Low temperature environment (temperature below 5°C) to ensure that the engine can be started. In a low temperature environment

2. Main performance and parameters

A. Heater

type	Heating with fuel
	YJ-Q30/AS
Model	ÿ- 25° Celsius
Operating temperature	Rated heat
Rated heat	30 kilowatts
flow Rated voltage	Rated power
Rated power	24 volts
of the motor	105 watts
(Motor's rated power)	
Fuel consumption rate	3.2 kg./hour
(Fuel consumption)	
Water circulation mode	The water pump creates a circulation loop.

B. Water pump

The water pump is the LB-4A centrifugal fuel pump of the fuel supply system.

1) Centrifugal fuel pump

	LB-4A
Model flow rate	2100 liters per hour
Outlet pressure	ÿ68.647 kilopascals (kPa)
(Outlet pressure difference)	

2) DC electric motor

BDZ-110

Model Running speed

7200±500 rpm

Rated torque Rated
current

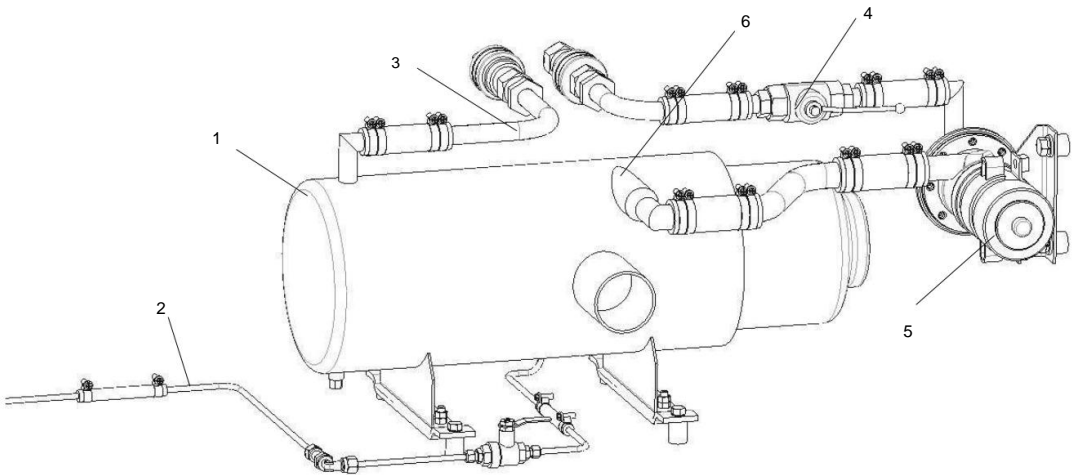
0.1472 newton-meter

~7 amps

(Consumption current)

3. System composition and principle

A. System Composition



1. Heater (Heater)

4. Water control valve (Ball valve)

2. Fuel inlet pipe

5. Water pump (Water pump)

(Fuel supply pipeline) 3.

Water outlet pipe

6. Water inlet pipe of heater

(Water outlet pipe of heater)

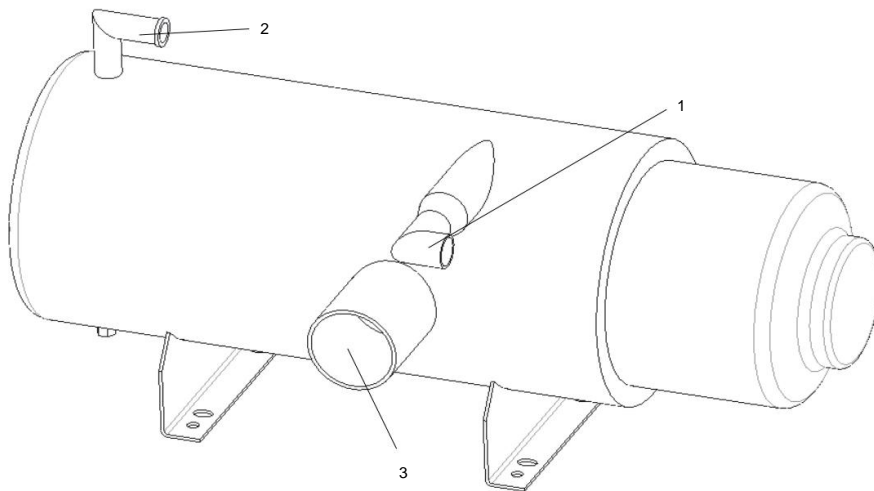
**Figure 32: Components of a heating system
(Schematic diagram of heating system)**

The heater system is mounted in the heater compartment on the left side of the rear of the vehicle, which is between the air filter room and the air tank room. The heating system consists of Heater, water pump, water control valve, Fuel inlet pipe and water inlet pipe (Coolant). The system is connected to the cooling system with a changeover joint.

B. Main components

1) Heater

The heater is the main component of the heating system, which has its main function is to heat the coolant in the cooling system. By receiving heat from burning fuel.



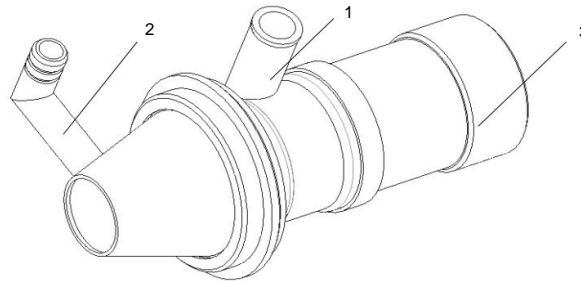
1. Water inlet of heater 2. Water outlet of heater
3. Smoke exhaust

Figure 33 Heater

2) Water pump

The water pump is responsible for creating the flow of cooling fluid (coolant) in the machine.

Heating



1. Water inlet of water pump 2.
Water outlet of water pump 3. Pump
body

Figure 34 Water pump

3) Water control valve (Ball valve)

The water control valve is used to connect or disconnect the heating system.
and cooling system

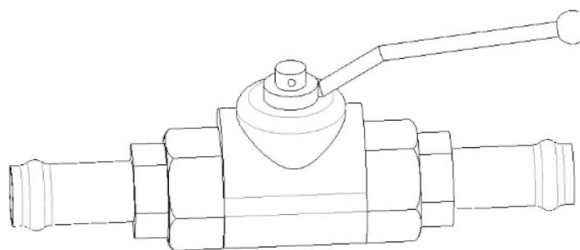


Figure 35 Water control valve (Ball valve)

C. Working principle: When the heating system

works Fuel flows through the fuel delivery pipe into the injector. of the heater The fuel is then atomized and enters the combustion chamber. fuel that The atomized gas is ignited with a spark plug and combustion occurs in the combustion chamber. fuel that The combustion heats the coolant that circulates in the heater.

When the heater is working The water pump sends the cooling fluid through the engine. to the heat exchanger of the heater. The temperature of the coolant will increase. flows back to the engine And the exhaust gases from combustion will be exhausted through the smoke exhaust pipe. Leave the heating room.

Chapter 9

THERMAL SMOKE DEVICE SYSTEM

1. General

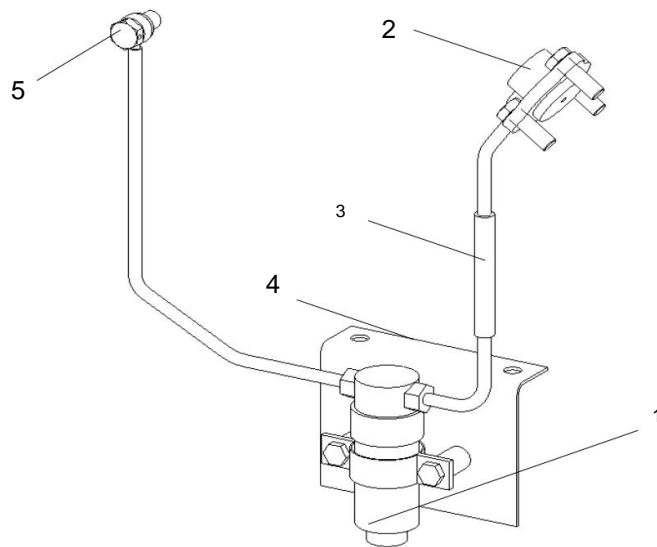
Functions of the thermal smoke screen It is to create a smoke screen between our side and the enemy. to cover our tanks

2. Main performance and parameters

The thermal smoke screen machine should not be operated continuously for more than 5 minutes.

3. System composition and principle

A. System Composition



- | | |
|--|-------------------|
| 1. electromagnetic valve (Electromagnetic valve) | 4. Fixing bracket |
| 2. Fuel injector (Fuel ejector) | 5. Joints (Joint) |
| 3. Fuel pipe (Hose) | |

Figure 36: Components of a heated smoke screen generator.

(Thermal smoke screen components)

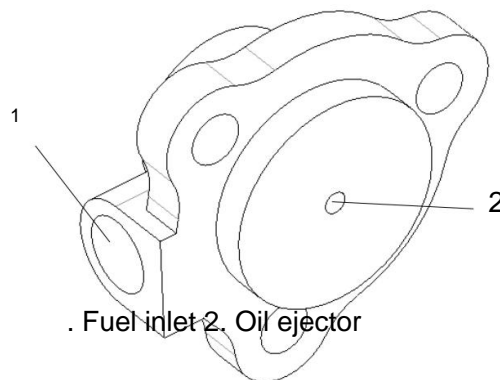
The heated smoke screen generator is installed next to the exhaust system in the generator room. The smoke screen generator consists of an electromagnetic valve. Fuel injectors and fuel pipes. The smoke screen generator is connected to the fuel system pipes through a coupling. Fuel injector installed inside the exhaust pipe. The electromagnetic valve is mounted on a mounting bracket. Thermal smoke screen generator switch "SMOKE SCREEN" is located in the driver's switch box which controls the heated smoke screen system.

B. Main components

1) Fuel injector (Fuel ejector)

The fuel injector releases a smoke screen in a heated smoke screen system.

The size of fuel droplets depends on the cross-sectional area of the fuel flow.



1. Fuel inlet port (Inlet port) 2. Nozzle (Nozzle)

Figure 37: Structure of oil ejector

2) Electromagnetic valve (Electromagnetic valve)

The electromagnetic valve is also the main control element of the smoke screen system. Thermal, which controls the flow of fuel used to create a thermal smoke screen, the driver's cab has a switch. A smoke screen machine which controls the operation of an electromagnetic valve.

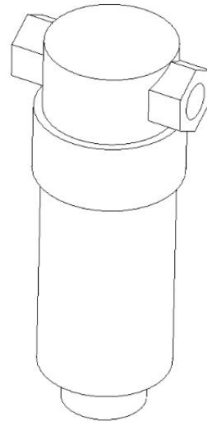


Figure 38: Electromagnetic valve (Electromagnetic valve)

C. Working principle

When the engine is running Open the electromagnetic valve by turning on the smoke screen generator switch. in the switch box to the left of the driver. Diesel fuel from the engine's low pressure diesel pump flows through the valve. electromagnet to the fuel injector Diesel mist coming out of the nozzle enters the exhaust pipe. and mixes with hot exhaust gases emitted from the engine and becomes a mixed gas of exhaust gases. and fuel vapor The temperature of the mixed gas is higher than the temperature outside the vehicle. Therefore, when the mixed gas is released into the outside atmosphere and combines with the air Causes condensation, causing a smog condition.

To confuse the enemy and to protect yourself.

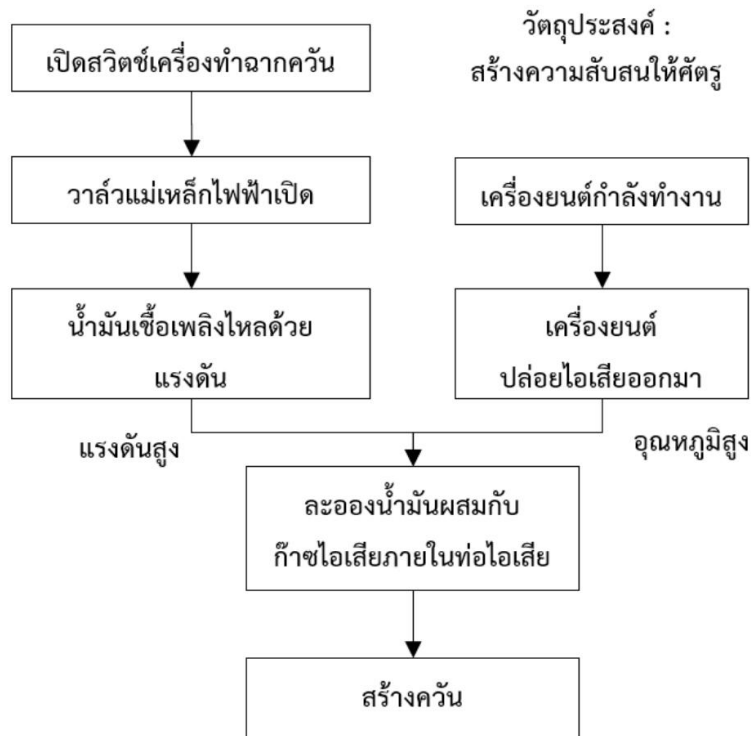


Figure 39: Thermal smoke screen working principle

Chapter 13

Driving the car (RUNNING GEAR)

1

Section: General Introduction (GENERAL INTRODUCTION)

The running gear consists of a track propelling unit and a suspension system, a belt drive unit, and the ground.

There will be interactions with each other. By converting power output from the transmission system into traction force for driving.

Keep the tank moving. The vehicle's body support system serves to reduce shocks and vibrations caused by

The movement of the belt drive unit that is transmitted to the vehicle.

1. Track propelling devices

Belt drive unit Its purpose is to convert the torque transmitted from the commutator.

Speed to the belt drive sprockets (Driving sprockets) is the traction force, causing the vehicle to move, providing traction force.

Drag and braking force and improve the vehicle's maneuverability under terrain conditions. that are very different

Belt drive unit Consists of 2 sets of belt drive gears, 2 belts.

12 belt pressing wheels, 8 belt receiving wheels (4 outer belt receiving wheels and 4 inner belt wheels) and 2 belt adjustment wheels with track adjusters

2. Suspension

A vehicle stabilizer is a vibration dampening system that connects the vehicle to the belt press wheels.

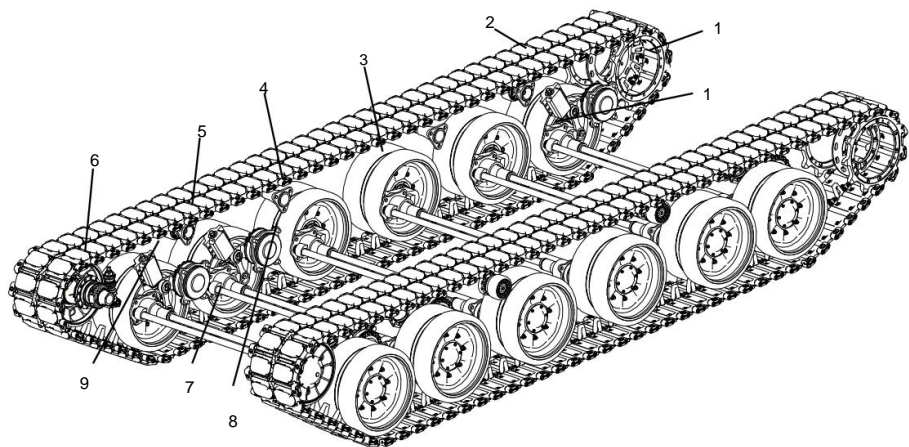
It serves to reduce the impact force transmitted from the ground to the belt and belt wheels to the vehicle.

While the vehicle is moving and reduce vibration to keep the tank running smoothly.

The vehicle body support device consists of a torsion beam. Hydraulic vibration dampening machine

Hydraulic press arm stop and belt pressing wheels with sleeves (bushings)

The vehicle body support device consists of 12 torsion beams (6 beams installed on each side), 12 sets of belt press arms with bushings (4 types ----- sets. Left belt pressing arms 1, 2, and 6; Press arm set Left belt 3, 4 ; and 5; Set of right belt pulley arms 1, 2, and 6; Press arm set Right belt 3, 4 and 5), 6 sets of hydraulic dampers (2 types----- Left side vibration relief device 1 , 3) 2 and 3 ; Right-side vibration relief device 1, 2, and and 6 sets of hydraulic press arm stops (2 types----- side hydraulic press arm stops left and right hydraulic press arm stop)



- | | |
|---|--|
| 1. Belt drive gear
(Driving sprocket) | 6. Belt adjustment wheel and belt adjuster
(Idler wheel and track adjuster) |
| 2. Belt (Track) | 7. Torsion bar |
| 3. Road wheel | 8. Hydraulic vibration dampening machine
(Hydraulic shock absorber) |
| 4. Outer belt receiving wheel
(Outer top roller) | 9. Hydraulic press wheel arm stopper
(Hydraulic buffer) |
| 5. Inner belt receiving wheel
(Inner top roller) | 10. Balance arm
assembly) |

Figure 1: Components of the car driving set (Running gear)

Part 2

PERFORMANCE DATA

1. Track propelling system

A. Belt drive system

Type B. Belt	Belt with gear driving the belt at the back.
drive sprocket (Drive sprocket)	

Number of gear teeth	11
----------------------	----

Number of belt drive gears	4
----------------------------	---

C. Belt

type	Double pin and double shoe, rubberized pins, replaceable	rubber pad
------	---	------------

belt rubber	82 pieces
-------------	-----------

Track width	600 millimeters
-------------	-----------------

Belt joint pitch (Track pitch)	180 millimeters
--------------------------------	-----------------

D. Road wheel

quantity	12
----------	----

type	Two edges, rubber covered, diameter 750 mm.
------	---

E. Top roller (inner/outer)

Number	8
of installation locations	<p>The inner belt receiving wheel is between the first belt pressing wheels.</p> <p>and 2</p> <p>The outer belt take-up wheel is positioned between the attached belt press wheels.</p> <p>2 and 3</p> <p>The outer belt take-up wheel is positioned between the attached belt press wheels.</p> <p>4 and 5</p> <p>The inner belt receiving wheel is between the 5th belt pressing wheels.</p> <p>and 6</p>
type	<p>Single edge wheel, internal buffer structure,</p> <p>Diameter 200 mm.</p>

F. Idler wheel and track adjuster

Belt adjuster type	<p>Worm gear adjustment bolts and alignment bolts</p> <p>Adjust the worm, crank structure to adjust</p>
Belt adjustment wheel type	Two-rim wheels, rubber covered, diameter 570 mm.
quantity	2

2. Suspension

A. Suspension system

type	<p>Cantilever structure supports independent torque together with the machine.</p> <p>Hydraulic damping and arm stops</p> <p>hydraulic press</p>
------	--

B. Hydraulic shock absorber (Shock absorber)

type	Vane, two-way hydraulic (Hydraulic dual-action)
Installation location	Belt press wheels 1, 2, and 6
quantity	6

C. Hydraulic press arm stopper (Hydraulic buffer)

type	Hydraulic, piston rod type (Piston rod)
Installation location	The belt press wheel 1 and 2
quantity	6

D. Torsion bar

Installation model	Spline fit
quantity	12

E. Belt press arm (Balance arm)

Forming process	One-piece forging (One-piece forging)
quantity	12

F. Dynamic travel

The position of the belt	1	268 mm.
press wheel at Belt press wheel position 2 to 6	225 mm.	

Part 3

Structure and working principles (STRUCTURES AND WORKING PRINCIPLES)

1. Track propelling devices

A. Belt (Track)

The belt used in the vehicle is a double latch belt and double belt rubber grommets. Belt latch. It is connected to the end of the belt link to transmit thrust. In addition, the belt link is equipped with a hinge. The rubber-covered metal has a replaceable rubber pad on the side that contacts the floor. Each belt Consists of 82 belt joints (see Figure 2)

The belt joint set (track shoe) consists of 2 belt joint plates (Link) and a belt pin (Track pin) that is pressed into the hole of the belt joint plate. Belt joint plates are made from forging. Formed (Forging) with a socket for installing lightweight rubber at the top and a socket for installing tires. Support at the bottom The ground contact rubber is secured to the belt coupling plate with bolts and nuts.

Belt latch (2) is a shaft with a round face at the end of the belt latch for Assemble the lock ring. Each belt latch is enclosed with 14 rubber rings that act as Rubber bushings when pressed into the belt joint set The rubber bushings of the belt pins provide flexible torque. (Elastic torsion) when the belt moves

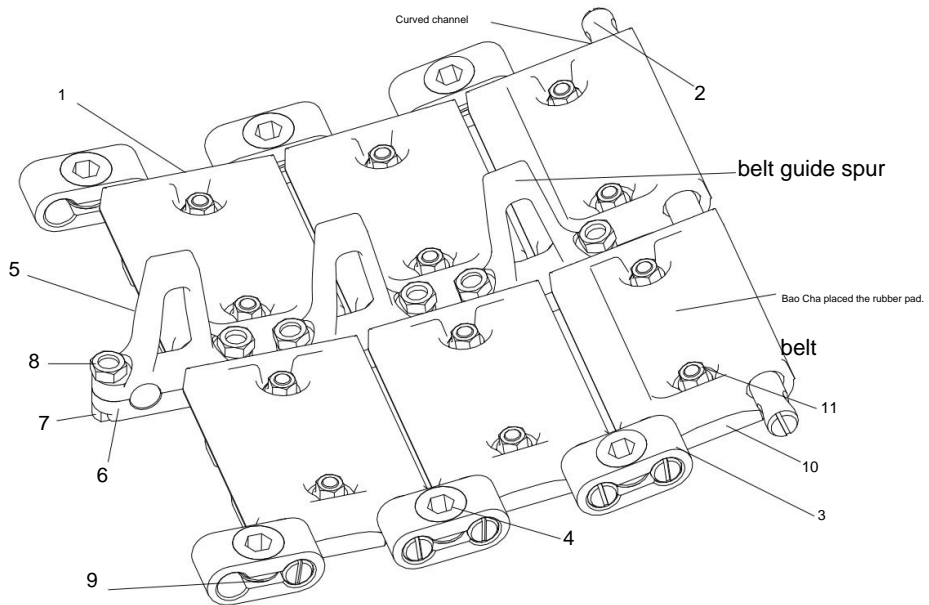
The belt is connected to other belts by means of Center connectors and End connectors, which hold the upper belt guide (5) and the bottom (6) of the belt guide (Center- connector) and the bolt (7) are used for middle connection The two belt joints (3) and bolts (4) are used for connecting the ends.

both ends To assemble the belt connector at the end of the belt latch The joint must be rotated.

Adjacent belts are set at a specified angle to prevent the belt joint from moving along the axis of the belt.

Belt latch A lock ring (8) attached to the curved part of the belt latch end and a bolt (4) used to secure the belt joint. The bolts should be coated with Loctite 263 (China) glue on the threads.

before tightening The belt uses a structure in which the upper belt guide is secured by a divided guide spur.



- | | |
|---|-------------------------|
| 1. Belt joint plate (Link) | 7. Bolts securing the |
| | (Center connector bolt) |
| 2. Track pin | 8. Bolts for fastening |
| | (Center connector nut) |
| 3. Belt joint (End connector) | |
| 4. Belt joint fastening bolts | |
| (End connector bolt) | |
| 5. Attach to the upper belt guide spur. | 9. Stop ring |
| (Upper half of center connector) | 10. Rubber pad |
| 6. Attach to the lower belt guide spur. | 11. Nut |
| (Lower half of center connector) | |

Figure 2: Belt (Track)

B. Belt receiving wheel (Top roller)

The belt receiving wheel serves to support the upper belt, preventing the belt from slackening.

Single edge wheel type belt There is a rubber inside to absorb shock. There are 8 wheels in total, 4 on each side (wheels 2 wheels for the inner belt and 2 wheels for the outer belt)

The belt reel consists of a hub (1), a rubber shock ring (2), a rim (11), a bracket and axle (6), and a sealing cover (4) (Fig. 3) The wheel hub is on a bracket and the axle passes through 3 cartridges.

The bearings are 2 spherical roller bearings (15) and 1 spherical ball bearing.

Bearing (3) The bearing is secured using a shaft end threaded plug (12). The shaft end threaded plug is also firmly fixed.

Locking bolt (13)

There are radial holes A on the mounting bracket and shaft (6) to lubricate the working edge of the seal cover. (sealing cup)

The sealing cover (4) is secured to the wheel hub using 10 self-sealing bolts (5) inside the sealing cover. The edge of the self-sealing oil seal attaches to the surface of the

The shaft is securely connected with a spring ring. The sealing cover is fitted with a rubber ring (10) in the circular groove in the cover.

Seals (4) and Labyrinth seals (8) make up the Labyrinth seal set. Labyrinth seal set (8) is connected to the mounting bracket.

The shaft inside the belt wheel is filled with semi-fluid extreme pressure gear grease up to the bottom edge of the belt. Refill on the wheel hub Correct wax filling hole

Closed by screw cap (14) with conical sealing sleeve. Hole A shall be arranged on the mounting bracket of the belt reel.

That's at the top. Therefore, when installing the belt drive wheel onto the vehicle The "UP" mark must be displayed on the page.

The mounting flange is located on the fender side above the belt.

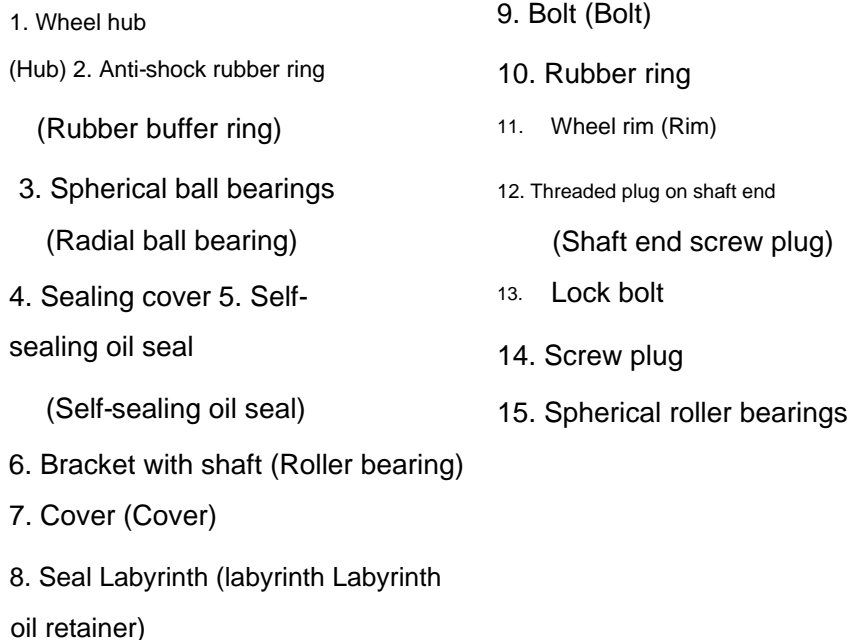


Figure 3: Inner top roller assembly

C. Belt drive sprocket (Driving sprocket)

The belt drive gear transfers torque from the final drive gear to the belt.

Consists of 2 sets of belt drive gears (1), 2 sets of limit plates (2) and final drive gears (6).

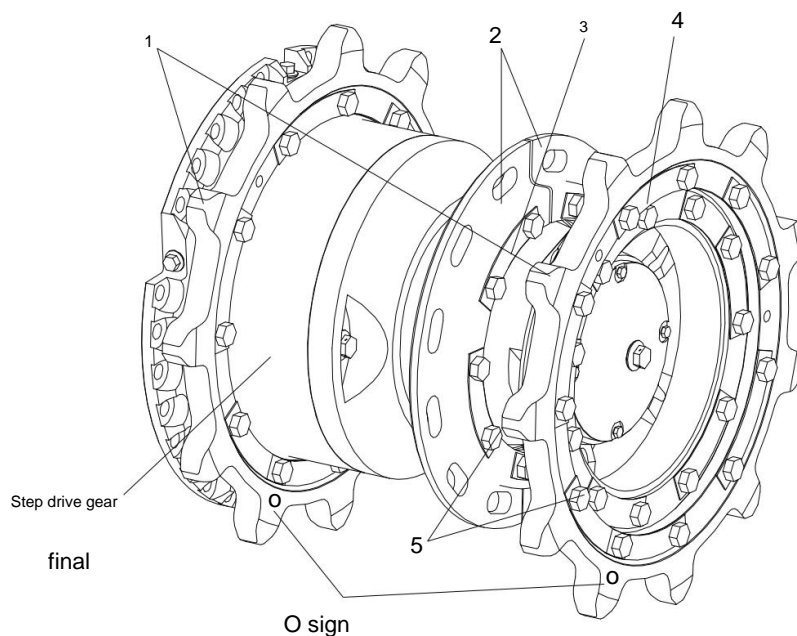
(Fig. 4) The belt drive gear is secured to the final drive gear using bolts (5) and washers.

Locking support (4) The limit plate is secured to the final drive gear using bolts (5) and washers.

Lock (3) to prevent the belt from pulling out to the side.

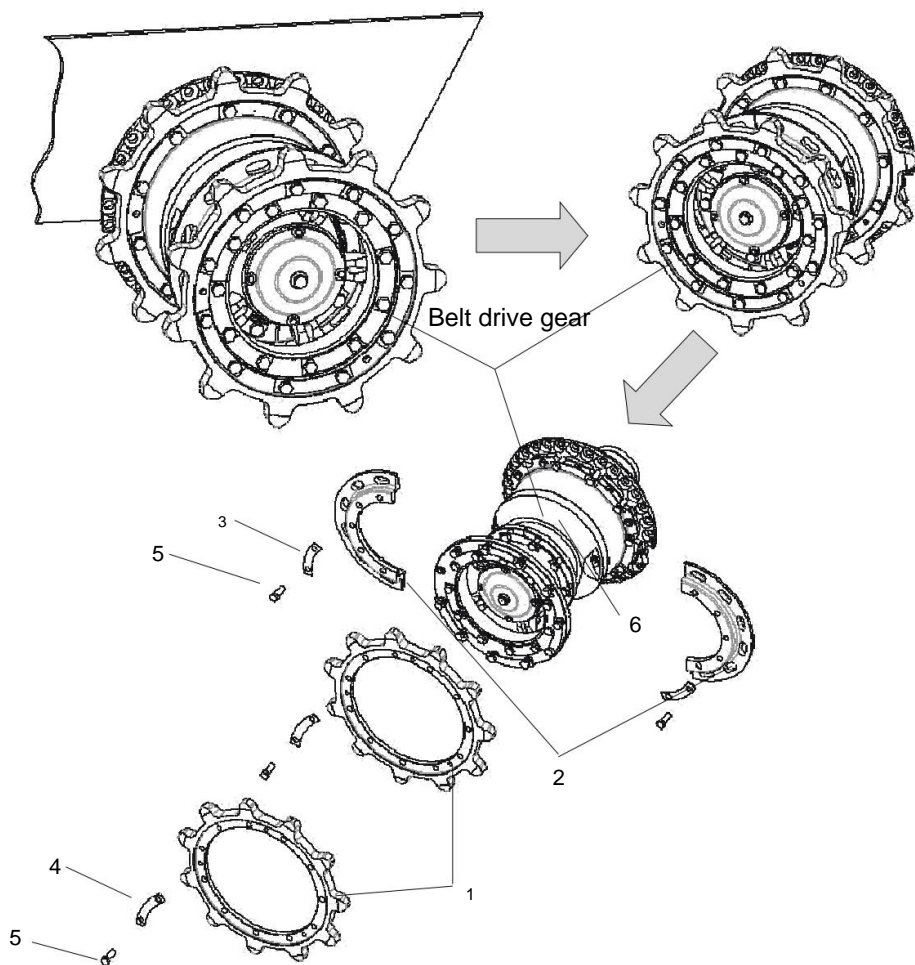
When installing the belt drive gear Reference gear teeth (Datum) marked with both "O"

The gear teeth must be in the same line.



- | | |
|-----------------------------------|-----------------------------------|
| 1. Belt drive sprocket (Sprocket) | 4. Lock washer |
| 2. Limiting disk | 5. Bolt (Bolt) |
| 3. Lock washer | 6. Final drive gear (Final drive) |

Figure 4. Components of a belt drive gear. (Installation of sprockets)



- | | |
|-----------------------------------|-----------------------------------|
| 1. Belt drive sprocket (Sprocket) | 4. Lock washer |
| 2. Limiting disk | 5. Bolt (Bolt) |
| 3. Lock washer | 6. Final drive gear (Final drive) |

Figure 5. Components of a belt drive gear. (Installation of sprockets)

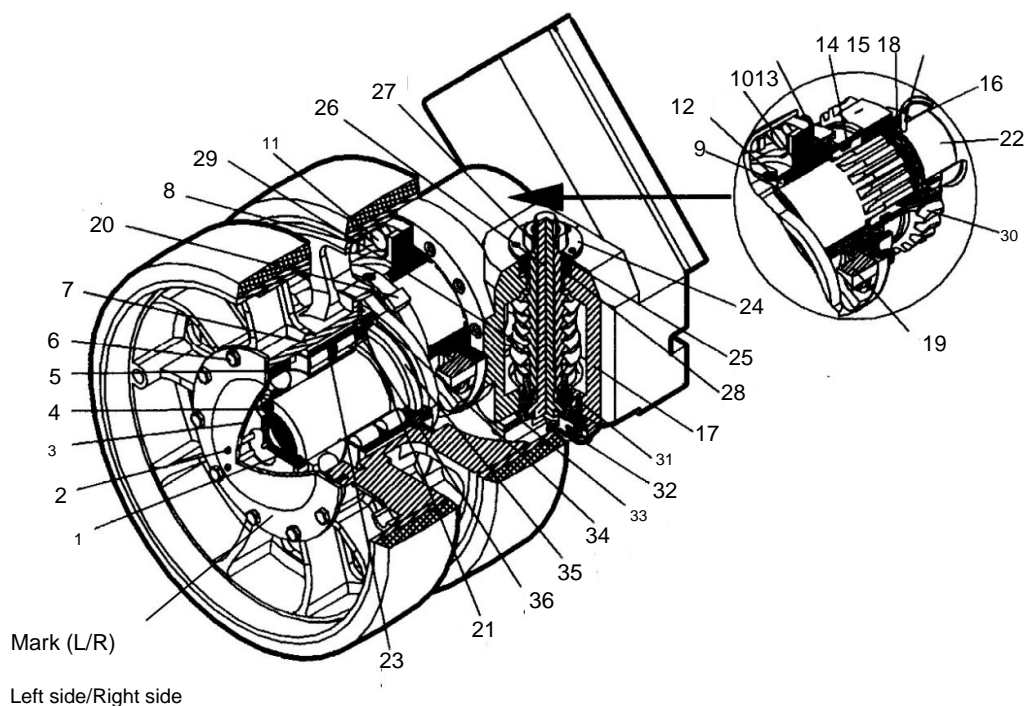
D. Belt adjustment wheel (Idler wheel)

The belt adjustment wheel (Figure 6) serves to hold the belt in power transmission during The belt has reverse rotation. and adjust the belt tension with the belt adjuster.
(track adjuster)

The belt adjustment wheel is made by extruding a rubber steel rim and a steel wheel disc together. The belt adjustment wheel is located on the short shaft of the crank arm (22) is supported by a ball bearing (5) and two rows of ball bearings (23). The coupling between the outer edge of the bearing and the wheel hub is Loose fit type, the inner rim of the bearing is pressed into the shaft. Belt adjustment wheel to the crank arm with a threaded cap (1) to prevent the belt adjustment wheel from moving in the axial direction. The thread cap is

locked with a threaded nut (4) Seal Labyrinth (21) is inside the wheel hub. The cover is fixed on the belt adjustment wheel using bolts (8) with spring washers. and sealed with a fiber gasket coated with a sealant. YP015 Inside the cover, there is a felt gasket (35) and a self-sealing oil seal (36).

The axle cover (3) is secured to the outside of the hub with bolts (6) and sealed with a coated fiber gasket. Apply YP015 sealant. Power connector claw (2) is connected to the cover. To drive the drive shaft to rotate the speedometer. (Tachogenerator) The speedometer will It converts the electrical current generated by the rotation into the revolutions per minute of the belt tensioner wheel. The final step is then processed and the vehicle speed is displayed on the gauge. speed Ten threaded holes used The axle cover mount has two threaded holes that connect to the hub slots to lubricate the bearings. These two threaded holes are opposite sides on the hub cover symmetrically. These lubrication holes are usually sealed with a pin. Threaded tightly The heads of the bolts covering the lubrication holes are painted red for visibility. Unscrew tank number 2



1. Screw plug 2. Coupling
yoke 3. Shaft cap 4. Screw 5.
Spherical ball bearing (Ball
bearing) 6, 8, 11, 32.

Bolt 7. Belt adjustment wheel (Idler
wheel)

9. Rubber ring

10, 16. Shaft support (Bush) 12.

Journal bush 13, 33 Adjusting
shim

14. Bracing bush 15. Round nut 17.
Bracket

18. Split end pin (Pin)

wheel and track

adjuster

20. Stop block 21. Labyrinth
oil retainer cap 22. Crank arm 23. Double-row
roller bearings

bearing)

24. Cover (Cover)

25. Rubber gasket 26. Screw rod

27. Rubber bush 28. Shaft
support (Bush)

29. Worm (Worm)

30. Worm wheel

31. Seat, oil seal

34. (Oil retainer)

35. Felt oil seal 36. Self-sealing oil

seal (Self-sealing seal) 19. Limiter **Figure 6 Idler**

E. Track adjuster

The belt adjuster is a bolt-on type that adjusts the worm gear. Worm and threaded shaft of adjuster

The belt exerts force directly on the belt adjustment wheels.

The belt adjuster consists of a crank arm (22), a worm pair and a threaded shaft of belt adjuster Locking bolt stem and sealing kit (Figure 5)

The crank arm is assembled with a journal bush (12), a shaft sleeve (14), and a worm spur and worm gear of the belt adjuster (30), rubber rings. (9) installed

Between the crank arm flange and the journal bush. and the adjustable shim (13) installed.

Between the journal bush and the mounting bracket (17), the worm gear is secured to the crank arm with a nut (15). Then the nut The threaded insert is locked with a split end pin (18).

The crank arm (22) is mounted on two support points. One point is the mounting hole of the mounting bracket. (17) and another point is the mounting hole of the journal bush (12). Both holes have bushings (10 and 16).

The journal bush (12) is attached to the mounting bracket (17) with bolts (11). At the same time Use the two long bolts (11) at the top to secure the limiter (19) to the journal bushing. The limiter and Two stops (20) welded to the side of the front of the crank arm can limit the rotation angle. of the crank arm. To avoid the worm gear and worm spur from falling apart in while the belt is tight

The belt adjustment wheel cover (3) is marked with the letter "L" or "R" after The belt adjuster is installed.

The support point of the worm shaft (29) is a bushing (28) that is pressed into the mounting bracket (17) and shoulder. The support (31) is attached to the mounting bracket using the bolt (32) at the bottom of the set pin. There are threaded holes for Threaded shaft (26) for locking the worm shaft that can be threaded. The locking thread shaft is sealed with a bushing. The rubber shaft (27) is installed in the groove of the worm shaft. and the worm shaft is sealed with a rubber gasket (25) fitted in the groove of the mounting bracket and sealed together with the cover (24) on the bush (28) using twist

F. Road wheel

There are 6 wheels each for pressing the belt on the left and right sides because beams must be placed to support the torque.

Two sides of the tank Therefore, the right belt press wheel is 115 mm behind the left belt press wheel.

Two-edged belt press wheels (Figure 7) have solid rubber covering the outer edge of the wheel.

Two extruded aluminum alloy wheels (34). The assembled wheels are pressed onto a steel wheel hub (35) and fixed with bolts (39) and nuts. Wear-resistant edge (40) is pressed onto the wheel.

Press down on the belt on all wheels to prevent wear on the wheels from the belt guide axles.

The belt press wheel is mounted on a belt press shaft supported by bearings. Because the press wheel Belts 1, 2, and 6 bear a heavier burden of karma, so they are 1 Spherical radial bearings (55) and 2 used. Cylindrical bearing (54), but for belt press wheels 3, 4, and 5, 1 radial bearing will be used. round and 1 Cylindrical bearings only. There is a bushing (36) installed between the ball bearing and the bearing. Cylindrical

To prevent the belt press wheels from sliding along the axis. Therefore, tighten it using the nut (37). Screw the nut onto the belt drive shaft and prevent loosening with the bolt (38). The belt drive hub is Close the labyrinth seal cover (53), the wheel hub cover using the bolts with spring washers and Sealed with a fiber gasket made of YP015 sealant, two self-sealing oil seals (30), installed on the belt drive shaft. with the edge of the seal pressed firmly against the Labyrinth seal. With tweezers (31)

Labyrinth seal cover (53) and Labyrinth seal ring (52) together form a LABIRINT SEAL KIT The seal ring (52) is pressed onto the belt drive shaft and welded to the crank arm.

The outside of the belt press hub is covered with an axle cover (56) which is supported by Fiber gasket made of YP015 sealing material has 6 mounting bolt holes on the belt press axle cover.

It has two holes connected to the wheel hub slots to lubricate the bearings. The two lubrication holes are symmetrically located on the The wheel, with the lubrication hole location being a semi-spherical bulge on the wheel stem. bolt head The lubrication hole cover is painted red for easy identification. Inside the wheel hub was the wax of tank number. 2 GJB4364-2002 Belt press wheels 1, 2, and 6 are designed to carry the burden of karma.

more compared to belt press wheels 3, 4, and 5, but the external appearance of the belt press wheels

Both of these are the same. Therefore, belt press wheels 1, 2, and 6 can be replaced with
Belt press wheels 3, 4, and 5 can be used.

2. Suspension system

A. Torsion bar

The torsion beam (20) is a flexible component of the vehicle's support system (Figure 7).
Round steel bar, one end is grooved to form a long spline all around (long spline) and the other end is grooved.
to be a short spline with threaded holes for fastening on the flange of the long splined end. This
threaded hole is used to secure the cover (2) with the bolt (1).

A torsion beam with a long grooved end is connected to a crank arm. and opposite side
That is, the short grooved end is combined with the crank arm
bush (45), snap ring (5) and cover (2), used to protect the beam from receiving torque from
Axial movement

This is because one end of the torsion beam is fixed to the crank arm and the other end
One side is attached to the bush. When the belt press wheels move on uneven terrain Make the crank arm
rotates, causing the torsion beam to twist. Therefore, it reduces shock and vibration.
that is broadcast to the vehicle

Both the left and right side torsion beams cannot be replaced. Torsion beams
The left side is marked "L" and the right torsion beam is marked "R" at the end of the long groove. Coat
the smooth surface of the torsion beam with a 1.5 mm thick layer of polyurethane material to
Prevent damage to the surface.

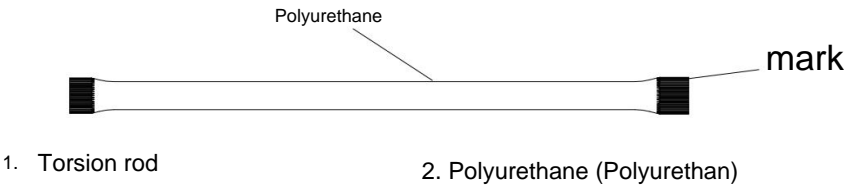
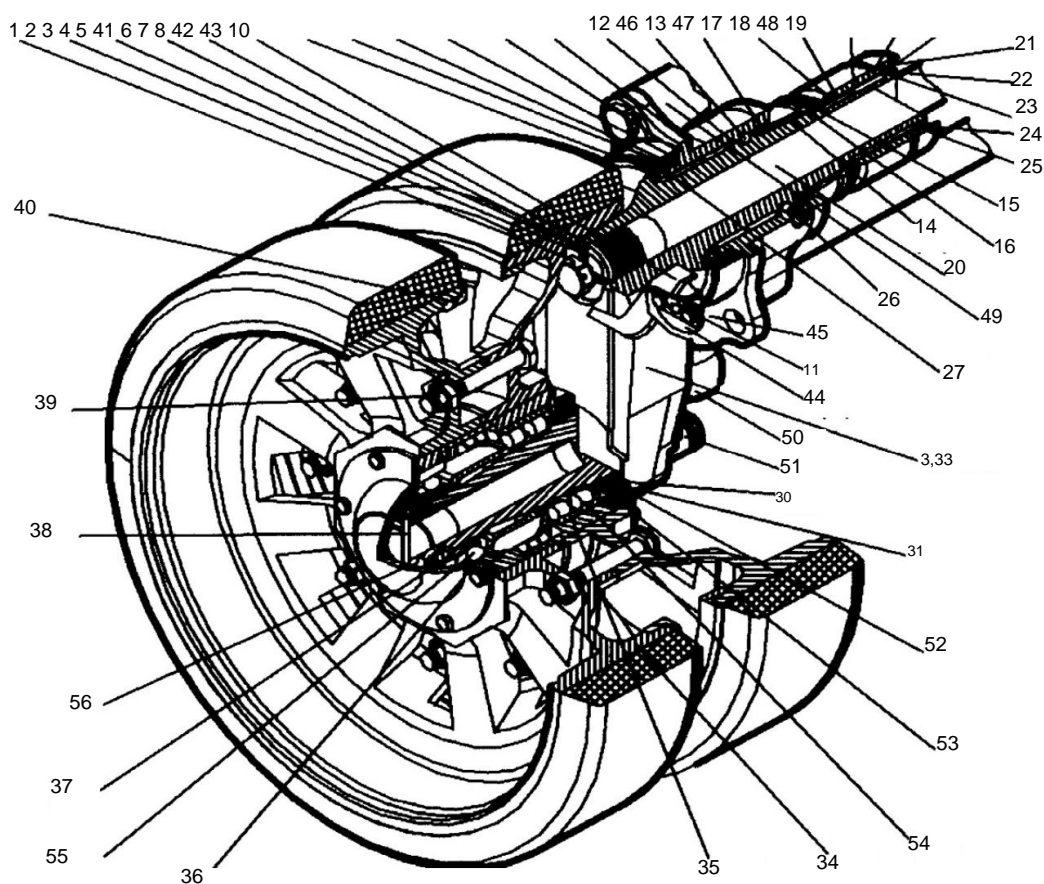


Figure 7 Torsion bar assembly

B. Balance arm assembly The balance arm assembly

is an integrated part. which consists of crank arm (32), crank arm bushing (45), bushing (14) and outer ring of bearing (17). Crank arm (32) produced By means of forging (forging) with a crank shaft. and the belt drive shaft are all in one piece.

