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Torch Set for Gas and Liquid Fuel, Burner Assembly for Fuel Gas & Liquid Fuels

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ABSTRACT

The two combustion chambers are located vertically around the turbine and are connected to the turbine housing by side flanges. This type of design makes it possible to keep the inlet air from the compressor to the combustion chamber and from the combustion chamber to the turbine in one direction and causes the least relative pressure drop and relative velocity. Compressed air from the compressor entering the combustion chamber cools the outer shell of the hot gas. In addition, the symmetrical inlet and dual variable airflow results in a symmetrical temperature distribution with minimal pressure change in front of the first row of rotating vanes. Each combustion chamber consists of 8 burners (BURNER) designed for both gas and diesel fuel. Fuel burners operate in accordance with the law of reverse flow. This arrangement of the combustion chamber creates a great flexibility in the dimensions as well as the shape of the combustion system and provides a good possibility for inspection as well as the possibility of easy assembly and disassembly. Combined burners 1 cause diffusion as well as premixing of the flame and produce nitrous oxide and low carbon monoxide without spraying water and steam injection. However, a gas turbine engine can use a water or steam injection system to reduce pollution.

Introduction

The compressed air delivered by the compressor in the combustion chamber ignited with gas or diesel fuel and enters the turbine with a special temperature. There are two combustion chambers on the left and right of the turbine [1]. The air coming from the compressor enters the combustion chamber through a circular chamber and passes through a circular chamber between the pressure cover and the flame where the burners are supplied. In this part, the necessary rotation of the flame stability is given to the air by the flame rotators [2]. At the bottom of the fire tube are variable air vents that open and close with the turbine outlet temperature. Of course, this is done by an adjusting ring made of sealing sheets. The location of the ring is controlled by an electric servomotor connected tangentially to the same ring. The burners are connected to the combustion chamber with a flange.

They are shown in the form of dual fuel burners (gas and diesel). For operation at low load, the gas is directed to the diffusion burner and in operation at high load, it is directed to the premixer burner. The connections in the liquid fuel burners are for cooling air also for returning diesel fuel [3]. The ignited hot gas leaves the combustion chamber and goes to the turbine. There is a valve for inspection as well as observation and access to the combustion chamber as well as access to the turbine inlet parts [4].
The flame is detected by two flame sensors in each combustion chamber covered. A flame inspection hole in the valve cover allows the flame to be viewed. Each torch assembly has an igniter 1 to light the pilot. There is a barrel plate around and above the combustion chamber. Fuel, cooling air, spark plug gas pipelines are all located above the combustion chamber, allowing them to be easily inspected and repaired [5].

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See the Flame

The main flame and the top row of refractory bricks can be seen through the view hole installed on the inlet valve. The operator should be acquainted with the shape and form of the flames by comparing the condition of the flame in different loads day by day and gain experience [6-10]. To apply these observations, the user can hold a piece of white paper or cardboard at a fixed distance from the viewing funnel. This method is somewhat more useful for observing the shape and slate of a flame with diesel fuel.

In a situation with a similar load, the operator remembers that the image of the flame appears in reverse on the paper. In such cases, differences become apparent. Burners should be inspected as soon as possible [11-20]. If these changes coincide with an increase in ATK temperature difference, it is clear that the problem with the burners is due to ESV being discontinued.

Pressure Cover (Pressure Jacket)

This cover (chamber) forms the outer shell of the combustion chamber. It consists of internal pressure and internal component retainers, and in total is a hollow cylinder with a cap at the highest point and an elbow at the lowest point. Compressed intake air and hot exhaust gas connected to the turbine by a flange (A). The openings (B) include the burners and the openings (C) are the valves.

The pressure cover made by the combustion chamber shell and placed in the area of the mixed air inlets with a cap and a welded protective line [21-28]. The following welded inside the combustion chamber cover:

- ✓ Central part for keeping the flame cylinder.
- ✓ Hooks for transportation.
- ✓ Holders.
- ✓ Valve cover flanges.
- ✓ Nozzles for connecting PURGE airline.
- ✓ Two flanges.
- ✓ Two nozzles for flame receivers.

The following are welded on the cap

- ➢ Burners assembly nozzles.
- ➢ A central nozzle for the gas line.

The connection of the cap and cover (jacket) established by screw and by three guide pins to achieve correctness [29-39]. The turbine shell and the jacket are connected by screws in the horizontal connection area, and this is done by screws and nuts.

Combustion chamber internal components

Inside the combustion chamber is the space where combustion takes place by mixing gases. The hot gases leave the chamber in (A), so that the primary fuel and air are supplied from (B) [40-49]. The main internal components include the top plate of the flame tube, the flame tube and the mixing chamber. The flame tube consists of a cylindrical outer shell with an independent inner cover. The ceramics are held vertically on the cooled ring and horizontally with a special holder. The ribs in the fire tube section hold it in a central position.

The adjusting ring is rotatable and suspended. Sealing sheets change the opening sections by rotating the adjusting ring. The mixing chamber consists of a conical section. The junction between the turbine and the center of the combustion chamber is on two TRUNNIONs and has free movement and is located in the center with two guide pieces.

Just as an independent unit is designed to cover all purposes, the torch assembly is no exception to this rule and includes the following:

- ✓ Liquid fuel burner.
- ✓ Gas fuel burner with axial rotator.
- ✓ Pilot.
- ✓ Spark plug.
- ✓ Gas distributor before mixing.
- ✓ Diagonal rotator.

Liquid fuel burner, pilot gas and igniter are protected in the burner holder. Axial rotators are combined with gas fuel burner. The diagonal rotator is part of the fire cylinder. The pre-mixer gas distributor is close to the diagonal rotator. Most of the initial air required for combustion passes through a diagonal spinner [50].

Here the air rotates by applying force and enters the combustion zone. The central air of the burner is rotated by a spinner and mixed with gas or diesel fuel upstream of the spinner. In high load operation, most of the gas fuel is supplied for air combustion before the diagonal rotator. In this case, it enters from the inlet of the pre-mixer (PREMIX) and the distributor and mixes with the combustion air.

In low load mode (LOW LOAD), the gas fuel is supplied through the burner holder from the burner emission inlet and moves to zone (A). At the head of the burner, it mixes with the central air of the burner and after passing through the rotator, it moves towards the combustion zone [51-60]. When the gas fuel enters from the pre-composite path, part of the gas fuel mixes with the air in the center of the burner, i.e. the pilot path, at the pilot point of the burner.

When the liquid fuel burners are operating under the return law, part of the fuel is returned to the return line of the burner. The amount of liquid fuel for combustion escapes through the rotating nozzles to form a hollow core of the atomized mixture. The water injection system is installed only to reduce pollution [61-70]. The main flame is generated using an auxiliary flame generator such as a spark plug. Ignition gas enters the burner holder in the relevant system.

Adjust Air Mixing

The air mixing control controls the amount of air entering the combustion chamber and the primary air flow to the burners, as well as the secondary air flow not for combustion but for the mixing openings. The lever moves between its two ends by an electric motor and gearbox which is located in the pressure chamber of the combustion chamber. This motion is transmitted to adjust the ring by a roller with rotation of the ring [71-85]. By moving the ring, it is possible to control the inlet current to the openings.

Figure 1. Water Damaged Turbine Moving Blades

Visit valve with tube

The access of this valve to the inner part of the combustion chamber and the initial and upper part of the turbine is for visiting. The inspection tube is placed on the valve cover to indicate the combustion method [86-93]. The existing opening on the mixing chamber is closed to reduce air leakage. The door of the valve located at the elbow of the pressure cover is closed with a hook. The funnel (FUNNEL) with the retaining arms is placed on the opening of the mixing chamber and is locked by a screw. Opening The visit closes with a visit tube equipped with two lenses [94-105]. The second lens is inserted for safety. If some air comes out, it means that the first lens is broken. In this case, the use of the observation tube should be prohibited and the lens should be replaced as soon as possible.

Installation

The compressor and turbine are a compact assembly that is assembled at the factory. This eliminates the need to configure the site during the installation process. The shell rests on the base of the front bearing as well as the exhaust bearing. The two legs at the entrance are designed as fixed points for free adjustment [106-119]. The exhaust section rests on a flexible base with a central guide, allowing for axial as well as radial expansion of the shell. The oil tank is located in the front part of the air intake (INTAKE) and the oil pumps as well as the diesel fuel are located on the relevant bases and the filters as well as the automatic control equipment are also located in this part. This series of equipment is tested and controlled during construction. In compressor and turbine assembly, lateral heats as well as oil tanks will be fully transported for installation.

There are three shells in the axial compressor to hold the compressor blades in place. Fixed blade retaining shell No. 1, which is attached to the beginning of the central shell. Fixed blade retaining shell 2 and 3, which are connected to the central shell in a way that allows expansion due to temperature changes. The support bases of these shells are in a way that they can be adjusted and centered relative to the central skin. There are two eccentric pins at the top and bottom of these shells that establish the main connection to the central shell and hold the shells in place after adjustment.

The task of transferring the torque applied to the fixed blades and then the shell holding the fixed blades to the central shell is also performed by these pins. There are grooves on the central shell on which the shell holding the fixed blades 2 and 3 adjusted by the chimney. To transfer the forces acting on the shell holding the fixed blades to the central shell.

There is a small distance between the fixed blade support shell through which air passes and enters the space between the central shell and the fixed blade support shell [120-123]. At start-up and when the compressor has not yet reached its design work point; Some of this air is transferred to the unit exhaust by opening the valves in the path and through the pipe. In addition, this air is used for cooling different parts of the turbine based on the pressure of different points. At the beginning of the compressor, there is a row of fixed blades, the angle of attack of which can be changed, changing the exhaust outlet temperature and the amount of excess air consumption in the combustion chambers, thus creating the best conditions for air to pass through the compressor.

Movable Compressor Blades

The moving compressor blades are mounted on rotor disks and their task is to convert the received energy into kinetic energy and increase the pressure on the inlet air and then direct them to the fixed blades. Each stage of the compressor consists of a row of movable vanes and then a row of fixed vanes, which in the assembly of the stage increase the pressure of the passing air.