The crankshaft is designed with an inner spline for assembly with the torsion beam (20). The crankarm is welded to a B-seal. Rin (52 and 42) and sweeping lever (41) which are welded with wear-resistant material. The sweeping wand is used for cleaning Cleanliness of mud on vehicle sides on belt press wheels



- | | |
|--|--|
| 1, 39. Bolt (Bolt) | 34. Wheel disk |
| 2. Cover (Cover) | 35. Wheel hub (Hub) |
| 3. Rubber gasket | 37. Nut |
| 4. Washer (Washer) | 38. Carved (Pin) |
| 5, 6, 21. Snap ring | 40. Protecting rim |
| 7, 23, 30. Self-sealing seal | 41. Scraper |
| 8, 22, 31. Leaf spring (Spring) | 42, 52. Labyrinth oil retainer ring |
| ¹⁰ . Adjusting shim | 43, 53. Labyrinth oil retainer cap |
| 11. Rubber plug | 44. Clamping bush |
| 12, 16, 18, 19, 27. Spacer ring | 45. Balance arm bush 46. Ball bearing |
| 13, 15, 48. Seal ring | 47. Needle |
| 14, 36. Bracing bush | bearing |
| 17. Outer ring of the bearing (Outer race) | 49. Bracket |
| 20. Torsion bar | 50. Press (Ram) |
| 24. Spacer collar 25. Sector | 51. Connecting pin |
| piece | 54. Cylindrical bearing (Roller bearing) |
| 26. Screw plug | 55. Ball bearing 56. Shaft cap |
| 32, 33. Balance arm | |

Figure 8 Road wheel and suspension system

Connecting the crank arm to the hydraulic damper The connecting pin (51) is pressed into crank arm pairs 1, 2 and 6. In addition, in striking the piston rod of the stopper, the ram crank arm (50) is pressed. also pressed into the crank arm. The crank arm rotates through bearings, needle bearings (47) in the bushes (45) and outer rings of the bearings (17). The ball bearings (46) are used to limit the Move along the axis of the crank arm.

The crank arm bushing (45) is designed to have a spline hole in the hole to hold the end of the groove. The short groove of the torsion beam has four threaded holes on the coupling flange of the bush. Fixing bush to the crank arm mounting base (49) through these 4 threaded holes. Clamping bush (44) is pressed into the coupling flange. Bush's leech The bush clamp is designed with a through hole for driving. The damaged torsional beam can be removed. This hole is sealed with a rubber stopper (11). The bearing outer ring (17) is fixed on the crank arm by a ring (24) and a three-piece piece. Section (25) The bearing is also sealed. Labyrinth seal (42 and 43 together), wax-proof seal with spring (7 and 23) and Sealing rings (13, 15 and 48). The self-sealing seal is securely fixed with abrasive rings (6 and 21).

The crank arm bush and bearing outer ring are installed in the mounting holes of the crank arm mounting base. crank (49) with the support of the bush (45). The crank arm assembly is also fixed on the crank arm mounting base. 4 bolts. The bolts are locked with special washers and latches.

To make sure the belt press wheels are aligned. The adjustment shim (10) has been Installed between the coupling flange of the crank arm bush and the crank arm mounting bracket. Belt press wheels 1, 2, and 6 work together with hydraulic press arm stops to cushion bumps and limit the twist angle of the beam. Torque The mounting angle of the crank arm relative to the torque beam is marked at . matching car side

The needle bearings inside the crank arm assembly are lubricated. through the hole in the crank arm mounting base There is a screw plug to cover the lubrication hole. Every crank arm must be filled with tank fluid.

No.2 GJB4364-2002 approximately 120-200 grams

The crank arm 1, 2 and 6 on the same side of the tank are interchangeable. that are compatible and so are crank arms 3, 4, and 5. The difference between the left crank arm And the right side is the installation location of the sweeper. Because the crank arm 1, 2 and 6 Designed with a shaft that drives a hydraulic damper and a ram that drives with hydraulic press arm stopper Those crank arms are therefore different from crank arm 6 in case of 3, 4 and emergency. Allows interchangeability of corresponding crank arms on both sides. or change the joint arm Crank numbers 3, 4, and 5 with the crank arm that 1, 2 and 6

C. Hydraulic shock absorber

Hydraulic vibration dampers function to dampen vehicle vibrations and absorb
Absorbs part of the shock transmitted to the vehicle while the vehicle is moving on uneven terrain.

The tank is equipped with an Arm-vane type hydraulic vibration damper.

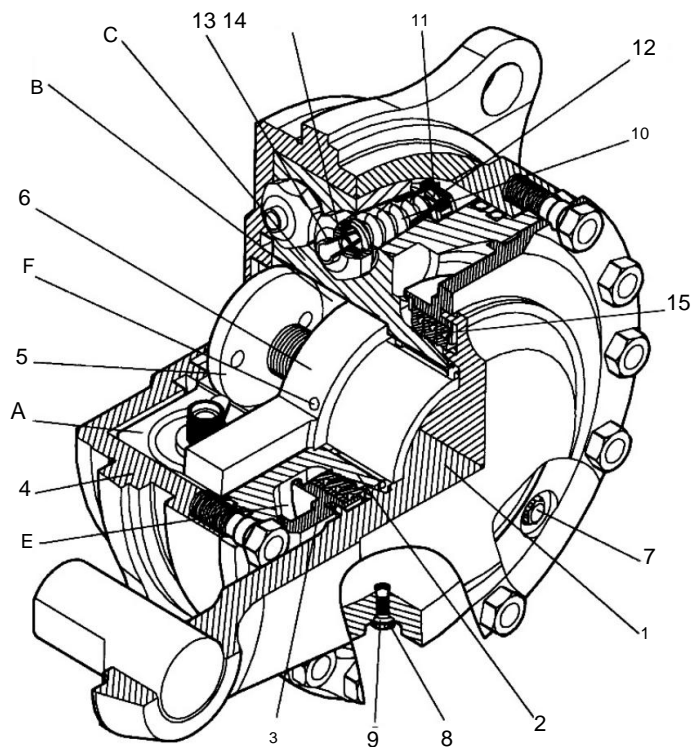
6 sets of hydraulic absorbers, 3 sets on each side of the vehicle near the belt drive wheels. 1, 2 and 6

The hydraulic damper consists of a housing (4), a plate (2), an impeller (6), an extension
arm (1), along with a shaft and a cover (3). (Figure 8) The propeller is mounted on the shaft shaft groove.
and secured with a screw plug (5).

The interior of the hydraulic damper housing is divided into four work rooms A and B by
the impeller and the protrusion C of the baffle or 4 work rooms in two groups

They are connected to each other through hole F on the propeller shaft.

There are two valve units in the protrusion of the baffle. Each valve set consists of
Positive stroke valve (13), leaf springs (12 and 14), negative stroke valve (11) and leaf springs (10).



- | | |
|---|---|
| 1. Connecting arm | 12, 14. Spring seat |
| 2. Spacer plate | 13. Positive stroke valve |
| 3. Cover (Cover) | 15. Self-sealing seal (Self-sealing oil seal) |
| 4. Vibration relief engine housing (Body) | E. Compensatory oil room (Compensating chamber) |
| 5. Screw plug | A, B. Working room (Operating chamber) |
| 6. Vane (Vane) | C. Protrusion of the partition (Protruding portion of spacer plate) |
| 7, 8. Screw plug | F. Oil hole (Hole) |
| 9. Washer (Washer) | |
| 10. Leaf spring (Spring) | |
| 11. Negative stroke valve | |

Figure 9: Hydraulic shock absorber

The coupling flange of the baffle (2) and the inner surface of the cover (3) form

It is a compensatory oil room. (Compensating chamber) E to collect working fluid that leaks from the working chamber through the gaps between parts and add working fluid to the chamber. work The compensating oil chamber and the working chamber are connected through two beveled holes. Each hole is equipped with a one-way valve.

To protect the working room from oil Flows to the compensatory oil room. The one-way valve is secured with a screw cap. and holes to prevent falling out The compensating oil chamber is sealed with three self-sealing oil seals.

The body (15) is installed in the cover (3). The vibration damper uses a working fluid, namely hydraulic oil.

SAO-26-1 approximately 2600 cubic centimeters. Threaded plug (8) used to close the hole for filling working fluid.

There is a hole on the cover to bleed air while adding working fluid. Screw plug (7) is used to cover the bleed hole and washer.

Aluminum (9) is under the screw cap. There is no need to add additional working fluid to the relaxer.

hydraulic vibration

The hydraulic damper is mounted to the vehicle with 4 bolts.

(1) (Fig. 9) The bolt is locked with a stop washer (14) and a pin (2). Bolt tightening torque

Every thread is 1,000 – 1,200 Newton-meters (N·m).

The hydraulic damper is connected to the crank arm via a pull arm (4) and upper and lower hinges

(Fig. 9). The side hinge The upper consists of the coupling shaft (3), shaft bushing (5) and pull arm bushing (6). The plane on the coupling shaft is used to prevent it from slipping. Let the inner shaft bush rotate. and a slot at the top end of the pull arm (4) can limit the rotation of the pull arm bush (6). A mounting cover (7) is also mounted on the power coupling shaft.

Two bolts (8) with spring washers to prevent

The shaft bush, tension arm bush, and tension arm have come loose from the power shaft. The bottom hinge consists of a bushing.

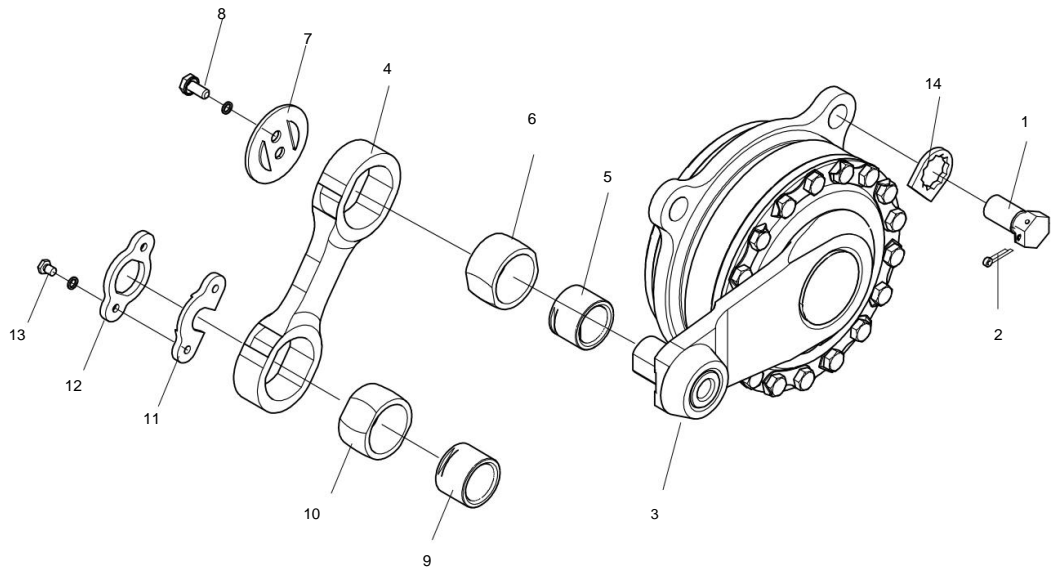
Inner shaft (9) and outer pulley bush (10) The plane on the crank arm power shaft is used to

Prevents the inner shaft bush from rotating. and the hole at the lower end of the pulling arm (4) can limit the rotation of

Outer tension arm bush (10)

The pull arm (4), inner shaft bush (9) and outer pull arm bush (10) are held in place by plates.

Stop (12) and snap plate (11) to prevent the crank arm power connection shaft from coming off.



1. Bolt (Bolt)

2. Pin (Pin)

3. Connecting arm (Connecting

arm) 4. Pull arm (Pull arm)

5. Shaft bush 6. Pull

arm bush 7. Fixing cover

8. Bolt 14. Stop

washer **Figure 10 Components of crank arms and hydraulic dampers.**

9. Inner shaft bush

10. Outer pulling arm bushing

(Outer pull arm bush)

11. Snap plate

12. Stop plate (Bolt)

13.

The working principle of the vibration damper is as follows (see Figure 11): When the tank

Passing over an obstacle that protrudes from the road surface will cause the belt wheel to lift up relative to the road surface.

The vehicle body causes the crank arm to rotate and drives the connecting arm of the vibration damper to rotate.

upwards (positive stroke) through the pull arm. In this case, the propeller (8) connected to the pull shaft rotates accordingly.

as well, at the same time Pressure is created in work room A when the pressure rises to a level.

One, the positive valve (15) opens and the liquid flows to work chamber B under pressure.

Through the circular space between the valve (15) and spring seat (16) and hole K on the negative stroke valve (13), when

the pressure decreases The positive valve will close. Liquid flows only through holes K when the wheels press on the belt.

moves down relative to the vehicle (negative stroke), the propeller rotates in opposite directions. As a result, pressure builds up in the room.

Work B Now the positive stroke valve closes under the force of the leaf spring (12), so the liquid flows.

From room B to work room A only through the delay hole K, the friction force resulting from the transmission of

Liquid passes through holes in the valve causing resistance. Under the action of such resistance

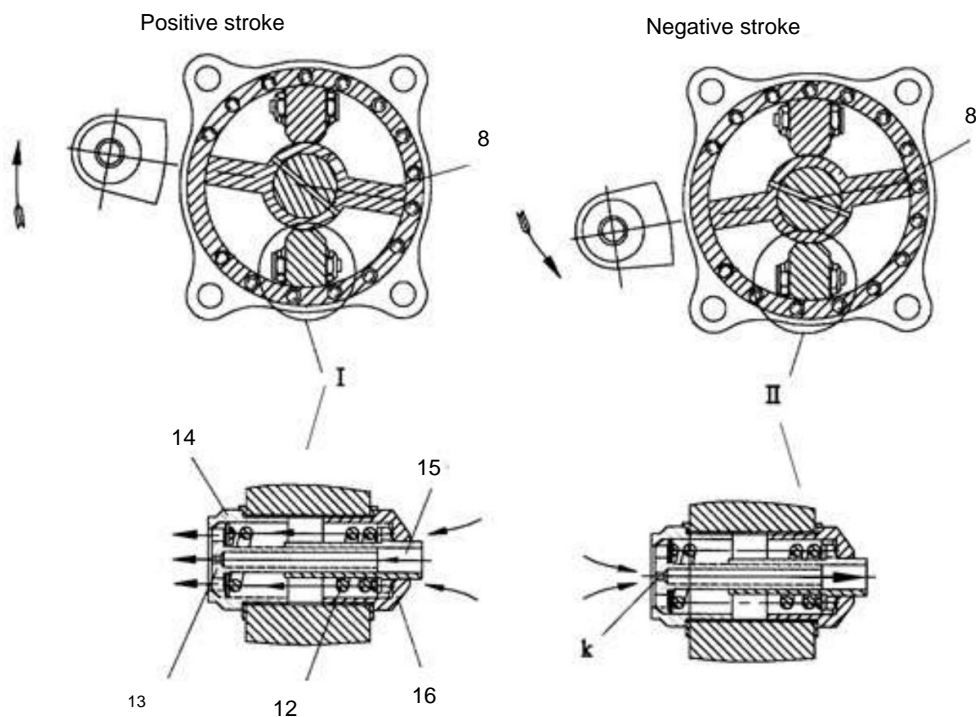
Resulting in reducing the vibration of the vehicle.

Vibration dampers must be installed according to the numbers marked on them.

Vibrations marked "L123" on the connecting arms must be installed on belt pulleys 1, 2, and 6.

Left side of the vehicle Meanwhile, dampers marked "R123" must be installed on the wheels.

Press belts 1, 2, and 6 on the right side of the vehicle.



8. Propeller (Vane)

12. Leaf spring (Spring)

13. Negative stroke valve

(Negative stroke valve)

14, 16. Spring seat

15. Positive stroke valve
stroke valve

K. Damping hole

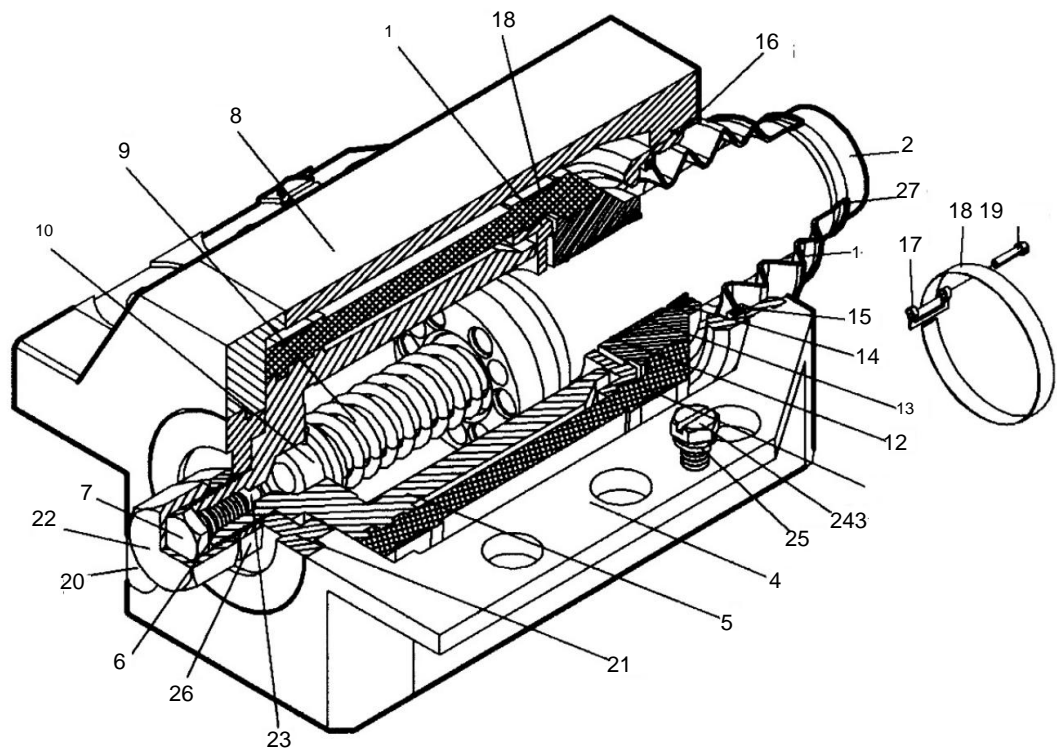
Workroom A, B (Operating
chamber)

Figure 6: Working principle of a hydraulic vibration relief machine.

(Operation principles of hydraulic shock absorber)

D. Hydraulic buffer (Hydraulic buffer)

Hydraulic belt press arm stop Consists of cylinder housing (5), piston assembly (2), rubber bushing assembly (3), housing (4) and cover (8) (Fig. 12). Press-mounted wheel arm stop. It attaches to the vehicle with six bolts.



- | | | | |
|---------------------------------------|--|---------------------|--------------------------------------|
| 1. Dust jacket | 2. Piston assembly | 16. Support sleeve | 17. Clamp |
| 3. Rubber bush Assembly | 4. Housing | 18. Clamp strap | 19. Clamp bolt |
| 5. Cylinder body | 6. O-ring O-ring) | 20. Rubber plug | 21. Bushing |
| 7. Screw | 8. Stop cover (Buffer cover) | 22. Nut | |
| 9. Leaf spring (Spring) | 10. Cylinder rod (Guide rod) | 23. Stall ball | |
| 11. Supporting disk (Supporting disk) | 12. O-ring and Separator (O-ring and baffle) | 24. Bolt (Bolt) | |
| 13. Wear sleeve | 14. Dust ring | 25. Washer (Washer) | |
| 15. Snap ring | 16. Support sleeve | 26. Nut | 27. Anti-loosening wire (Steel wire) |

Figure 7: Hydraulic buffer arm stopper

For belt presses 1, 2, and 6, when the ram on the crank arm moves upward and collides with the head of the push arm stop piston rod. The press arm stop will work. As the pusher pushes the plunger from the bottom to the top. The piston moves upward, then the liquid between the piston head (2) and the cylinder housing (5) is compressed, causing the liquid to flow through.

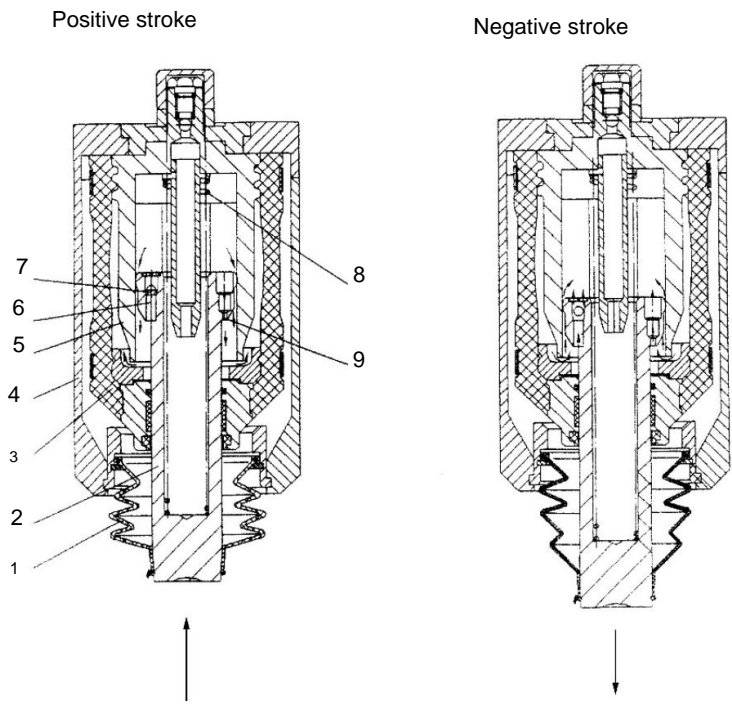
The circular space between the cylinder body and the three holes B on the piston head (Fig. 8) to the bottom of the body. Cylinder and the gap of the rubber bushing (3). Because hole B is small, when the liquid flows through the hole B therefore creates resistance on the piston. When the crank arm pusher moves away from the piston rod head

The piston rod moves down under the force of the leaf spring (8). At this moment, the liquid under the piston head and inside

The rubber bushing assembly not only flows through the space between the piston rod's piston head and the cylinder housing and

The three holes B on the spherical head of the piston rod only But it still flows through a one-way valve hole with a round steel ball. (Check valve) A, all 6 holes (at this time the one-way valve hole is in the open state) because the size of hole A is quite large.

large, the fluid flows quickly back to the space above the piston head. Return the piston rod to original position



- | | |
|-----------------------------|------------------------------------|
| 1. Dust jacket | 6. Hole |
| 2. Piston (Piston assembly) | A 7. Round steel ball (Steel ball) |
| 3. Rubber bush assembly | 8. Leaf spring (Spring) |
| 4. Housing | 9. Hole B |
| 5. Cylinder body | |

Figure 8. Working principle of the hydraulic press arm stopper.
(Working principle of hydraulic buffer)

Chapter 14

Electronic and electrical systems

(VEHICULAR ELECTRONIC AND ELECTRICAL SYSTEM)

When 1

the vehicle information system (VEHICULAR INFORMATION SYSTEM) is discussed

1. in general (General),

the vehicle information system has a concept that comes from the need for information. Information from every vehicle system by creating a data platform that is based on a network of data transmission lines at many points and using F. The crew monitor is the backbone. The system is responsible for sending and receiving data, processing, analyzing and Use aggregated data The system is effective in controlling and managing the overall data flow. Inside the tank and between tanks, with the crew as the mainstay in controlling and coordinating the work of various systems. The system monitors the operating mode and determines the location. Modify all of the tank's secondary systems to increase the tank's overall command and support capabilities. You can also check the battlefield conditions. and can coordinate battles through the

command system between other tanks. The vehicle's information system consists of the following secondary systems. Electronic systems Integrated communication and control and command system Communication system The command and control system includes the IFF system, radio sets and combat management software, etc. The integrated electronic system consists of The sub-components are as follows: Control screen for the vehicle commander's situation. Driver's monitor Data collection unit Data transmission lines,

monitoring sensors, and internal data transmission networks. The system uses a CAN bus network structure with two layers of duplicate data separation. (Double-redundancy) and consists of 3 levels of control area network: vehicle data network, contact control data network. communicate and fire control and protection networks. For system components, see Figure 1.

complete

C. Fire control and protection network (Fire power protection bus) connected with operator situation display, fire control computer (FCS), control unit Active defense, automatic loader control unit, NCC control unit, fire control and defense network. The organization can check the status and control

The operation of weapons and defense systems is complete.

D. The operator's situational display is connected to the radio set via the serial port, creating Digital communication between the tank operator's situational monitor and the driver's monitor. Connect to the data network (CAN bus) to create internal data links with electronic devices. or electrical equipment installed throughout the vehicle and navigation systems, etc., at the same time the control screen

The operator's situation can also be transferred between tanks and voice communication via the system. radio and achieve real-time cooperation of the fire network. Exchanging information with each other and between mobile fighting platforms and between

Mobile combat platform with battlefield information system

E. The driver's display is a means of exchanging information on the vehicle data network and Communication control network The operator's situational display is a means of exchange. Communication control network information Fire control and defense networks

2. Technical characteristics

A. Technical characteristics of the system (System technical parameters)

Table 1 Technical characteristics of vehicle information systems

(Technical parameters of vehicular information system)

number	Features	Technical information
1	System startup time	≤90 seconds
2	How to connect (Bus interface)	The network sorts out duplicate data in two layers. (Double-redundancy CAN bus), uses CAN2.0B
3	How long the system has been running continuous	≥12 hours

number		Technical information
4	Characteristics Average time since damage until it can be used each time (MTTR)	MTTR ~30 minutes
5	Data collection (Information storage requirements)	Record data within a 12-hour cycle. Message storage: ~300 copies (calculated according to usage criteria A battle message with 1,000 characters of data content is one copy.) Map storage capacity: ~40 maps (calculated based on size The area of each map is 20 km × 20 km. The scale is 1: 50000)
6	screen	10.4 inches; Monitor resolution: 1024×768;
7	supported map file formats	Jpg electronic map file (internal to the system);
8	map display scale	The map can be enlarged and reduced with the push of a button.
9	Software	VxWorks embedded multi-task real time operating system
10	Electrical power used	Direct current 28 volts according to GJB military vehicle specifications. 298A-87
11	Trust	Average time before each failure, hours; (MTBF): ~160 Continuous working time: ~12 hours
12	weight	~50 kg

B. Data network technical information (CAN bus)

The system is divided into 3 data networks (CAN bus): control network communications, vehicle data network, fire control network and system protection. Connect the driver's monitor, engine electrical control system, brake electrical control system, fire extinguishing and explosion protection system control box, electrical system. Control the speed changer, signal collection unit through the vehicle network data transmission line. Connect to the situation control screen of Vehicle operator Satellite navigation device Inertial navigation device and system control screen Authenticate Faction (IFF) over the communications control network and connect to the situation control screen of the vehicle commander NCC protection equipment, FCS fire control computer, ammunition loading machine automatic and active defense equipment through fire control and defense networks.

Table 2 Data network technical data (CAN bus technical data)

number	list	Technical information
1	Network type	Double-redundancy CAN bus
2	Speed of receiving and sending data	250kbps
4	Network standards (Bus agreement)	CAN2.0B

C. Technical data of the commander's mission control screen terminal)

Table 3 Technical data of the operator's situation control screen

number	Equipment	Technical information
1	Power supply unit (Power supply module)	Direct current 20-32 volts (DC/DC20-32V)
2	Motherboard module (Master board module)	CPU: Pentium M, main frequency: 1.4GHz Memory: more than 1GB Storage capacity (Electronic disc): 32GB Keypad: Position the keys in an "L" shape and have a total of 36 (9+27) keys. Network connection: 1-wire Ethernet, 10/100Mbps Serial connection: 3 wires according to communication standards. RS232/422/485 USB connection port : 1 channel according to USB2.0 communication standard.
3	LCD monitor	Size: 10.4 Inch (238.5 mm.x177.8 mm.x 11.2 mm.) Input: Standard 8-line differential LVDS. Resolution: 1024x768 Brightness: 300 cd/ m2 Number of displayed colors: 65536 colors
4	Software	real-time multi-mission operating system VxWorks 5.4 with programming language C++
5	Network connection CAN	2 double-redundancy lines

Table 3 Technical data of the operator's situation control screen - continued.

Order of	equipment	Technical information
6	Energy use The whole system	~100 watts
7	Power supply (Power supply adaptation)	Direct current 28 volts according to military vehicle specifications. GJB 298A-87
8	weight	~8.6 kg

D. Driver's mission terminal technical information

Table 4 Technical data of driver's mission terminal

number	Equipment	Technical information
1	Power supply unit (Power supply module)	Direct current 20-32 volts (DC/DC20-32V)
2	Motherboard module (Master board module)	<p>CPU: Motorola PowerPC series, main frequency: more than 300MHz.</p> <p>Memory: more than 128MB</p> <p>Program size: more than 32MB.</p> <p>Storage capacity: more than 2GB</p> <p>Video output connection: 1 line of LVDS output interface, supports true color resolution 1024×768</p> <p>Keypad: 1 line of PS/2 keyboard interface.</p> <p>Network connection: Single line, 10/100Mbps Ethernet. Serial connection: 2 lines of RS232 interface of 8-wire system.</p> <p>USB connection: 2 lines, according to USB2.0 communication standard.</p>

number	Equipment	Technical information
3	LCD monitor	<p>Size: 10.4 Inch (238.5 mm.x177.8 mm.x11.2 mm.)</p> <p>Input connection: Standard 8-line differential LVDS.</p> <p>Resolution: 1024x768</p> <p>Brightness: 300cd/m²</p> <p>Number of colors displayed: 65536 colors</p>
4	Software	<p>real-time multi-mission operating system</p> <p>VxWorks 5.4 with programming language C++</p>
5	communication module (Communication module)	CAN bus interface: 2 lines.
6	weight	8.6 kg

3. Components and working principles

A. System components

The vehicle information system consists of the following secondary systems:

Integrated electronics and command and control communications systems

Command and control communications include departmental verification systems. (Prove that the target friendly or enemy), combat management software and radio sets, etc. Integrated electronics including location control screens Operator's situation, vehicle's display

Driver, data collection unit Data transmission line Measuring device The system works with the electrical system. that controls the engine, brakes, speed converters and fire extinguisher and deterrent control boxes.

Explosions, satellite navigation systems, inertial navigation devices, field verification systems, equipment NCC defense, fire control computer, automatic ammunition loading system, active protection system through the information network

The vehicle information system consists of a standard data transmission platform. Extensive data exchange, analysis and use on all secondary systems for

Propulsion, weapon use, protection, navigation, etc., using the crew's mission as the axis.

Principles based on the network to transmit and receive various data and make various systems work together and

Share resources of all secondary systems, Figure 1

Shows a diagram of system components.

B. Working principle

The main functions of the system are twofold: internal data collection, processing, and data exchange between each other. Application of information to operating systems for propulsion, weapons use, protection, navigation, etc., and external data communication with vehicles.

other combat operations and exchange information with battlefield information systems.

1) Commander's mission terminal

a) Functions of the operator's situational control screen

Can transmit military orders, documents, and situational information to other vehicles.

Battle messages can be created and sent quickly. Mark and draw diagrams. Manage maps.

Electronics Collect data and be able to provide information for decision making.

It can receive information such as battle orders and operations sent from the command level.

Higher level commanders, etc., can report various requested information. Information about the status of the vehicle itself

Support information to a higher level of command, such as the number of ammunition, the amount of fuel

or engine oil, the number of crew injuries or deaths, the location of the vehicle, etc.

Can set bus routes Set departure warning parameters. and send it to the screen of the driver

who is at a lower level. to instruct the driver to follow a specified route. If necessary, the commander can transmit

received combat orders and situation information to the driver. I

Can receive and display various information. about the condition of the vehicle, the situation in

Battlefields and digital maps Information about the vehicle's health, including vehicle speed and

Related system errors Notification information Information about the situation on the battlefield, including

Situation map of the enemy's location - the location of our vehicle. battlefield topographic map Walking route map

The car can be enlarged/reduced. and scroll left/right You can view the top/bottom of digital maps and situation maps.

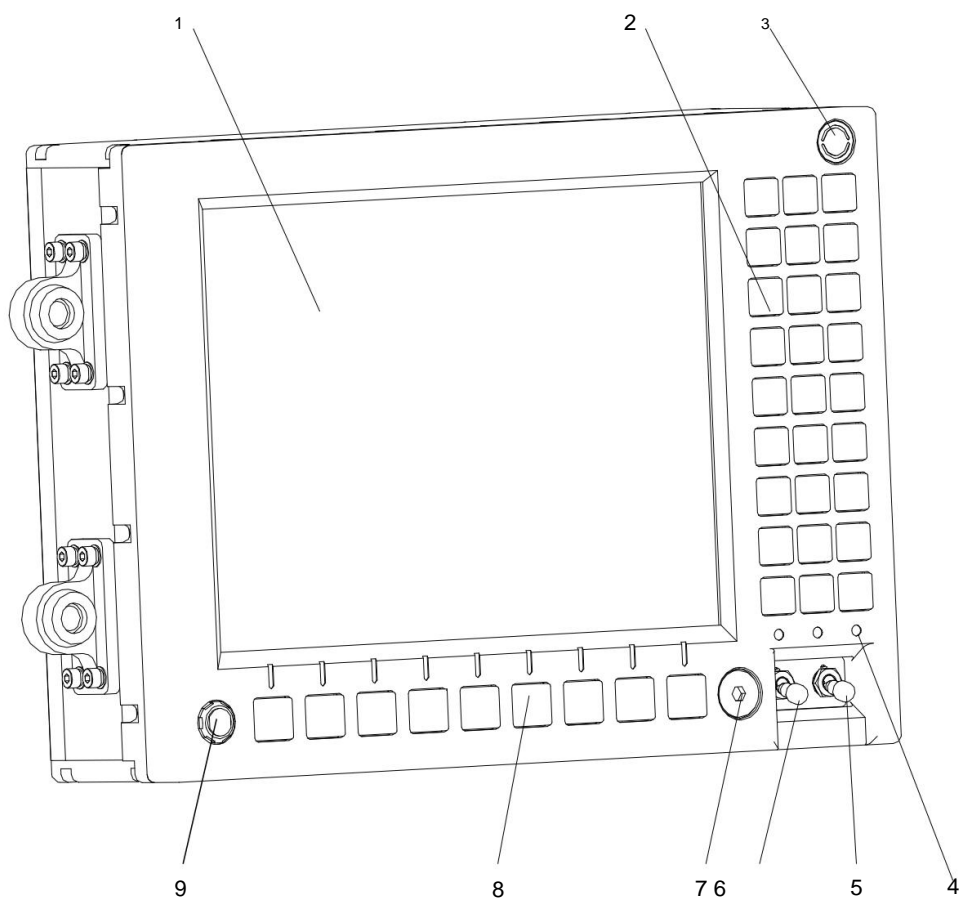
The system time can be set to synchronize with the navigation system. It has the function of receiving and displaying information about inertial positioning navigation, GPS navigation and hybrid navigation. Can show location Tanks on the course of the tank's movement (Course) and recording the path the vehicle has traveled (track), warning of departure from the course (Yawing alarm), etc. can be received. Displays information on vehicle status, operating mode, number and type of ammunition of the fire control system. Automatic ammunition loading system and transmit vehicle speed information, commands from the northern unit, etc. to the fire control computer and related operational control commands to the fire control unit. Automatically loads ammunition. Can receive, display laser alert information. Controlling the firing of smoke grenades (Smoke grenades) and grenades (Shrapnel) at various firing pipe positions and display information Status of the grenade loaded in the launch tube and the results of firing the smoke grenade and launch grenade. The operator's situation control screen is responsible for checking for abnormalities. Related systems of the vehicle and the vehicle's information network system can test and Shows the working status of all devices with a network diagram (Nodes) and has functions.

Show error warning

b) Components of the operator's situational control display The

operator situation display is mounted on the right front of the operator in

Turret Characteristics of the control screen for the operator's situation, see Figure 2.



1. Image display screen

2. Control buttons (27 buttons)

3. Data delete switch

4. Monitor signal light

Power supply switch 5.

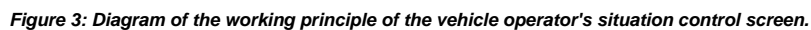
6. Dehumidification switch 8. Menu buttons for selecting items (10 buttons)

7. Battery box

9. USB device connector

**Figure 2: Controller's situation screen.
(Commander's mission terminal)**

Shows a diagram of the operating principle of the operator's situation control screen.



• Power supply module

The power supply module provides redundant power supply for Control screen for the entire system. This is the basis for the normal operation of the control screen, and affects Reliable Electromagnetic compatibility (electromagnetic compatibility) and Safety of the device.

The system power supply module uses international advanced DC/DC module power supply design. It can still work normally even if the input voltage of the tank power supply will change greatly within the DC voltage range of 20 - 32 volts, and when it occurs surge voltage. Can meet the requirements for an unsafe electrical environment.

Favorable for tanks. You can protect yourself when there is an abnormality with the vehicle's power supply, such as

The power supply is connected incorrectly or there is a short circuit, and can automatically restore normal operation when the vehicle's power supply returns to normal operation. In addition, to reduce interference from the light bulb circuit

The back light circuit of a liquid crystal display screen (from using a 12 volt power supply). Therefore, that interferes with other electrically powered the ground of the 12 volt power supply is completely isolated.

Circuits, completely from the ground of 5 volt and 3.3 volt power supplies, as well as the power supply system. Car power supply

Both vehicles must avoid the back light circuit.

In order not to affect the power supply system of the entire vehicle when the monitor is turned on.

• Master board module

It consists of CPU, internal memory, storage, display interface, keyboard interface, network interface, network interface, Serial, USB interface and battery interface, etc.

• Bus communication board module

The communication network circuit board uses a standard 3U CPCI bus reinforcing board structure. The module consists of 2 RS232 connection cables (8-wire system) and Connect to network double-redundancy CAN bus, 2 lines

• Liquid crystal display screen (Liquid crystal display screen)

Size: 10.4 inches (238.5 mm. x 177.8 mm. x 11.2 mm.)

Signal reception connector: Standard 8-line differential

LVDS. Resolution: 1024x768

Brightness: 300cd/m²

Number of colors: 65536 colors

Required power supply and power consumption: 3.3±0.3 volts, 0.7±0.2

watts for liquid crystal display circuit. and back light circuit (Back light circuit) • Touch screen (Touch screen)

Resistor type touch screen. A 5-wire wiring system is designed and installed on the front panel of the situation control screen. of the operator to use and control command input by touch. Resistive touch screen Use the pressure sensitive principle. (Pressure-sensitive principle) can be used even when Wear gloves when driving. Resistive touch screens use analog to digital signal conversion.

(A/D changeable handling mode) The connection board is simple and high-definition. •

Keyboard module The keyboard module

circuit uses standard connection. PS/2 screen to provide reliable connections for all button circuits. To avoid manufacturing errors and assembly problems, a flexible circuit board consisting of both rigid and soft components is used. To be used for connection between all push button circuits. Between the entire keycap circuit and the USB port, the keyboard module's keycaps are made of a special rubber material. Has waterproof, dustproof, and splash-proof properties. and better protection from electromagnetic waves The slim keys are easy to assemble and install. A light source is designed inside the keys to emit light to help the operator. The vehicle can be operated with a keyboard without turning on the lights if there is not enough light inside the turret. enough

• Bottom board module The bottom board module supports the main board module and the module. Expansion circuit board It also provides electrical inputs and outputs. The CPCI bus provides mutual communication for the motherboard module and the printed circuit board module. Expanded on the bottom plate. CPCI bus is a type of high speed signal bus. The circuit board module below complies with Electrical standards defined by the CPCI bus interface architecture and applicable design specifications. Strict requirements for the operation and length of certain types of signal cables meet the requirements for conductor impedance. and the insulation impedance of the given circuit board. by relevant standards The lower circuit board module is designed with signal layer, power supply layer, and ground layer according to the CPCI bus standard to avoid mutual signal interference caused by Unstable operation of the control screen, etc. The bottom circuit board module is connected to the input signal cable. and output through a flexible circuit board by combining hard parts and soft parts and connecting them. with wires soldered directly Design and determine the soldering position and length of the wires according to Common location of bottom circuit board modules Input terminals and output terminals to prevent damage Caused by twisting and weakening of the circuit board.

• Software used (Software design) The operator's situation control screen uses a real-time multi-operating system. mission operating system VxWorks 5 . 4 with programming language C++, translating and edit environment Tornado 2.0 and WindML 2.0 interface

Electromagnetic compatibility design (Electromagnetic compatibility design)

electrical and electronic equipment in the commander's situational control display Cars produce frequency signals and electromagnetic interference. Therefore, it must be reduced. electromagnetic interference generated by those electrical devices and prevent their harmonics. Electromagnetic noise is prevented from radiating outside. Methods for reducing this noise include: Blocking electromagnetic field waves (Electromagnetic compatibility shielding) of the control screen housing, how to assemble the component modules. For electromagnetic compatibility, wiring of printed circuit boards, component placement, and compatibility Can be protected from electromagnetism of control screen housings, etc.

Blocking electromagnetic field waves of the control screen housing, etc., includes blocking electromagnetic field waves with the electrical conductivity of the plate. until the housing cover and frame Control panel housing, oxidized housing surface to increase electrical conductivity, installation

of conductive gaskets, panel sealing screen, etc. The electromagnetic compatibility of the component modules depends on the installation. Power supply filter on the input side of the power cable. Module selection Power supply with excellent

electromagnetic compatibility Thorough analysis of the entire circuit PCB design considerations and wiring methods include the following: Proper circuit layout and design, wire-to-wire interference, ground and power distribution. Please provide power, special signal arrangement, data sampling rate and layout. Proper decoupling capacitors. Handling of multiple signals. a lot and noise etc.

C. Driver's mission terminal

The driver's display is a fully computerized system. It is integrated with the motherboard module, interface window module. liquid crystal display Operation control buttons and power supply switching The driver's monitor is responsible for processing vehicle information, displaying results, controlling operations, serving as a window for entering and receiving information, etc.