Each of the compressor moving blades is made of stainless metal. The best cross section designed for air to pass through these blades. The root shape of these blades is the smallest and they installed on the grooves installed on the rotor disk. The presence of washers and fasteners that installed on the disc prevent the longitudinal movement of the blades on the disc grooves. This method allows the blades to be replaced or inserted when even the rotor has not been removed. A protective layer has used to prevent damage by wear on several rows of the original moving compressor blades.

Compressor Outlet Diffuser

The compressor outlet diffuser converts the kinetic energy of the compressed air into a static pressure with high efficiency. A guide wall at the diffuser outlet prevents air from circulating. The diffuser is made as a circular ring with inner and outer walls. These walls are connected at the opening as well as the last row of fixed compressor blades. The outer wall is screwed to the third carrier of the blades. The inner wall is fixed relative to the location of the inner protective wall.

Compressor Shaft Glands

At the inlet of the compressor, the axle prevents the oil from entering the oil-bearing system. Sealing around the fixed blades of the gland reduces row-to-row drop and at the end of the compressor reduces air leakage to the turbine. More details given in the turbine section. In the compressor inlet area, the function of the glands in front of the hollow shaft is to prevent the bearing oil from leaking into the compressor in the air intake section. For this purpose, ambient air enters the bearing through the gaps, although the volume of this air is very small.

Part of the air flow through the SEAL of the oil box to the bearing space where the atmospheric pressure decreases as the oil evaporates. A steam absorber is installed to prevent oil leakage. A small portion of this atmospheric air travels through the clamp of axis 1 to the inlet channel where the pressure is the ambient pressure. LABYRINTH seals are located between the fixed blade ring and the movable and rotating blade ring and minimize the return of air inside the compressor. The gland axis at the compressor outlet between the central hollow axis and the diffuser, provides a part of the air that is sealed against the very hot gas between the fixed and moving blade of the turbine.

Figure 2. Compressor Shaft Glands

Exhaust Outer Casing

The gas turbine shell is located at the end of the turbine on the bearing and prepares the flow path for the gas. It is designed as a fixed diffuser to minimize drops and is divided into horizontal and welded pieces. This shell consists of an outer cylinder and an inner cylinder which are connected to elliptical and curved pipes and clamps. Flanges are designed to connect to the center shell as well as the outlet diffuser. The inner part of the exhaust shell contains the turbine bearing and includes the elliptical tubes. The turbine supports are located in the horizontal convex part at the lowest flange. A net 1 with a lid 2 protects the fasteners and retaining walls from hot exhaust gases.

Exhaust Gas Diffuser

The turbine exhaust gases reach the stack 1 through the exhaust diffuser. As a result of this passage, the static pressure increases and the velocity decreases. This part is made of conical shell and expansion mesh and is welded at both ends. The air is sucked out of the compressor through the lower pipes when starting and also turning off the turbine and exits through this diffuser.

Cooling and Sealing Air

Both the turbine blades and the inner shell of the shell are exposed to hot gases and are therefore made of high temperature alloys. These cases require intense cooling because the thermodynamic and thermal problems and applications are beyond the temperature range of these particular alloys. Cooling also improves the reliability of these parts exposed to hot gases and withstands corrosion and heat stress due to high temperatures. A suitable cooling and sealing system protect the gas turbine, especially the rotator turbine, from overheating. Cooling and sealing air for fixed turbine blades is provided through rows 1 and 2 of the compressor fixed blades and is sucked from part 2 (downstream of compressor row 15) and reaches the fixed turbine blades of rows 3 and 4. This air passes through holes in the fixed blade carrier and first cools the fixed blades and the turbine blade cover. Air from chamber 1 is used to cool row 1 of the fixed vanes and reaches the inner vanes in the hot gas path. Air from chamber 2 is used to cool row 2 fixed vanes. Until most of it passes through the hollow blades towards center 1, so as to prevent hot gas from entering the axial gland below row 2 of the fixed blades. The air passes through chambers 3 and 4 to row 3 of the fixed, empty vanes. So, the sealing air meets the gas path. The inner shell is cooled by air absorbed from the exhaust diffuser.

In places where the air flow is very low and they have little efficiency for cooling the inner shell, a calculated distance is created by the cooling air wall. Cooling air is controlled and limited by flow limiters in the form of desired volumes, which is done in row 1 of fixed vanes and upstream of the flow. Cooling air for the first row of twelve blades is taken from the last row of the compressor rotating blades. The air in this part takes a spiral state and removes impurities and impurities in a peripheral way and moves towards relative cleanliness.

Air flows into space 3 through a cylindrical gap. A small portion of the air flows through the helix (A) as sealing air into the space 5 between the protective and hollow nets through holes 4 toward the center of the hollow above the cooling air portion. Secondary cool air flow and drifts 2, 3, and 4 of the moving blades are taken from row 12 of the compressor fixed blades downstream. This air passes through the holes in the rotating disk of the compressor 13 and flows through the cooling air pipe and the rows of rotating blades 2, 3 and 4 and through the central holes in the turbine disk.

Here the air cools the row 2 blades and the roots of the rotating blades 2, 3 and 4. Cooling air then flows into the hot gas, creating a wide film over the center. On turbine disks, a spiral flow forces the contaminant particles to the periphery where they have deposited in a single layer. Correspondingly, sediments in the air ducts are very small even after a lot of work. The described cooling air ensures the strength and resistance of drum structure 1 of the rotor structure, which is in contact with hot gas. This air prevents final thermal stresses and rotor deformation during loading or rapid start-up. Compressed air from the turbine not only cools the turbine but also heats it up when starting quickly. For this purpose, turbine disks are generally exposed to compressed air. A small amount of air taken from the downstream row 5 of the compressor flows through a tube into a chamber between the hollow end of the shaft and the end shaft of the shaft 7, protecting the glands in the turbine outlet area.

Bearing

Turbine Bearing Location

The job of the turbine bearing is to maintain the rotor with the exhaust shell. It is installed with an internal cylinder from the exhaust shell and accompanies thermal expansion. The bearing is positioned horizontally and vertically by the support base below the shell by the central guide. Further adjustments are made by the chemists. The journal bearing is located inside the bearing with the adjusting ring. The oil space is closed by a seal ring at the front and a cover at the end. The oil is fed to the bearings by threaded pipes that are screwed to the bearing location by pipes. The bearing cover is equipped with insulation to prevent heat from entering.

Journal Bearing

This bearing holds the rotor at the end of the turbine and consists of two tube nuts 1 of the bearing. The active surface is coated with white metal and the four wedge edges of the oil are placed between the bearing and the shaft during rotation. The pressurized oil is injected into a bag of 2 oils, which is placed like a channel in the bearing nut and the circular groove of 3 rings.

During the start and shutdown of the oil with high pressure, lift the shaft through the lower oil bag and create friction by the oil. This oil protects the white metal and makes the shaft rotate easily. The walls contain a circular space on each side, which collects the leaking oil and directs it out through the drain holes 4. The temperature of the white metal is measured by thermocouples and shown to be screwed into place of the lower bearing nut. The seat bearing of the journal bearing is located in an adjusting ring. The upper adjustment ring is designed as a bearing base and is screwed to the bearing location. The lower adjustment ring on the bearing position is adjusted by horizontal and vertical adjusters. Interchangeable shims below the regulator allow for radial switching on the rotor. The return pin prevents the bearing from rotating in the adjusting ring.