1) Driver's mission terminal

a) Able to receive and display bus routes sent from the situation control screen of Commander and superior unit orders, forwarded situation information (Retransmitted) from the operator's situation control screen. Can receive and display system time corrections sent. It comes from the operator's situation control screen.

b) can receive and display various signals Sent from the measuring device (sensor) of all equipment on the vehicle, status information, information from instruments and information Warnings sent from all secondary systems of the vehicle. and can collect Record data and report data

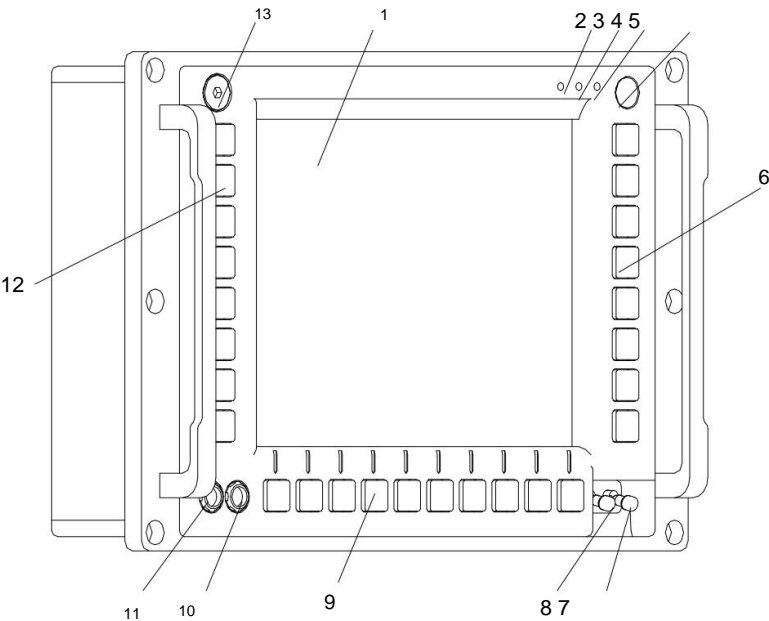
Vehicle support c) Has the duty to check for abnormalities in systems related to the vehicle and bus system. Able to test and display the operating status of equipment at all nodes of the bus and Show notifications

d) When programming the driver's monitor or the main circuit board is unable to function normally, the driver display's emergency interface can display main instrument information. and warning information accurately.

e) Able to record information on the working status of all secondary systems, warning information, information about Error and waste information, etc., to facilitate Subsequent analysis and diagnosis of defects

2)Using the driver's monitor The

driver's monitor is mounted on the driver's control panel, see Figure 4.



1. Information display (Display screen)

2. Light indicating the operation of the heater.
(Heating indicator)

3. Light indicating the removal of steam fog (Defrost
indicator)

4. Light showing the receipt of electric power (Power
indicator)

5. Self-destruct switch (Self-destruction
switch)

6. Special function key (6 buttons)

7. Power switch

8. Defrost switch

9. Menu key (10 keys)

10. USB peripheral device connector

11. Serial connector

(Debug serial port)

12. Function key (10 keys)

13. Battery box

Figure 4: Profile of driver's mission terminal

3) Working principle of driver's monitor

mission terminal)

The driver's display is a fully computerized system, which is integrated with the module Main circuit board Interface module Liquid crystal display, keyboard, and switching Power supply to process vehicle data, display, control functions, Input and output connections, etc. Diagram of the operating principle of the driver's monitor. Refer to Figure 5.

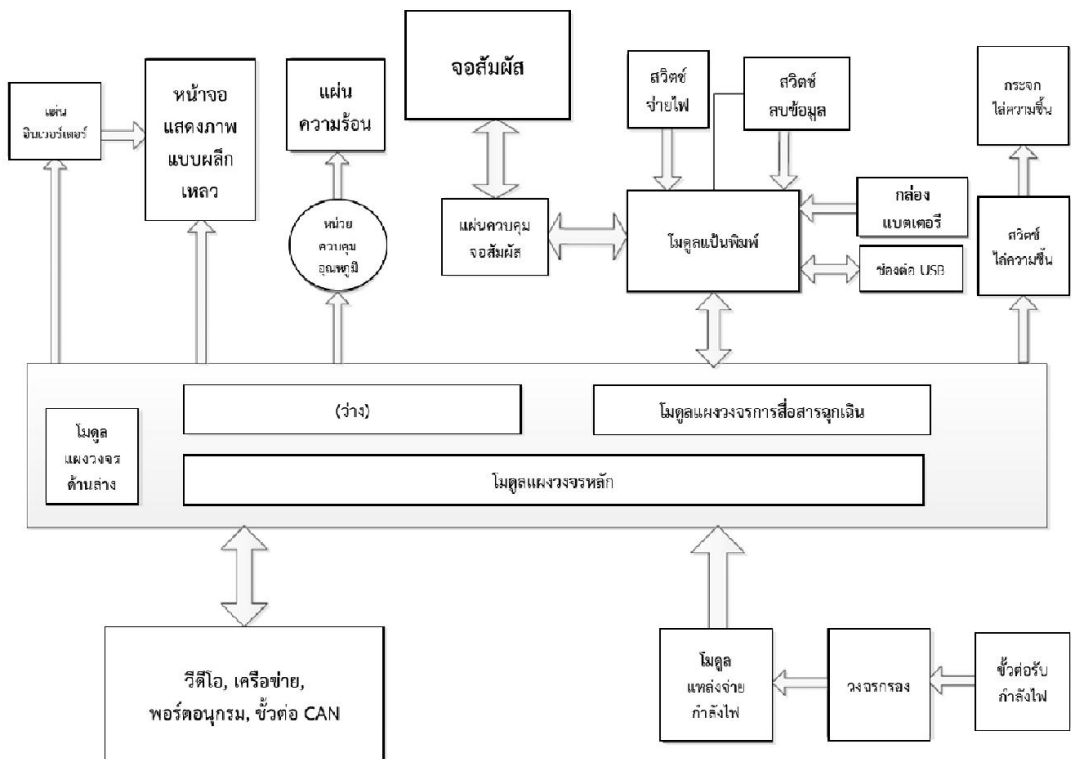


Figure 5: Diagram of the working principle of the driver's monitor.

(Block diagram of driver's mission terminal working principle)

a) Power supply module

The power supply module of the driver's display is the same as the control display.

The situation of the vehicle operator.

b) Master board module

• Bus interface: CPCI bus

• CPU: PowerPC series of Motorola Corporation, main frequency

More than 300MHz.

• Internal memory : SDRAM, more than 128MB

• Program size : more than 32MB

• Storage : more than 256MB

• System Extension PCI bus: Supports no less than 3 32-bit devices to extend PCI , the system via PCI bus.

• Display output connection : 1 LVDS output cable, supports

Color images at a resolution of **1024x768**.

• Keyboard : **PS/2** keyboard type Quantity • 1 row

Network connection: 1 wire, 10/100Mbps Ethernet type

• Serial port : USB 2-wire RS232 connection cable, 8-wire system

connection port: 2 cables, according to USB2.0 communication standard.

Battery: Provides power to the system's clock.

Deleting data: Serves as a window for deleting data.

Power supply and energy use: Supply voltage 5 volts and 3.3

Volts, power consumption 20 watts

Circuit board size: Standard size is 3U.

100 x 160 mm.

Circuit board thickness 1.6 mm.

c) Emergency communication circuit board module (CAN emergency communication board module)

The CAN emergency communication circuit board uses a standard 3U CPCI bus reinforcing board card structure and includes a 2-wire CAN bus interface. If the main circuit board module loss of efficiency The driver display can display emergency results using the CAN bus interface of the emergency communication board, i.e. the vehicle information can be displayed directly on the driver display. Drives through the CAN bus interface to allow temporary use during emergencies.

Bus interface: CPCI bus.

CAN bus interface: 2 wires

Power supply and energy consumption: 5 volt, 3.3 volt and 26 volt power supplies, power consumption does not exceed 5 Wattage

Size of the circuit board: The size of a standard 3U circuit board is 100 mm. × 160 mm. Circuit board thickness 1.6 mm.

d) Liquid crystal display screen (same as the screen of the situation control screen of vehicle commander)

e) Keyboard module (same as the screen of the operator situation display) f) Lower circuit board module (same as the screen of the situation control screen of vehicle commander)

g) Software design

The driver's monitor uses VxWorks as the system software platform, board supporting packages (BSP) and driving programs (including graphs, network, USB, etc.). serial) to edit all system resources. The operation of the software system uses a mechanism. Event-driven information flow and sharing of information across components Managing this information Software consists of a set of components that can receive and transmit data.

h) Design of electromagnetic compatibility. (same as control screen situation of the vehicle operator)

D. Working principle of the signal transmission system (bus system)

The CAN bus information system uses the CAN2.0B agreement standard. Data transmission rate (baud rate) 250 kbps uses frame transmission 0065 extended frame transmission

1) PGN code

A PGN code is a unique identifier based on its physical meaning. different according to the specified rules It takes up 3 bytes. The type and meaning of the CAN data package can be found through this code.

The format of the PGN code is defined as follows:

Reserved PF	PS
23-16 15-8 7-0	

8-bit PF is the data type code, 8-bit PS is the data type expansion code. (data type extended code) When

the PF value is less than 240, the data package is point-to-point type),

PS should be 0,

When the PF value is equal to or greater than 240, the data package is data. Broadcasting

Reserved bit should be filled with 0.

2) Details of the CAN bus information system format. The

CAN bus information system defines a unique number of 29-bit data sets (29-bit identifiers) of CAN. extended frame, which takes up 4 bytes of space, unique number of the set

29 bits of data according to the following table

Reserved Priority level	Reserved	PF	PS/DA	SA
31-29	28-26	25-24	23-16	15-8 7-0

3-bit priority level is the priority level of the CAN data package,

There are 8 priority levels available and 000 is the highest priority level.

8-bit PF is the data type code, 8-bit PF is the target address or data type extended code. When the PF value is less than 240, then PS is the target address DA (when target address is 255, meaning this data is exported data) when the PF value is equal to or more than 240, then PS is a data type extended code 8-bit SA is the address of the CAN bus for the transmission node.

3) Node names for related devices and address numbers (distributed addresses)

Name of device node	Position number (Address)
Commander's mission control screen terminal)	71
Driver's mission terminal Inertial navigator	72
Satellite navigator Fire extinguishing &	73
explosion suppressing control box NBC	74
protection control box Fire control computer Automatic ammunition loader (Auto-loader) Active protection	75
system (Electric control box for engine) Electrical	77
control box of the changer Speed (Electric control	91
box	95
	96
	00
	03
for transmission)	05
Electric control box for brake (Signal collector)	15
	255
Broadcast address	

4) Design of connection hardware

- a) Data transmission rate (Bus transmission rate): 250kbps.
- b) Data transmission mode (Transmission mode: Direct coupling transmission)
- c) Transceiver voltage withstand : Complies with system requirements.

Supply +28 volt power to the tank

- d) Signal separation (Isolation): Design of CAN bus interface circuit.

Photoelectric isolation scheme is used to ensure electrical isolation between the transceiver and receiver.

Signal (CAN transceivers) see Figure 6.

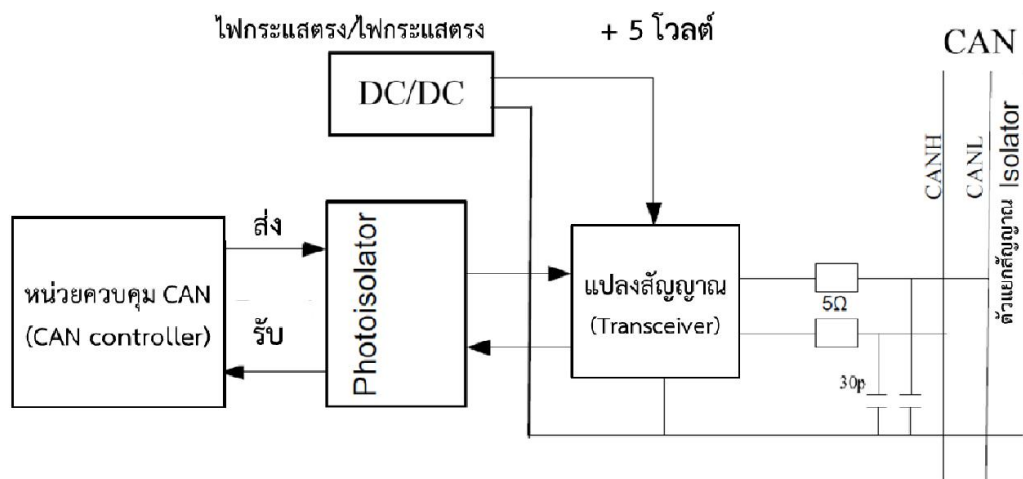


Figure 6: Principle diagram of signal separation design.

(CAN bus isolation design principal block diagram)

• Type of CAN bus cable

Use a 3-core signal cable; The signal is set to CANH, CANL, isolated ground.

• End connector

There is a resistor attached to the CAN bus terminal.

E. Information collector. The information collection unit is

used to collect vehicle conditions. Support information Warning signs and

Status information, etc. inside the vehicle, which can handle various sensor signals. and status information

the vehicle and can report the processed data to the driver's monitor for display on the screen.

of the driver

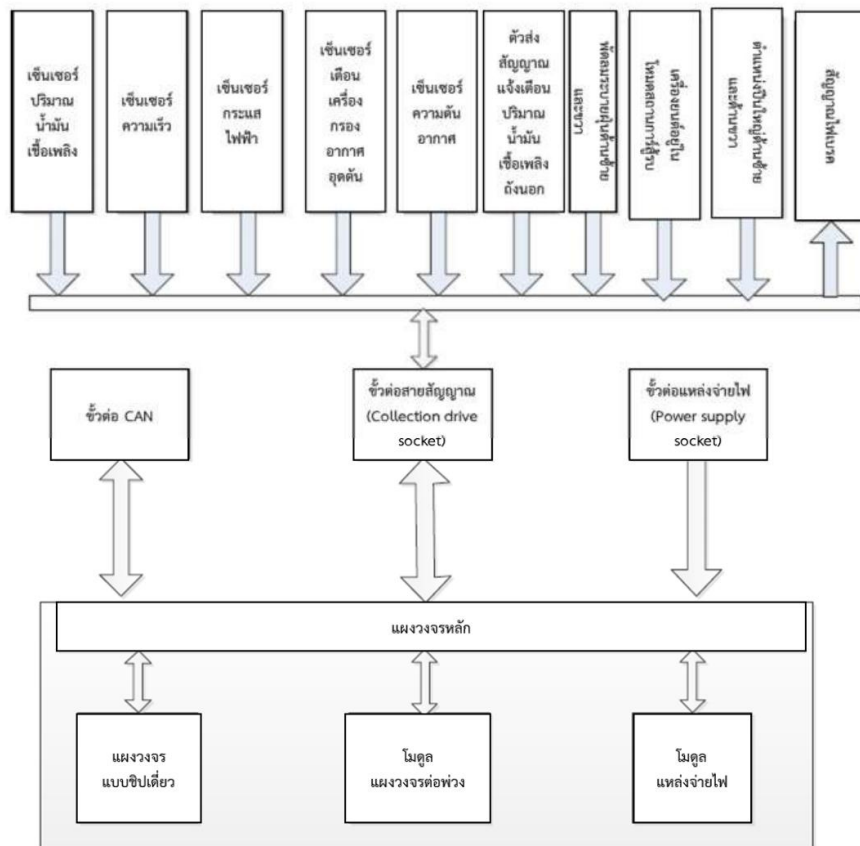


Figure 7: Information collector block diagram

1) Power supply module

The power supply module provides a secondary power supply for the data collection unit. The module
The power supply is fundamental to the normal operation of the data collection unit, affecting its reliability.
Electromagnetic compatibility and safety of the equipment

The power supply module is a DC/DC modular power supply.
The power supply of the vehicle can still function normally when the voltage changes greatly and
surge voltage which can meet the electrical needs of tanks in harsh environments.

Conveniently, the module can prevent damage to the module itself when the tank's power supply is abnormal, such
as connecting the positive and negative wires alternately. When the tank's power supply condition returns to normal,
The power supply module will automatically recover to normal operation. The module can supply 5-12 , 12 and -
volts of power.

2) Peripheral circuit board module consists of a sensor

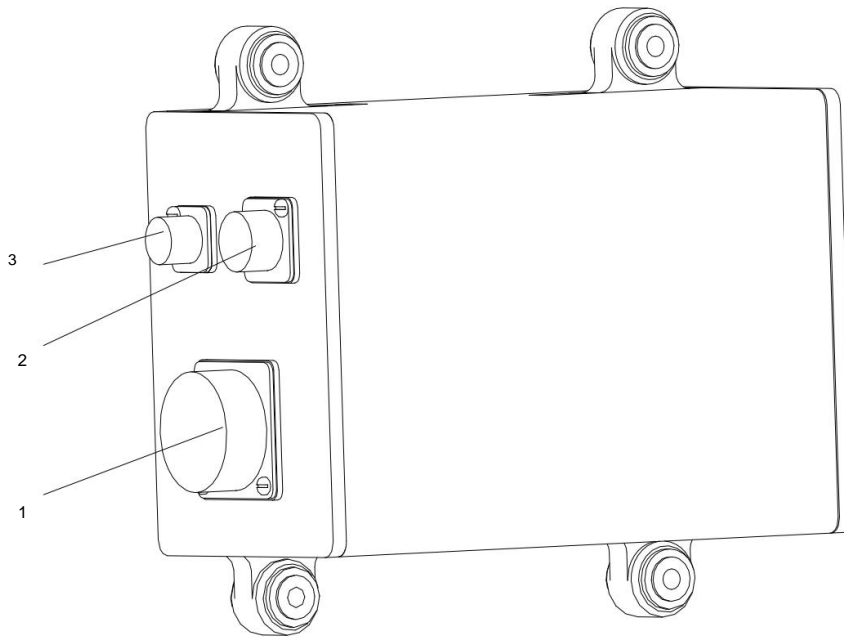
signal processing circuit, a signal amplifying circuit, and an electronic
signal conversion circuit. analog to digital
(A/D conversion circuit), Power drive circuit, etc.

3) Single-chip board assembly

It consists of a single-chip microcomputer chip, a CAN communication
module, and related circuitry.

4) Mother board template (Mother board template)

The motherboard module supports the power supply module, peripheral modules, and
A single-chip circuit board (Single-chip board) and also an input and output channel of
data collection unit as well Motherboard modules are also connected to input and output signals.
Cable



1. Signal cable connector (Collection port)

2. Bus cable connector

3. Power supply connector

Figure 8 Information collector unit

F. Dust signal box

Dust extractor fan motor alarm box Serves as a signal converter.

The AC (alternating current) dust blower fan motor outputs DC (direct current) voltage to the unit.

Collect signals (Signal collector) to collect and transmit signals. and show working status

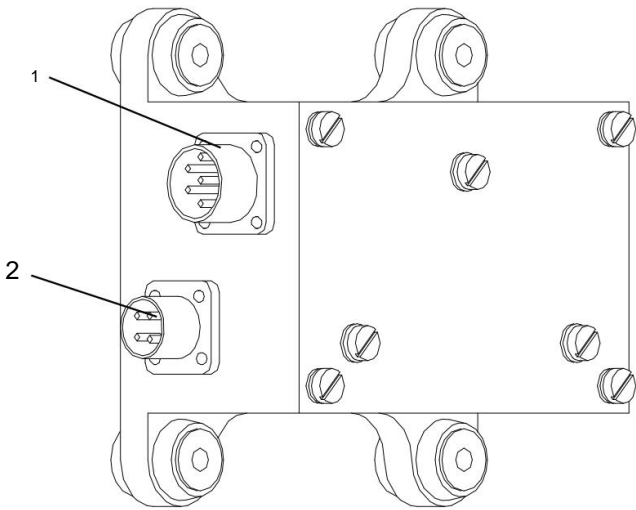
Dust ventilation fan motor

A two-way 90-110 volt AC signal will send out a power signal.

10 volts direct current to the signal collector. By passing from the capacitor through the rectifier circuit.

Full-wave rectification circuit, voltage divider circuit (Voltage-dividing circuit), and voltage maintaining circuit (Voltage-stabilizing circuit) in the blower motor alarm box.

The dust exhaust air is used to show the working status of the dust extractor fan motor.



1. Signal receiver connector 2. Signal output connector to the signal collector.

Figure 9: Dust signal box for motor warning.

G. Measuring and transmitting equipment or sensors (Sensor)

The measuring and transmitting equipment monitors the operating parameters and Notification status

name	Duties	Installation location
CUT-64A-1 fuel amount sensor (fuel quantity sensor)	Measure the amount of fuel remaining. In the left middle fuel tank.	Installed on the fuel tank middle left
CUT-64B-1 fuel amount sensor (fuel quantity sensor)	Measure the amount of fuel remaining. in the right front fuel tank	Installed on the fuel tank Front right
CUT-64C fuel amount sensor (fuel quantity sensor)	Measure the amount of fuel remaining in the Fuel tank and ammunition rack Large front left	Installed on the fuel tank Front left

name	Duties	Installation location
CUT-64D fuel amount sensor (fuel quantity sensor)	Measure the amount of fuel remaining. In the right middle fuel tank	Installed on the fuel tank middle right
KY5-600 current sensor (electric current sensor)	Check the car's overcurrent. (overload current)	Installed in the battery room. right side
CCJC-01-A speedometer sensor (speed sensor)	Check the speed and distance of the car.	Installed on the right side cover of speed changer
YLBK-02 fuel amount alarm switch (volume warning transmitter fuel)	Check the amount of fuel. Fuel tank, outside group number 2 When the amount of fuel in the outside tanks is Warning signs Shows that fuel tanks number 2 and 3 There is no fuel.	Installed on the fuel tank Outside group number 2
KZY-C2 Air filter resistance sensor (Air filter warning sensor blockage)	Check the negative pressure of the filter. weather	Installed on the air filter
YBK-0.2-A air pressure sensor (Air pressure sensor)	Check the pressure of the rubber seal. (Pneumatic seal strip)	Installed on a 3-way connector in front of the engine room wall. power generation

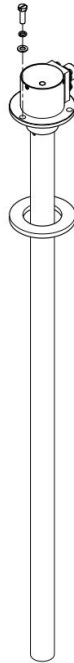


Figure 10 Fuel quantity sensor
(CUT-64A-1/CUT-64B-1/CUT-64C/CUT-64D fuel amount sensor)



Figure 11 Air pressure sensor (YBK-0.2-A air pressure sensor)

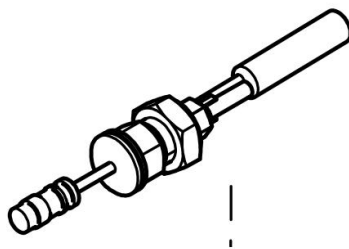


Figure 12: Fuel quantity warning signal transmitter
(YLBK-02 Fuel amount alarm switch)

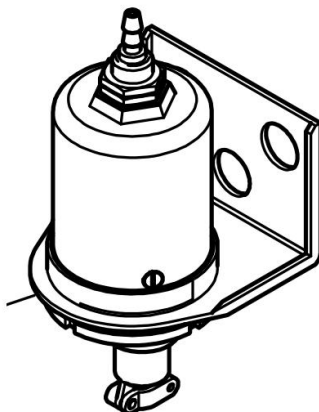


Figure 13: Clogged air filter warning sensor (KZY-C2 Air filter resistance sensor)

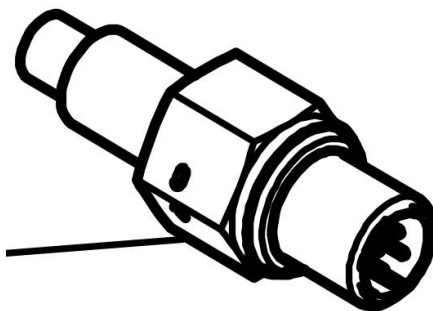


Figure 14 Speed sensor (CCJC-01-A Speedometer sensor)

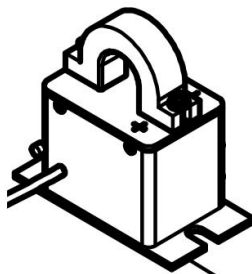


Figure 15 Current sensor (KY5-600 Current sensor)

H. Signal splitter cartridge (Splitter)

A splitter is used to connect the CAN bus core to the bus subunits. The CAN bus network is the tank's information system. designed by dividing lines and parts Where the network nodes of the CAN bus are connected from beginning to end in sections. Therefore, it facilitates

It is convenient for inspection and maintenance of the bus network. Figure 16 shows the external appearance of the cartridge. signal splitter

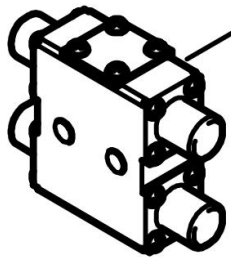
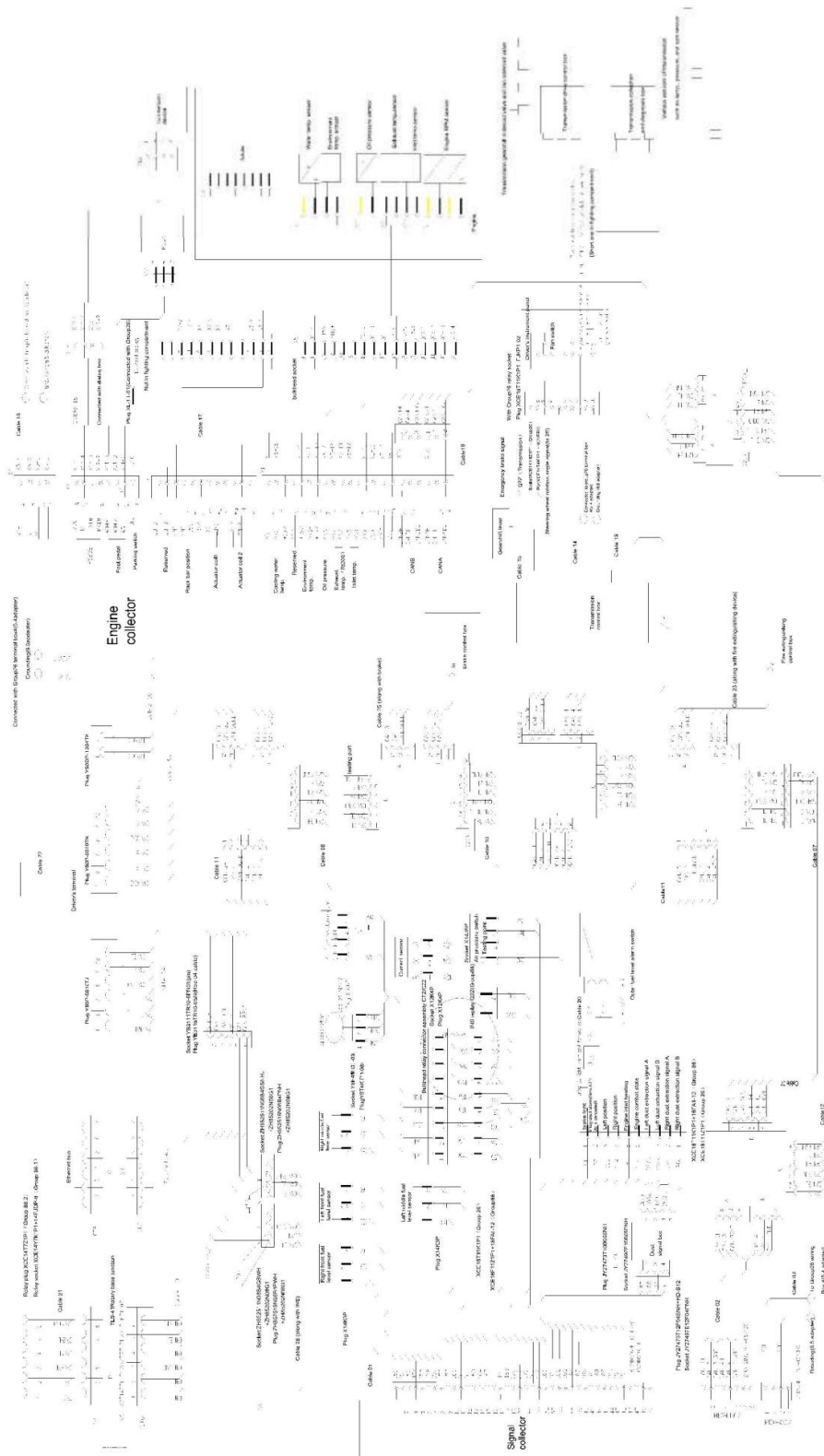
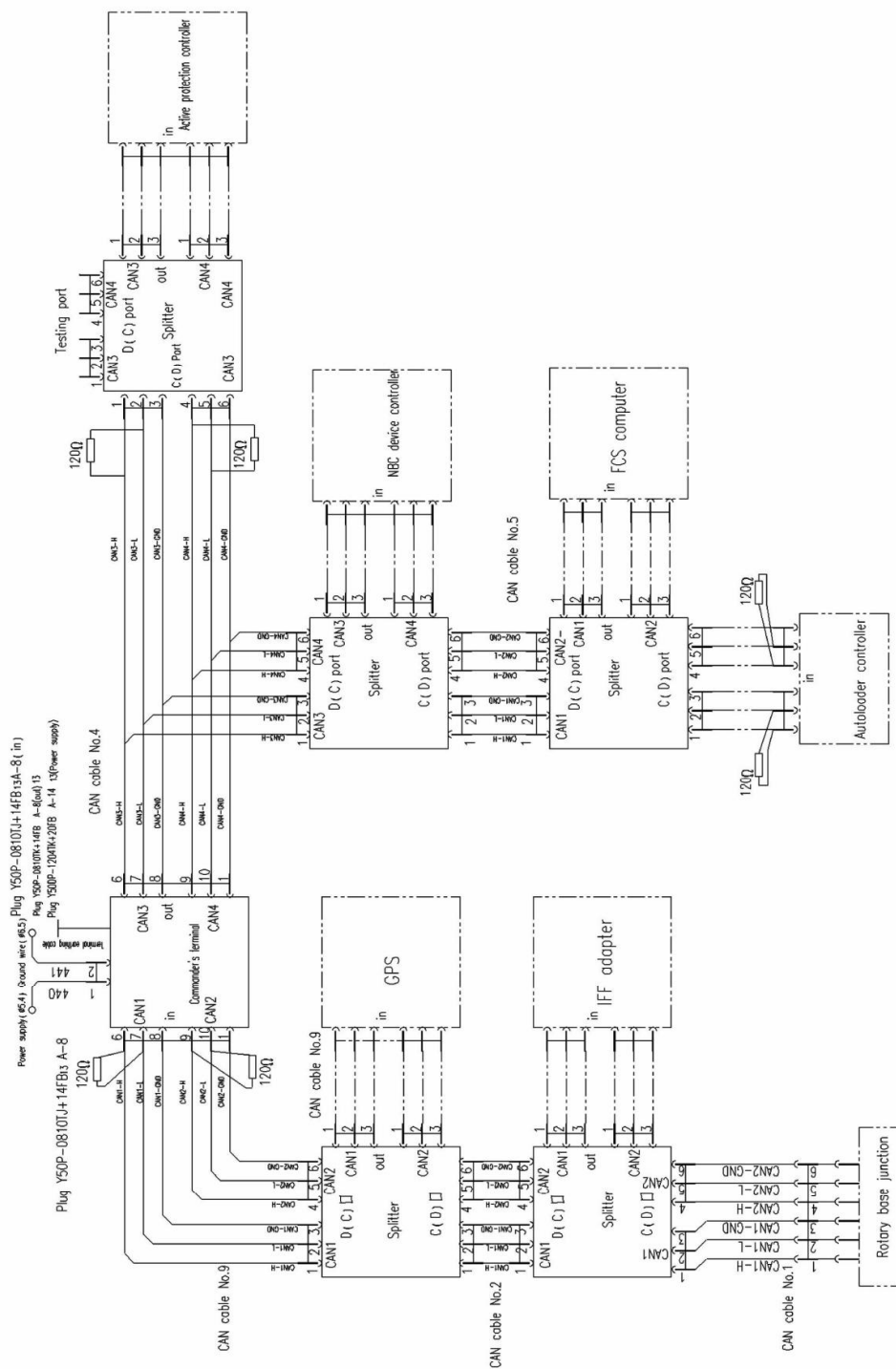


Figure 16 Signal splitter cartridge (Splitter)





Part 2

Electrical system (ELECTRICAL SYSTEM)

1. General

The electrical system performs the function of power supply and current distribution as well as electrical protection.

All of the tanks To make the system different can work and control general electrical work, creating Ensure the safety and reliability of tank operation by increasing driving efficiency. and safety of the crew

2. Main performance and parameters

A. Main function

1) Power supply system: uses a generator and

Battery to supply electricity to all vehicle systems

2) Power distribution system: use fuse box, distribution box.

Main power, driver side dashboard power distribution box, power relay box, box

Powers the gun turret, the operator's and gunner's power supply control box and the wiring connection box to Proceed with distributing electricity

3) Protection system: Use a fuse and a thermal circuit breaker switch.

(Thermal protection switch) to protect electrical equipment of every car system

B. Main technical characteristics

1) Technical characteristics of the system

Type of wire (Line type)	Direct current, (Single-wire and double-wire coexist)
Line voltage	26 ± 4 volts (Starter line-24V)
Electrical protection system (Line protection system)	Thermal circuit breaker switch and fuse

2) Technical characteristics of the battery (Battery technical parameters)

Main battery (Main battery) Additional battery (Fine battery)

Model	12-TKA-125	12-TKA-50A
quantity	4 pieces	1 blade
Total capacity	500Ah	50Ah
weight	67 kg.	35 kg.

3) Technical characteristics of the generator (Generator)

	YZF15D (electric generator: Generator)
Model Weight	~50 kg.
Minimum speed at which the battery is charged.	~1900 rpm
Generator mode (Generator mode)	Direct current output (DC output) 15 kilowatts, alternating current output (AC output) 3 kilowatts.
	Rotational speed (Rated speed): 4400 rpm
DC electrical characteristics (DC characteristic)	Output Voltage: 28 volts
	Output Current: 500 amps.
AC power characteristics (AC characteristic)	Output frequency: 586Hz
	Voltage (Line voltage) : 110±10 volts
Voltage accuracy at steady state (Steady state voltage accuracy)	When working within the rated speed range and rated Current and voltage at steady state: 28±0.7 volts
Model	Generator controller model FKH-15A (Generating control box)
weight	18 kilograms

3. System components and working principles

A. System components

It consists of a power supply and a power supply control system. Electric start system

Lighting and visual signaling equipment Auxiliary electrical equipment and equipment that requires electrical power

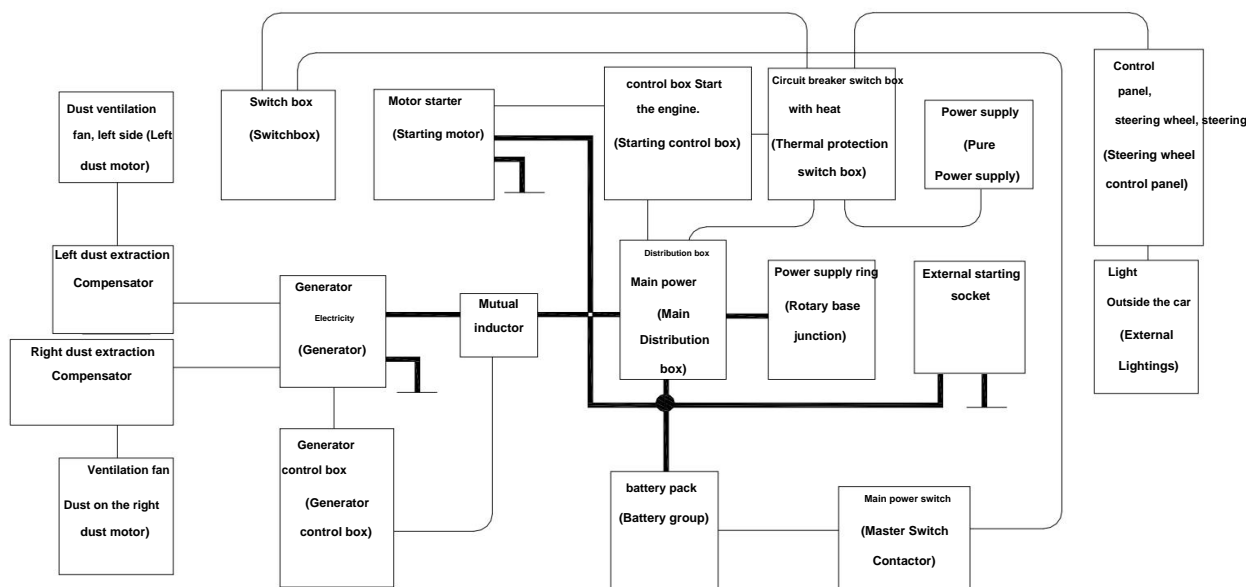


Figure 19: Diagram of electrical system components.

(Electrical system composition block diagram)

B. Working principle

1) Power supply equipment : vented generator Oil heating, size 19 kW (AC output 3 kW and DC output 15 kW) as supply. Provides power to electrical equipment inside the vehicle and at the same time charges batteries, generators, etc. Works with the FKH-15A control box.

2) Auxiliary power supply equipment: to ensure

The vehicle's auxiliary power supply capability The main battery uses a lead-acid battery that does not require adding water.

Distilled (fully sealed maintenance-free lead-acid) 12-TKA-125, 4 pieces, by battery

¹ The blade has a capacity of 24V125Ah. It also uses an additional battery (fine battery) 12-TKA-50.

Lead-acid battery without adding distilled water. ¹ Leaf capacity 24V50Ah battery total capacity

Total 500Ah. When the engine is not turned on, all electrical equipment will receive power from a 125Ah battery.

Number of 4 cards connected in parallel. And when starting the engine, use 4 125Ah

batteries to start the engine electrically. After the engine is turned on and the engine is running at

Generator rotational speed Then the generator will start producing electricity and when

The engine speed increases. The generator supplies electricity to electrical equipment.

all and charge the battery as well.

3) Chassis power distribution equipment:

600 amp fuse box, main power distribution box, driver power distribution box, relay box

Transmit electrical power and 2 electrical wiring junction boxes

a) Fuse box : A 600 amp fuse box serves to distribute power.

Main Its main function is to supply power for the motor starter and main power distribution box.

b) Main distribution box : Electrical distribution box

The main function is to distribute power at the second level. Its main function is to provide power protection for

Electrical equipment such as gun turrets, accelerator motors of 2 combination brake systems, switch boxes

Cut off electrical circuits with heaters, water pumps, lubricant pumps and heaters, etc.

The main power distribution box contains one 150 amp fuse and one 200 amp fuse. ¹ and

Fuse 500 amps ¹ which

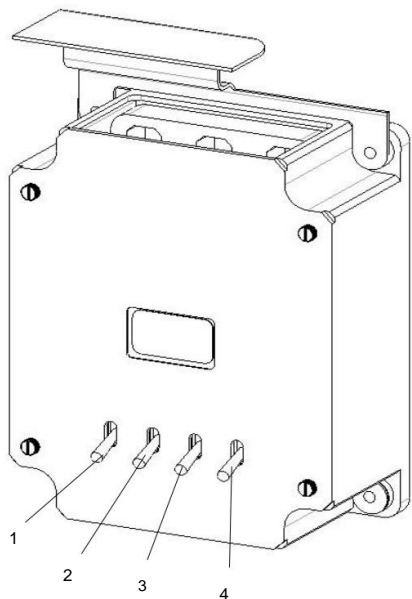


Figure 20 Main distribution box

Table 5: Names and functions of switches of the main power distribution box.

number	name	Duties	note
1	Thermal circuit breaker switch of the accelerator motor 1 (EA MOTOR 1)	Used for controlling the electrical power supplied to the motor. Power booster 1 of the combined brake system and protect the circuit	
2	Thermal circuit breaker switch of the accelerator motor 2 (EA MOTOR 2)	Used for controlling the electrical power supplied to the motor. Power booster 2 of the combined brake system and protect the circuit	
3	Thermal circuit breaker switch of the lubricant pump	Used for supplying power to devices that Works with a lubricant pump and prevents cycle	
4	Thermal circuit breaker switch of the pump	Used for supplying power to devices that Works together with a water pump. and protect the circuit	

c) Driver's power distribution box: has a thermal break switch box. Switch box and engine control box The thermal circuit breaker switch box is responsible for distributing electricity. Level 3 and provides power protection for electrical equipment that uses lower current. 20 amps The switch box and engine control box are responsible for controlling the power supply of the engine.

Electrical equipment

• Thermal protection switch box

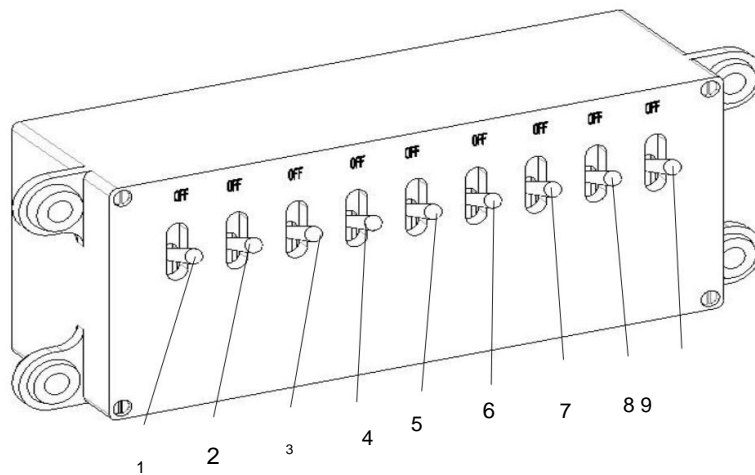


Figure 21 Thermal protection switch box

Table 6 Names and functions of switches on the thermal circuit breaker switch box

No.	name	Functions of use	note
1	electrical control switch engine and Driver's monitor (ENGINE ECU, TERMINAL)	Used to turn on and off the power from the fine battery to the electronic control box. of the engine, the driver's monitor and equipment Gather information	
2	The machine's electrical control switch Change speed and brake (TRANSMISSION CONTROL , BREAKING CONTROL)	Used to turn on and off the power supplied to the control system. Electronics of the speed changer and Brake electronic control system	
3	System electrical control switch NCCC / Fire extinguishers and deterrents Bomb (NBC)	Used to turn on and off the power supplied to the NCCC system. Fire extinguishers and explosion suppressors.	
4	electrical control switch The steering wheel is in use. Many functions (STEERING WHEEL)	Used to turn on and off the power supplied to the steering wheel. Turn Perform multiple functions	
5	Box electrical control switch control Starting the engine (START) CONTROL)	Used to turn on and off the power supplied to the control box. Installing the engine	
6	electrical control switch Fuel pump (FUEL PUMP)	Used to turn on and off the power supplied to the gas pump. Fuel and driver's cabin lamps	

No.	name	Functions of use	note
7	Reset switch (RESET)	Used to turn power on and off to reset the generator. power and reset the left dust extractor and right side	
8	Main power switch (MASTER SWITCH)	Used to control the power that is supplied to the vehicle's electrical network.	
9	Negative pole switch (NEGATIVE)	Used to turn on and off the negative power of the electrical system. two lines	

ÿ Switch box

Warning

When the thermal break switch returns to the **"OFF"** position , do not

push it back to the **"ON"** position . You must find the cause of the problem first.

The switch should be pushed back to the **"ON"** position only when the fault has been resolved.

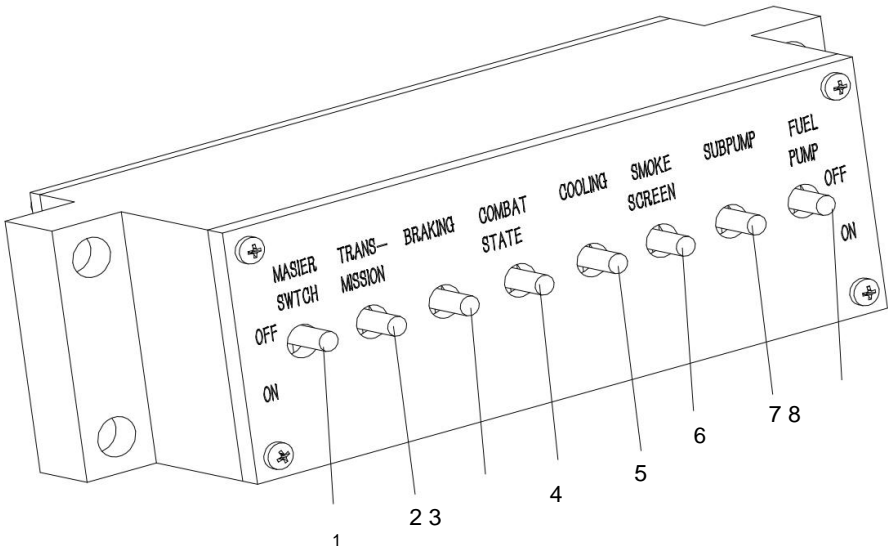


Figure 22 Switch box

Table 7 Names and functions of switches on the switch box

No.	name	Functions of use	note
1	Master switch turns on/off all power in the tank's electrical network.		
2	changer control switch speed	Turn on-off the power of the control unit. of the speed changer	
3	The switch controls the operation of the prohibition. Wheels	Turn on-off the power of the control unit. Combination brake	
4	War status switch	Put the engine in a war state.	
5	Thermal shirt control switch	Turn on/off the power to control the operation of the vest. Cooling	
6	Smoke screen generator switch	Turn off - turn off the operation of the smoke screen heater.	
7	water pump	Turn on and off the water pump for crossing water.	
8	switch Fuel pump switch	Controls the operation of the fuel pump.	

Starting control box

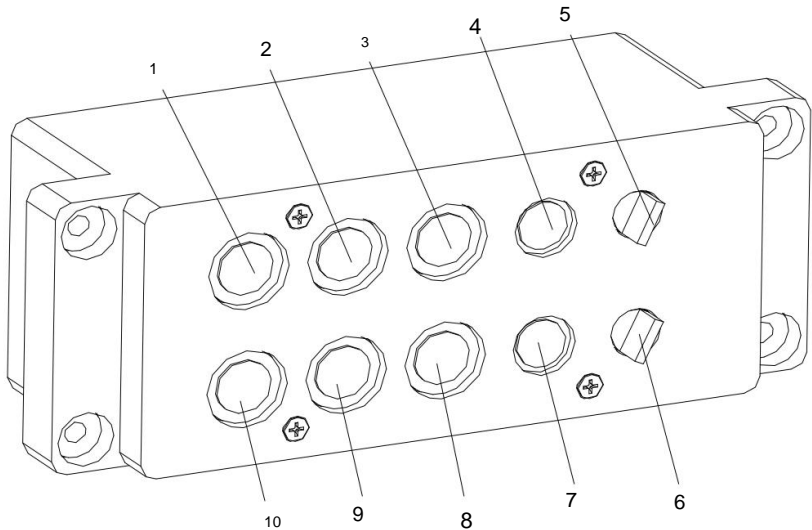


Figure 23 Starting control box

Table 8: Names and functions of switches on the engine control box.

No.	name	Functions of use	note
1	Emergency circuit break button for Rotate the tank cannon turret. (Emergency gun- laying)	The driver is used to control the movement of the turret in the event of Emergency when The artillery stabilizing device is working. Pressing this button will Make the turret rotate to the left. Counterclockwise and release. This button stops the turret from rotating.	
2	Pump control buttons Lubricating oil (Oil pump)	Pressing this button will cause the engine lubricant pump to work. and releasing this button will cause the lubricant pump to stop working.	
3	Pneumatic engine start button (Air starting)	When the conditions for starting the engine are ready Press this button to turn on. the engine and release this button when the engine is started.	
4	Standby	This button is not used.	

No.	name	Functions of use	note
5	Ventilation fan control button heat (Transmission fan)	Controls the rotational speed of the cooling fan at power generator	
6	Converter control buttons Hydraulic torque (Hydraulic converter)	Controls the power of the hydraulic torque converter in the machine. Change speed in combined power generator	
7	Transmission diagnosis	Not in use (speed changer system spare switch)	
8	also the engine start button Electricity (Electrical starting)	When the conditions for starting the engine are ready Press this button to turn on. the engine and release this button when the engine is started.	
9	Engine stop button (Shut-down)	Press and hold this button to turn off the engine.	
10	Ignition button (Detonation)	When you press this button The cover and casing seals, etc., will explode when this button is pressed. Provides power to ignite the detonator attached to the lid. Cover seals that remain closed while the tank is moving underwater to burst.	

4) Turret power supply system protection device: Operator 's power supply control box.

Gunner's Power Distribution Box, Junction Box, and Gun Turret Power Distribution Box

a) Operator's power supply control box Used to protect the power supply and

Electrical controls for automatic loaders, anti-aircraft gun control systems

From inside the vehicle, active protection system, communication system, GPS navigation system, display

Image and control of the operator's situation, NBC blast fan, ceiling lighting

Safety cable tower and connector

b) Gunner's power distribution control box Used to protect power supply. For Fire Control Systems (FCS), Gun Control Systems, Electric Triggers , Turret Ceiling Lights and Fans, and Faction Proof Systems. C) Boxes

Includes electrical wires (Junction box) that serves as the center for distributing power to

Electrical equipment of the secondary system

d) The large arm power box receives electricity. from the power distribution ring (Rotary base junction) and then supply power to the user's power distribution control box. Control vehicle and gunner's power supply control box, gun control system, air conditioning

Commander 's distribution box

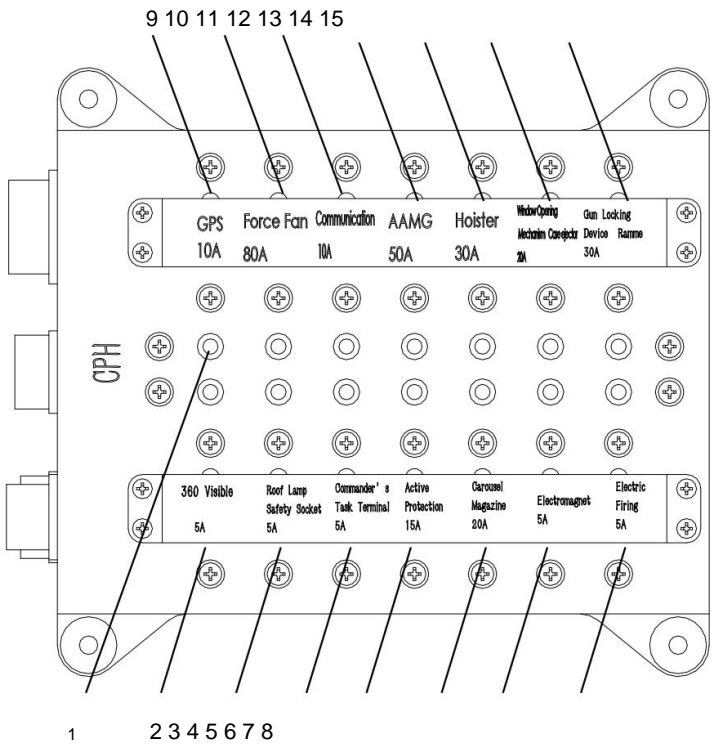


Figure 24: Operator's power distribution control box

Table 9: Names and functions of the operator's power distribution control box switches.

number	name	Functions of use	note
1	switch signal light bulb various	When the power supply switch is turned on signal light bulb The switch will light up. and turns off when the switch is turned off.	
2	Surveillance camera switch All around (Panoramic device)	Used to supply power and protect surveillance cameras.	
3	Turret ceiling light switch and safety terminals	Used to supply power and protection to ceiling lights. Safety towers and connectors	
4	Display switch and control the situation of Car commander	Used to supply power and protect the control display. situation of the car commander	
5	Linear protection device switch Proactive	Used to supply power and protection to environmental protection equipment. Proactive	
6	Ammunition rail switch (Carousel magazine)	Used to supply power and protect the ammunition rails.	
7	electromagnetic switch (Electro-magnet)	Used for power supply and electromagnetic protection. of the ammunition rail and the ammunition storage pulley.	
8	Electric trigger switch (Electric firing)	Used for controlling electric triggers.	
9	GPS switch	Used to supply power and protect the GPS.	
10	Fan switch	Used to supply power and protect the fan. NCCC	

number	name	Functions of use	note
11	Communication switch (Communication)	Used to supply power and protection to communication equipment.	
12	P.O.T. station control switch (AAMG internal control)	Used for supplying power and protection to the PTO control station.	
13	Storage hoist switch Bullet(Hoisting mechanism)	Used to supply power and protection to the storage hoist. ammunition	
14	Soil ejector switch Send (Case ejector)	Used to supply power and protect the earth casing machine. send	
15	Bullet pusher switch (Rammer)	Used to supply power and protection to the bullet pusher. ported	

Gunner's distribution box

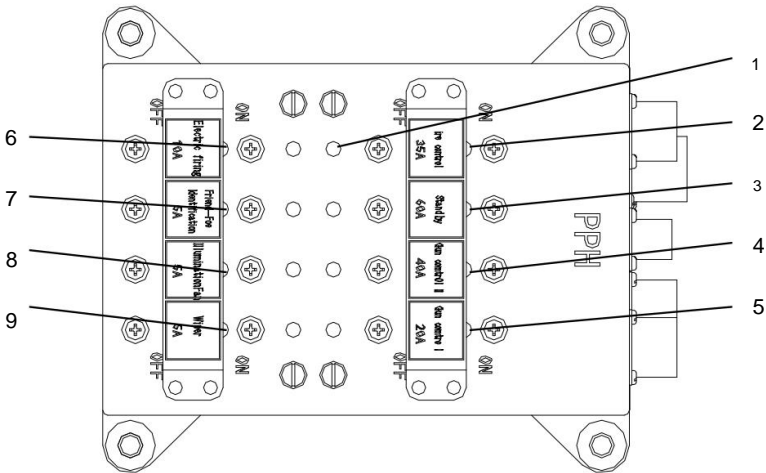


Figure 25: Gunner 's distribution box

Table 10: Names and functions of the gunner's power supply control box switches.

number	name	Functions of use	note
1	switch signal light bulb	When the lamp power switch is turned on, the signal of the switch that is turned on will be lights up, and when the switch is turned off, the lamp turns off.	
2	Fire control switch	Used to supply power and prevent short circuits to affected parts. Controlled by fire control system	
3	Spare (spare parts)		
4	Gun control switch II	Provided to protect the power supply of the gun control system.	
5	Gun control switch I		
6	Electrical trigger switch	Provide protection against the power supply of the electric trigger.	
7	Side Authentication System Switch	Provide power protection for the authentication system.	
8	Ceiling light and fan switches wind	Provide protection for lighting and fans.	
9	Internal unit fan switch a lot of things air conditioner	Provides protection for the computer's external unit fan. air conditioner	

5) Steering wheel control panel: used to control the lighting and Exterior lights, horn and driver fan

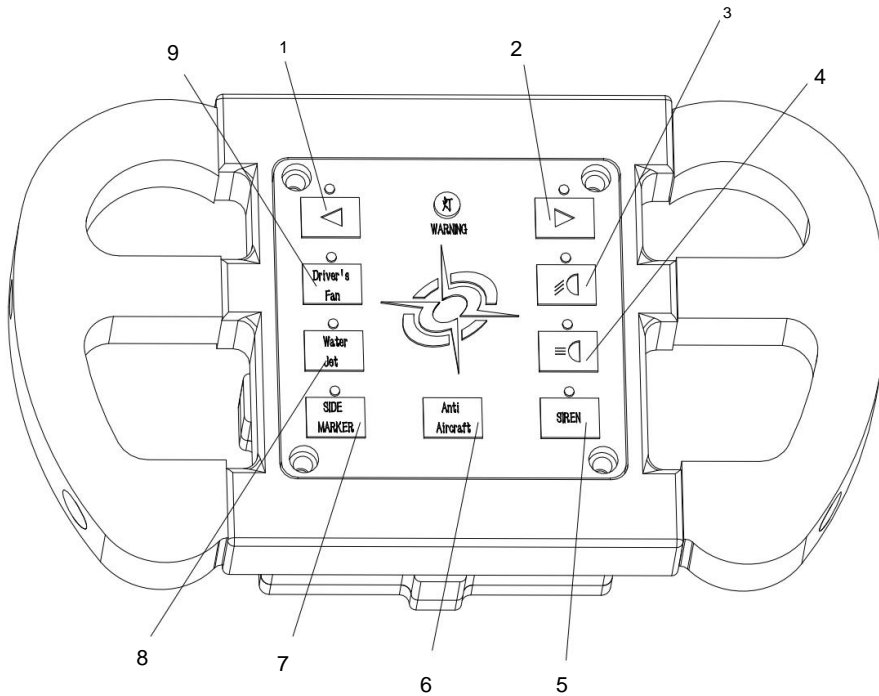


Figure 26 Control box of steering wheel

Table 11 Names and functions of switches on the steering wheel control panel.

number	name	Functions of use	note
1	Turn left.	When the button is pressed, the left turn direction indicator will come on.	
2	Turn right	When the button is pressed, the right turn direction indicator will come on.	
3	Low beam - large lamp at the front of the car.	When the button is pressed, the low beam beam of the large lamp will light up.	
4	High beam - large lamp at the front of the car.	When the button is pressed, the high beam of the large lamp will light up.	
5	trumpets	When you press the button, the horn will sound.	
6	camouflage driving lights	When the button is pressed, the driving lights will come on.	
7	Side lights	When you press the button, the side lights will turn on.	
8	Spray water on the glass	When the button is pressed, the windshield washer motor will work.	
9	Driver's fan	When the button is pressed, the driver's fan will be activated.	

6) Heater system control box (Heater): used for controlling heat.
of the heater and serves to protect the power supply of the heating system.

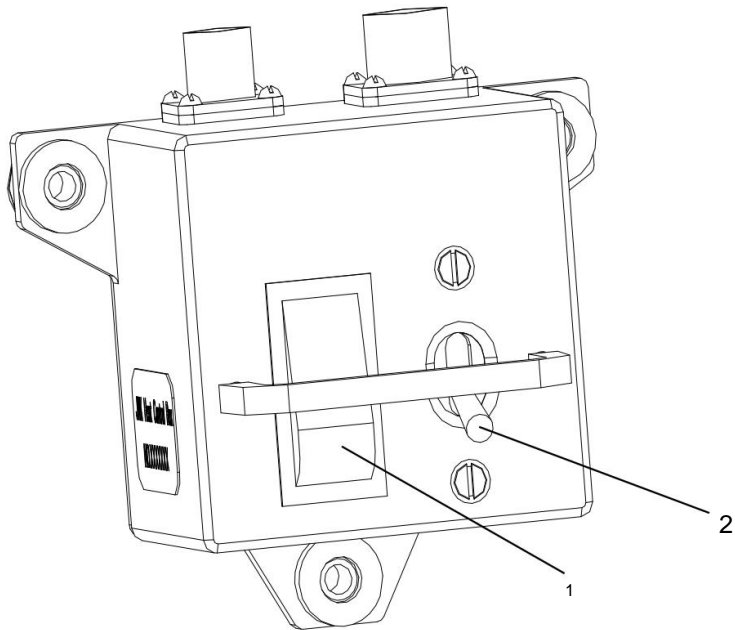
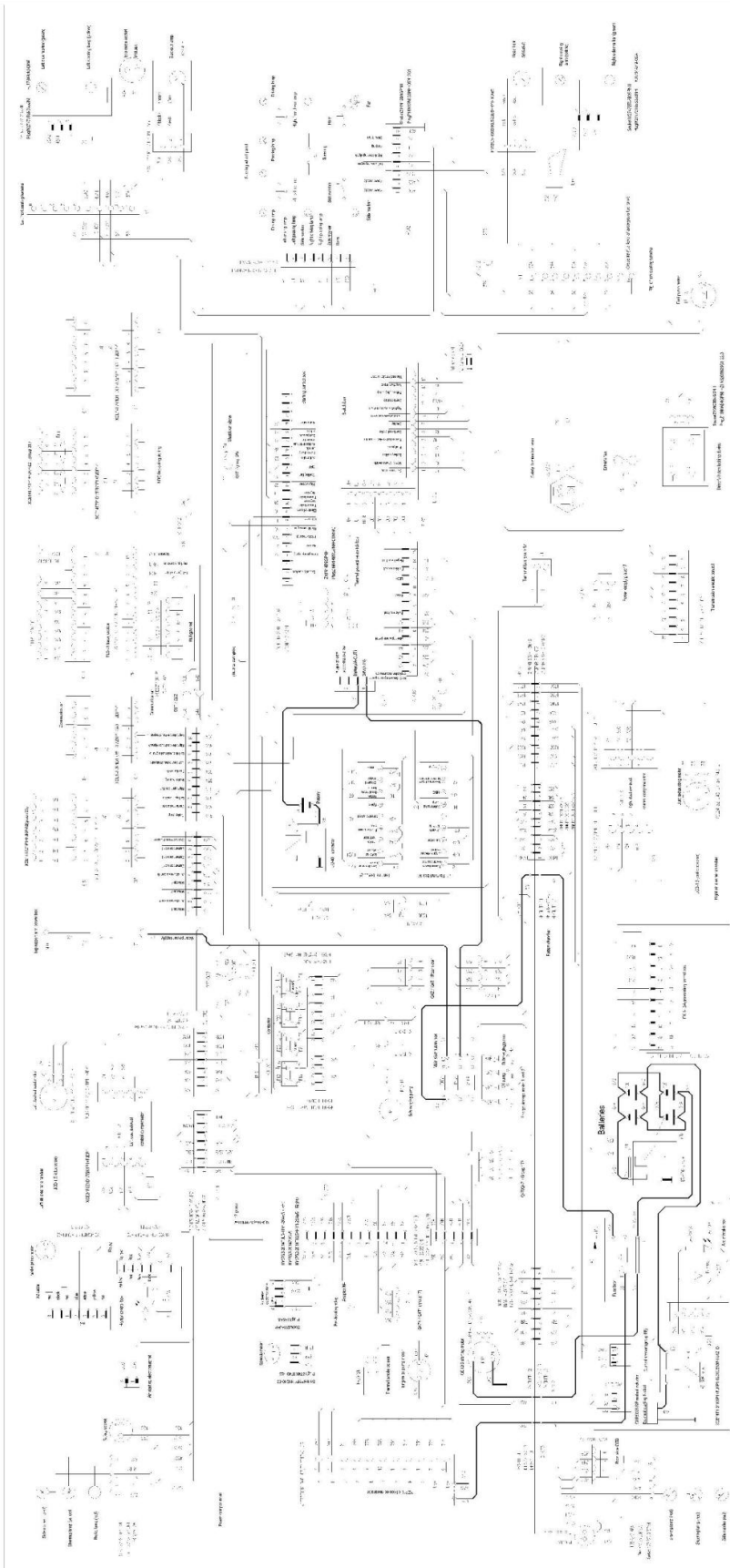
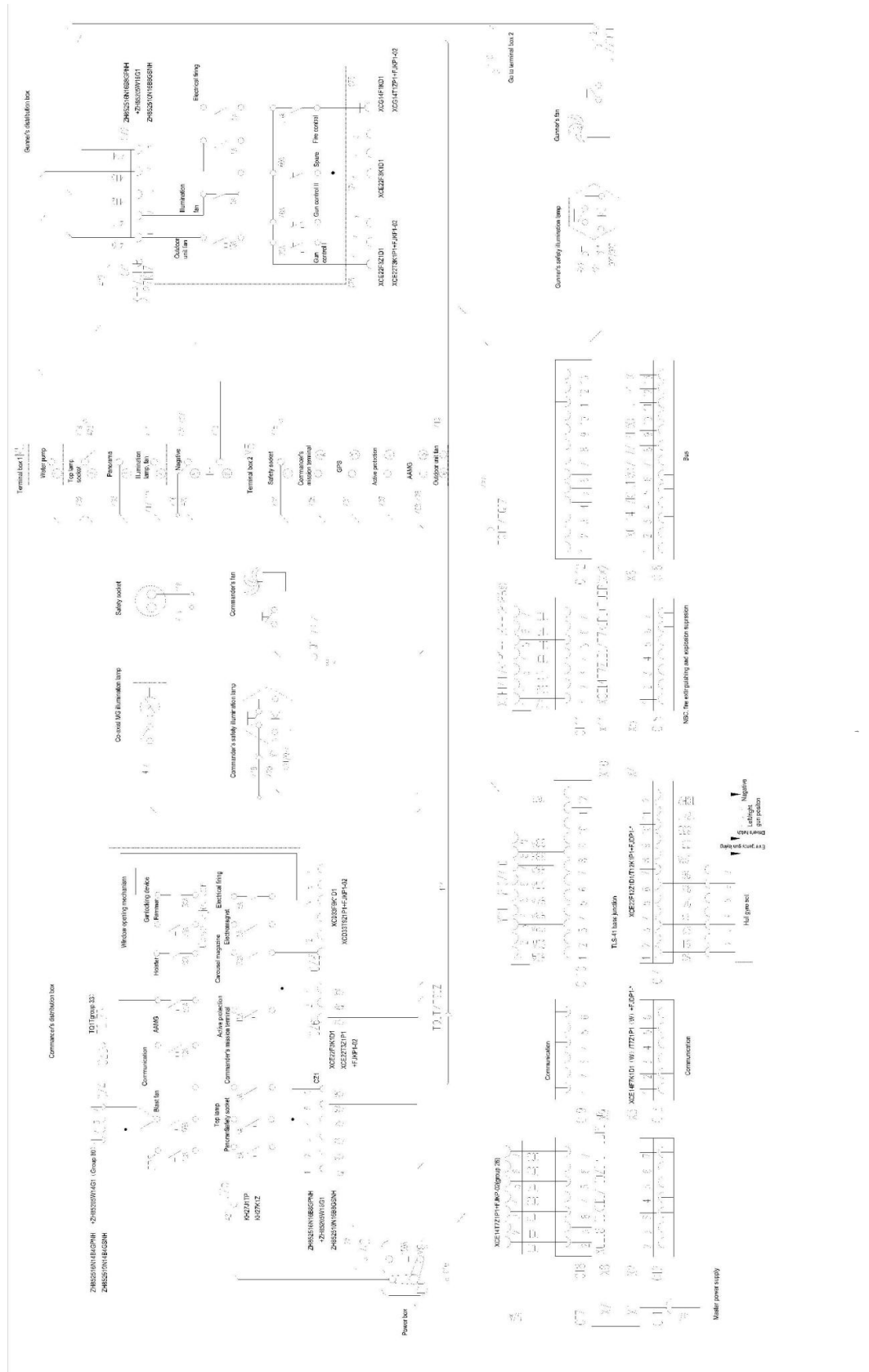


Figure 27 Control box of heater

Table 12: Names and functions of switches on the heater system control box.

number	Switch name	Functions of use	note
1	up. Control switch Machine temperature Heating	When pressing the switch The indicator light inside the switch will light At this time the heater starts to work. after cleaning After heating, press the switch on the other side. Stop heating	
2	Circuit protection switches	Normally, set it to the ON position and provide protection. Power supply of the heating system	





Part 3

NAVIGATION SYSTEM

integrated navigation system It consists of a GPS satellite navigation system and an inertial navigation system. The GPS satellite navigation system and the inertial navigation system work independently. and both systems can work together Navigation with integrated positioning navigation

1. **Inertial positioning navigation system.** General .

The inertial navigation system works in conjunction with an odometer to independently determine the vehicle's location and navigation. It works through a communications interface, receiving satellite positioning data from the driver's display. That is, when the GPS system is operating, it uses a combination of inertial navigation and deterministic navigation. Position using satellites that work together as a positioning navigation system. The

function of the inertial navigation system: It can locate and guide The tank can travel freely. There is a function to send information about location coordinates, direction and position, movement patterns (e.g. climbing up a slope/descending a slope. and sloping kidneys) of the vehicle

B. Main performance and parameters

1) Error in finding north (North-seeking accuracy) : **±3.0 milliam**
(Root mean square : RMS); 2) Attitude accuracy :

± 1.0 millimeters (Root mean square: RMS); 3) Time taken to find north. (North-seeking time) : **±5 minutes**; 4)

Time to prepare for finding north. (North-seeking preparation time): **±3**

minute ;

5) Accuracy of positioning
and navigation) **± 0.5%** of the traveling distance (Circular Error Probable : CEP),

- 6) Interval for realignment : \approx 2 hours;
- 7) Continuous working time: \approx 12 hours
- 8) Map coordinate system : 84 coordinate system **X**, Y coordinate system
- 9) Power supply : DC 26 ± 4 volts; **22-30** volts;
- 10) Electrical power consumption: \approx 20 watts.
- 11) Environmental temperature

Working temperature: -40° to $+60^{\circ}$ Celsius

Storage temperature range: -50° to $+70^{\circ}\text{C}$.

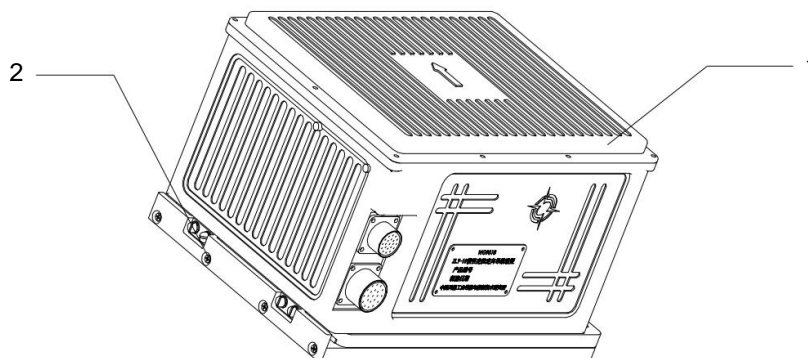
C. System composition and principle

1) System Composition

The tank's inertial navigation system consists of an inertial navigation device.

Inertial ZLY-10, INS mounting base, wire from the INS power supply and signal wire from the speedometer, INS bus cable

Inertial navigation is suitable for a region between 60 degrees south latitude and 60 degrees north latitude, known as initial geodetic rectangular coordinates. coordinates)



1. Inertial navigation device ZLY-10

2. Inertia navigation device mounting base

Figure 30: Main components of the system

2) Working principle

The connection diagram of the inertial navigation device (INS) is shown in Figure 31.

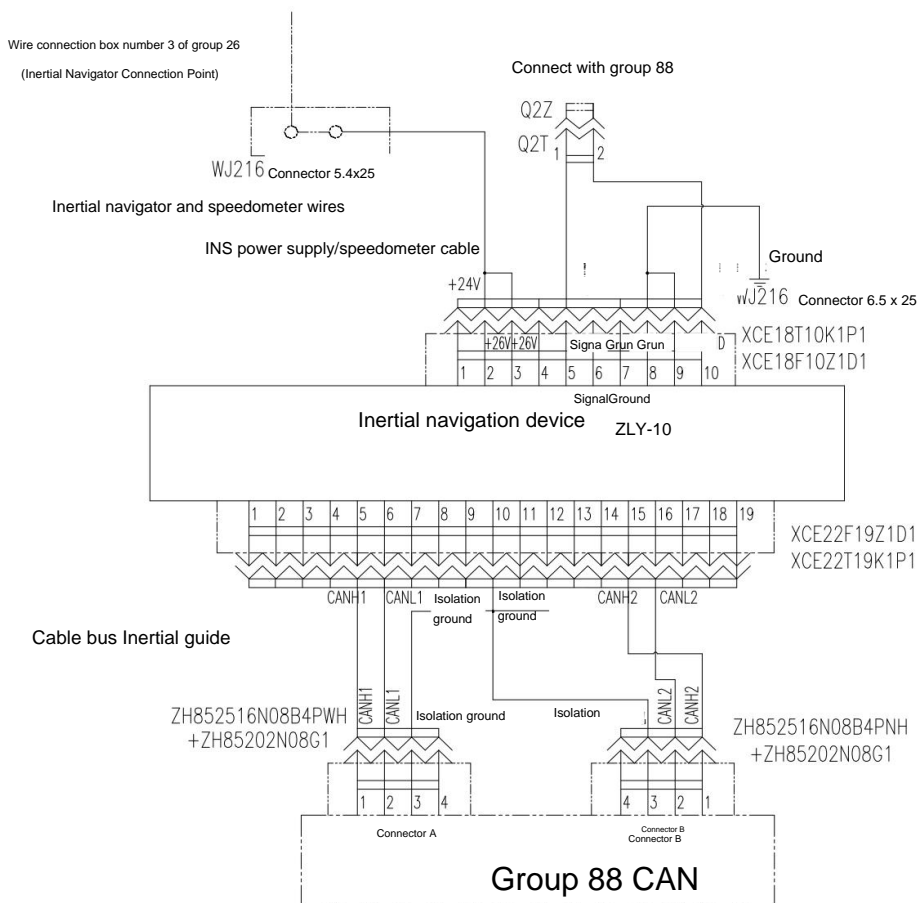


Figure 31: Wiring diagram of an inertia navigation device.

The main operating elements of an inertial positioning navigation instrument is the ZLY-10 inertial navigation device. The inertial positioning navigation system is FOG Strapdown Inertial Navigation System The system steps are:

Turn on the system ÿ Adjust the condition (inertial alignment) ÿ Specify Position and navigation (navigation resolving)

Working principle of inertia navigation device (As shown in Figure 32) and The process is :

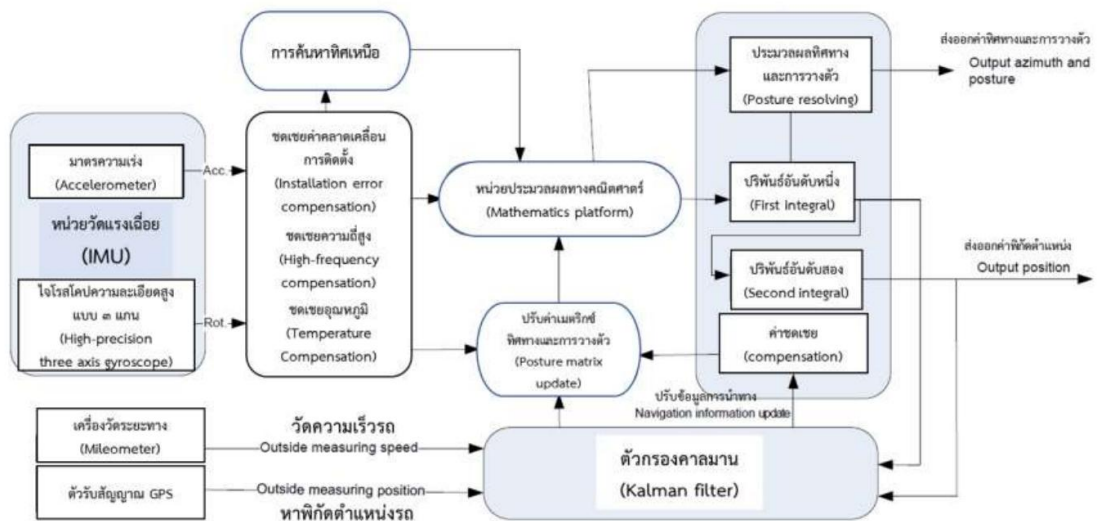


Figure 32: Diagram showing the working principle of an inertial navigation device.

(inertial navigation instrument)

a) Turn on the system (Power-on starting)

The inertial positioning navigation system uses +26 volts direct current.

After the system is turned on, A complete self-test will begin to ensure that the sensor

The inertial sensor can work normally after preparing the system.

automatically within 3 minutes

b) Inertial alignment

Receive vehicle position information and calibration commands given by the driver monitor.

Things to remember

Before searching north The operator's situational control screen should be used to

Set the default grid coordinates. (or longitude and latitude) of the vehicle location

present to the inertial navigation system.

Searching for north with an inertial navigation system should take no more than 5 minutes. A search for north can only be performed with the engine turned on, and the tank has vibration

According to the latitude information of the geographic location where the tank is located, inertial navigation device Use the inertial coordinate system as the reference coordinate system. Measure the angular/linear movement path of the vehicle body in Inertial coordinate system and conditions for changing direction of acceleration and gravity. Accurately estimate the Inertial posture matrix of the inertial coordinate system relative to the coordinate system. Geography by gyro and accelerometer output (Accelerometer) and then processed into the directional angle value. c) Navigation resolving The system will automatically enter the navigation state after the north search is completed. The

angular velocity and linear acceleration of three-dimensional motion are measured by gyros and geodesics.

Acceleration and process the directional position, orientation, and position of the vehicle in real time using Strap-down (installation of inertial measurement unit directly on the vehicle) to determine the orientation and position of Real time tanks This way the inertial navigation system works efficiently, complete freedom Meanwhile The system reads and receives signals from the odometer.

(Mileometer) if it can receive signals from satellites. It can be used to determine the position of the tank. The inertial navigation system works with satellite positioning and distance measuring systems and uses a Kalman filter to assess the most significant discrepancies. Stay away from Strap-down inertial navigation to improve positioning accuracy by adjusting Continuous accuracy d) Information output The inertial positioning navigation system outputs position

coordinates. d Angle of direction of movement and

orientation angle (Move up/down and inclination) of the vehicle in real time to the display and send the information to the control device via the CAN bus interface.

2. Global navigation and positioning system (Gps positioning navigation)

A. General

Satellite navigation systems are positioning devices that provide coordinates.

Location of tanks driving on the ground Its main function is to determine the position of the tank during movement and send coordinates of the tank's current position (in the wgs-84 coordinate system) including information about longitude, latitude, direction of travel, altitude, time, location status, etc. in real time via the vehicle data network (CAN data bus).

B. Main performance and parameters

1) Positioning accuracy: ± 20 meters

(2DRMS)

2) Positioning time:

- In the case of turning on the power supply switch (Cold starting) for the GPS system, use the specified time.

Position not more than 3 minutes

- In the case that the power supply switch for the GPS system is turned on and the GPS system is in ready mode.

Work (Hot starting) takes no more than 1 minute to determine the location. 3)

Navigation determines the location using the WGS-84 coordinate system.

4) Power supply and use of electrical energy:

Voltage required by the system : DC power 26 ± 4 volts.

Maximum power: < 20 watts.

5) Data updating frequency: 1Hz

6) Scope of work: able to navigate all areas around the world.

7) Continuous working time: >12 hours

8) Relative humidity: $95 \pm 3\%$ at $+35^\circ$ Celsius.

9) Data output interface: Double CAN2.0B extended frame format.

10) Environmental temperature

Working temperature: -25° to $+65^\circ$ Celsius

Storage temperature: -30° to $+70^\circ$ Celsius.

C. System components and working principles

1) Components of the system

The satellite navigation system consists of an integrated GPS unit,
Sealing gasket, power supply/timing signal cable, bus cable

Satellite navigation systems are suitable for location navigation.

on areas around the world

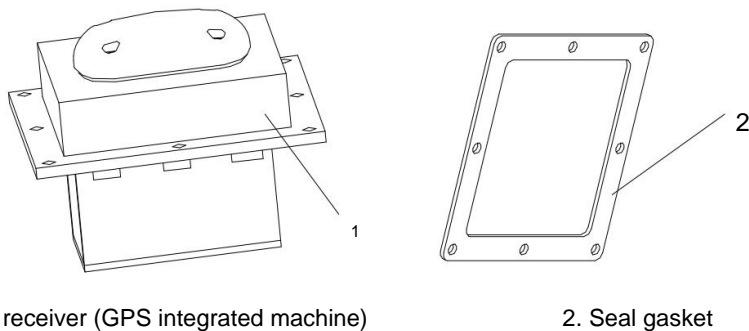


Figure 33: Main components of the system

2) Working principle: The connection

diagram of the inertial navigation device **(INS)** is shown in Figure 31.

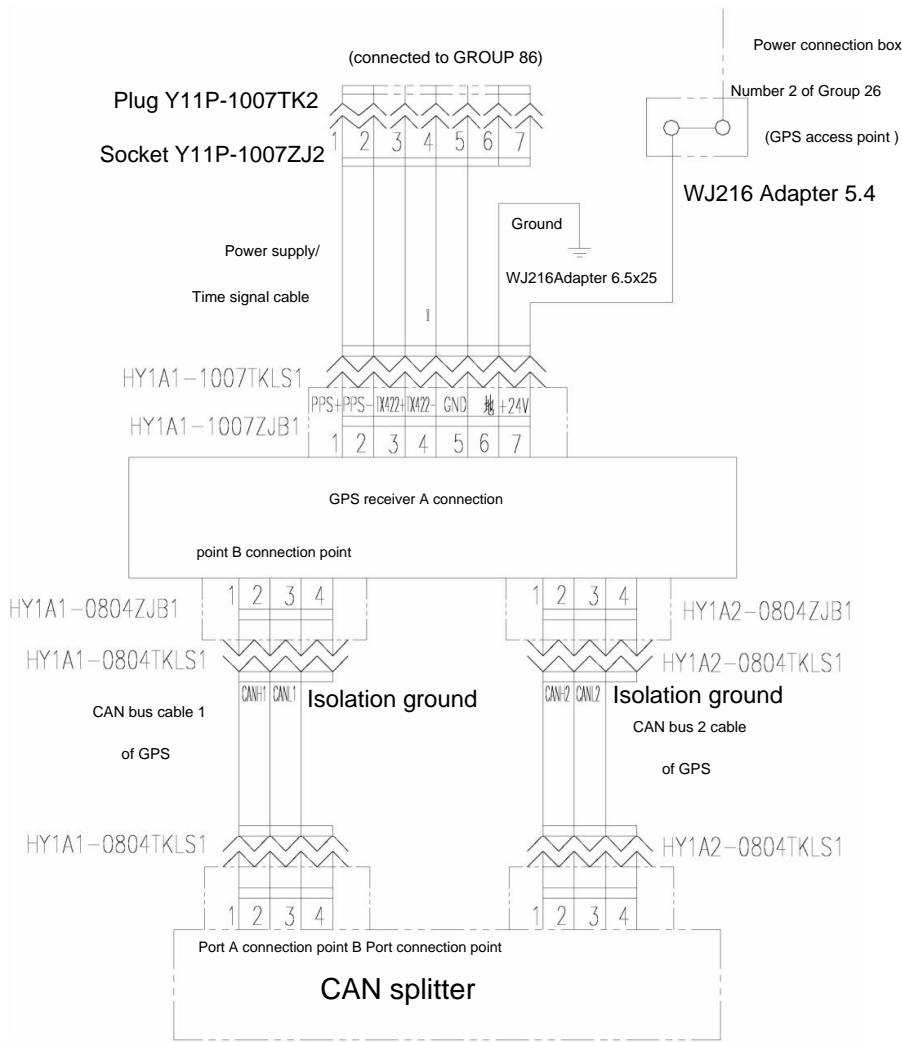


Figure 34: Signal wiring diagram of a satellite navigation system device.
(Satellite positioning navigation Device Wiring Diagram)

The main operating elements of a satellite navigation device are:

GPS system (GPS integrated machine) The GPS system's main component is the GPS antenna.

(GPS antenna), GPS receiver (GPS receiver), control circuit (control circuit), components

Power supply and data cable

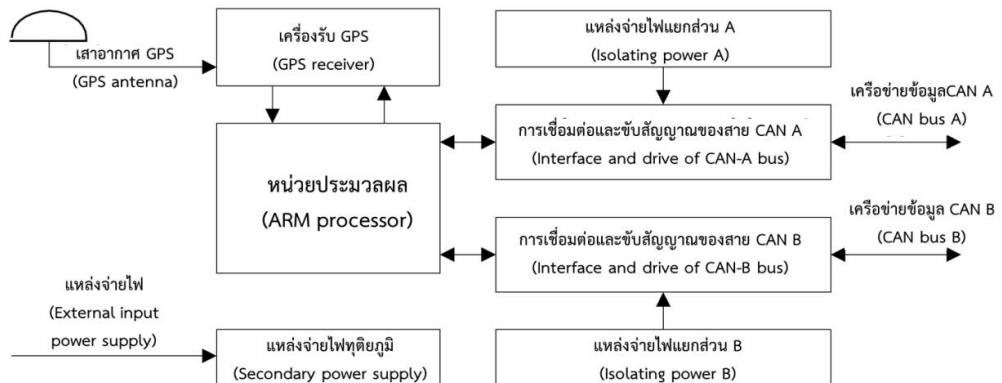


Figure 35: Working principle diagram of the GPS system.

(Principle block diagram of GPS all-in-one machine)

The GPS system receives satellite signals by the GPS receiver, then the control circuit

Perform configuration and receive data and process it into the position of the tank as information such as

longitude, latitude, height above sea level, time, and course angle.) etc. under

the user's coordinate system and send the information to the operator's situational screen and vehicle display.

The driver uses the CAN bus to display positioning and navigation results while the tank is moving.

in real time

Part 4

AUXILIARY POWER UNIT

1. General

A tank's auxiliary generator (APU) is an electrical generator installed to help conceal Disguise the location of the tank and when it is difficult to mount the main engine. or to help extend the life of the main engine in Time between ambush operations The generator has the advantage of being small. It is a source of electrical power. large reserve Resistant to all environmental conditions and the output voltage is highly stable, etc.

2. Main performance and parameters

A. Technical data of auxiliary generator (APU)

Voltage	28 volts
Electric current	214 amps
Electrical power	6 kilowatts
Weight	170 kilograms
(APU) Fuel consumption rate	3.8-4.2 liters/hour
Fuel tank capacity B.	10 liter

Engine technical parameters

Cylinder width (Bore) Stroke	95 millimeters
(Stroke)	100 mm.
Cylinder volume (Displacement)	708 cubic centimeters
direction of rotation (Rotation direction)	counterclockwise (Looking from the flywheel energy)
Power (Continuous power)	9 kilowatts
Speed (Revolution)	3000 rpm
Compression ratio ratio)	1:19

Engine oil pan capacity	2.1 liters
(Oil chamber capacity)	
Lubricant consumption	1.0 grams/kilowatt hour
sound level	No burden: 93 dB(A)
	Maximum load: 98 dB(A)
Maximum tilt level	15°
and level	

C. Voltage regulator technical parameter

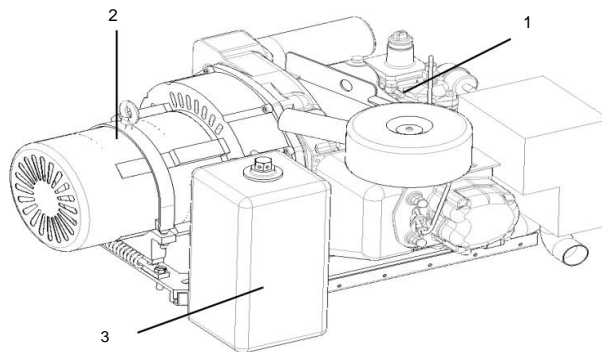
Overvoltage protection range	30.4 - 31 Volts
Current supplied to field winding	
(Excitation current)	Not more than 2 amps

3. System composition and principle

A. System Composition

The auxiliary generator (APU) consists of a small cylinder diesel engine. 9 kW, brushless silicon controlled rectifier generator.

28 volts (Brushless silicon rectifier generator) and voltage control circuit (Voltage regulator), APU control box and connection cables



1. diesel engine
(Diesel engine)

2. Electric generator
(Generator)

3. Fuel tank
(Fuel tank)

Figure 36: Auxiliary power unit.

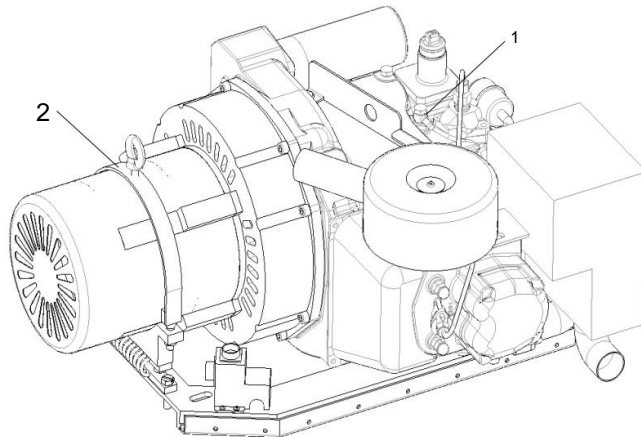
B. Working principle

Air cooled generator Manually controlled rectifier
Silicon brushless Driven by engine When the speed reaches approximately 3000 rpm. minute the generator creates magnetic lines of force. (Self-excitation generation) under
The operation of the voltage control circuit allows the generator to maintain the voltage in the range of 24.2-28.2 volts from the start. There is a karmic burden until there is a karmic burden.

C. Main components

- 1) Engine : A 4-stroke, single-cylinder diesel engine with a capacity of 9 kilowatts provides driving power.

The rotation of the crankshaft by the combustion of fuel in the engine to provide driving power.
generator



1. Engine 2. Generator (Generator)

Figure 37: Picture of the auxiliary power unit structure.

- 2) Generator: When the main engine is not working, the generator is used.

Generators help in distributing direct current electricity. to various devices the turret and charge it.
battery

- 3) Voltage regulator circuit: The generator creates force lines.
self-magnet Under the operation of the voltage control circuit, the generator can
Maintain the voltage in the area of 24.2-28.2 volts from the time there is no karma until there is karma.

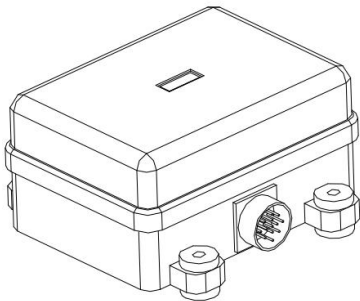


Figure 38 Voltage regulator circuit

4) Generator control box: controls engine starting. engine operation Turning off the engine and warming up the machine before starting in winter On the control panel there is an indicator light. Charging Motor over temperature indicator Engine warm-up light Work light and the dial shows the number of accumulated working hours (hours).

Table 14: The functions of switches and signal lamps of the generator control box help

number	name	Duties or work	note
1	Circuit breaker switch	Push the switch to supply power to the APU.	
2	Key switch	Controls engine startup, operation, engine shutdown and warm-up. machine in winter	
3	Status light bulb work	The light bulb is on. When the generator works normally	
4	warning light bulb The temperature is too high.	The light bulb is on. When the generator coil helps The temperature is over 130 degrees.	
5	Hour counter work	Count the accumulated running hours of the engine.	
6	Status light bulb Charging	Light bulb electric charge situation signal light is on When the generator does not work There is no voltage output.	

number	name	Duties or work	note
7	Status light bulb Warm up	When the environment temperature is too low (below -10°C) if Want to start the engine The first step is to turn the key switch to the engine warm-up position (preheating), then the indicator light Engine warm-up situation will light up.	