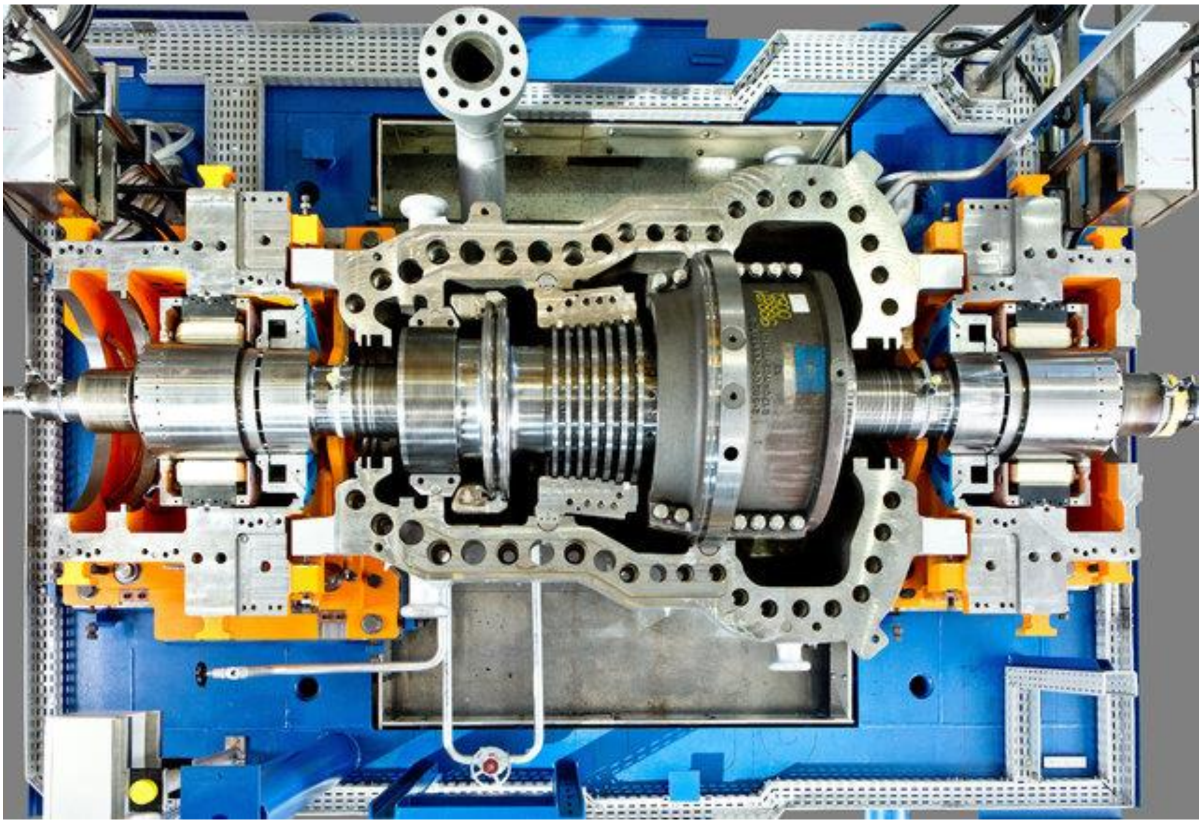

Figure 3. Turbine Bearing Location

Compressor Bearing Location

The location of the compressor bearing is to support the rotor and keep the compressor and turbine on the foundation. That part of the outer shell is attached to the fixed blade carrier of the compressor inlet shell at the bearing location. Bearing location consists of an inner and outer shell that includes the compressor inlet channel and is connected by fasteners. The journal-thrust bearing is fitted with the adjusting ring and is sealed on the shaft clamp plate by a sealing ring at the front, rear and an oil box at the end. The nozzle diaphragm of the hydraulic gearbox is covered.

Combined Bearing Trust / Journal

This composite bearing is a simple and separate bearing. The bearing surface is covered with Babbitt 1 and during operation, oil enters it to maintain the shaft. The pressurized oil flows to the envelope 1 oil through holes in the adjusting ring and circular groove in the bearing housing.

During start-up and shutdown of the jacking oil turbine, 2 wing pressure enters the bearing through holes and causes fluid friction. This oil protects the Babbitt and makes it easy to spin. A thermocouple is located at the bottom of the shell and at the maximum open to indicate the temperature.

The thrust bearing includes the bearing bed which is covered with Babbitt. It is positioned with bearings and flexible chemicals at the bearing location for load distribution. The axis edges on the contact surface automatically adjust the pads 3, resulting in the formation of oil layers. Existing oil comes out of the lubrication gaps laterally and fresh oil is supplied from the journal bearing on both sides. Sealing tapes control and limit the oil outlet flow. The resulting plates define the boundaries of a circular space in which oil is collected and change its upward direction through the slits. Thermocouples are placed on both sides of the bearing housing to measure and display temperature.

The axial forces are transmitted to the bearing location through the wires as well as the bearing circumference. The adjustment ring covers the outlet circumference of the bearing circumference and is held in place by the support base. The center guide determines the side position of the bearing and adjusting bearing.

Turbine Gear

Hydraulic Drive

This hydraulic device is responsible for turning the gas turbine rotor after shutdown in order to cool it symmetrically and prevent it from buckling.

Minimum speed is required for this purpose. This device is attached to the front of the compressor bearing. It consists of a Pelton impeller with six nozzles at the top and a cover. The oil moves the impeller through the cover and nozzles, causing the center shaft to rotate.

Manual Turbin Gear

This device is in addition to the automatic device and has the task of turning the shaft manually. Includes a pin 2. The shaft rotates with this pin which should be accessible through the radial holes of the middle shaft. Depending on the design, it will be accessible by removing the entire top and perimeter 3 or by removing the entire top. Jelly oil pumps must be switched on before circulation.

Intermediate Axis (INTERMEDIATE SHAFT)

This shaft connects the gas turbine to the generator and provides useful power transfer. This is an integrated shaft and is fitted with flange 1 (1 & 4) flanges are used to fasten to the front flange. The blades 2 are located in the middle shaft environment to engage the handler.