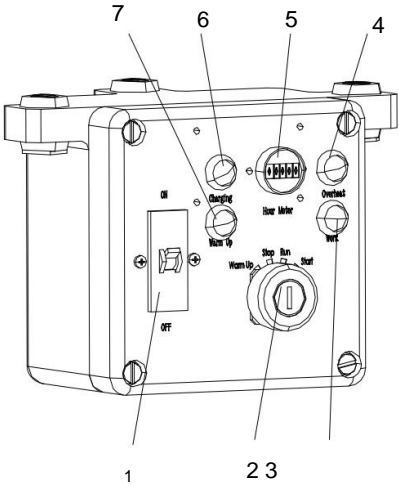
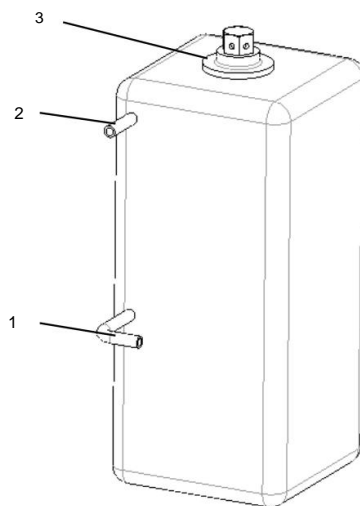


Figure 39: Generator control box

5) Fuel tank The fuel

tank is where the oil that provides fuel for the engine is stored. fuel

It is sucked into the engine by a pump from the fuel supply pipe. Add fuel through the fuel filler port.
Fuel Install the fuel tank inside the generator room and secure the tank with clamps.



1. Fuel distribution pipe

2. Fuel return pipe

3. Fuel filling compartment

Figure 40: Picture of the structure of the auxiliary generator fuel tank.

Chapter 15

PROTECTION SYSTEM

1

Section: General mention (GENERATION INTRODUCTION)

The protection system includes a protective shield, special protection. (which will include the NCCC system, Fire extinguishing and explosion suppression systems, deep water crossing systems, air conditioning systems, laser warning systems and smoke grenade launchers. and department verification system

Part 2

ARMOR PROTECTION

1. General introduction

During tank protection measures Body armor is one of the most important protective equipment. Ultimately, the hull and turret are the basic elements of any armor protection. Its duty is to prevent All crew members and parts/equipment are also equipped with composite armor plates and armor. Reaction chambers were placed on the top of the vehicle and in front of the turret to increase defensive capabilities. The belt guards mounted on both sides of the vehicle and the grille on the turret are Extra protection

2. Main performance data

Information on vehicle and turret protection:	Also protects against penetration by armor piercing (AP) rounds.
Basic and normal armor:	550 mm thick, rolled-in armor with RHA value. Protects against penetration of anti-tank (HEAT) shells with 750 mm-thick, rolled-in armor. mm.
	RHA value
FY-II Reactive Armor:	Protects against penetration by armor-piercing (AP) rounds. ÷ 750 mm.RHA
	Prevents penetration of anti-tank (HEAT) explosive shells ÷ 1,300 mm. RHA
The thickness of the armor is measured by composite material (car body).	Vertical/level = 474 mm./670 mm.
(including basic armor)	
Thickness of composite armor (turret)	Vertical/level =550 mm./634 mm.
(including basic armor)	
Reactive armor information (vehicle)	Thickness 35 mm. (special shaped box)

3. **Working principle:** Composite armor is

made of high-hardness, low-density metal and non-woven materials. Metals are created with the property of large bevel angles and areas that will cause asymmetry of the sides. Impacting the bullet or the flow of the jet stream causes the bullet or the flow of the jet to The vapor is disturbed, causing its stability to decrease. As a result, the penetration depth and penetration caused by the ball The bullet and the vapor flow are shortened. In order to achieve the objective of preventing and ensuring tank survivability and crew safety Reactive

armor is a type of armor created by attaching a reactive armor box to the base. Its function is to resist explosive projectiles to redirect and destroy their impact. Accumulation of energy causes the penetration depth and penetration of the bullet or jet stream to be shorter. To increase confidence in the survivability of the tank and the safety of the crew.

Rubber belt shields mounted on both sides of the hull and grilles on the turret are responsible for stimulating the explosion of grenade rounds. Tanks (HEAT) in advance to reduce damage. Happens to the vehicle and gun turret caused by high-explosive anti-tank (HEAT) shells.

Part 3

NBC PROTECTION SYSTEM

1. General introduction

The NCCC protection system is a means of protection for combat in special conditions. It is used for Detection of attacks from nuclear weapons, biological weapons and chemical weapons and weapons defense. Biological Nuclear and chemicals with the NCCC filtration system and personal protective equipment. Meanwhile It has work on internal ventilation, smoke exhaust and cooling. Safety of The crew can gain full confidence by separating or coordinating their operations. NCCC system and can also improve the environment inside the vehicle to increase survivability in combat.

2. Main performance data

A. Prevent the accumulation of overpressure values (Overpressure value of collective protection)

When the tank is stationary and the engine is not The overpressure value must not be less than 250 pascals (Pa) under the condition that all inlets and outlets of the tank are closed.

B. Automatic notification of nuclear attack.

C. Low dose gamma radiation (γ -ray) warning rate.

When the alarm rate of gamma rays (γ -ray) reaches 1 milligray/hour (mGY), it will be generated. Low radiation warning signal within 0.05 seconds.

High gamma radiation (γ -ray) dose warning rate

When the warning rate of gamma rays (γ -ray) is higher than 1×10^4 milligrams/hour. (γ -ray) will generate a high radiation warning signal within 0.05 s.

D. Gas protection performance

Can effectively protect against military poisons, biological agents, and radioactive dust. efficiency

Hydrochloride resistance time (hydrochloride) (1 milligram/L. (mg /L))	~30 minutes
--	-------------

Resistance time to sarin gas (0.05 milligrams/L. (mg /L))	~4 hrs.
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The period of use and storage of the adsorbent filter is 8 years.

E. Automatic notification of phosphorous toxicant.

At a temperature of -20°C~50°C When the concentration of sarin gas is greater than 1.5 milligrams/cubic meter. 5 seconds

At a temperature of -20°C~50°C When the concentration of Vx is greater than 4 milligrams/cubic meter 10 seconds

F. Time required for shutting (Time required for shutting) The length of

time since receiving the alarm signal to turn off/reposition the mechanism.

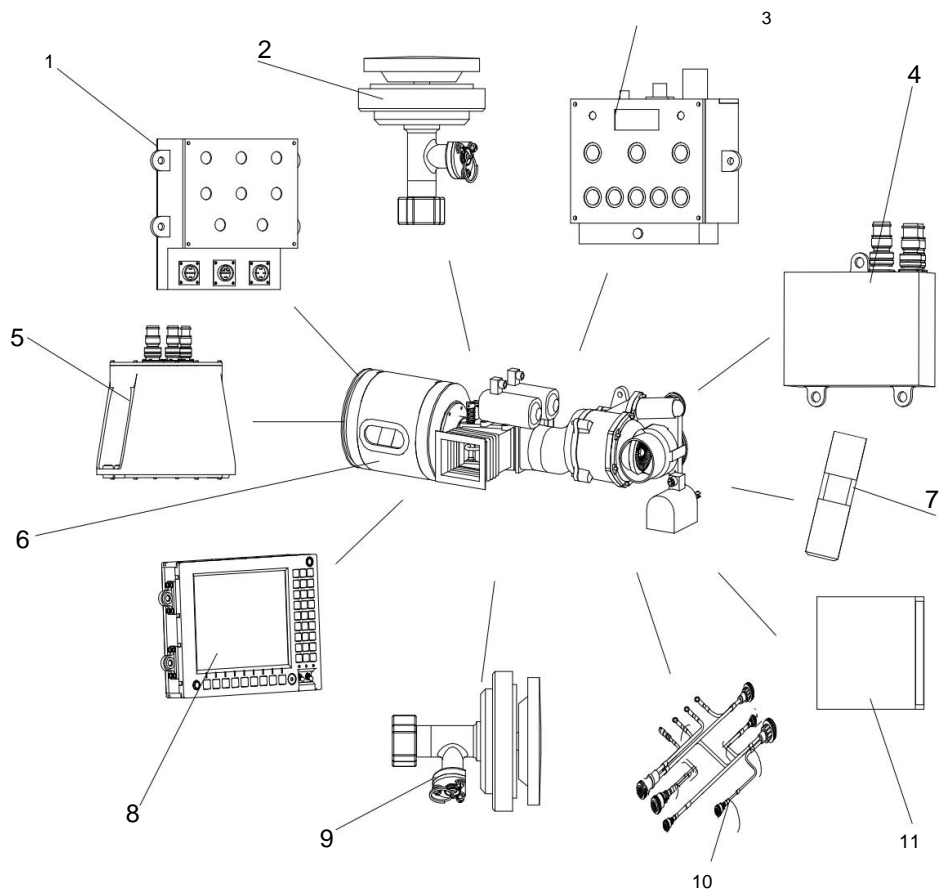
More than 150 milliseconds

3. Components of system and operational principles

principle)

A. Components of system

The NCCC system consists of an SFY common NCCC controller, an SFC-1 NCCC detection drive box, a common radiation/toxic detector, Ventilation filter device (consisting of a powerful dust-pushing fan, a four-way valve position closing/opening device, a closing mechanism imported air conditioners and absorbent filters, etc.), imported internal air purifiers, driver cabin ventilation vents, fire extinguisher detector drive boxes, and air conditioners. SMC-1, overpressure signal lamp Y250, gas mask and connection cable sets, etc.



- 1. SFY-1 type NCC control box
- 2. Mechanical mechanism for closing the ventilation openings in the driver's cabin
- 3. Combined radiation/toxic detector
- 4. Search box for fire extinguishers
- 5. Box that drives the search for NCCC.
- 6. Ventilation filtering equipment

- 7. Overpressure signal lamp Y250
- 8. Driver's mission control screen
- 9. Cleaner in the import compartment
- 10. Set of cables to connect to the NCCC system.
- 11. Gas mask

SMC-1 NBC

Figure 1: Components of the NCCC system.
(Components of NBC system)

As shown in Figure 1, responses to nuclear/chemical and Manual signal switch button of the SFY-1 type combination controller, the actuating mechanism of the NCCC, such as a motor. The fan pushes dust with force and the electromagnet of the mechanism to close the channels, etc., and it acts according to the specified program to allow the system to clean. Protected under Driving the detection box of fire

extinguishing equipment B. Operational principle When

a tank is under attack from a biological nuclear

weapon. And the NCCC protection system chemistry works together with the tank's sealing structure to create overpressure inside the vehicle to cause

Collective prevention At the same time, the NCC protection system together with alternating current electricity will be used.

The function of internal ventilation, exhaust fumes, internal temperature control and Air circulation and ventilation. See Figure 2 for the system's working principle.

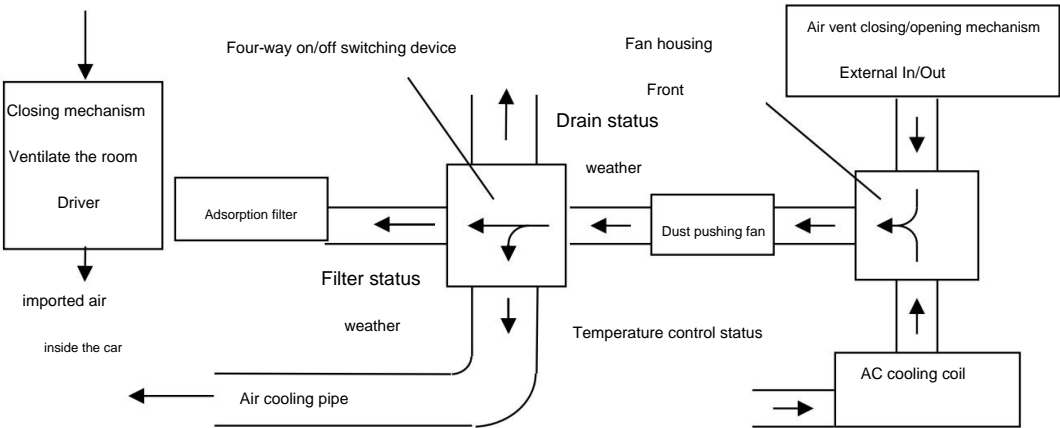


Figure 2: Diagram of the system's working principle.
(Operation diagram principle of the system)

1) Operational principle of protection

When the vehicle enters protection mode The outside air intake/export vents will open and The air intake inside will close. The four-way closing/opening switching device will be in the air filter open state after the dust blower starts. Contaminated air from outside that has been dust-treated is sucked up. It enters the vehicle through an absorbent filter that works in conjunction with the vehicle's leak prevention system. and create overpressure. inside the vehicle to ensure overall protection.

2) Operational principle of ventilation/exhaust smoke (Operational principle of ventilation / smoke exhaust)

When the vehicle enters the ventilation and exhaust operation mode, the outside air intake/export vents will close and the inside vents will open. up ON/OFF switching device The four outlets will be in the open ventilation state. The crew cabin vents will open after the fans start up. The air inside is expelled from the vehicle along the path of the evaporator coil. Alternating current Air inlet Dust fan Four-way on/off switching device Ventilation pipe At the same time, fresh air outside will be added. inside the vehicle from the driver's ventilation vents to create

internal circulation. Causing the exhaust fumes inside the vehicle to be expelled from the vehicle. 3) Working principle for

temperature control

When the vehicle enters temperature control operation mode, the outside air intake/outlet will close and the inside air intake will open. climb The four-way on/off switching device is located In the state of internal recirculating air and external alternating current generator, it will work after the dust-pushing fan starts to work. The air inside the vehicle returns to the vehicle along the path of the evaporator coil. Alternating current Air inlet Dust fan Four-way on/off switching device Internal ventilation pipe to create internal circulation The air temperature will decrease. When flowing through the alternating current evaporator coil which is the work of controlling the temperature

4) Working principle of air circulation (Working principle of air circulation)

When you want to circulate the air inside the car Open the outside air intake/export vents and close the inside air intake vents. The four-way on/off switching device must be located In the state of circulating outside air Turn on the dust fan. Outside air will enter inside. Car passes through the intake port with inner inlet/exit closing mechanism ÿ Dust fan ÿ Changing device. Four-way closing/opening ÿ interior ventilation channels to create air circulation inside the vehicle.

C. Main components 1) Integrated radiation /

toxicant detector The integrated radiation / toxicant detector (Figure 3) will include the circuit of Notification unit Poison warning and radiation warning signal, etc. To complete the work, such as sending signals to warn of toxic substances. Radiation and relative data to the search drive module. The radiation warning unit uses integrated circuit and signal chip technology. Microcomputer, the cumulative radiation dose display screen of the LED monitor will show the working results in

Tests and measurement results

The working principle of the radiation alarm unit: When gamma rays (or beta ÿ particles in source testing) irradiate the detector, The detection circuit produces a stimulus. Electricity at a frequency proportional to the rate of radiation level, after trimming and separating, is sent to the digital connector of the digital chip programmed with the size. Then the operation of the device is implemented in the control program of the microcomputer signal chip, the measurement and ÿ gamma ray alerts will be recognized for this

reason. Exposure to gamma ÿ radiation occurs automatically due to nuclear explosions or In the contaminated area Then it sends out an electrical signal within 0.05 seconds and automatically displays the results of ÿ gamma irradiation from the outside. The measurement range is 0 ~ 9

Exposure to phosphorus poisoning is automatic. and will send an electrical alarm signal

Within 5 seconds - 10 second

The working principle of the poison alarm unit: The radiation source in the device will

Continuously emits alpha rays to break down nitrogen in the air into nitrogen ions.

(N+) and electrons By using a polarized voltage to create nitrogen ions N+ and

electrons to create a flow of current (called base flow) when toxic molecules in

The device captures ionized electrons being absorbed. It will form into negatively charged molecules and continue to be transferred.

This transfer will make it easier for collisions with nitrogen ions N+ to form compounds.

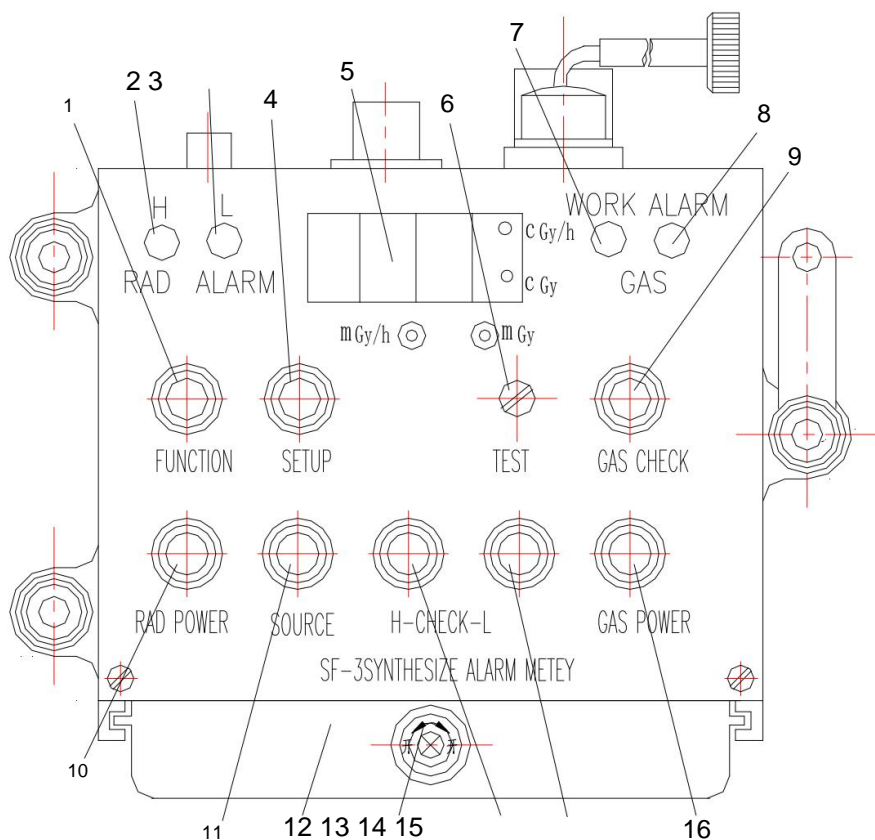
neutral to help reduce the shedding of a large amount of base At the level of measurement, if this variation

This is consistent with the level of concentration of phosphorus toxins measured in the air. Make the measurement

The concentration of toxic phosphorus in the air can be determined with a summary list of changes.

Signal of voltage when the concentration of toxic substances reaches a certain value. It sends an electrical signal.

alert and the red flashing lamp will flash.

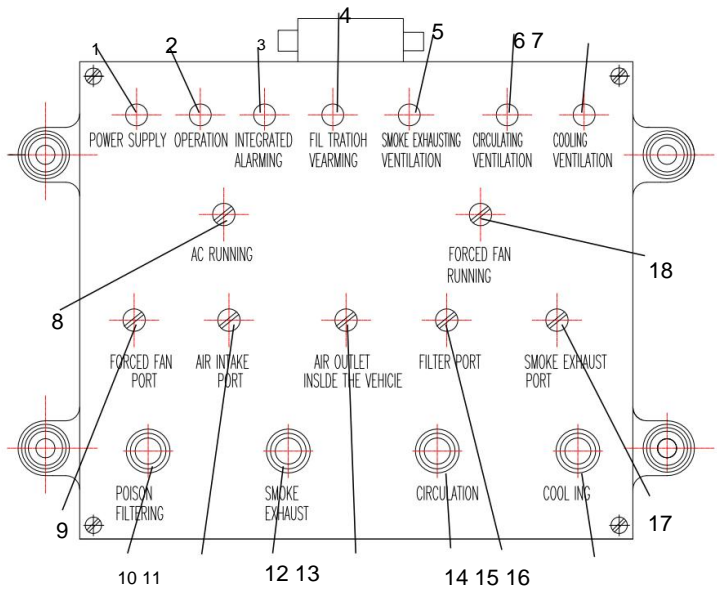


- | | |
|---|--|
| 1. Switch button | 9. Manual toxin detection switch button |
| 2. Nuclear explosion warning light bulb | 10. Electrical radiation detection switch button |
| 3. Clear radiation warning light bulb. | 11. Test button for toxins from the source |
| 4. Settings button | 12. Equipment storage box |
| 5. The screen shows the accumulated radiation dose. | 13. Equipment storage box latch switch |
| 6. Test plug hole | 14. High volume test switch button |
| 7. Work warning light bulb | 15. Low volume test switch button |
| 8. Poison warning light bulb | 16. Electrical toxin detection switch |

Figure 3: Combined radiation/toxic detector.
(Integrated radiation / toxicant detector)

2) SFY-1 NBC integrated controller

The SFY-1 joint NCCC controller serves to receive warning signals. Sends out control signals to control the operation of the actuating mechanism according to the steps. Protection within 0.05 seconds and manual control of fresh gas filtration, exhaust fumes air circulation and air conditioning cooling of ventilation equipment/filtration equipment, etc.



- | | |
|--|--|
| 1. Power supply warning lamp | 8. Air conditioning warning light bulb |
| 2. Work warning light bulb | 9. Fan compartment warning light bulb |
| 3. Common warning light bulb | 10. Gas filtration switch button |
| 4. Lamp to warn of filtration/drainage status.
weather | 11. Warning lamp for air entering the vehicle |
| 5. Exhaust smoke/venting status warning light bulb
weather | 12. Exhaust smoke switch button |
| 6. Light bulb to warn of the status of circulation/
ventilation | 13. Warning lamp for expelling air from the vehicle |
| 7. Cooling/cooling status warning light bulb
ventilation | 14. Air circulation switch button |
| | 15. Air filter compartment warning light bulb |
| | 16. AC cooling switch button |
| | 17. Exhaust
smoke warning light bulb |
| | 18. Light bulb to warn of dust-pressure fan operation. |

Figure 4: SFY-1 NBC integrated controller.

3) Filtering/ventilation equipment (Filtering/ventilation device)

The filtration/ventilation device (see Figure 5) serves to remove dust, filter and suck. Absorb contaminated air into the chamber and create a system to protect the NCCC from overpressure inside.

vehicles to achieve collective protection. The kit includes four operating modes: "Gas filtration/Ventilation", "Exhaust smoke/Ventilation", "Recirculation/Ventilation".

Air" and "Cooling/Ventilation" in the operating mode group. "Gas filtering/

Ventilation" will be used to create Total overpressure protection for the entire tank

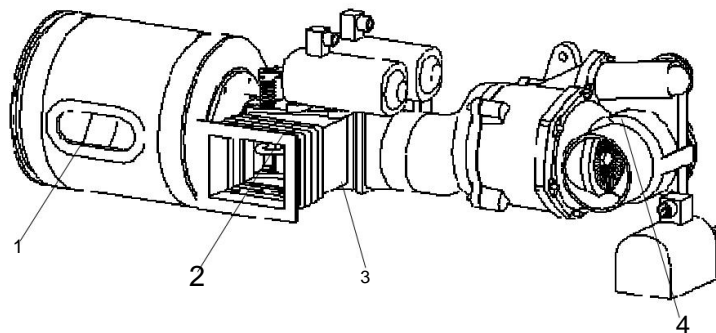
Under nuclear, biological and chemical conditions, the operating mode "exhaust smoke/ventilation" is

used to exhaust smoke and ventilate air after firefighting and gunfire. The operating mode "recirculation/

Ventilation" is used to bring fresh air from outside into the vehicle.

When the vehicle body is unprotected, the "Cooling/Ventilation" operating mode is used to deliver

Cool air to the chamber when the AC power system is in the cooling state.



1. Filter and adsorption

2. Device for changing the closing/opening of four channels.

3. Connection pipe

4. Dust-pushing fan and mechanism for closing/opening the import/export channels.

Figure 5 Filtering / ventilation device

4) Dust blast fan

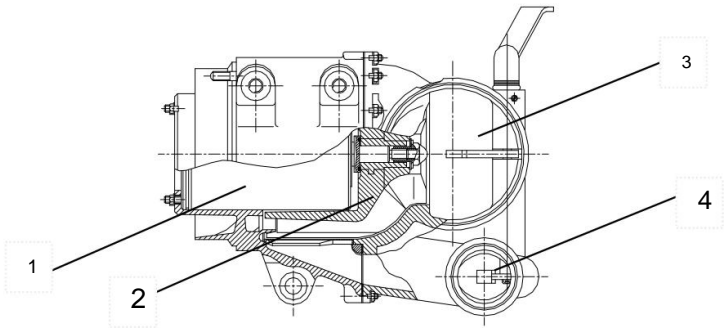
Dust fans are mixed flow fans with axial flow and

The effect caused by centrifugal force, the fan speed will be at 800 rpm.

By flowing along the axis, air from outside is pumped into the vehicle and pressurized.

At one level, centrifugal dust separation will spray dust in the air that is larger than 5 microns from the

The car body acts as primary filtration. or coarse filtering (see Figure 6)



1. Motor type ZD-1,000 2. Propeller set 3. Inlet port 4. Dust outlet port

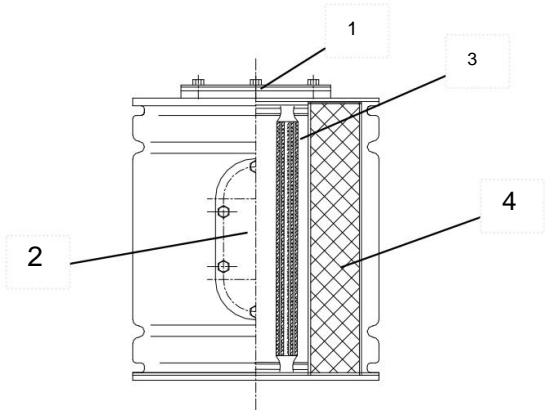
Figure 6 Dust blast fan

5) Filter absorber 200 m 3/hour, type 83 (200m 3/hour filter absorber type 83)

Absorbent filter 200 m 3/hr. Model 83 consists of a paper filter layer, a filter layer.

Activated carbon and casing Used for breaking down and absorbing toxins. Radioactive dust

in the air, biological warfare agents, it cleans the air inside the tank for the crew (see Figure 7).



1. Air inlet 2. Air outlet 3. Paper filter layer 4. Activated carbon filter layer

Figure 7: 200m 3/ hour filter absorber type 83 (200m 3/ hour filter absorber type 83)

6) Replacement of filter absorber after the tank is operated in an area

contaminated with toxic substances such as hydrogen chloride, or hydrocyanic acid or work in an area with phosphorus toxins and other permanent toxins for more than 2 hours. The housing of the absorbent filter has

pores or channels more than 8 mm deep. The sorbent filter has a storage period of more than 8 years when using the ethyl thiol compound to check its working capacity.

of the adsorption filter It will be found that the substance can permeate.

Part 4

Cooling system (COOLING SYSTEM)

1. General introduction

The cooling system consists of an air conditioner and an individual cooling vest. The air conditioner is provided on the turret. Its main function is to cool the gunner. A personal cooling vest is provided on the vehicle which is used to reduce the temperature of the driver's body.

A. Air conditioning (Air-conditioner)

Used for controlling air. It will work together with the NCCC system. It is responsible for Heat dissipation creates a comfortable interior environment for the crew.

B. Single-man cooling vest The single-man cooling vest is a

device to reduce the body temperature of the crew. This makes the crew more comfortable in high-temperature working conditions and increases their endurance and combat capability in high-temperature working conditions.

2. Main performance parameters A. Air conditioning (Air-conditioner) 1) The

air conditioner has the function of

cooling and ventilating the air. 2) Cooling output value: in the

nominal working condition is 4,000 watts. **(W)** 3) Refrigerant: R 22 (1.2 kg.) 4)

Operating temperature: -20 °C to

+60°C 5) Storage temperature: -55°C to +70°C

6) Operating voltage: **26±4** volts

B. Single-man cooling vest

- 1) Rated power: not more than 360 watts (W).
- 2) Noise: not more than 90 decibels (dB).
- 3) Weight: not more than 12 kg.
- 4) Operating temperature: 0°C to +50°C
- 5) Outlet water temperature of the main refrigeration unit: 15°C to +28°C.
- 6) Operating temperature: 26 ± 4 volts

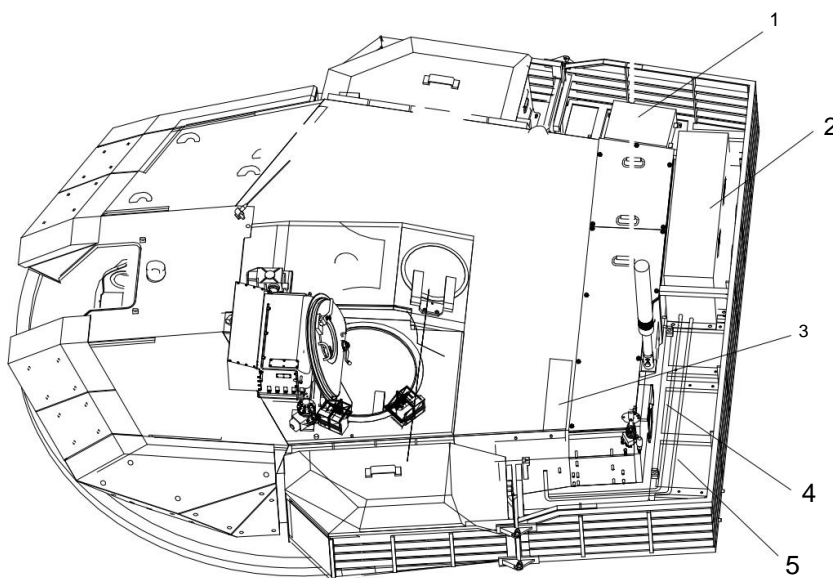
3. Composition and working principle

A. Air conditioning (Air-conditioner)

- 1) Composition: An air conditioner consists of an external unit, a compressor (compressor).

It is included in the external unit), internal unit, power conversion compressor, cables and pipelines.

See picture 8.



- | | |
|---|--------------------------------|
| 1. The compressor converts electricity. | 4. High pressure cooling pipes |
| 2. Units outside the vehicle | 5. Low pressure cooling pipes |
| 3. Units inside the car | |

Figure 8: Composition of air conditioner

The system responds to cooling control signals. and supply a voltage of 220 volts from the external controller to the inside of the electric compressor for operation. in cooling

2) Working principle after turning on

the system The power supply of the converter compressor sends
Output voltage: 220 volts, electric compressor inside the external unit. will work by

Absorbs the refrigerant water vapor with lower temperature and pressure from the lower pressure end and compresses it into refrigerant water vapor with lower temperature and pressure. high blood pressure Then it will be forwarded to Condenser, external unit to condense and condense liquid.

Cooled liquid It passes through the liquid storage and drying filter to enter the pressure reducing valve for control. Volume and pressure reduction It then enters the sublimation machine to be

vaporized and absorbed. The sublimated refrigerant vapor passes through an air/liquid separator to be absorbed. also compressor for the next cycle.

a) Compressor inverter power supply. After turning on the switch to use the compressor system, inverter power supply It's already happened. The

car's power supply will be converted to 220V voltage to supply power to the electric compressor, and the compressor will work under The driving force of electric current

b) Outdoor unit

The external unit consists of an electric compressor, a heating coil (condenser), a condenser fan, a liquid storage unit, a switch. pressure, etc. The electric compressor is responsible for sending and compresses the water vapor of the refrigerant and cause the refrigerant steam to circulate in the cooling system. The compressor releases the refrigerant gas cap with high temperature and pressure. The heat is distributed to the outside air by a condenser (cooled by a condenser fan). The liquid storage unit is responsible for liquid storage and can store refrigerant The pressure switch has the function of protecting against low pressure.

c) Indoor unit

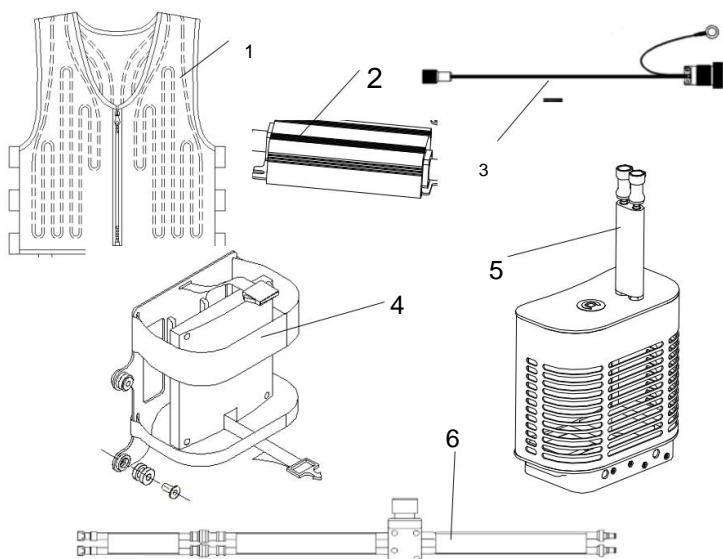
The interior unit consists of an evaporator (cooler), an expansion valve. Hot (pressure control valve), connecting pipe, automatic air control valve, connector, etc. for making Internal cooling uses a method of turning the refrigerant into a liquid that is a boiling gas and being cooled. Control the volume and reduce the pressure in the sublimation machine. It will then absorb the heat of the air near it. the surface of the sublimation agent to lower the temperature Lower temperature air is blown into the vehicle using Forced fan to lower the temperature inside the vehicle.

B. Single-man cooling vest

1) Composition: The

individual cooling vest consists of a main cooling unit.

as individual, main transfer unit plate, frequency filter unit, cooling pipes, wiring harness and Cooling shirts, etc.



1. cooling vest
2. Frequency filter set
3. The cooling line is a person.
4. Main transfer unit plate
5. The main refrigeration unit is individual.
6. The cooling pipe is a person.

Figure 9: Components of a personal cooling vest.
(Composition of single-man cooling vest)

2) Working principle

After turning on the machine The compressor drive circuit board will receive a start signal. and speed control signals from the control circuit board Drive the compressor to start working at speed. As specified, the refrigerant compressed by the compressor turns into supercondensed steam and enters the Condenser to condense it into a saturated liquid state. Saturated liquid coolant will

The pressure is reduced and flows through the capillary pipe and returns to its original state. It then absorbs heat and makes it gas to dry the saturated steam state in the sublimation machine. The steam compression cycle is finished, the circulating medium in the cooling vest flows through the sublimation heater to cool off. heat and flows back into the vest through a water pump to exchange heat with the body.

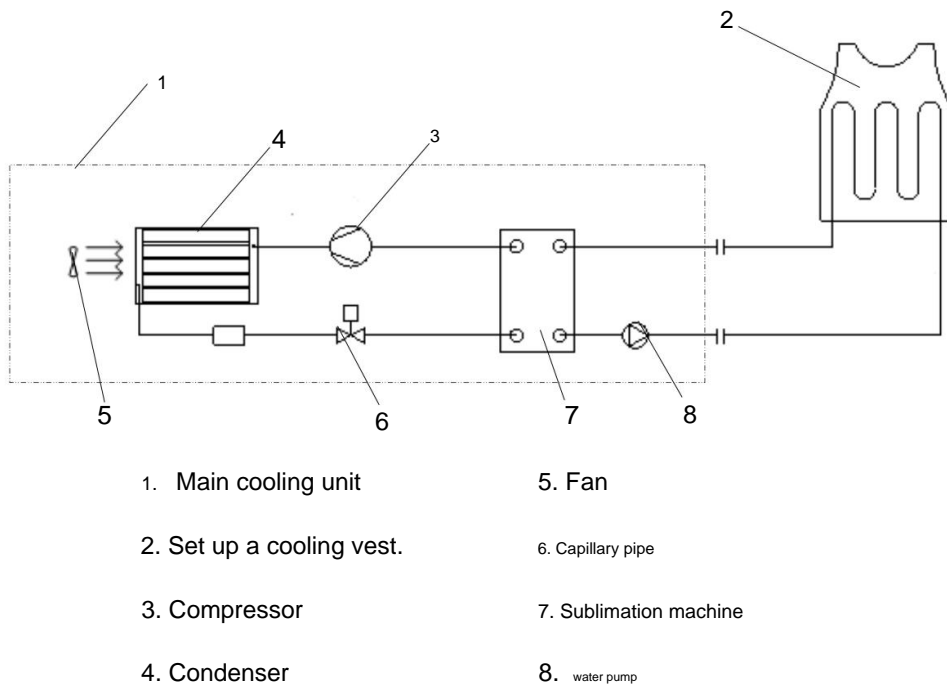


Figure 10. Components of a personal cooling vest.
(Composition of single-man cooling vest)

Part 5 Fire

extinguishing/explosion prevention system

(FIRE-EXTINGUISHING / EXPLOSION SUPPRESSION SYSTEM)

1. General introduction: Fire extinguishing/

explosion suppression systems are divided into fire extinguishing systems within the engine room and Fire extinguishing/explosion prevention system

within the tower room A. Fire extinguishing system within the engine room (Fire-extinguishing system of power compartment) is

used for extinguishing fires that occur in the engine room. and can detect fires that are hazards within the engine compartment automatically Then extinguish the fire with the control of the device. Extinguish fire by hand or with automatic fire extinguishing equipment. B. Fire

extinguishing/explosion suppression system within the driver's cab and inside the gun turret.

Used to prevent the explosion of engine oil/fuel mixtures and It provides immediate air protection and also protects the crew and internal tank components/equipment. Damage is caused by secondary effects that occur after

the vehicle is shot. Various anti-tank weapons or anti-tank rockets Most of them are hollow dynamite. Explosive anti-tank (HEAT) shell after the vehicle's armor is shot. Metal vapor current High temperature and pressure are produced and then sprayed into the tank. The flow from IP will not only directly kills the crew, but also causes damage to the engine oil/fuel and various hydraulic pipes, causing the engine oil/fuel that is sprayed When released and mixed with air, oil-air mixtures can burn and explode in a matter of milliseconds if they are not restrained. Immediately, an explosion will occur and injure the crew. and damage to the tank is called "secondary impact". Tanks damaged by secondary impact cannot be repaired. Therefore, as a fire extinguishing system /Suppress explosion Not only can it extinguish internal fires. The tank quickly But "secondary effects" can also be prevented, that is, by implementing fire-fighting and explosion-proof capabilities.

2. Main performance parameters

A. Scope of capabilities of the fire extinguishing system within the engine room.

1) Flame response time ≤ 5 seconds

2) Two GF7-2.7 fire extinguishers.

3) Spraying type of fire extinguisher

a) Automatic mode: The fire extinguisher will work by spraying within a period of time.

according to the order of the time delay. 10 seconds according to the conditions of the fire that occurred

b) Semi-automatic mode: Controls the fire extinguisher to spray fire extinguishing agent to the room.

engine by pressing the switch button manually.

4) Work on sending warning signals with sound and light.

B. Scope of capabilities of the fire extinguishing and explosion suppression system within the driver's cab.

and inside the turret

1) The system will automatically react to resist the metal vapor current within

Time 10 milliseconds and prevent explosions caused by mixtures of oil vapors or flames.

of any other fuel within 80 milliseconds after the tank was fired.

2) Limit the explosion pressure within the range to 0.1 megapascals (MPa). The soldier's skin

The vehicles that caught fire will be restricted within a grade one area.

3) The system can work to stop explosions continuously, automatically and

in two quick bursts after the inside of the tower room was shot. or do a fire extinguishing

four times continuously Under the condition that the power system is cut down (within a period of two hours) the system will still

Able to extinguish fire by hand

4) Fire extinguisher spraying mode a) In combat

mode: when one of the four camera detectors detects a signal

A fire will trigger two Type (B) 1301 fire extinguishers to spray extinguishing agent simultaneously.

b) In normal use mode: When one of the four camera detectors detects

The fire alarm will not spray out fire extinguishing fluid. While the detection camera receives a fire signal

fire. One type (B) 1301 fire extinguisher will spray fire extinguishing agent in waves upon exposure.

Fire alarm signals that last more than 30 milliseconds and within a time period of less than 30

millisecond fire extinguisher Fire extinguishing system inside the engine room (B) 1301, two tanks will be sprayed.

Simultaneous fire extinguishing agents When the three fire detection cameras receive a fire signal, the fire extinguisher

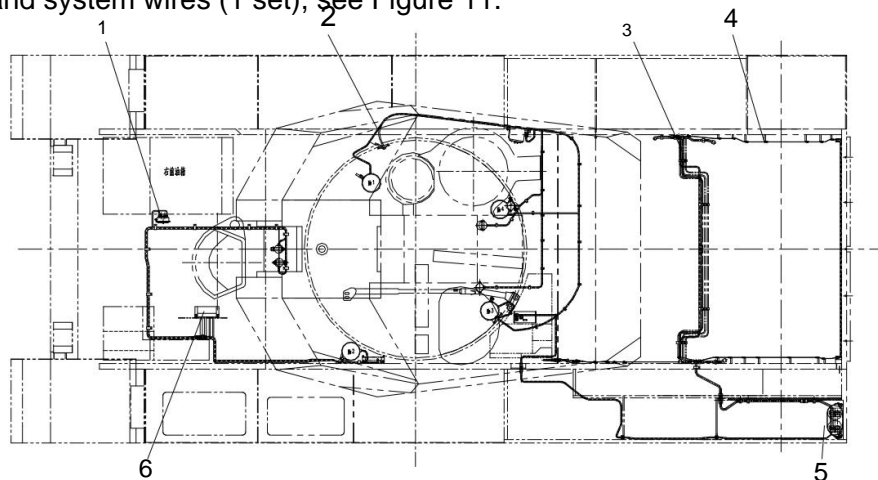
Form (B) 1301 Two tanks spray fire extinguishing agent simultaneously.

3. Components of system and operational principles principle)

A. Components of system

1) Fire extinguishing system within the engine room (Fire-extinguishing system of power compartment)

The system consists of 1 shed extinguishing/explosion suppression system control box, Two GF7-2.4 fire extinguishers, wire flame detector, signal horn, fire extinguisher hose and system wires (1 set), see Figure 11.



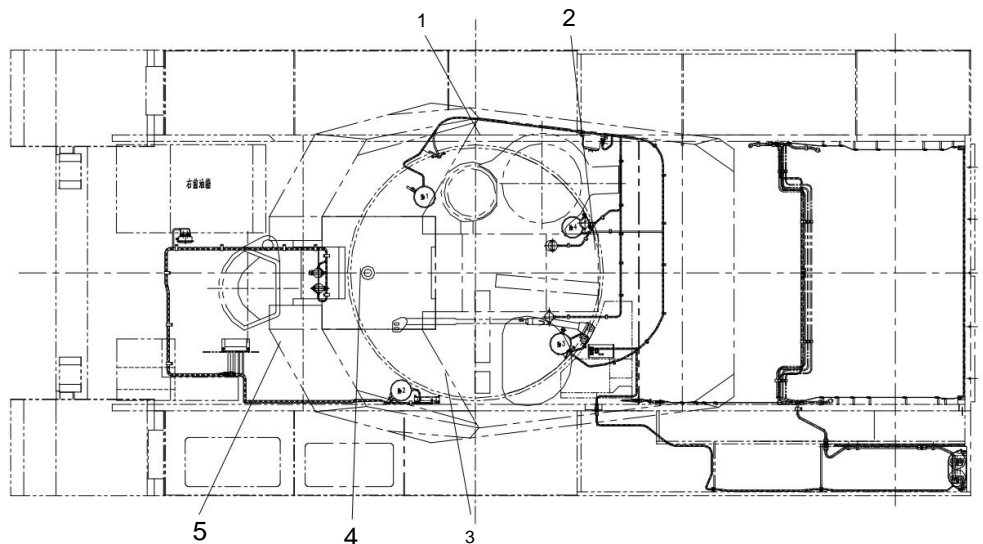
1. Horn signal
2. Fire extinguisher/explosion suppression wire
3. Fire extinguisher hose
4. "Linear" wire detector
5. Fire extinguisher type GF7-2.4
6. Fire extinguisher/explosion prevention control box

Figure 11. Components of the fire extinguishing and explosion suppression system in the engine room.

(Components of fire-extinguishing system of power compartment)

2) Fire extinguishing/explosion suppression system in the driver's cabin and inside the gun turret (Fire-extinguishing/explosion suppression system of driver's compartment and fighting compartment)

The system consists of one fire extinguisher/explosion suppressor control box, one Light detection camera 4 (two inside the turret and each of the vehicle), an emergency switch. 1 piece, bucket Model fire extinguisher 1301 4 tanks (3 tanks inside the turret and 1 tank on the vehicle) and System signal cable (1 set), see Figure 12.



1. Fire extinguishing/explosion suppression system signal cable
2. Emergency switch
3. Fire extinguisher type 1301 (B)
4. Signal detection camera
5. Fire extinguishing/explosion prevention system control camera

Figure 12. Components of the fire extinguishing/explosion suppression system in the driver's compartment and inside the turret.