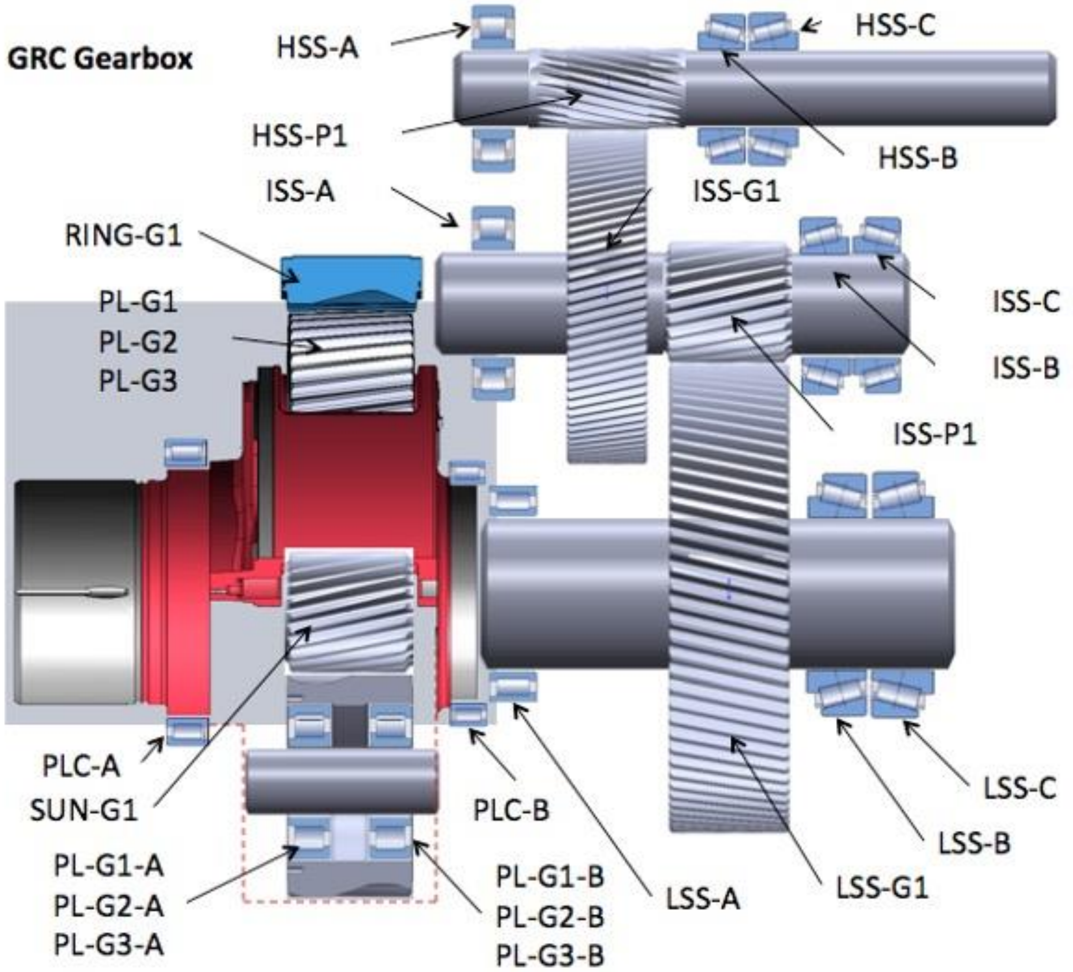

Figure 4. Gearbox internal component schematics

The diesel fuel system feeds the burners with liquid fuel and controls the amount of fuel injected into the combustion chambers based on the unit's needs in starting, operating and stopping conditions. Liquid fuel is introduced into the gas turbine liquid fuel system by the pumps of the forwarding system through the 9A flange with a pressure of 3 to 5 times. Liquid fuel from this source is first filtered. Certain parts of the liquid fuel that is not used in the gas turbine into the diesel fuel tank or into the liquid fuel filters (twin filter design, one of which is ready). Materials and impurities that may cause damage to components. Such as pumps, fuel nozzles and turbine blades are filtered.

Because very fine filters are used in this system, the fed liquid fuel must first enter the pre-filter stage (several pre-filter stages must be used if necessary). This prevents the filter from being replaced frequently and prolongs the cleaning interval. An alarm signal is issued by the pressure difference switch when the pressure drops due to the filter dirt increases. As a result, you have to manually put another filter in the service. In this case, it is necessary under any circumstances to make sure that the filter is full of diesel and ventilation, and to be careful in this regard. Only when the clean filter is ready and the dirty filter is insulated by closing the special valves can dirty nets be removed from the dirty filter housing and replaced with a clean, new net. A drain line is located at the highest point of the liquid fuel line after the twin filter. Air bubbles that form when stopping leave the auxiliary return line through an orifice. An additional discharge path is located at the top of the filter, and any amount of air generated in the form of small bubbles that can pass through the filter exits this discharge path and passes through the auxiliary return line through the orifice. SHUT OFF valves in the filter discharge lines are always open during gas turbine operation. An ophthalmic instrument (site glass) is in the discharge line after the two orifices.

Injection Pump

Using this pump, the diesel pressure returns to the pressure of the return line of the diesel to the forwarding pumps.

Start-up Pressure Relief Valves

When the liquid fuel system is started, the injection pump is switched on before the FO ESV is opened. The fuel is then sent directly to the diesel return line via the starter pressure relief valve. This valve has special values for setting the upper and lower limits. The upper pressure limit setting point should be much higher than the operating supply pressure of the system and the lower limit setting point should be slightly higher than the maximum combustion chamber pressure. Using the solenoid valve, the low setting limit is switched on to turn on the pump so that the pump will not start if the pressure is high.

After starting the pump and opening the FO ESV, the supply of the solenoid valve is cut off and as a result, with the closing of the valve, the pressure after the pump increases. When the injection pump is switched on, if the starter pressure relief valve starts to open for any reason, the safety valve operating at the pressure set above the valve relief operates and opens. Due to the standard size design by the manufacturer, the amount of liquid fuel sent by the injection pump is more than the required gas turbine. The excess liquid fuel injected by the pump is directed to the return line through two throttle valves.