(Components of fire-extinguishing/explosion suppression system of driver's compartment and fighting compartment)

B. Operational principle 1) Working principle of

the fire extinguishing system in the engine room. Wire

detectors can detect signs of fire hazards. It happened in the engine compartment of a tank. and the fire alarm signal will be sent to the control box. Fire extinguishing/explosion suppression is carried out by the NCCC propulsion control box (SMC NBC) installed on the vehicle. The fire signal is then processed by the fire extinguishing/explosion control box. inhibit explosion According to the operating mode set on the control system, the spray signal of the fire extinguishing fluid tank will be Send it out and the GF7-2.4 fire extinguisher will start working by the search drive control box. Fire extinguishing and NCCC type SMC-1 to extinguish fire and drive the signal of the stimulating mechanism. external relations to control the working mechanism Emergency switch on the control box Fire extinguishing/explosion suppression system for engine rooms can be operated manually in extreme conditions. emergency so that the fire extinguishers in the engine room can begin their work in extinguishing fires. connection and Communication of the system between the turret interior and the hull components is achieved by through the CAN bus signal connection cable at the same time External CAN bus connection for data communication with the tank interior, complete with control box design. Fire

extinguishing/explosion suppression 2) Principles of operation of fire extinguishers and explosion sup

Turret

An optical camera mounted in the turret can detect and inspect the area. of the VT4 tank gun turret Yes, the fire alarm signal will be sent to the fire extinguishing/explosion suppression control box by the joint NCCC control box. When the emergency switch is in the activated state, the signal will be forwarded to the fire extinguishing/explosion suppression control box by the NCCC control box. When in the shutdown state, the fire extinguisher 1301 No. 4 on the turret will begin to extinguish the fire directly. The light detection camera mounted on the vehicle can detect and detect Examination of the vehicle The fire alarm is sent directly to the fire suppression/explosion control box. All transmitted signals are analyzed and managed together by the fire suppression/explosion control box. Then it will work according to the mode in which the system is set. Tank spray signal The fire extinguisher will be sent out. The fire extinguisher 1301(B) will be started directly or started by the box.

joint control of the NCCC To prevent explosions and fire extinguishing and the driving signal of the mechanism

The corresponding external stimulus is sent. Emergency switch on fire extinguisher control box/

The explosion suppressor for the inside of the gun turret can control the operation of the system manually. In

In the event of an emergency, the fire extinguisher inside the turret can begin extinguishing the fire. Connection and communication

between the turret and the vehicle's sub-assemblies Connection and communication between

The turret and other vehicle components can be operated using the CAN bus signal cable in

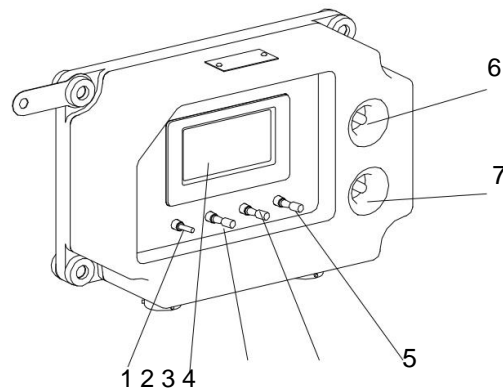
the system, while the external connection of the signal cable is also available. CAN bus is used for

install information media with the car, is on the control box.

Fire extinguishing/explosion prevention

C. Main components

1) Fire extinguishing/explosion prevention control box (Figure 13)



1. Test switch (TEST)
 2. Status display and test data
 3. Automatic and semi-automatic switches (AUTO/SEMI)
 4. Select switch for use in combat/normal use (COM/NOR).
 5. Switch to turn on/off the system (ON/OFF)
 6. Emergency switch button in the tower room (CREW)
 7. Fire extinguisher switch button for the engine room. (emergency switch)
- (EMERGENCY SWITCH-ENGINE)

Figure 13: Fire extinguishing/explosion prevention control box
(Fire-extinguishing/explosion suppression control box)

The fire extinguishing/explosion suppression system control box can be monitored and managed.

Sub-components in the dorm room (including gun turret and body) and engine compartment, control box

Fire suppression/explosion suppression can be signaled by an emergency switch from the turret generated by the machine.

Control joint NCCC with the CAN bus signal cable of the fire alarm system of

Detector and data in fire extinguisher control mode 1301 Quantity: 3 tanks, etc.

At the same time, it can also supply power and monitor sub-components of the optical detection camera.

On the vehicle, which receives fire alarm signals and monitors the operation of 1301 fire extinguishers,

quantity 1 according to the operating mode of the activated system, a spray signal is sent. go out

According to the number and interval of fire alarms, start the use of fire extinguishers 1301.

To prevent two explosions or to extinguish fire once, go to the inspection area inside the turret and the body.

vehicle, while also controlling the current detection time of wire and tank detectors.

Two GF7-2.4 fire extinguishers installed in the engine room with a drive control box.

Search for SMC-1 NBC on the vehicle. The fire extinguishing/explosion suppression control box can receive

Fire alarm and information on the control mode of the fire extinguisher GF7-2.4

Number of 2 tanks reported by the NCCC control box and the SMC-1 search drive of the vehicle.

with the CAN bus signal cable of the system according to the operating mode that is currently being used.

Drive the GF7-2.4 fire extinguisher to prevent fires in the engine room and

Transmits drive signals of external relative actuation mechanisms (fans, sirens).

Fire extinguishing and fire extinguishing/explosion suppression control box are started.

manually when the system is under the system power-on condition. Manual fire extinguishing operations for

Inside, the tower and engine rooms are separated. Fire extinguishing and fire extinguishing control box/

The Explosion Proof is designed to provide a fully automated self-test that can

Check and test the current control mode of system components. At the same time, it can also perform the

function of diagnosing faults and finding all errors.

The test results are displayed together on the display screen. The descriptive words are words used in conjunction with the icons.

Shows images and logic designed by the software. You can specify the control mode of each operation.

The system is clear and convenient for users. in use and maintenance It has also been designed

Connection with CAN bus cable for complete data communication within the tank.

2) Linear flame sensor

The detector resembles the inner structure of a wire, with a very thin wire in the center coated with a heat-sensitive glass fiber. It has a negative temperature coefficient and has a stainless steel metal casing. By exporting double variable values The resistance value will be decreases and the resistance of the power capacitor increases as the ambient temperature increases. When the temperature increases quickly A sudden turning point occurs during the reduction of the resistance value. Once the sudden turning point is passed, an overheating alarm and a fire alarm m different

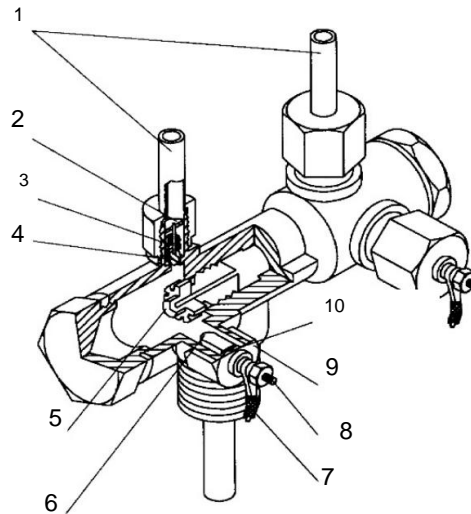
3) Fire extinguisher type GF7-2.4 (Fire-extinguishing bottle GF7-2.4)

The tank consists of a thermostat (Fig. 14), extinguishing agent and a steel tank.

The extinguishing tank is filled with GF7 substance (i.e. HeptafluoropropaneHFC-227ea)

The operating temperature is -20°C to 55°C and the allowable working pressure is 6 megapascals (MPa).

The tank can hold the substance. Can extinguish 2.4-0.130 kg of fire. Charged with nitrogen with a compression force of 4 megapascals. The charged extinguishing agent is colorless and has no pungent taste. I Normal temperature if heated It will turn into white smoke that is less toxic. Less corrosion It has a good fire extinguishing effect and has zero ozone layer destruction potential (ODP). It is a fire extinguishing agent that Environmentally friendly



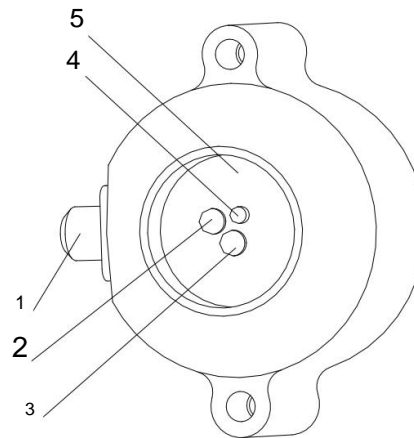
- | | |
|------------------------|---|
| 1. Lead pipe | 6. BD-2 gunpowder charging tube (squib) |
| 2. Barrier plate | 7. Electrical conductor plate |
| 3. Coiled leaf springs | 8. Wire |
| 4. one way tongue | 9. Screw cap |
| 5. Hollow spiral seal | 10. threaded shaft cover |

**Figure 14: Control head of fire extinguishing
bottle GF7-2.4 (GF7-2.4 Control head of fire extinguishing bottle GF7-2.4)**

The control head on the fire extinguisher is first equipped with a BD-2 gunpowder charge tube. To extinguish a fire, the control box signals a command to blow up the gunpowder charge tube. Group of gases that arise from The explosion of the gunpowder tube pushes the bullet against the hollow threaded seal. After the bolt head Broken from being hit The center hole will be pushed in. and the fire extinguishing agent will be pumped out at high speed. high under pressure of 4 megapascals

4) Optical detector

See Figure 15 for the structure of the dual infrared detection camera.



1. Connector

4. Red LED light bulb

2. Components that are sensitive to infrared light 1 5. Quartz glass

3. Components that are sensitive to infrared light 2

Figure 15: Optical detector

Dual infrared light detectors select the wave band with the highest value of energy available.

Radiation from the combustion of two flames is 2.7 micrometers (μm) and 4.3 micrometers.

Two signal paths are sent out as a real fire alarm. oriented control

The internal logic is achieved with a single chip. The software is designed to be calibrated.

To be used in tracking the light of the current environment and achieving goals in

Responding quickly to fire alarms Because all equipment is fixed to solid surface

When the detector detects a flame, the red LED lamp will light (if there is no flame

But the red LED bulb lights up. indicates that the detector is not working.) Two photosensitive lamps in

Separate detectors detect two infrared wave bands of 2.7 micrometers and 4.3 micrometers

only when the signal is received by the two light sensing elements.

can be detected and then an electrical signal can be sent out.

5) Fire extinguisher 1301 (B)

See Figure 16 for the structure of the fire extinguisher.

In normal conditions, the fire extinguisher will be filled with extinguishing agent. 1301 Quantity 2.7+0.14 kg.

(such as Trifluorobromomethane Freon Halon) and pressurized nitrogen ions

The pressure in the tank is kept at 4.2 MPa to 4.3 MPa when the temperature is 21°C.

A perforated fire extinguisher shock absorber is a safety device made from a protective cover.

Perforated impact when fire extinguishers are accidentally released during loading and transport.

A shock device can slow the extinguishing agent to reduce the risk. Cover

Short circuit protection is a safety device used to prevent malfunction of the lamp.

Gunpowder charge during assembly/disassembly and installation When installing the short-circuit cover

This means that the gunpowder cartridge and the housing are short-circuited to prevent the gunpowder cartridge from firing.

An explosion occurred. A diverter plate is used to change the spraying direction of the extinguishing agent.

This allows fire extinguishing agents to be quickly sprayed to all protected areas.

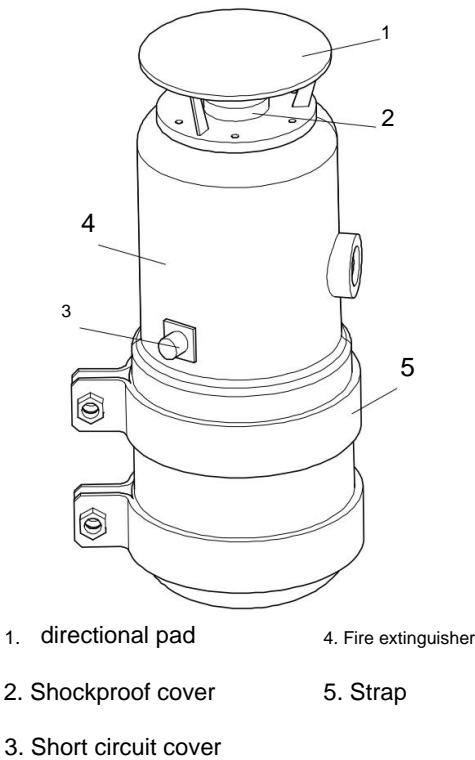


Figure 16 Fire extinguisher 1301 (B) (Fire extinguisher bottle 1301 (B))

After removing the protective cover of the fire extinguisher You will see the structure of the injection unit.

The fire extinguisher can be sprayed as shown in Figure 14. The pressure switch is designed to be used in

Sends a signal regarding the status of the extinguishing agent in the fire extinguisher at any time. When the pressure in the tank

The fire extinguisher has dropped below the permissible value due to a malfunction or leak.

The pressure switch changes from closed circuit to open circuit to send a continuous signal to the control box that

The fire extinguisher is not ready for use. At the same time the circuit is cut. The function of the pressure relief

valve is When the pressure in a fire extinguisher increases to dangerous values due to overheating or from

Other reasons: We can automatically open the vent valve to allow the extinguishing agent to come out slowly. Fill valve

Fire extinguishing agent is used for adding fire extinguishing agent. The gunpowder charge tube is Explosion of the diaphragm

(Diaphragm) of the nozzle to cause the extinguishing agent to spray out of the fire extinguisher after receiving a signal.

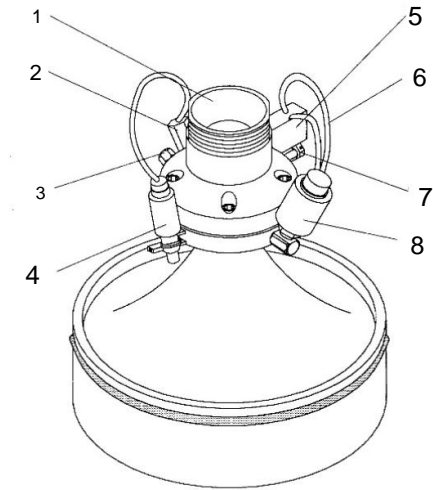
ignite Most gunpowder charge tubes can be detonated under the action of electric current.

size 0.6 amps, when the current is up to 5 amps, the ignition speed can reach the maximum value at

The ambient temperature is 20 degrees Celsius. One fire extinguisher can spray for approx.

110

millisecond



- | | |
|--------------------------|--------------------------|
| 1. Nozzle | 5. Spray switch |
| 2. Gunpowder charge tube | 6. Pressure switch cable |
| 3. Filling valve | 7. Pressure relief valve |
| 4. Receiving platform | 8. Pressure switch |

Figure 17: Spraying part of fire extinguisher bottle 1301 (Spraying part of fire extinguisher bottle 1301)

6) Engine shut-down: When a fire occurs

in an automatic system condition, the system will control

The engine will automatically shut down and the cooling fan will stop working. In this way

The fire extinguishing effect will be better.

7) Ventilation device

Ventilation and ventilation after fire fighting, and

Fire extinguishing/explosion suppression is achieved through the relevant components of the NCCC system.

Ventilation and exhaust fumes are controlled by the NCCC control box. SFYB type submersion

Chapter 6

Laser and smoke screen alerts

(LASER WARNING AND SMOKE SCREEN)

1. **General introduction** After the

laser alert system detects the use of guided weapons and threats, from enemy military laser equipment, for example, a 1.06 micrometer Nd:YAG neodymium laser, a laser beam from a neodymium crystal Premium (Nd glass) and laser beam change 1.54 micrometer Raman frequency shift and laser beam From Erbium glass, the system fires a smoke-type grenade according to the steps. Firing a preset within one second to create a smoke screen. By using the connection of Protection system with laser warning system and smoke grenade launcher to increase efficiency In general protection of tanks

A. Laser warning system

The laser light detection head is connected to the light alarm signal processing unit. The laser passes through the connector of a coaxial fiber optic cable. Fiber optic cables transmit light signals. The laser received from the detector head is sent to the signal processing unit. control unit The display shows the threatening laser parameters. Then fire the smoke grenade automatically according to How to fire the designated smoke grenade in automatic state or manual firing state? You can choose the pipe. The smoke grenade can be fired manually and is activated by pressing the corresponding trigger switch button. The display control unit has the following controls. loop that is connected to the dual CAN bus signal cable to send the value Threatening variations in laser light Self-test information and control the number of grenades fired Smoke type to CAN bus signal cable

B. Smoke screen grenade launcher Smoke screen grenade launcher

is used primarily to create a smoke screen that is stable over a period of time. short period the front of the vehicle while the vehicle is moving (or stationary) can make the enemy blind. Can be blinded in a short period of time Smoke grenades can block visible light interference. Can reach a wave size of 8 mm and can block and disturb guided weapons with lasers and other equipment. Efficient search/monitoring and a thermal imaging camera with a wave size of 8 mm. This type of device is a reactive weapon that uses a wide frequency band and countermeasures. to strengthen The ability to provide total protection to the tank is very good. The smoke grenade launcher can also Can fire air-fracturing grenades. Firing air-fracturing grenades can intimidate and kill any enemy that enters. Effectively close to tanks to create blind zones in close-quarters tank combat.

2. Main performance parameters

A. Capabilities of the laser warning system

1) Detects laser light with wavelengths: **1.06 micrometers (μm), 1.54μm, 1.57μm;**

2) Detection range: more than 1.5 times in normal operating range (under standard

environmental conditions) 3) Weather warning: **360° direction,**

altitude 90° (-10° - +80°) 4) Alert resolution: direction 20°±2°, divided altitude into 3 zones 5) Possibility In detection: more

than 98% 6) Error rate in notification: ≤1 time/100 hours

7) Response time: Time since detection and receipt Receive a threat signal from The enemy's laser beam to produce processing results takes less than 20 milliseconds (not including the time of verification code)

8) Ability to process multiple targets: able to process

Sources of threats from different directions at the same time 3 direction

9) Ability to prevent interference: Able to resist interference such as

Sunlight saturation, man-made light, etc.

10) Self-testing capability: When the switch is turned on, it can be tested.

itself and set the defective position to replace the defective unit according to the position.

11) Verification ability: Able to verify the laser signal that

can shoot and signal laser guidance.

12) Multipath resistance capability: ≈ 30 cm.

13) Duration of continuous work: ≈ 12 hrs.

14) Power supply: DC26V \pm 4V

B. Scope of work of the smoke grenade launcher

1) Width of the barrel 76 mm.

2) Length of the 250 mm.

launcher 3) Weight 1.99 kg.

4) Shooting range 50 m.

5) Height of explosion 6) ≈ 5 m.

Time to create smoke screen ≈ 2.5 seconds

7) Length of the smoke screen 50 m. - 60 m.

8) Properties of smoke It is non-toxic, anti-corrosion and

scenes Refraction of smoke scenes with gray or milky white light

9) Ambient temperature in operation -40 to 50°C.

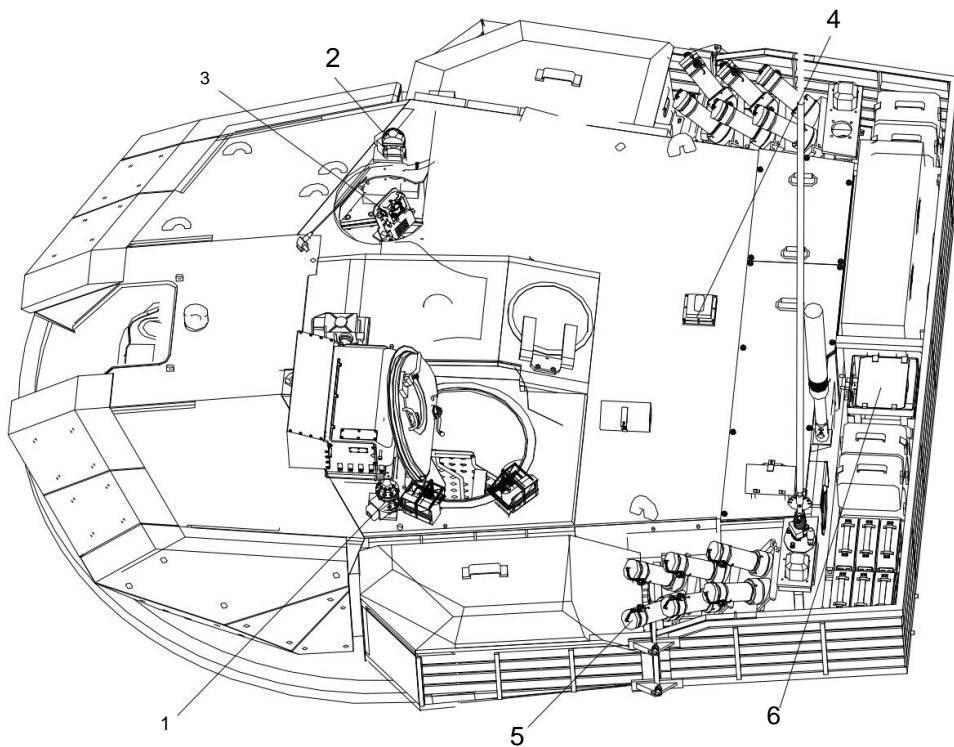
10) Reliability in use $\approx 95\%$

11) Safety current in ignition ≈ 100 milliamps (mA)

3. Composition of system and working principle)

A. Composition of system

Laser detector heads are mounted on the right and left sides of the gun turret deck. The laser alarm processing unit is mounted at the position of the internal longitudinal center line. Turret The display control unit is mounted on the right front of the operator inside the turret. The launcher The smoke grenade has 12 launch tubes, divided into two sets, mounted on the right and left of the turret. respectively



1.2. Laser light detection head

5. Smoke type grenade launcher tube

3. Display control box

6. Smoke grenade storage box

4. Processor

**Figure 18: Laser and smoke grenade launcher warning system
(Laser warning and smoke grenade linkage system)**

B. Working principle

1) Working principle of the laser warning system

The laser detector head consists of a receiver antenna base. Fiber optic cable connectors and connector bases The laser detection head base guarantees adjustment accuracy. Direction of the fiber optic connector The fiber optic laser connector consists of an aperture glass, a diaphragm and a lens and ensures that each The exposure reservation works in harmony with Field of view (FOV) respectively

The laser light detection head has a separate structure. It consists of an antenna. Two semi-circular receivers A total of 20 fiber optic laser connectors are arranged inside. The two hemispherical receiver antennas are mounted on a two-layer receiver antenna base. Each layer has 10 connectors, each at an angle of 40° to each other. Field of view for cameras Fiber optic detection is limited by using the diaphragm of each fiber optic connector to limit it. Each adjacent aperture is provided with overlapping vision at an angle of 20° in direction and at an angle of 30° in elevation. The laser detector head is connected to fiber optic cable fiber optic connector A multi-core unit is set up at the end of the connection between the fiber optic cable and the body. Process the signal to provide a connection to the receiving antenna and data processing unit. fiber optic cable A laser light detection head and fiber optic cable are used for It receives the threatening laser signal and forwards the laser signal to the

processor. The signal sent from the laser detector head through the fiber optic cable enters Detection signal amplification module Each detection module in the amplifier module has a circuit. Threshold If the amplitude of the extended laser signal exceeds the specified threshold value, The threshold circuit sends data. about the arrival time of the laser signal (front edge of the excitation) and its width. Triggering including voltage level (TTL) to the signal processing module.

The signal processing module performs pre-processing. Treating the amplitude of the excitation signal and eliminating the second reflection of the Received signal After setting the laser signal The signal processing module calculates the direction. The path of the laser incident is under the control of the central processing unit (CPU), which processes the existence or non-existence of the laser signal and information. Information of the time entered Arrival of the trigger signal The shock arrival time cycle records the shock arrival time. Arrival of each excitation signal simultaneously The code identification circuit corrects duplicate codes and frequencies. According to the time period of the measured excitation signal variable, a multi-target selection circuit is arranged.

multiple laser targets according to the laser beam's incident direction and its parameters Excitation signal received from the detection channel Threat types of lasers and level judgment circuits The laser distinguishes whether the threatening laser is a rangefinder signal or a signal from a rangefinder. Laser guidance and determine the level of threat of the laser in the final step. The system will return the results. of data over a communication connection line

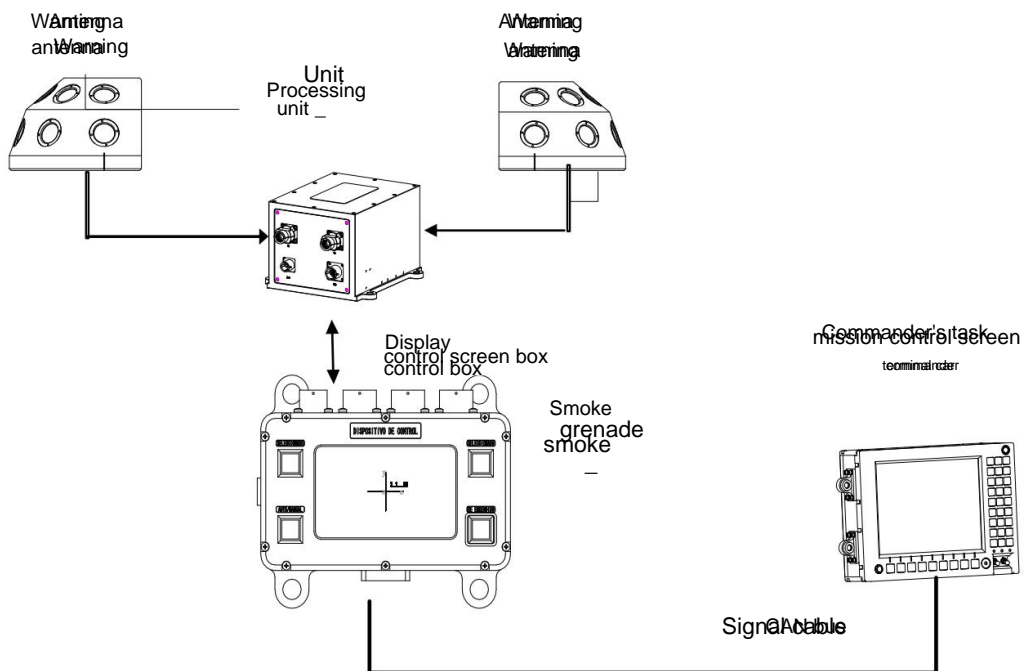


Figure 19 Connection of laser warning system

2) Working principle of smoke grenade launcher

After loading the smoke grenade into the launch tube, Press the trigger switch button.

on the control box to ignite the electric fuse at the end of the grenade to ignite the propellant in the grenade. The propellant will be

Combustion takes place in a pressurized chamber to create a rapid increase in gas pressure. and the gas pressure will

Blow up the pressure control plate to allow the explosive gas to flow into the firing tube and push the grenade into motion.

away from the mouth of the shooting pipe During the burning of the land, it will ignite the soil and delay the time. After the grenade was fired,

After 2.4 seconds (approximately 50 meters), the flame of the delayed soil ignites the expanded soil.

The explosion inside the earth tube amplifies the explosion and causes it to explode. Flames from the ground expand

The explosion ignites the smoke bomb, causing the smoke bomb shell to explode. smoke bomb

Interfering Substances The interfering aluminum flame spreads rapidly to create a smoke screen.

Mix it up

C. Smoke screen grenade launcher

The launcher has a total of 12 launch tubes, each set of six launch tubes, installed on both sides of the fort.

The guns, respectively, are firing tubes number 1, 2, 3, 4, 5, and 6 on the left side and firing tube number 1,

2, 3, 4, 5, and 6 on the right. The firing tubes are mounted on a bracket and pressed against the compression sleeve.

The base of the launch tube is secured with bolts on a launcher mount welded to the turret wall.

The firing angle of the firing tube is 28° . Angle in the direction of the firing tube. (The horizontal angles with the cannon line) are as follows: 1, 2, 3, 4, 5, and 6, namely 3° , 10° , 17° , 24° , 31° , and 38° , respectively. Order of direction angle

The right angle is the same as the left direction angle.

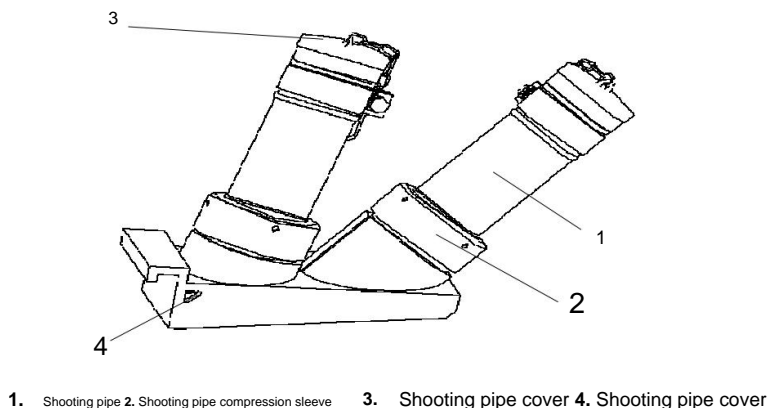


Figure 20: Composition of smoke Screen Grenade Launcher

Electrical circuit

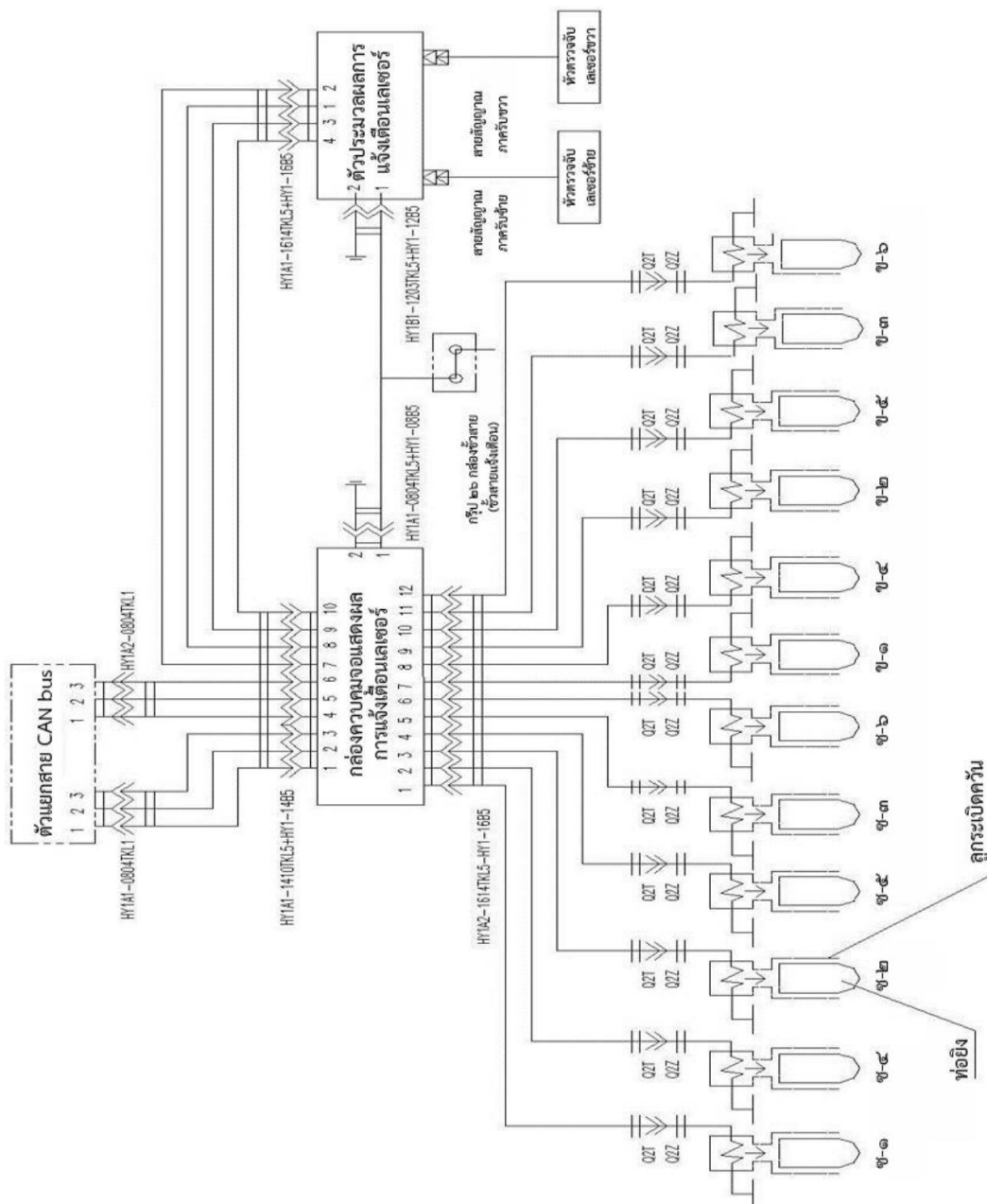


Figure 21 Wiring diagram

D. Structure of smoke grenade

This type of grenade is a multi-purpose smoke grenade with a wide smoke screen. Consists of ring, waterproof cover, tubular grenade shell, small tube of explosive powder. (Squip), interference unit, aluminum flame unit, smoke bomb unit, time delay unit, Tail section, ignition unit, propellant unit, etc. (Refer to Figure 22)

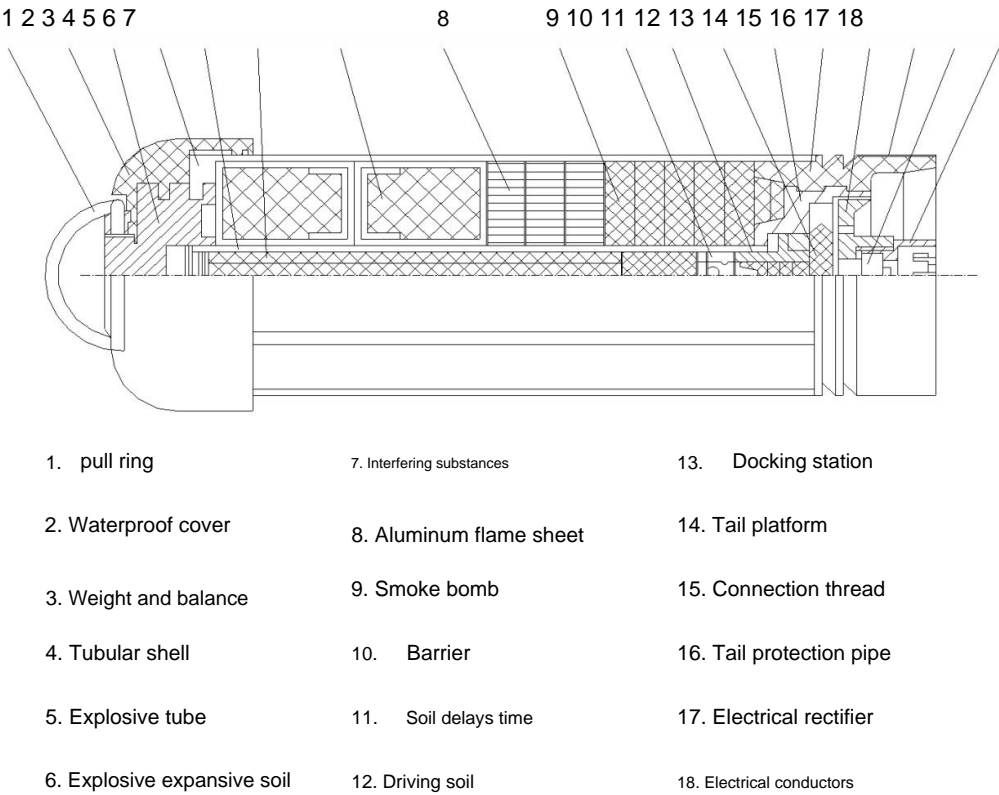
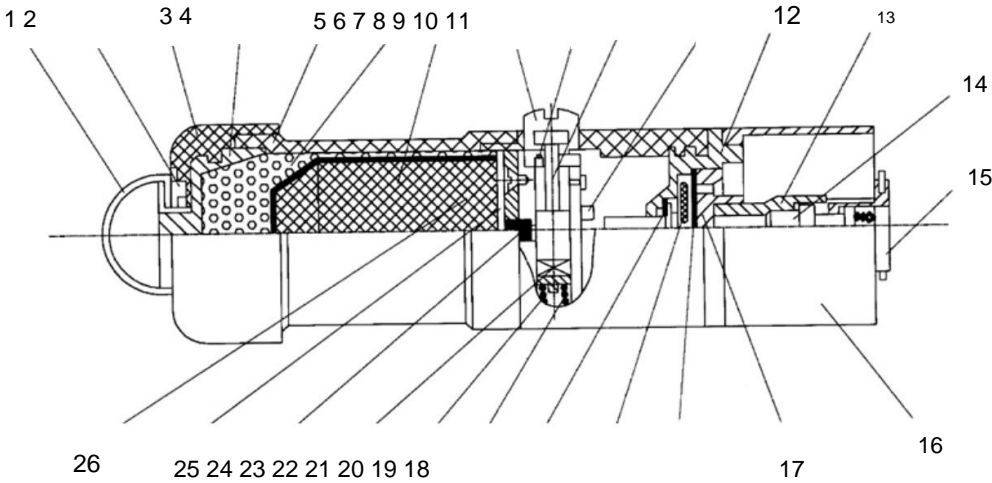


Figure 22: Schematic diagram of the structure of a 76 mm multi-purpose smoke grenade.
(Structural diagram of 76mm multi-purpose smoke grenade)

E. Structure of an air-fracturing grenade. (Construction of shrapnel)

Air fragmentation grenades are shrapnel used to kill at close range. Components It mainly consists of a waterproof sealing device, a front cover, a warhead, a detonator, a time delaying device, and a firing device. Lures and safety equipment (see Figure 23)



- | | | |
|-----------------------------|---------------------------------------|-----------------------------|
| 1. pull ring | 10. engraved tube | 19. Driving soil |
| 2. Compression shock | 11. Salak Nirai | 20. Guide sheet |
| 3. Waterproof cover | 12. The central shell | 21. Time-lapse earthen tube |
| 4. Front cover | 13. Connection | 22. Pressure tweezers |
| 5. Upper shell | 14. Electrical detonating device JD-2 | 23. Detonator |
| 6. Steel ball bearing shell | 15. Short-circuit plug | 24. Khanuan clay tube |
| 7. Explosive core | 16. The last part of the shell | 25. Head block |
| 8. Bolts | 17. Covering the bomb room | 26. Mixed shell |
| 9. Latch limiting cover | 18. Pressure adjustment copper plate | |

**Figure 23: Structure of a 76 mm air-fracturing grenade.
(76mm shrapnel construction)**

Part 7

Department verification system Our side - or - the enemy?

(FRIEND-OR-FOE IDENTIFICATION SYSTEM)

1. Generally

speaking, verification of the side Our side or the enemy? Used to identify targets on the battlefield that use space. densely and concentratedly, accurately and quickly and by monitoring the situation, making it possible To avoid damage to our vehicles, the system has implemented a question/answer unit. On ST-16A vehicles, it is used to work together with the linkage adjuster and control display. of the vehicle commander to know the work of identifying friendly or enemy personnel. Devices to prove that the side is using a system for adjusting compliance. You want to encode the time digitally, based on the cryptographic information and base time. The system password will change to reflect the time. Encrypted side questions and side answers. By specifying specific characteristics and working directions. To prove all sides of the target The verification device will end the process in the specified time. Specific target characteristics are whether it is our side or the enemy between people by using the method of directly asking the side. and working together in responding to the department Asking the department using millimeter waves (electromagnetic waves) and use frequency jump response, time jump, carrier wave to be specified. Frequency in the form of a direct unique code, digital encoding system and identification technology. Harmony of time The advantages are strong anti-jamming capability, low interception possibility, etc.

2. Main performance parameters

A. General characteristics

Operating frequency range:	6.7 gigahertz (GHz) to 37.0 gigahertz (GHz)
Operation mode:	Proximity mode, Proof mode Full system side, data exchange mode, data connection mode
Time to prove the side	~1 second
Probability of side verification:	~98%
Faction verification distance:	00 m. - 5.5 km. (Faction verification mode Close-range/Full system verification mode/ Data exchange mode) 100 m.~1 km. (Data connection mode)
Tolerance range	Better than 50 m.
Work coverage area	Asking sides: Direction ~5°, Elevation ~25° Response: direction 360°, elevation ~40° (-10° to +30°)
Multi-Target Verification B.	~3

Application Qualifications

Relative speed of the equipment mount	~140 km./hr.
Relative slope of the mounting base to the longitudinal slope	~30°, slope ~20°.

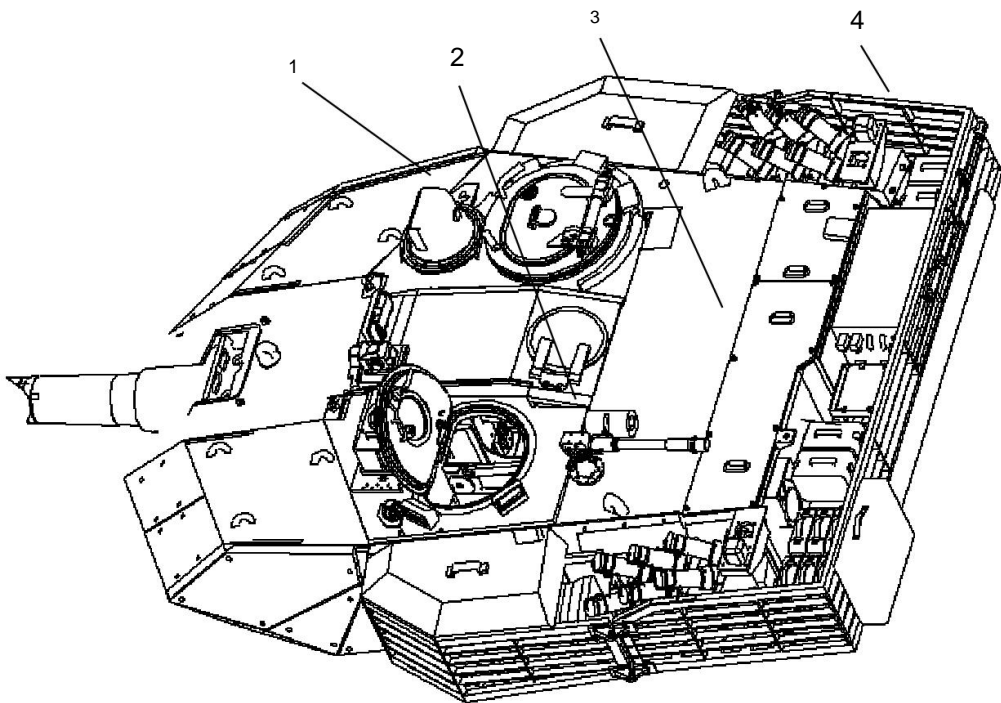
C. Time requirements

Time consistency management system on the vehicle to provide working hours	Install GPS as a single device
Working to keep time	~4 hrs. (meets the requirements)
Errors in the operation of the system)	

3. Composition of system and basic working principles (Composition of system and working principle)

A. System components

The faction verification system consists of a main unit, a faction inquiry antenna, a faction answer antenna, and signal connection adjuster



1. Front-end inquiry control device

3. Front response control device

2. Connection adjuster

4. The main unit of the departmental verification system Our side - the enemy

Figure 24: Components of the department verification system. Our side - or - the enemy?

(Composition of friend-or-foe identification system)

The component diagram is as follows:

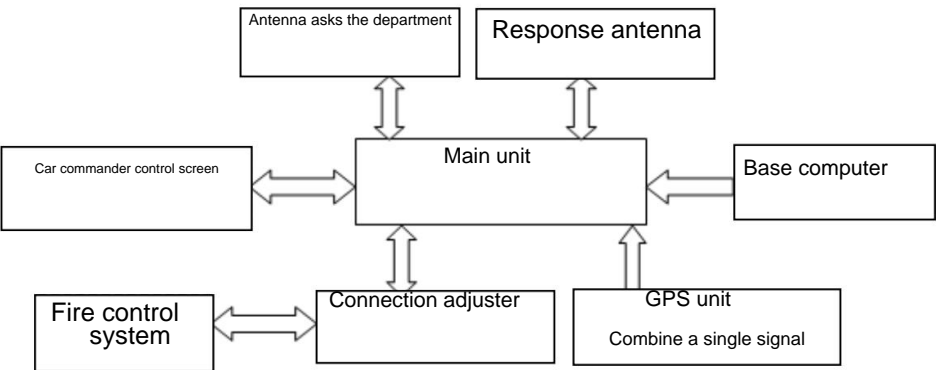


Figure 25: Department verification system diagram Our side - or - the enemy?

(Block diagram of friend-or-foe identification system)

The main unit works on encoding/decoding, converting data into signals/

Converting signals to data, changing the frequency range for transmitting signals/changing the frequency range

return and electrical frequency conversion in asking side/answering up/down side to prove side giving

Completed

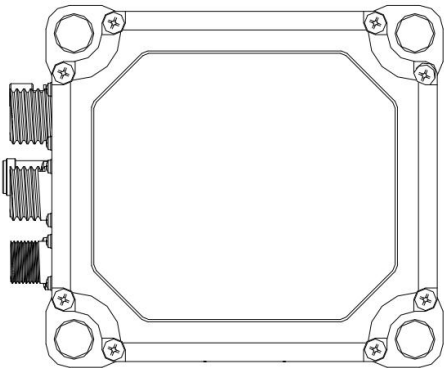


Figure 26 Outline of main unit

The antenna asks the party to convert the mid-band/radio frequency signal to verify the party.
friendly or enemy, as well as the work of broadcasting/receiving radio frequency signals directly to
Completed.

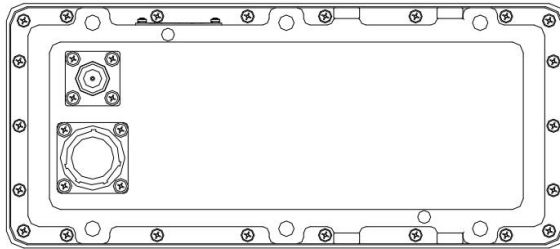
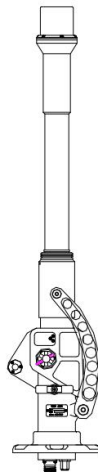


Figure 27 Profiled outline of inquiry antenna

The DWSB antenna responds to and converts mid-band/frequency signals.
radio to complete data transmission as well as direct radio frequency signal transmission/reception.



***Figure 28: Outside view of the answering antenna.
(Outside view of responding antenna)***

The connection adapter performs various functions such as display and system operation.

Verification of the side Our side or the enemy? encryption key injection/destruction of cipher keys, as well as

Exchange of data of vehicle fire control/electrical systems

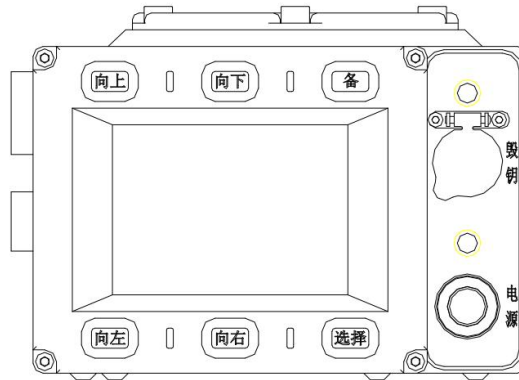


Figure 29: Outside view of interface adapter

B. Working principle

1) Working principle of asking questions

When the system verifies the party The friendly-or-enemy searches for targets. The gunner rotates. Turret to aim at the target The antenna asks the side to aim at a consistent target.

When the gunner fires the laser, measures the distance and sends a command to the enemy team, the interrogation begins and the data The target distance is entered into the defense verification system. friendly-or-enemy automatically at the time same

After the system has verified the Our side - or - the enemy has received orders to question the side. It performs data encryption and converts the data into a signal of the current cryptographic data, then sends a wave. Millimeter of signal directly from the antenna, receives the signal and processes it. Millimeter wave response signal, distance resolution of complete verification. After that, match the distance of the target according to the laser distance measuring data. Finally, proceed. Report information such as characteristics, target distance, number of targets to the fire control system. and displayed on the gunner's sights and the operator's control screen. in order to decide on issuing orders

The next step is to shoot.

2) Working principles in responding to parties

Department verification system Our side - or - the enemy? When the state responds to the side waiting to receive a signal

Ask a faction normally after receiving a question signal from another signaling base of the same faction. Decide if it comes from the main wave signal of the questioning side or not. and decide that the information

Is it effective? If the signal to ask that side is effective Data-based encoding and conversion

Current secret code Sends millimeter waves directly to incoming signals with the antenna on the other side. If the party's inquiry signal has no effect, the system will not respond.

3) Principles of sending information

In data connection mode, startup, quiet or

Shut down

When the data connection mode is set to the startup state This mount can transmit data connection mode signals. (including information on the situation of goals and basic brief preparation) with automatic and periodic signals, between the mounting base Situation information includes the location of this and other mounts. of the same side It can receive data link mode signals sent by other installations. of the same side and then report the information to the operator's control screen.

When the data connection mode is set to silent state This mount does not Can transmit data connection mode signals. It can receive data connection mode signals. only and reports the received information to the operator's control screen.

When the data connection mode is set to the off state This mounting base Unable to send and receive data connection mode signals.

Chapter 8

Deep water wading system (SUBMERGING SYSTEM)

1. General Introduction

The scuba gear is the most important functional part of the tank. Deep water wading system It can ensure that the tank can cross water areas and slow flowing rivers. By being able to cross Water areas with a depth of 4 m. - 5 m. and a width of 600 m.

2. Main performance parameters

A. Submerging and fording

- 1) The deep water crossing area has a depth of 4 m. - 5 m. by installing a deep water crossing kit.
- 2) Distance for crossing: 600 m.
- 3) Depth for wading across deep water without installing a deep water wading kit: 1.2 m.

B. Water pump type ZDB-500

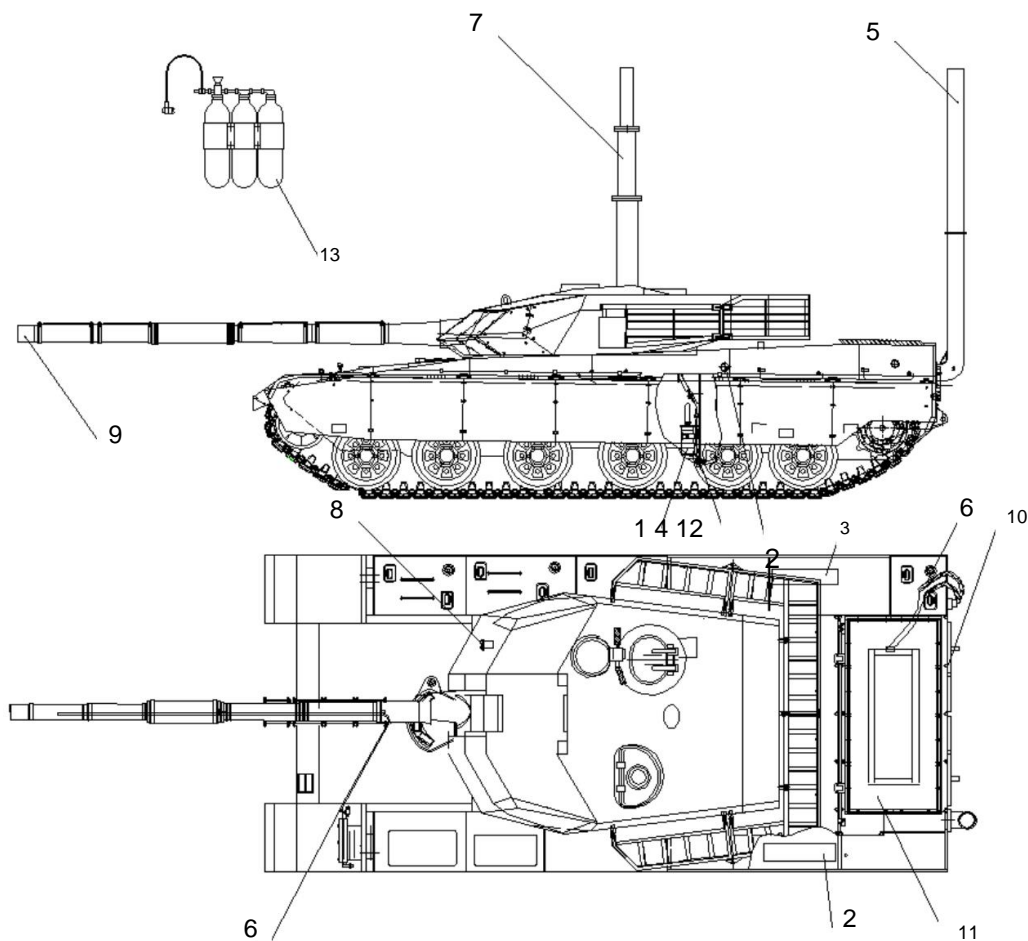
- | | |
|-------------------------------|---------------------|
| 1) Direct current voltage | 26V±3V/DC |
| 2) Electric current | 30 amps (A) |
| 3) Drive shaft power | 500 watts (W) |
| 4) Kinetic energy range (26V) | 8 m. |
| 5) Flow rate (26V) | 7 cubic meters/hour |

C. Respiratory tube type TH83-1

- | | |
|--|---------------------------------------|
| 1) Type of work | Half face breathing mask, open type |
| 2) Depth of work | 5 m. underwater |
| 3) Time of operation 4) Total weight | 20 minutes
12.5 kg. |
| 5) Air tank volume | 1.6 L.×3 |
| 6) Maximum compression force for inflation 7) Wearing position | 19.6 megapascals (MPa)
Front chest |

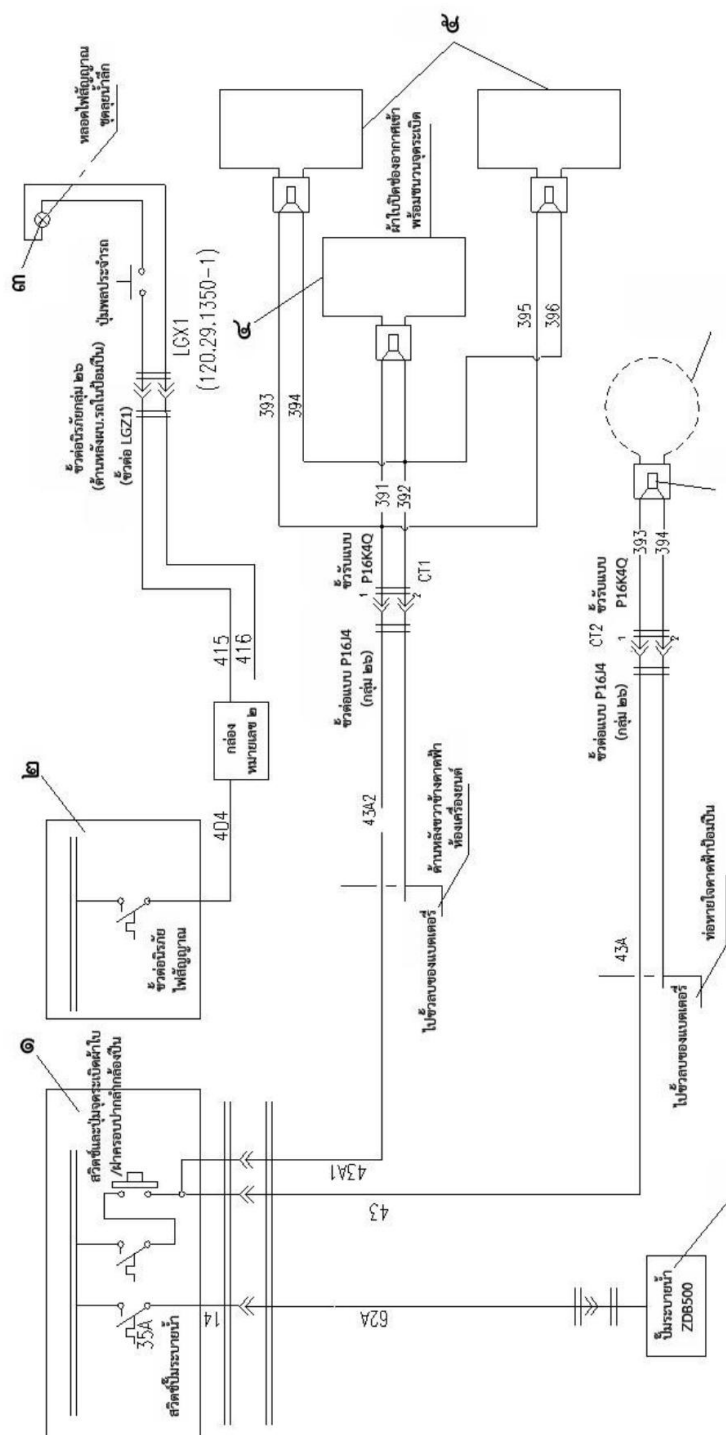
3. **Composition** The deep

water wader system consists of two types of parts and components: fixed parts or components installed on the vehicle and removable parts or components used When wading in deep water The system can ensure that the tank has the ability to cross deep water. By combining the sealing structure on the entire tank Fixed parts or installed components The tank includes: ZDB-500 drainage pump, overflow valve and mechanical parts. manual controls, etc. Special parts or removable elements for deep water crossing include: snorkel pipe, ventilation pipe, cover. Sealed cover for coaxial machine gun launcher, gun muzzle cover, left air filter cover plate and right side, vent cover Air cleaner exhaust dust, air inlet/outlet cover sealing cloth, fording light Deep water crossing at night, deep water crossing antenna, bomb cable and detonator fuse, TH83-1 crew breathing apparatus, and trace paste. Leak type 1601 and other special parts or These removable elements are stored in a spare parts box for deep water crossings. for the installation location of each component on the tank. Refer to Figure 30 for a wiring diagram. See Figure 31.



- | | |
|---|--|
| 1. drainage pump | 8. Co-axial machine gun sealing cover |
| 2. Left air filter cover plate. 3. Right air filter cover cover plate. 4. Installation kit and control valve. | 9. Cannon barrel cover |
| 5. Exhaust pipe | 10. A canvas covers the air outlet. |
| 6. Deep-water wader ignition wire. 7. Breathing tube. | 11. A canvas covers the air intake. |
| | 12. Air purifier exhaust dust vent cover |
| | 13. Crew breathing apparatus TH83-1 |

**Figure 30: Installation location of components for the deep water crossing system in the tower room.
(Mounting positions of components for deep fording kit system in fighting compartment)**

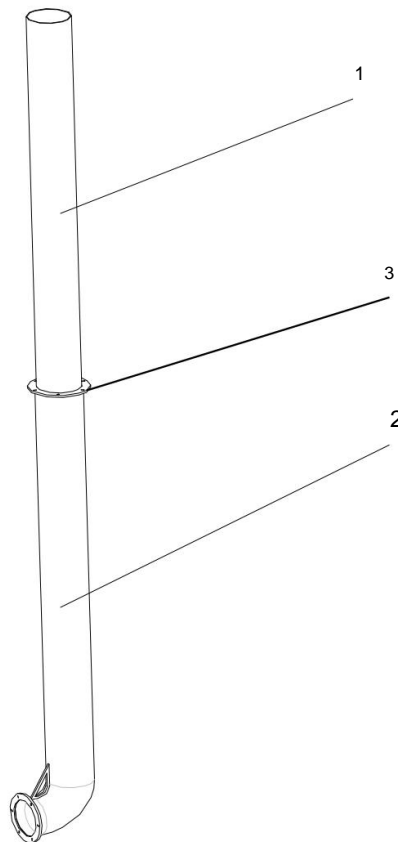


A. Removable components

1) Detachable components of the deep water crossing kit include exhaust ventilation pipe, underwater breathing tube (Snorkel) with signal lamp, Gun barrel covers and accessories Explosives, co-axial machine gun sealing panels, canvas air inlet/exit covers, TH83-1 respirator. , Putty 1601 (1601 putty), etc.

2) Broken ventilation pipe

The exhaust ventilation pipe consists of the upper exhaust manifold pipe (1) the exhaust manifold pipe The lower section (2) and gasket (3) are installed at the location of the engine exhaust pipe (see Fig. 32).



1. Upper exhaust manifold

2. Lower exhaust pipe

3. Gasket

Figure 32: Air exhaust tube

3) Diving breathing air tank type TH83-1 (Figure 33)

Three sets of TH83-1 diving respirators for life support.

Placed near three separate crew members. The crew can use it as a preparation device.

Provide yourself with fresh air to be able to swim out of the water in an underwater emergency.

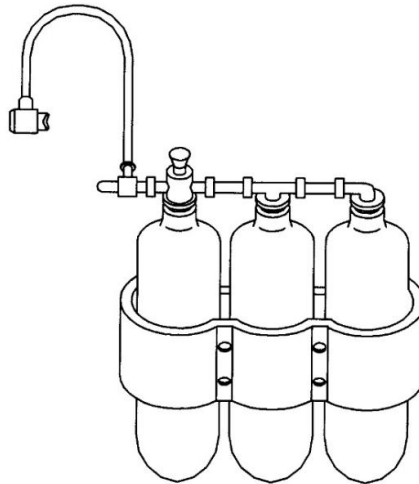
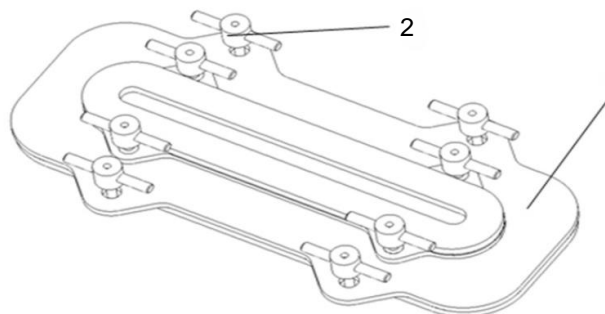


Figure 33: TH83-1 life-saving rebreather (TH83-1 life-saving rebreather)

4) Co-axial machine gun firing port sealing plate

When wading across deep water The coaxial machine gun chamber sealing plate (Figure 34) shall be installed on the outside of the upper coaxial machine gun chamber. Turret to prevent water from entering the muzzle of the machine gun. Joint shaft When installing, tighten the four bolts attached to the joint machine gun chamber sealing plate.

Attach the shaft to the optional mounting base at the machine gun gun port together with the shaft until it is secure.



1. Machine gun gun chamber sealing plate with co-axial 2. Bolts

Figure 34: Co-axial MG muzzle sealing cover.

5) Underwater breathing tube with signal light (Snorkel) (Figure 35)

An underwater breathing tube is mounted on the gunner's inlet/exist port. Used for providing air.

Clean breathing for the crew when crossing deep water. Deep water crossing antenna (1) installed

It is located in the special extension of the breathing tube. It will protrude from the breathing pipe

100 mm. and

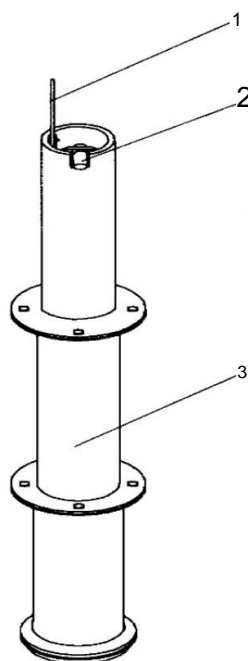
approximately. The other end connects to the radio set via a breathing tube to communicate with other radio sets outside the tank in

During wading through deep water

Signal light bulb (2) is used for sending light communication signals in

While wading across deep water at night It is attached to the top of the breathing tube and the LGX1 plug at

the other end connects to the LGZ1 connector inside the tank via the breathing tube. Breathe.



1. Antenna for crossing

2. Signal light bulb 3. Breathing tube

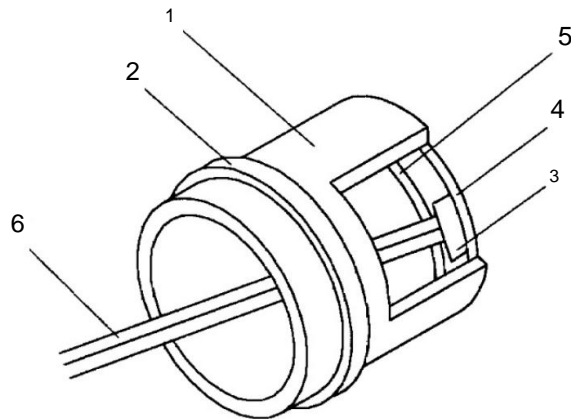
deep water. **Figure 35. Snorkel with signal lamp.**

6) Gun barrel cover (Figure 36)

During wading through deep water It is installed on the muzzle of the gun to seal the muzzle.

The gun camera and allows the tank to fire quickly through the detonator after firing.

Wade across deep water and out of water areas.



- | | |
|---------------------|-------------------|
| 1. Gun barrel cover | 4. Explosive fuse |
| 2. Garter ring | 5. Steel gasket |
| 3. Explosive clay | 6. Ignition wires |

Figure 36: Installation of the muzzle cover and explosive detonating device.

(Installation of muzzle cap and detonating device)

7) Explosive detonating device

It consists of a ignition button, wires, ignition fuse and electric fuse, etc.

Used for blowing cannon barrel covers, canvas covering air inlet/outlet holes. To ensure that the tank

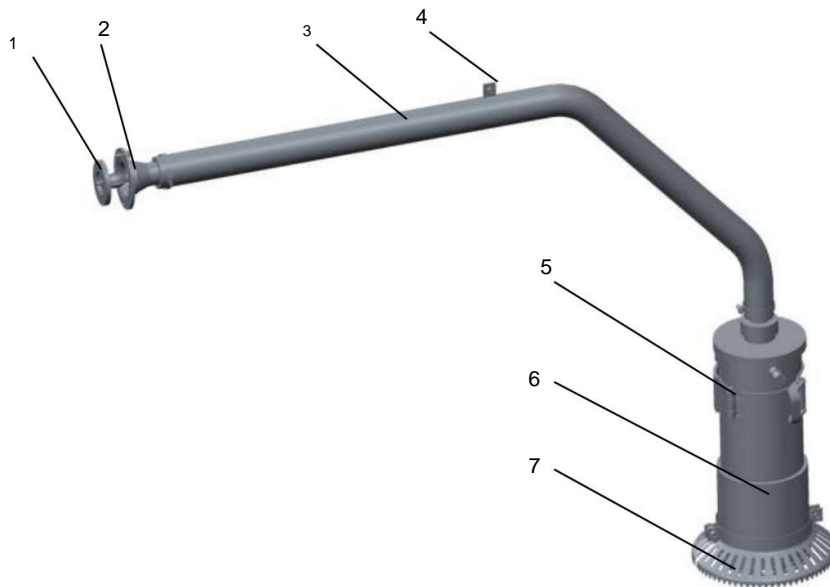
You can enter battle immediately after leaving the water area.

B. Fixed components Fixed

components include permanently installed components, including:

ZDB-500 drainage pump and drainage valve Installation and valve control set, etc. 1) Pump for crossing deep water in the tower

room. A deep-water crossing pump is located at the rear right of the tower. and installed with The engine compartment divider is used to drain water that enters the chamber when wading in deep water. The water pump in the chamber consists of a valve. Water outlet barriers, drainage pipes, pumps, brackets, half-stop plates for coarse filters, etc. (Figure 37)



1. Cover set 2.

5. Compression sleeve

Drainage valve 6. Deep water crossing pump 3.

Drainage pipe 7. Coarse filter half-stop plate

4. Fastening bolt

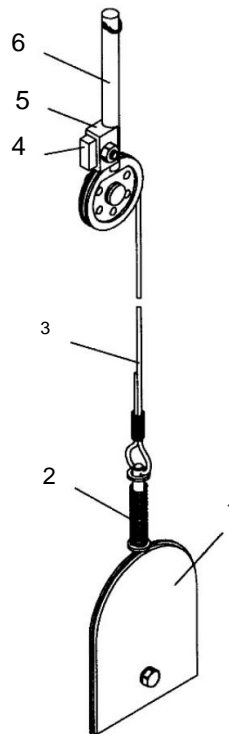
Figure 37 Water deep fording pump

2) Installation kit and drainage control valve (Figure 38)

Installed on the engine room bulkhead inside the tower room. When wading in deep water, it is used for

Open the valve to allow water in the engine room to flow into the tower room through the overflow port to allow water to flow out.

The pump can drain water from the tank. When overpressure occurs, the valve can be closed.



1. Synthetic rubber tongue set

4. Small clamping plate

2. Tweezers

5. Large clamping plate

3. Wire rope pulling set

6. Handle set

Figure 38: Installation kit and drainage control valve. (Installation and control of valve)

Chapter 16**OBSERVING SYSTEM****1****Section: General mention (GENERATION INTRODUCTION)**

Inspection equipment includes: Inspection cameras and cleaning equipment. Additional driver surveillance camera system. and panoramic surveillance cameras Surveillance camera and cleaning equipment will include a driver's camera. Operator's surveillance camera and the gunner, as well as cleaning equipment for the driver, commander and gunner. Surveillance system The addition of the driver means Device for monitoring the road surface in front and behind with cameras. When a tank enters/exits the Garage as well as driving at night with thermal imaging cameras. Panoramic surveillance cameras allow the operator to monitor the surroundings. Chom Surrounded by a camera mounted on the turret when the fire control equipment is not activated.

Part 2

Inspection cameras and cleaning equipment
(OBSERVING AND PURGING DEVICES)

1. Composition of system The driver's inspection system

consists of inspection cameras and cleaning equipment. The driver's inspection equipment consists of: Grab three periscope glass rods. The center camera is Main surveillance camera and additional surveillance cameras on both sides Cleaning equipment The driver's main surveillance camera consists of a water tank, water pump, inspection valve, pipe and nozzle, etc.

The operator and gunner's surveillance system consists of turret surveillance cameras, guns and cleaning equipment. The turret's surveillance camera consists of a periscope glass rod. Two sets mounted to the left of the gunner's entry/exit port. and three periscope glass rods installed To the right of the operator's in/out port. Cleaning equipment for the operator and gunner, including water tanks, water pumps, inspection valves and nozzle pipes. 2.

Main performance parameters directional vision range

Driver's surveillance camera		100°
(Side)	High visibility range,	40°
	reflection angle,	15°
	light transmission	50%
Driver's surveillance camera	directional vision range	120°
(middle)	High visibility range,	40°
	reflection angle,	15°
	light transmission	50%
Cleaning equipment	Water tank volume	3.5 million
Driver's surveillance camera	Rated voltage	24 volts/DC power
	Depletion rate	<140 watts
	Electricity	
Side inspection camera	directional vision range	90°

of the car commander	high visibility area	35°
Light reflection		25°
angle, light transmission		50%
Side inspection camera	directional vision range	90°
of the gunners	high visibility area	35°
Light reflection		25°
angle, light transmission		50%
Cleaning equipment Vehicle	Water tank volume	3.5 million
commander and gunner	Rated voltage	24 volts/DC power
	Electricity	<140 watts
	consumption rate	
	Diameter of	8/10 mm.
	internal water pipe/	
	external	

3. Working principle A. Periscopes

The surveillance equipment in the driver's cab and on the turret is a surveillance camera that consists of with a prism set or prism set. where the light beam passes through the surface of the reflector. The light at the top of the prism then refracts the beam twice and is sent out as a beam of prism. The advantage of a surveillance camera is that it increases the size of objects and protects the user. Figure 1 is a diagram of the main structure of a surveillance camera.

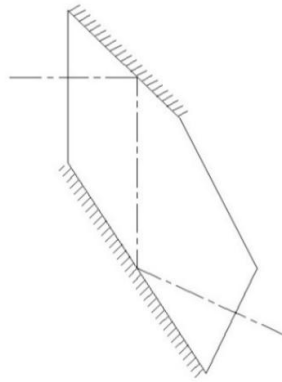


Figure 1: Diagram of the structure and working principle of the surveillance camera.

(Optical structure and principle diagram of periscope)

B. Equipment for cleaning the gunner's and driver's sights.

The driver's inspection camera cleaning equipment consists of a water tank, pump, inspection valve, water pipe and nozzle pipe.

Working principle: The water tank is filled with clean water or cleaning solution when the water is pumped. In operation, the water pump sends water or cleaning solution to the spray nozzle through the water pipe for cleaning. or wash the surface of the inspection camera, the inspection valve will prevent the water in the water pipe from flowing back and Use a centrifugal pump impeller to expel the water to prevent the water pump from running without water coming out.

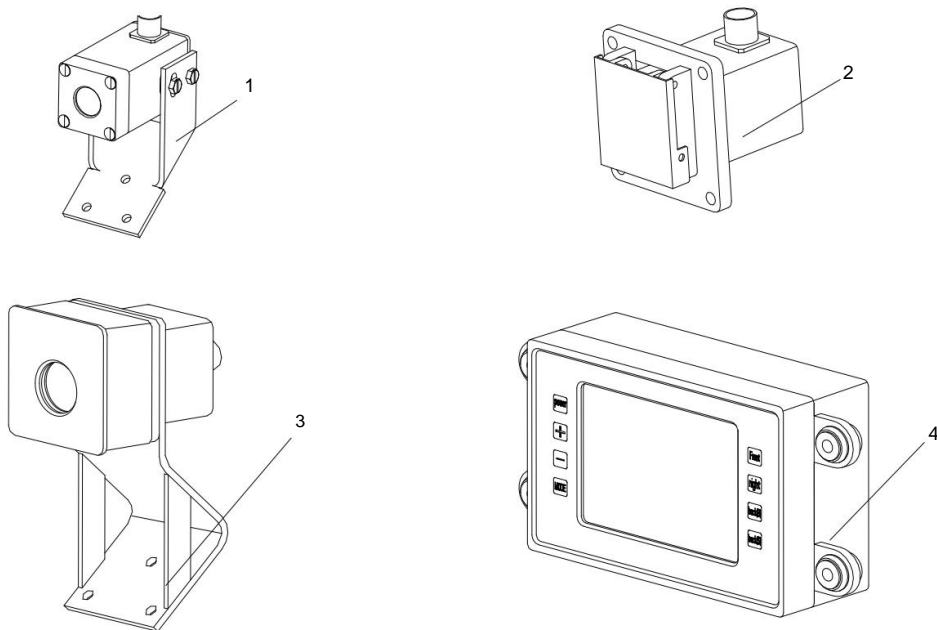
Part 3

Additional driver monitoring equipment (DRIVER'S AUXILIARY OBSERVING DEVICE)

1. Composition of system

Additional driver surveillance equipment includes a front CCD camera, image camera.

Thermal, rear CCD camera, additional driver display and lighting kit



1. Front CCD camera

3. Thermal imaging camera

2. Rear CCD camera **Figure**

4. The screen shows additional images of the driver.

2. System components of the additional driver monitoring equipment. (System composition of driver's auxiliary observing device)

2. Main performance and parameters

A. Front CCD camera:

Magnification	1 Equal
Perspective of the visual area	
direction	70°
high	55°
resolution	640×480
Inspection period	About 30 m.

B. Thermal imaging camera:

Magnification	1 Equal
Perspective of the visual area	
direction	36°
high	27°
resolution	384×288
Inspection period	Can be identified as a person Distance 80 m. Can be specified as Vehicles at a distance of 200 m.

C. Rear CCD camera:

Perspective of the visual area	
direction	70°
high	55°
resolution	640×480
Inspection period	About 30 m.

D. Driver's additional image display: 5-inch color monitor

Resolution	640×480
------------	---------

3. Structure and working principle

The image from the CCD camera or thermal imager is displayed on the display screen.

Driver's additions and through the switch button select the current display image of the corresponding CCD camera. together on the display screen.

The CCD camera works by switching control modes. which will switch the image to Automatic black and white mode in low light conditions (Which will have a light intensity value of approximately 17 lux) and will help increase the resolution of the image.

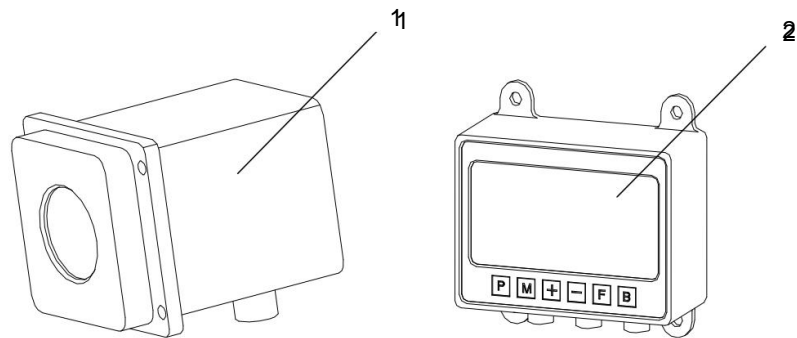
Part 4

Panoramic surveillance equipment
(PANORAMIC OBSERVING DEVICE)

1. Composition of system

The panoramic inspection device consists of front left, front right, CCD cameras.

The left rear and right rear are arranged around the gun turret deck and one display.



1. CCD camera 2. Panoramic image display

Figure 3. Components of a panoramic monitoring device.
(Composition of panoramic observing device)

2. Main performance parameters

Light detector Viewing

Magnification: 1 Equal

area view:

Direction ÿ100°

Altitude ÿ75°

Memorable distance

Can be identified as a person at a distance of 80 m.

Can be identified as a vehicle
at distance 100 m.

Resolution:

720x576

panoramic image display

Resolution: 800x600

wide screen

6-inch wide color screen

3. Structure and working principle

The four CCD cameras mounted on top of the turret deck are arranged at a 90° angle to neighboring cameras, so Therefore, the image can be seen 360° around the body when the system is working. Four CCD cameras work simultaneously to capture images in the field of view, and the images are sent to Display screen via cable set By selecting the image source that is consistent with the image Different images are displayed on the screen to provide panoramic (surrounding) monitoring.

Chapter 17

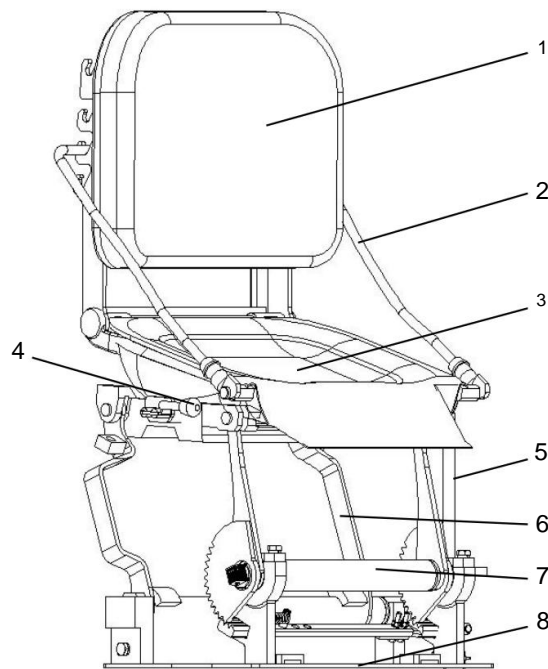
SEAT (SEAT)

When 1

the driver's seat (DRIVER'S SEAT)

1. Composition of system

The driver's seat consists of a backrest, a pull-lever, a cushion, a position selector, High rise/lower rocker, transverse axle receives the torque of the front parallel linkage, parallel linkage Back and base (Figure 1) The driver's seat position can be adjusted up/down and forward/backward.



1. backrest

2. Pull handle

3. Seat cushion

4. Position selection lever

5. Rocker for raising/lowering the high road

6. Rear parallel linkage

7. The cross shaft receives the torque of the front parallel linkage.

8. Installation base

Picture 1 Driver's seat

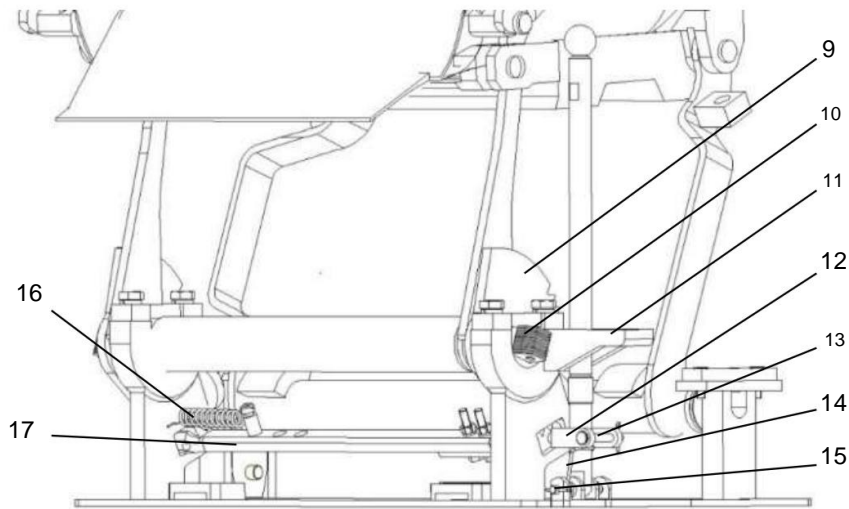
2. Main performance parameters

A. Height adjustment of the driver's seat ± 185 mm., Level adjustment ± 120 mm. B. Tilting of the driver's seat towards the forward position and at an angle. 5° - 8° to the level of the base, the driver's backrest angle can be adjusted. C. The seat has a backrest and cushion and is equipped with a seat belt.

3. Structure and working principle

A. Structure

The driver's seat (3) can be adjusted up/down and moved forward/backward by using the raised/lower handle (5) and position selection lever (4).) in order to respond to comfort The needs of each driver are different. The height of the driver's seat is adjustable from the lowest position. to the highest position of 360 mm. by using the adjusting lever (5) as shown in Figure 1. The adjusting lever (5) is on the left side of the seat (3) which Must be used on the left hand side, as shown in Figure 2. The height adjustment rocker (5) is a type of lever rocker structure with a hole at the end of the slit. By the shaft pin (15), the height adjustment rocker (5) rotates around the shaft pin (15) within the seat limit (10). The rocker can move only within the rectangular frame specified by the seat limiter. (11) and will come into contact with the shaft pin (13) to drive the shaft pin forward (13) and the bracket (12) respectively before reaching the end point on the side. Left reserved limited seats Because of the connection of threaded between the mounting frame (12) and the gear plate. The gear plate (9) is driven to release the gear plate from the support base (17). The cross shaft receives the linkage torque. Front in sequence. and the leaf springs can parallel linkage (7) and parallel linkage piece (10) are placed be rotated. The rear (6) has 13 leaf springs at one end to ensure that the driver can easily adjust it. Be sure to firmly insert the end of the holder. The cross shaft torques the front parallel linkage to the left side and the rear parallel linkage is fitted to the end. Right The height of the driver's seat can be adjusted using the driver's weight. After adjusting, adjust the seat height adjustment lever (2) to return it to its original state under Operation of the return leaf springs (14) and the pulling leaf springs (16).



9. Gear plate

12. Installation base

15. Shaft bolt

10. plate tweezers

13. shaft latch

16. Tweezers

11. seat limiter

14. Return springs

17. Seat frame

Figure 2: Elevation mechanism

Movement of the seat forward and behind the driver is carried out via

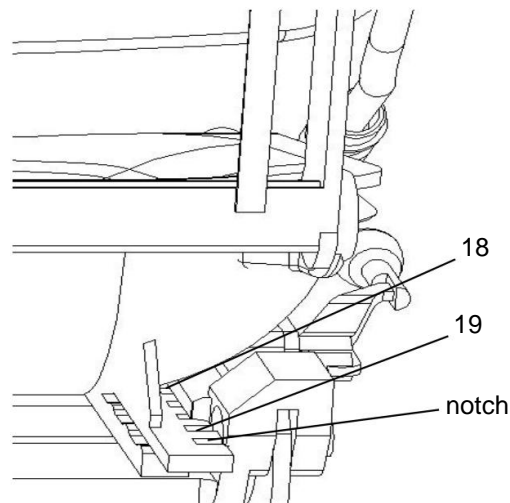
Rail structure and the position selection lever (4) and the driving pin (18) so that they can be inserted into the groove rail.

Right side (19) to hold the seat at the front/rear The right side rail (19) has 9 grooves.

The length can be adjusted to 144 mm. The position selector lever (4) is located on the right rear and is operated by Press in or release. The selector lever can be pulled out or pushed into the right notch rail (19).

To adjust forward and backward movement. The driver's seat mounting base (8) is used for fixing the seat.

The seat fits onto the bottom plate of the tank.



18. Drive latch

19. Right side groove

**Figure 3: Adjusting mechanism
for front and back direction .**

B. Working principle

1) Elevating mechanism (see Figure 2)

A leaf-spring mechanism is used to raise the driver's seat.

In the upward direction, the front parallel axle linkage and the rear parallel linkage consist of Torque springs 13 pieces to ensure stability. One end of the clamp is on the left side and The other end is on the right side. The height mechanism is fixed using a plate structure. Gears and gear tooth frames are used. After releasing the gear plate from the gear frame by pulling the lever Lift it to the outside. This causes the leaf springs to twist to lower the seat under the pressure of your body weight. of the crew. In this case, release the raised lever. The gear teeth on the plate engage the gear frame. automatically to hold the seat in a lower position. On the other hand, after releasing the gear plate from gear frame by pulling the lever outward. The leaf springs twist back to lift the seat.

When according to the weight of the body when rising up slightly In this case, when releasing the pedal to raise the gear plate level.

It automatically attaches to the gear frame to hold the seat in a higher position.

2) Adjustment mechanism for moving forward and backward (see Figure 3)

Movement of the driver's seat forward and backward is achieved by sliding the driver's seat forward and backward. Cushion on guide rail The front and rear positions are secured by inserting drive pins. With the push handle for selecting the seating position inserted into the groove of the right guide rail, the right guide rail There are 9 grooves, adjustable in length to 120 mm. The latch can be inserted into or pulled out of the grooves. It uses the coordinated operation of the position selector paddles to adjust the driver's seat for Forward and backward scrolling direction

The driver seat mounting base is used to secure the seat to the bottom plate.

Part 2

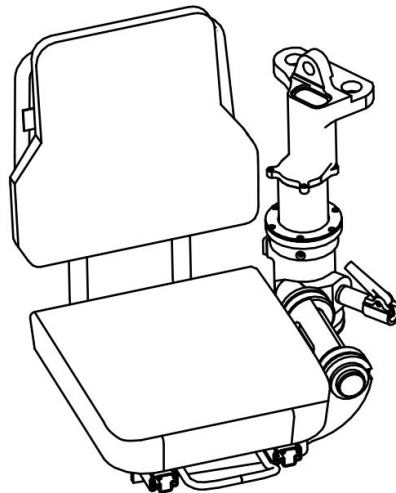
Gunner's seat (GUNNER'S SEAT)

1. Composition of system

The gunner's seat consists of an elevation mechanism, seat mounting base, seat, etc. See

Picture 4

The gunner's seat can be raised/lowered. and can move forward/backward



1. Mechanism for giving a high way 2. Seat

Picture 4: Gunner 's seat

2. Main performance parameters

A. The seat can be adjusted at a height of 100 mm. The distance between each adjustment is 25 mm.

Can be adjusted horizontally by 100 mm. Each adjustment distance is not more than 25 mm.

B. The gunner's seat can be tilted towards the top and at an angle of **5°- 8°** to the level.

of the base horizontally The seat backrest can be pushed in and pulled out. The shape of the backrest varies.

according to the shape of the spine

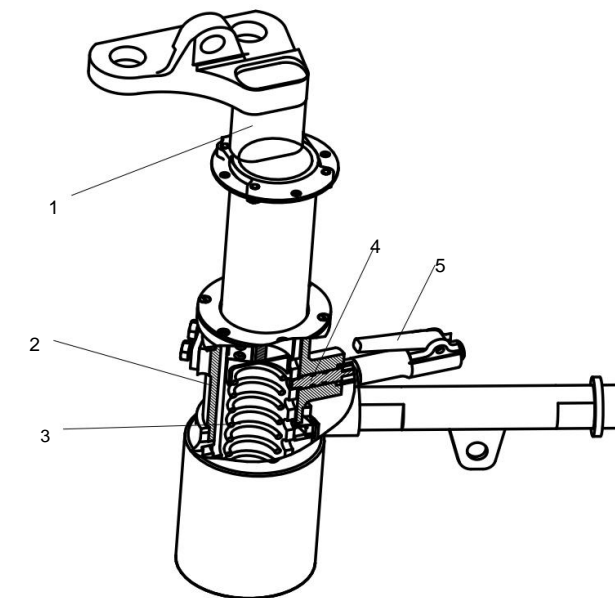
C. The seat has a backrest and cushion. With seat belt

3. Structure and working principle

The height adjustment of the gunner's seat is achieved by means of an elevating mechanism.

The lift consists of seat mount, sliding frame, leaf springs, handlebar, dust cover, etc.

See picture 5.



- | | |
|------------------------|-------------------|
| 1. Seat mounting frame | 4. Fastening bolt |
| 2. Sliding frame | 5. Pedal handle |
| 3. Coiled leaf springs | |

Figure 5 Elevating mechanism

The mechanism for lifting the gunner's seat uses a coil spring structure to help lift the seat.