Emergency Shut-off Valve

The function of this valve is to establish or cut off the flow of liquid fuel to the combustion chambers during start-up, stopping and also changing the fuel from liquid fuel to gas and vice versa. In addition, the valve shuts off quickly when operating protective controls due to disturbances occurring in the turbine that require a single unit trip. The emergency shut-off valve opens hydraulically and closes very quickly and completely if needed. ESV is closed by spring force in a fraction of a second. When the ESV is closed, the diesel fuel path is completely blocked without any leaks. Most of the fuel is returned (and less is injected into the burners). Closing the control valve means less fuel in the return path and as a result more liquid fuel enters the combustion chamber. This allows the atomized liquid fuel to enter the combustion chamber due to the high pressure of the fuel (and without the need for an atomized air system). When the liquid fuel system starts (when the diesel injection pump is on and the FO ESV is still closed) and also the diesel leak pump is running, the diesel flows to the 12A flange. This connection line (without emergency shut-off valves) must reach atmospheric pressure in the tank. So that no counter pressure is applied against this current after flange 12A. The most important components of the liquid fuel system (in the order of diesel flow) are described in the next section.

Filtration system

Necessary to atomize the burners (approximately 70 times). For this purpose, a SPINDLE SCREW pump of the displacement type is used. If the pressure before the pump is too low or the diesel temperature is too high, either can prevent the pump from running.

Liquid Fuel Burners

A total of 16 fuel burners flow to the front of the fuel is possible by a three-way valve and the fuel return line is opened or closed by a two-way valve. When the liquid fuel system is in operation, the three-way valve is CLOSED 4-5, and the fuel goes to the burners. The two-way valve then opens and opens the fuel flow path to the return line. When the three-way valve shuts off the flow of liquid fuel. (6-5,4 CLOSED) Compressed air from the compressor is connected to the liquid fuel burners for sealing (from connection Q, P). As a result, this compressed air from the liquid fuel burners to the combustion chamber is responsible for feeding the liquid fuel and atomizing it for the combustion chambers. All 16 of these burners are exactly the same, so the liquid fuel is evenly distributed in the combustion chambers. Liquid fuel enters the combustion chamber and in this place is divided into two parts. One part is injected into the combustion chamber and the other part is returned to the system from the diesel return line. The ratio between injectable fuel and return fuel depends on the pressure in the return line of liquid fuel. The return pressure depends on the condition of the liquid fuel control valve installed in the fuel return line.

Flowmeters

Liquid fuel flow rate is measured by a flowmeter and return flow rate is measured by another flowmeter in the return path. The difference between the two flowmeters determines the amount of liquid fuel injected into the combustion chamber.

Gasoline Tank Leaks

This tank collects leaking diesel from the combined valve wings and from various discharge and drain lines. An open-air line connects this tank to atmospheric pressure. The leak pump directs the leaking diesel to the tank and switches on and off automatically according to the fuel level of the tank. Replacement of liquid fuel to gas fuel during turbine operation. This fuel change is possible at any time from 20% to 100% of the base load. When the natural gas system is ready to connect to the turbine, the FG ESV opens and a gas flow flows at least to the unit. At the same time, the proportional control circuit changes the reference value of the liquid and gaseous fuels. Changing these values slowly and linearly causes the liquid fuel control valve to reduce the amount of fuel injected, and conversely the natural gas control valve (FG CV) to increase the amount of gas injected per unit. When the liquid fuel control valves reach the minimum position required to cut off the fuel, the FO ESV is closed, the injection pump is switched off and the fuel valve wings must be in the sealed air position. The three-way valve is 6-5,4 CLOSED and the two-way valve is closed, while the unit load is in an almost constant position. By Q-P connections, air from the combined valve flows from the outlet of the turbine compressor through the fuel inlet line to the liquid fuel nozzles. Sealing air is used for two purposes. Preventing the entry of hot gas from the combustion chambers into the liquid fuel system and also cooling the liquid fuel burners are among the purposes of using SEAL AIR. In fact, the sealing air is cooled by passing through a section of a pipe that is not insulated and acts as a Heat exchanger.

Switching from gas fuel to liquid fuel during turbine operation

Before switching from natural gas to liquid, fuel pipes must be filled with liquid fuel. Switching from gas to diesel can be done manually by the operator or automatically. In automatic mode, this switching is done when the natural gas pressure is less than necessary to continue working. This switching is done only when the gas fuel system is in diffusion mode. If the unit is in premix mode when changing the fuel, first the switch from premix to diffusion is done and then the steps of switching from gas fuel to liquid are performed. In case the automatic switching is due to the reduction of gas pressure, the switching from premix to diffusion mode is also done automatically at the beginning.

At the same time, the filling process of the diesel pipe is performed as follows:

- ✓ Liquid fuel thrust pumps are switched on. The starter relief valve is opened and the injection pump is switched on. The liquid fuel is then sent to the return line.
- ✓ Approximately 4 seconds later, the FO ESV and the FO SHUT OFF valve receive the opening orders on the return route while the combined fuel valve wings are still closed. In this way, the liquid fuel fills the feed path and return line with diesel.
- ✓ After a certain time (about 5 seconds) the SHUT OFF valve closes in the return direction and the FO ESV is still in the open position. When the pressure difference between the delivery line on the compressor side and the return line reaches below the limit setting point of the pressure difference switch MBN52CP001, it means complete and successful filling of the line and as a result FO ESV closes.
- ✓ At the same time, the pressure in the return line is comparable to the pressure in the combustion chambers. (Approximately 0.5 bar pressure difference).
- ✓ If the filling process is not successful within a certain period of time, the order of work is stopped and if necessary, the mentioned steps should be repeated. When the liquid fuel system is ready for connection, the wings of the combined fuel valves open (three-way valve: 4-5-6, 6 CLOSED Two-way valves: open) FO ESV opens and the flow flows at least towards the burners.