The sliding frame seat (2) is raised by the flexibility of the leaf springs. Then fix the mattress in the desired position.

By controlling the clamp (4) with the handle lever (5), lowering the seat can be done by pressing the coil springs.

(3) using body weight Then secure the seat in the desired position by controlling the mounting bolts (4).

Push handle (5), seat mounting frame (1) of the gunner's seat has 5 adjustment positions, length

Included in the adjustment is 100 mm.

Movement of the gunner's seat forward and backward is carried out by a mechanism.

Slide The slide mechanism consists of a frame securing the gunner's seat. Positioning box, pedal

Lifting rod, sliding rail frame and seat mounting frame, etc., see Figure 6.

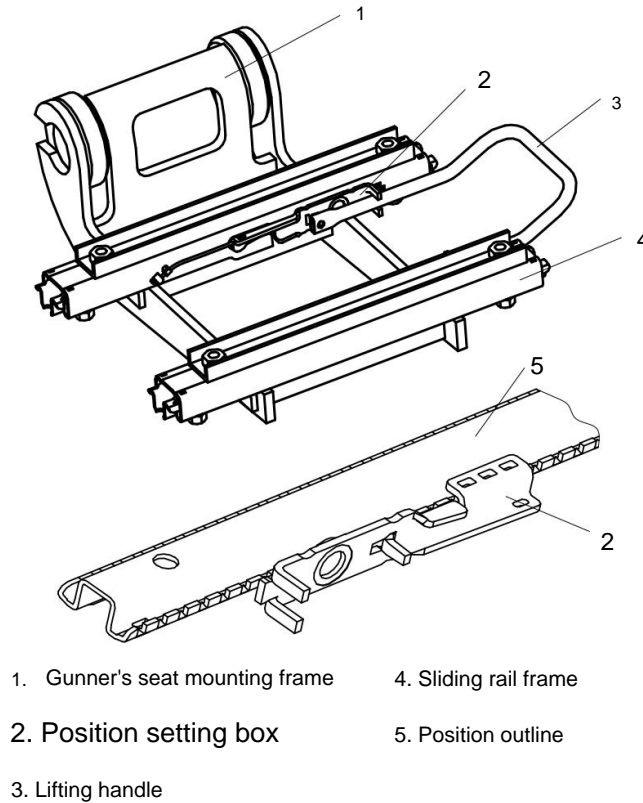


Figure 6: Sliding mechanism

The moving mechanism (2) of the gunner's seat is connected to the sliding frame (4).

firmly The positioning frame (5) is attached to the seat mounting frame (1) of the gunner when held.

The lift lever (3) and the position setting hole (2) are separated from each other. Frame for determining seating positions (5)

Can be moved to the desired position by pushing the lift lever (3). The positioning slot (2) is combined with the positioning frame (5) to adjust the seat to the desired position.

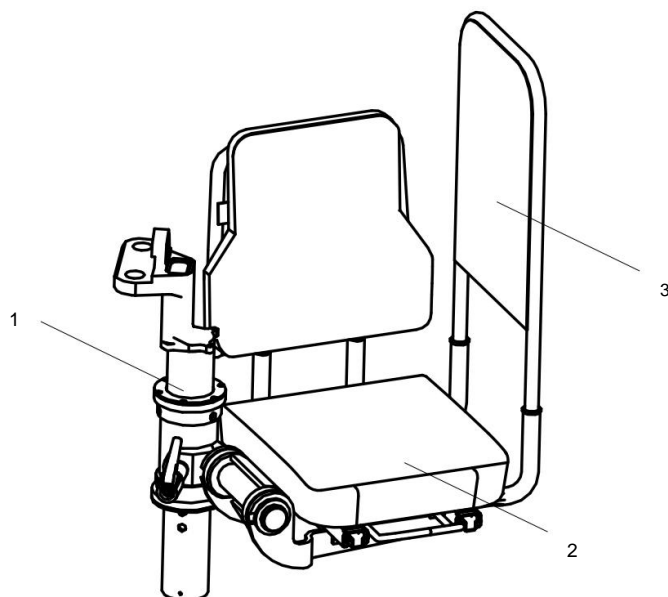
Part

3: COMMANDER'S SEAT

1. **Composition of system** The operator's seat consists

of a height mechanism, seat mounting base, seat cushion and position separator, etc. See Figure 7. The operator's

seat can be adjusted up/down and forward/backward.



1. Mechanism for

3. Separation plate

providing a

high road 2. Seat, **Figure 7: Commander's seat**

2. Performance and parameters

A. Seat adjustment at a height of 125 mm. Each adjustment interval is 25 mm. 100 mm. Adjust horizontally. B. Each adjustment interval is not more than 25 mm .

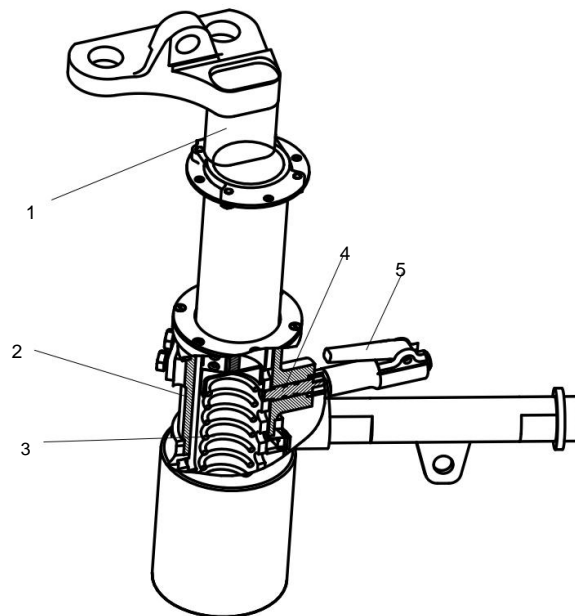
By tilting the seat towards the forward position and at an angle of **5°- 8°** from the level of the horizontal mounting base, the seat backrest can Push in and pull out to conform to the shape of the backrest. Will vary according to the shape of the spine. C. Seats will have a backrest and cushions. With seat belt

3. Structure and working principle

The movement of the operator's seat in height is achieved mechanically.

Lifting The lifting mechanism consists of a seat bracket, sliding frame, leaf springs,

Lever handle, mounting bolt, dust cover, etc. See Figure 8.



1. Seat mounting frame

4. Fastening bolt

2. Sliding frame

5. Pedal handle

3. Coiled leaf springs

Figure 8 Elevating mechanism

The operator's seat lifting mechanism uses a coil spring structure to provide lift.

The seat frame (2) is lifted by the flexibility of the leaf springs (3) and the seat is fixed.

The seat is in the desired position by controlling the mounting latch (4) with the handle lever (5). Lowering the seat allows

By pressing the coiled tweezers (3) using body weight. Then secure the seat in the desired position by controlling it.

The fixing bolt (4) with the lever handle (5) has a position for the seat mounting frame (1) of the operator's seat.

Adjustment in 6 positions, total length of adjustment is 125 mm.

Movement of the operator's seat forward and backward is possible. by sliding mechanism The sliding mechanism consists of a operator seat mounting frame, a position setting slot, a handlebar pedal, a sliding frame, and a mounting frame, etc. See Figure 9.

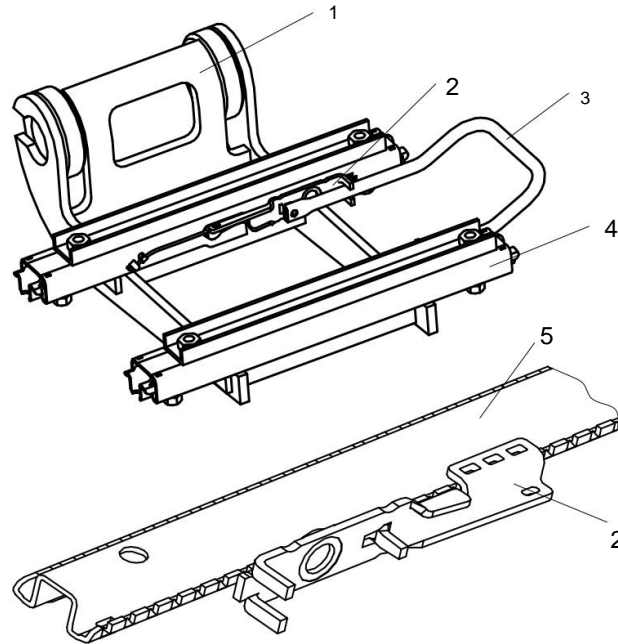


Figure 9: Sliding mechanism

The positioning port (2) of the operator's seat is securely connected to the sliding frame (4). The sliding frame (5) is fixed to the Seat mounting frame (1) of the operator's seat. When the handle bar (3) is raised, the positioning port (2) will separate from the sliding frame (5), seat. can can be moved to the desired position, using the release handle lever (3), the positioning slot (2) is attached to the sliding frame (5) and is clamped. Move the seat to the desired position. For the safety of the

vehicle operator A seat baffle is placed on the seat. The baffle can be pushed in and pulled out to allow the operator to quickly inspect the loading pulley or chute.

convenient

Chapter 18

Ammunition used on tanks

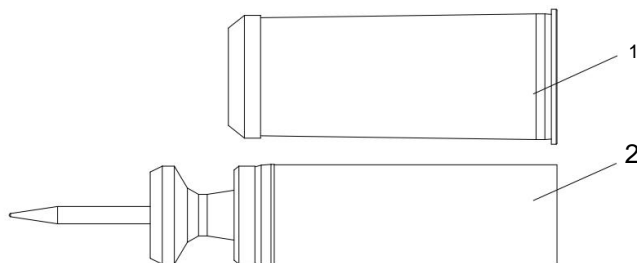
(AMMUNITION OF WHOLE VEHICLE)

1

Chapter: Basic information about ammunition (BASIC INFORMATION FOR AMMUNITION)

1. Armor piercing fin stabilized discarded sabot (APFSDS - armor piercing

fin stabilized discarded sabot) Armor piercing (AP) bullets are used for destroying tanks and enemy armored vehicles



1. Armor-piercing shell (AP) shell set, *Figure 1.*

2. Armor-piercing bullet (AP)

Armor-piercing shells leave a shell stabilized by a tail fin and a ground-launched shell.

(APFSDS projectile and cartridge)

Each armor-piercing (AP) round consists of a bullet. (with additional clay), shell casing and separate clay and box. (including packaging tube)

The bullet will be in contact with the additional soil. Consists of a secondary bullet. The shell consists of the bore, blast cover and tail fin assembly. The shell consists of the bullet ring. Front sight, shell, butt cap, seal and rear butt ring. Bullet shells are used to support bullets and act as a seal for gunpowder. and ensures that the movement of the bullet within the gun barrel is smooth. Stable and balanced. When a bullet is fired from the barrel of a gun, The shell is separated and Shake off immediately due to air resistance and smoke from burning. The shell has a saddle shape with a conical tail, which consists of 3 parts, divided into at 120 degrees per section, the shell will be welded. and the part that is driven out using teeth arranged in a circle. and is held in place by front and rear clamp rings. Complete with a bullet holder. After the bullet leaves the barrel of the gun, The shell will separate from the body. The bullet is propelled by the force of air resistance and smoke from burning.

soil. The bullet travels straight towards the target using the tail fin to help stabilize it. with the specified gun muzzle velocity due to the tangent of the corners on the tail fin. This allows the bullet to travel directly to the target. target with a certain rotational speed. which is beneficial to the accuracy of the bullet.

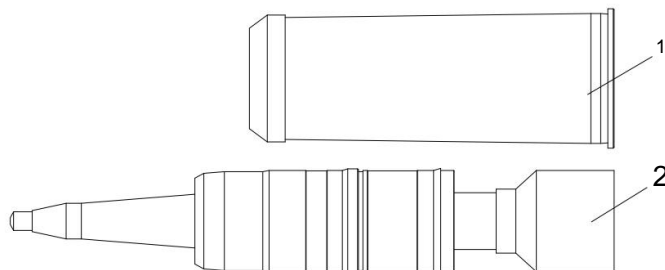
The shell is divided into three pieces that travel and spread at an angle of 2° and fall within 1,000 meters. Line is high and may injure people or damage unprotected equipment in the home. the front of the gun's muzzle. Consideration must be given to the protection of the flanks of the personnel. on the same side during the shooting.

The main propellant consists of semi-flammable gunpowder with a steel base. combustion expander Fuse end set and other combustion expansion units, etc.

2. HEAT-High Explosive Anti-Tank. High Explosive Anti-Tank (HEAT) is

used for destroying enemy tanks and armored vehicles and has the power to destroy. It is not affected by the target's range.

Anti-tank (HEAT) explosive shells consist of a bullet body and a shell casing (including the propellant carrier).



1. The earthen casing delivers the anti-tank (HEAT) explosive shell. 2. The anti-tank (HEAT) explosive shell. **Figure 2: The anti-tank (HEAT) explosive shell. Delivered with a sleeve. (HEAT projectile and cartridge)**

Anti-tank (HEAT) explosive shells consist of a bullet and a shell (including soil)

A bullet consists of a bullet body, a tail fin, a cavity explosive unit and a fuse, etc. A bullet consists of a bullet tube, a bullet body, a compression tube. and a threaded tube and two bullet casings in the shell of the chamber that contained the

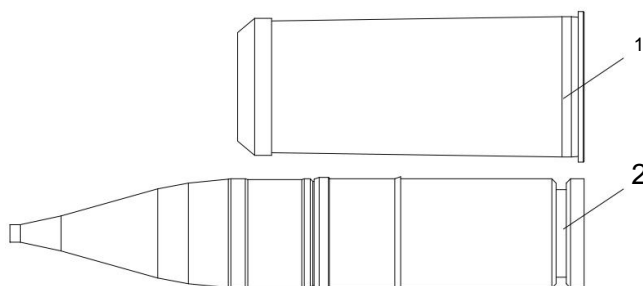
hollow-point explosive. The tail fin part consists of the tail fin shank, tail fin, shaft pin, tail fin clamp, The tail fin is mounted to the shaft, the tail fin is held in place by a shaft pin, and the tail fin clamp is mounted. on the tail fin shank with a pin which keeps the tail fin firmly in the closed position.

When the bullet moves at a high rate of acceleration inside the gun barrel. Tail fin clamp It moves backward under inertia to release itself from its connection with the fin. And after the child The bullet traveled out of the barrel of the gun. The entire caudal fin flares under the pressure difference. and centrifugal force to enable the bullet to travel stably into the air.

As soon as the bullet hits the target or obstacle The bullet fuse will be detonated. with the force of impact cause an explosion This will cause the bullet's body to explode, killing a person or exploding the target.

3. High Explosive Bullet (HE- High Explosive)

This type of bullet is used to destroy enemy forts and man-made structures, and kill military personnel. war It can also be used to destroy enemy tanks and armored vehicles. If the bullet is equipped with a radio proximity fuse, it can be used to attack military helicopters. Can fight



1. High-explosive (HE) **projectile** 2. The high-explosive (HE) bullet.
and cartridge (HE projectile and cartridge)

A high-explosive (HE) bullet consists of a bullet, a propellant case and a butt fuse. , high-strength explosives and stabilizers The stabilizer consists of the tail fin platform, tail fin, retaining pin, shaft pin, and retaining ring.

When the bullet travels inside the barrel tube, The tail fin cuts off the retaining pin while The bullet traveled out of the barrel of the gun. The tail fin pushes the retaining ring out by rotating it 90° and spreading it out to stabilize the flight of the bullet. When the bullet reaches the target or hits any obstacle, the impact fuse is stimulated and the bullet explodes.

4. Guided missiles fired by artillery. (Gun-launched guided missile) A guided

missile fired by a 125 mm cannon (hereinafter referred to as a guided weapon) is an incomplete type of bullet. Make an appointment to separate the soil packing and send it. Consists of a bullet and a set of clay delivered with a casing. It is a guided weapon with a laser beam fired from a cannon. Carried on a tank mounted with a 125 mm cannon, used for attacking enemy tanks, armored vehicles, and other fortifications within a range of 200 m. . – 4,000 m. Helps increase the ability to carry out accurate long-range attacks and operations. Can be used effectively with tank artillery in battle.

A guided missile consists of a guided missile and a propellant package with a casing. Consists of a bomb chamber. Second warhead engine igniter, equipment room and shell, see Figure 4. For the structure The sub-components of the earthing kit with casing include the mechanism. in the ejection, air tank, propellant, butt, and propeller casing. See Figure 5 for the structure.

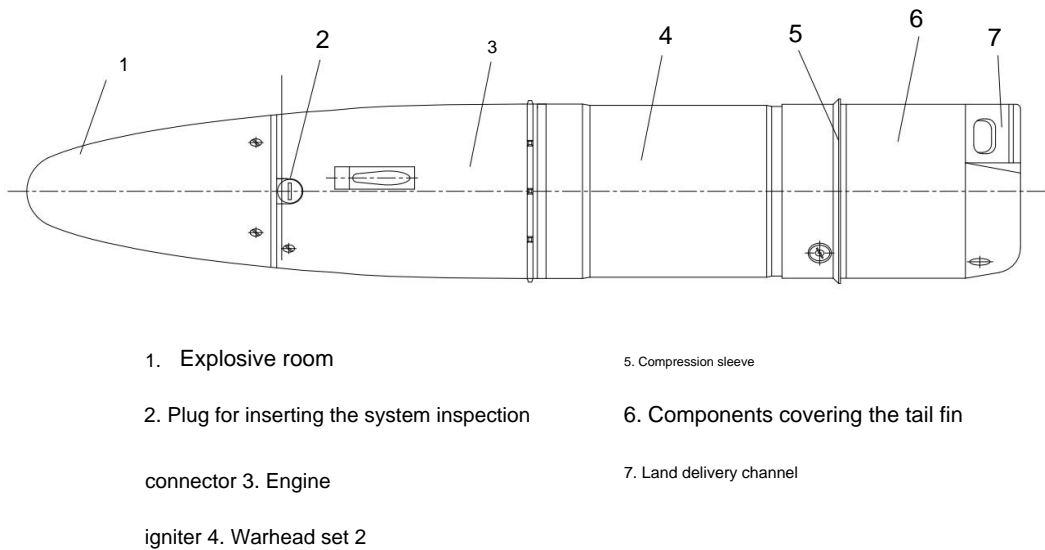


Figure 4: Appearance of missile

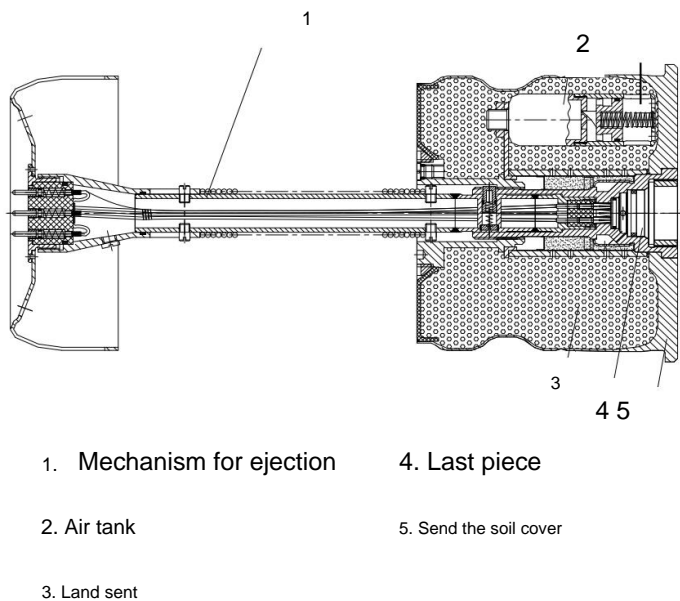


Figure 5: Structure of cartridge subassembly

After the missile is released from the barrel and the shell is thrown away, The missile receives data signals from the laser beam emitted from the missile device and maintains its flight within the target range. 6 cm center of data beam area receiver The missile's laser receives the laser data signal and converts the data signal into Electrical signals with diodes that respond to light The actuation device processes laser data, gyro signals, and ambient temperature signals into control signals and sends them to the operator. Servo control channel This allows pneumatic servo valves to control the direction of the wings to create The control force on the missile makes the missile move towards the center of the missile's range. Control data with the laser and maintain cruise near the center of the laser beam range until

Impact on the target

The pressure inside the chamber and the initial velocity of the missile are lower than that of conventional bullets and rockets. Therefore, it is a normal event that after the missile is fired, Close the machine The last one will not turn on automatically. This caused the crew to open the tailgate by hand.

After the missile hits the target A set of steering gears on the head of the The missile is deformed by impact and contact with the inner cover, switching on the section's electrical ignition circuit. The first warhead, along with the ground point, expands the explosion inside the head, creating a cone of steam that melts the metal in the plates on the outside of the target. The first warhead also penetrates the armor of the target. The second warhead. At the same time, the signal generated by the control circuit switch Work on the missile head that contacts the inner cover is output to a time delay switch. Electronics inside the equipment room to cause the delay circuit to start working After a delay of approximately 270 - 330 milliseconds The ignition circuit of the second warhead will work to Detonate the bomb and release a jet stream to penetrate the next layer of the target's armor. If the missile misses the target And after the guided missile has fallen to the ground and the ignition circuit switch at the head does not work. A self-destruct signal is sent from the output device. Commands within the equipment room

and detonate the second warhead

During the firing of guided weapons The fire control system controls the power supply. To fire the trigger to ignite the rear of the casing, and start the on-board heating battery. The shell of the missile weapon has a delay time of approximately 1.1 seconds - 1.8 seconds and then ignites the ground fuse. Starting from the soil, sending it on fire to burn the soil and send it to the stake. The propellant gas is produced to create a predetermined pressure inside the chamber. The missile moves forward under The work of pressure exerted and then passing out of the mouth.

Gun barrel

The pressure of the gas inside the air tank in the ground cover pushes the trapezoidal blades. Go out and cut the bottom of the air tank open and drill deep into the air tank at the exact location. At this time, the blades are blocked, preventing the liquid carbon dioxide in the air tank from spraying out. But it will cause the temperature and pressure of the liquid carbon dioxide in the air tank to increase during the process. Exchange heat with the walls of the air tank. This will cause the pressure to increase as well. When the weapon leads As the missile moves away from the mouth of the gun barrel, the pressure decreases and the pressure inside the air tank increases beyond that. pressure and will push the head of the blade out. This causes liquid carbon dioxide to flow into the gun barrel. and turns into vapor The air pressure inside the barrel pushes the combustion contents of the chamber outward to reduce it. Danger from soil gases that will harm the crew.

5. Packaging of ammunition (Packing of ammunition) A. Packaging of

armor-piercing ammunition, anti-tank high-explosive ammunition, high-explosive ammunition.

1) Each set of main launcher with casing and armor-piercing bullet with auxiliary launcher will be contained.

In special packaging tubes

2) To make it easy to store, transport and move. Packaging tube of penetrating ammunition Body armor and high-explosive rounds and anti-tank grenade rounds must be packed in self-contained containers.

3) The

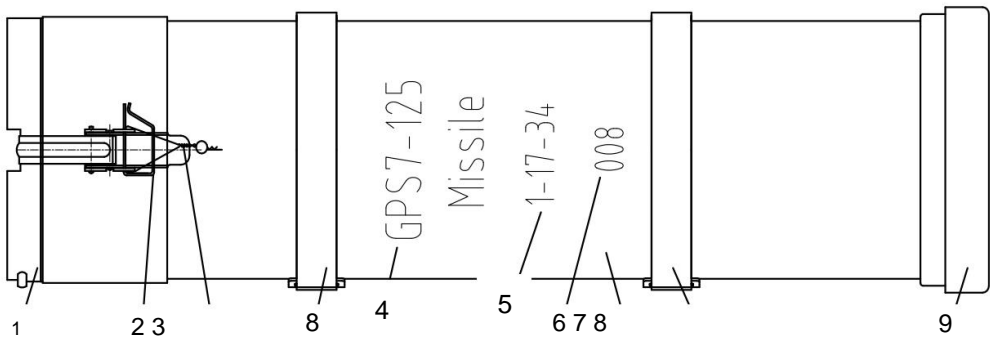
ammunition must be contained within the packaging tube and in the box with the equipment.

special

4) The outer packaging is A steel box for holding a single bullet and pencil. With one sleeve

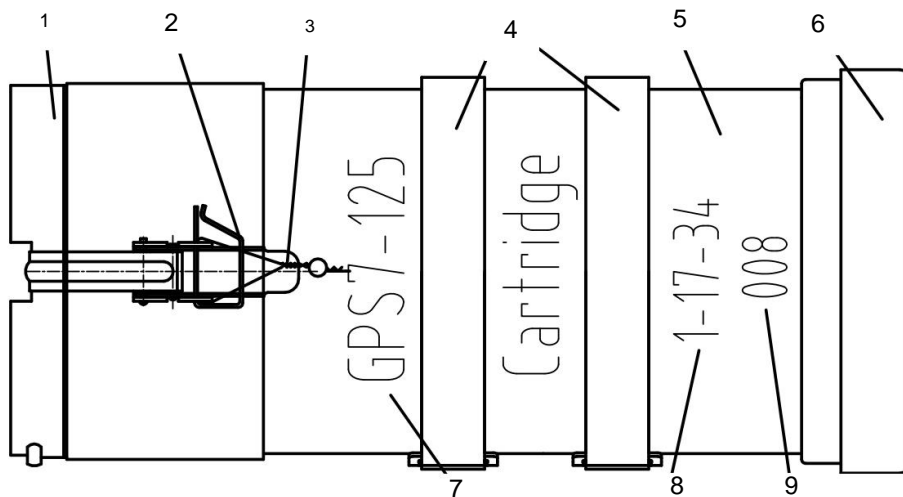
B. Packaging of guided missiles

The packaging of a guided missile fired from an artillery shall include a guided missile tube (size: length 788.5 mm., the outer filling pipe has a diameter of \varnothing 186 mm., see Figure 6), the soil delivery pipe Complete with sleeve (size: length 459 mm., diameter of outer filling pipe, see Figure 7) and box. Packing (with dimensions: 854 mm. \times 490 mm. \times 292 mm. see Figure 8) for the side markings of The container is referred to in Figure 7. The missile tube and the auxiliary ground kit together with the casing are packaged together. Inside the packaging box and a simple user manual will be packed inside the box as well. Status of the packaging tube for a guided missile fired by an artillery gun, see Figure 9.



- | | |
|--|--------------------------------------|
| 1. Filling pipe cover | 6. Guided weapon set number |
| 2. Latch holding hook | 7. Packing pipe |
| 3. Fixing wire and lead seal | 8. Belt for lifting the packed pipe. |
| 4. Missile weapon code | 9. End cover for filling pipe |
| 5. Series number code – Year – Missile weapon manufacturer factory | |

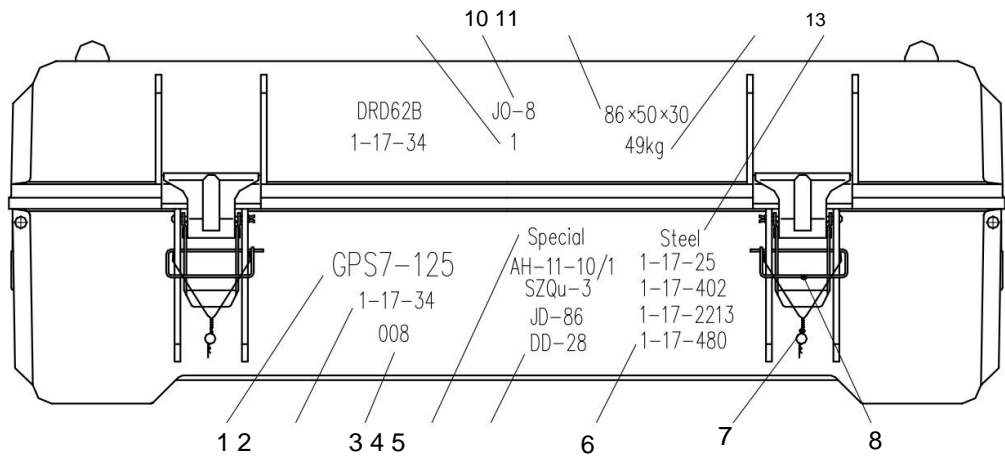
Figure 6: Appearance of missile packing tube



- | | |
|------------------------------|---|
| 1. Filling pipe cover | 6. End cover for filling pipe |
| 2. Latch holding hook | 7. Guided weapon code |
| 3. Fixing wire and lead seal | 8. Batch number code – year – soil manufacturer delivered with casing |
| 4. Pipe lifting belt | 9. Number of the soil kit sent together with the casing. |
| 5. Packing pipe | |

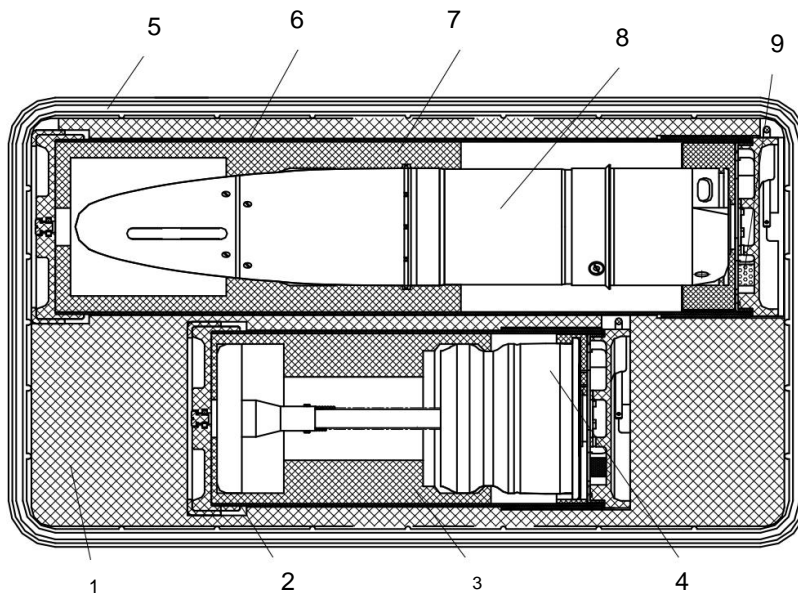
Figure 7: Picture of the outside of the soil-containing pipe with casing.

(Appearance of cartridge subassembly packing tube)



1. Guided weapon code
2. Batch number code – year – factory that produced the guided weapon
3. Guided weapon batch number
4. Special soil cover sent
5. Last trigger code
6. Batch number code – year – factory where the butt was produced
7. Fixing wire and lead seal
8. Latch holding hook
9. Number of weapons and weapons
10. Warhead explosive name
11. Volume of the container
12. Weight of the packaging box
13. Materials used to make clay casings

Figure 8: Appearance of packing box



1. Foam frame for the pipe containing missile weapons.

6. Guided weapon container tube

2. Pipe for containing the soil kit, delivered with a

7. Foam frame to support missile weapons

sleeve. 3. Foam frame for the pipe containing the soil kit, delivered

8. Guided missiles

with a sleeve. 4. Clay set Be ready

9. Moisture protection substances

with the sleeve. 5. Packaging box

Picture 9 : Picture of the storage location for guided weapons fired from artillery inside the container.

(Packing tube with gun-launched missile in the packing box)

6. Ammunition storage A. Ammunition must be well packed

and stored in a special warehouse. The markings on the container (packing tube) must be the same as on the bullet body or main carrier with casing. B. All equipment for

storage and transport must Meets the requirements for Protect from moisture Fire prevention and lightning protection and must stay away from flames or Electrical power supply

C. Must provide fire extinguishing equipment and technical security systems and systems. Fire protection required in ammunition storage. D.

Ammunition storage in ammunition storage must have good ventilation, temperature and Humidity must meet the requirements for storing ammunition. E. In the field,

temporary ammunition storage depots should be established on level ground. and the ammunition pile must Cover it with a herringbone waterproof tarpaulin. Cover with felt. or other materials To protect from sunlight, humidity, rain or lightning. Temporary ammunition storage depots must be located away from electrical power sources. or sources of fire Residential areas and buildings Do not place flammable, explosive, acidic or alkaline items near the storage area.

Part 2

Loading ammunition on a vehicle

(PLACEMENT OF AMMUNITION OF WHOLE VEHICLE)

When a tank is delivered to a unit, ammunition is not provided for use. The unit should prepare it themselves.

Warning

Transportation, loading and unloading of ammunition must not be violent.

1. Artillery ammunition and other types of ammunition (Ammunition and bullets)

- A. 38 rounds of 125 mm artillery shells (non-complete rounds, normally carrying 14 rounds of armor-piercing rounds, 12 rounds of anti-tank grenade rounds, high-explosive rounds 8 rounds tall and 4 guided weapons)
- B. 7.62 mm coaxial machine gun bullet.

3,000 shot
- C. Anti-aircraft machine gun ammunition of caliber 12.7 mm.

780 matches
- D. Smoke type grenade, size 76 mm.

12+8 rounds (in grenade storage box)
- E. 76 caliber air fragmentation grenade mm.

None (there is a smoke grenade launcher (fragment type Air(shrapnel)) number of 12 shooting pipes, 1

The spares box can hold a variety of grenades.

Smoke or air-bursting type can hold 8 rounds and still

Both types can be stored. The user can decide to use it. according to needs)

2. Placement of ammunition on vehicle

A. Artillery ammunition (38 rounds)

1) 22 rounds of ammunition are loaded on the automatic ammunition tray rails. Between the rails, the ammunition tray There will be 4 brown ammunition trays that can carry lead weapons. missiles or high-explosive projectiles Other ammunition trays can hold any type of ammunition.

2) The 15 rounds of ammunition will be carried in the ammunition compartment on the right side of the tank. Right rear fuel tank inside the driver's compartment. One round of ammunition is stored on a panel on the ammunition tray rail.

Things to remember

A round fired from a panel on the magazine tray should not be an armor-piercing round.

3) 15 rounds of clay delivered with casings will be carried in the storage compartment on the left rear In the driver's compartment, the soil was delivered with a number of casings. 1 fuel tank. The rounds will be carried in the loading panel on the

ammunition tray rail. B. Ammunition. 7.62 mm coaxial machine gun (12 boxes)

1) 5 boxes are loaded on the rotating plate under the ammunition tray rail (see Figure

10). 2) 1 box is loaded on the base of the ammunition box. 3) 6 boxes

carried in a steel basket at the end of the gun turret (see Figure 11) C.

Machine gun ammunition Aircraft size 12.7 mm (quantity 13 boxes)

1) 2 cargo boxes are in the steel basket on the left side of the gun turret; 10 cargo boxes are in the Steel basket at the end of the gun turret (see

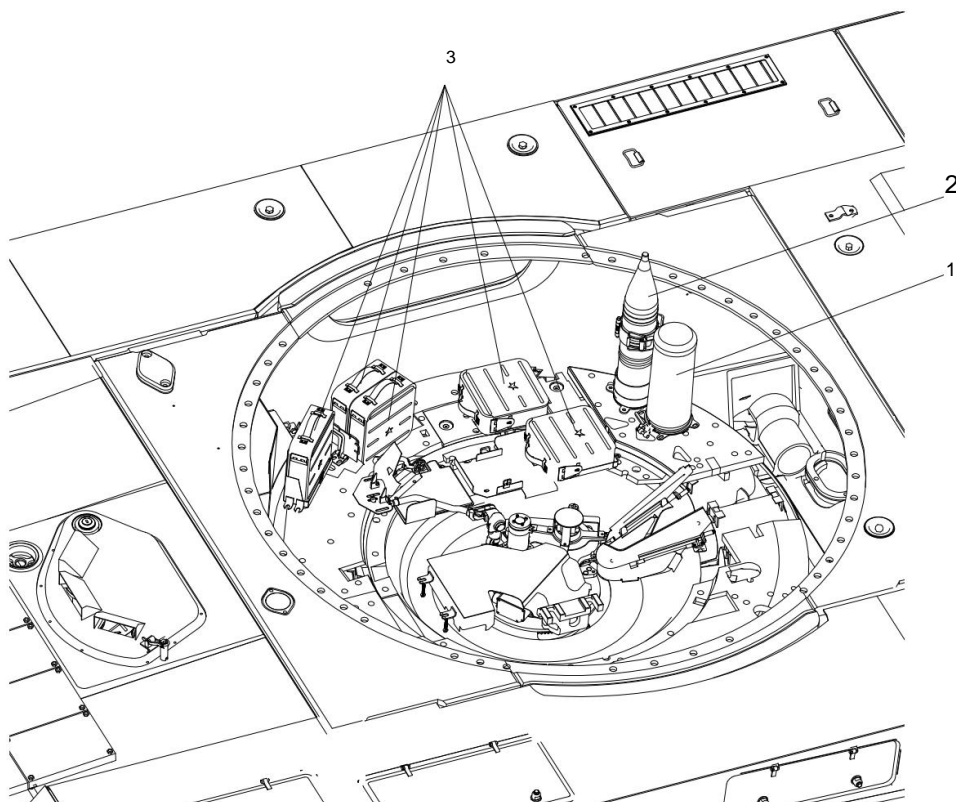
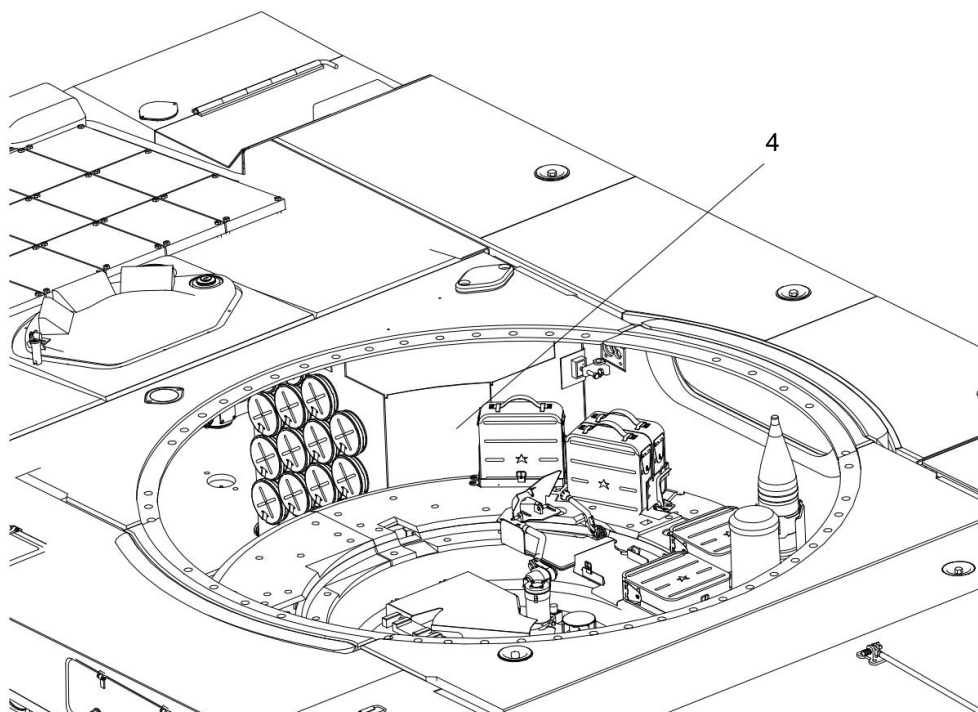
Figure 11) ỹ ỹ The box is with the gun

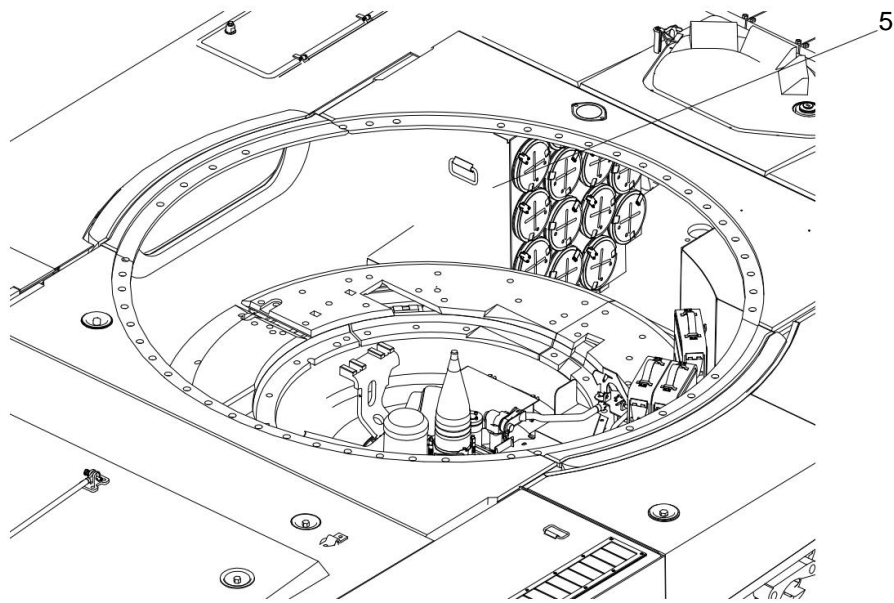
mounting base. D. Location of the smoke-type grenade. (Air cracking type)

Smoke grenade launchers (air fracturing) with 12 firing tubes are installed on both sides of the turret, which can be used to fire smoke grenades. (or air-cracked type) can be placed in a steel basket. The rear of the turret carries a box of 8 spare smoke (air-fracturing) grenades.

1) Able to load 12 rounds of grenades into the launcher tube in advance to ensure Ready to use

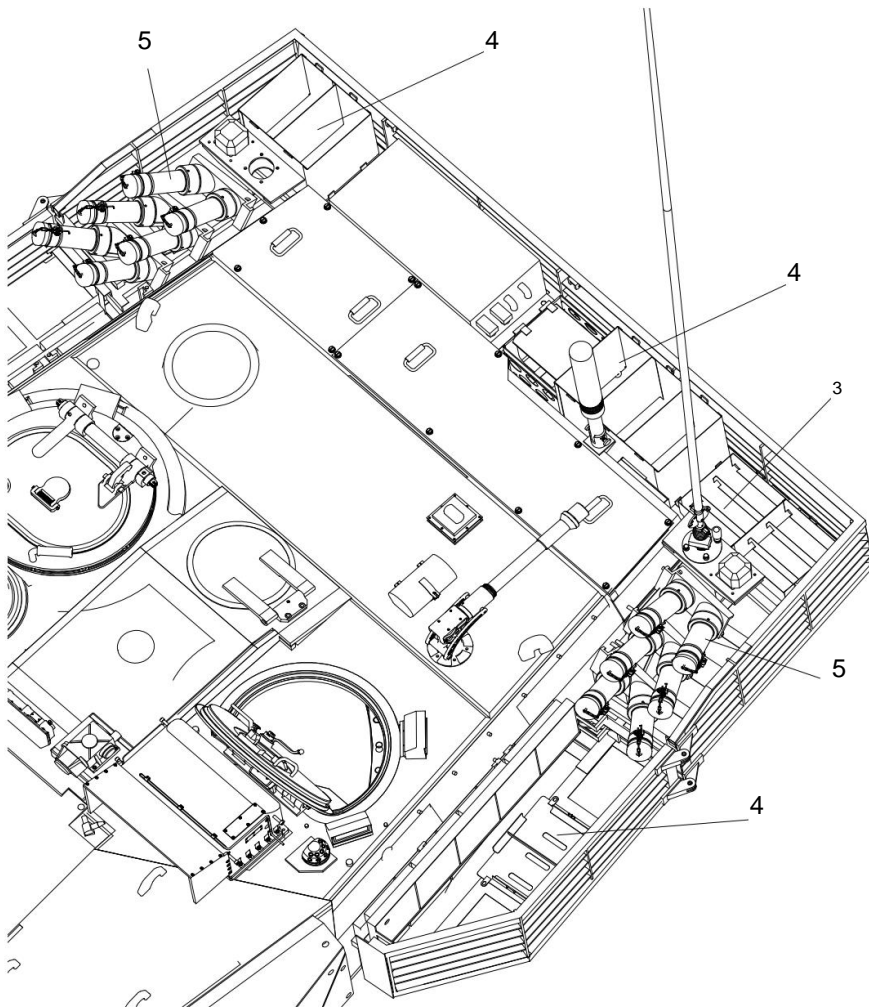
2) Storage box for spare smoke (air crack) grenades, able to carry 8 rounds.





1. Clay set delivered with
4. Ammunition storage compartment, fuel tank, left side (transportation
- casing 2. Bullet
- kit) 5. Ammunition storage compartment, fuel tank, left side.
- body 3. Machine gun bullet storage box with core (bullet)

Figure 10: Chassis Ammunition Layout



1. The bullet itself. 2. The

clay package delivered with the casing. 3.

The box for storing machine gun bullets together with the core.

4. Anti-aircraft machine gun (AAMG) ammunition storage box

5. Air-fracturing grenade launcher tube

Figure 11: Picture of the layout of loading ammunition on the turret (Turret Ammunition Layout).

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