This minimum flow is achieved by the minimum possible position of the liquid fuel control valve when connected to the turbine. At the same time the proportional control of liquid fuel changes and the reference values for liquid and gas fuel change. In such a way that the reference value (SET POINT) of gas fuel decreases slowly and linearly.

FO CV increases the amount of fuel injected into the combustion chamber and FG CV reduces the amount of fuel injected into the gas. FG closes the FV ESV when the FG CV reaches its minimum value or position for fuel cut-off. The unit load is in a steady state during this process.

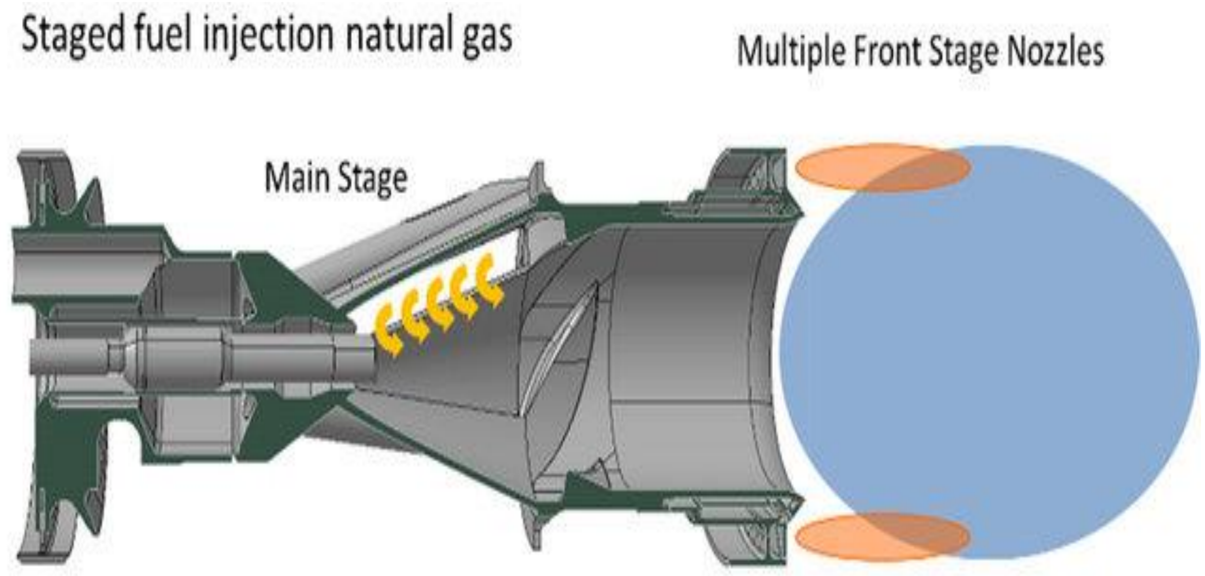

Figure 5. Liquid Fuel Burners

Liquid Fuel Burners

- ✓ **Description:** Liquid fuel burner atoms under all conditions such as stable operating conditions and conditions when liquid fuel is fully used. Liquid fuel burner includes chamber, cap, nozzle, 1 and return flow tube, with needle.

Principles of Operation

Liquid fuel burners use a rotating chamber 3 as a device for pulverizing 2 fuels and control the fuel injection rate with the principle of return flow control. The full volume of fuel delivered by the injection pump enters the rotation chamber and the burner nozzle. This fuel enters the chamber with an initial pressure of about 40 to 75 and then is divided into two paths with different flow rates. One of these two paths injects fuel into the combustion chamber and the other path enters the return line of liquid fuel. This distribution varies depending on the return fluid pressure due to the percentage of control valve open in the return line.

Closing the liquid fuel control valve reduces the percentage of diesel fuel passing through the line. This increases the fuel pressure in the return line and therefore increases the amount of fuel injected into the combustion chambers. The fuel entering the burners is through the inlet supply line of the burners.

Depending on the extent of this argument, for simplicity of speech, the characteristic end for each feed pressure consists of a higher and lower branch that intersect at one point. The difference between the upper branch and the horizontal dimension is the rate of fuel flow to the burner (feed rate) and the difference between the lower branch and the horizontal dimension is the rate of fuel injection. The difference between the two distances between the upper and lower branches is related to the reverse flow rate.

Principles of Operation and Construction

Ignition system gas is taken from natural gas fuel system or special gas cylinders. This gas enters through connection A and flows through the nozzle hole in the gas conductor pipe. At point B and at the end of the conductor tube, it ignites. This spark is generated by an ignition voltage of 5 kV and an electric arc is established between the ignition electrode and the end of the conductor tube (which is connected to the ground voltage level). This electric arc is present while the ignition system is in circuit. The air distance between the tip of the igniter electrode and the end of the conductor tube must be precisely adjusted so that a complete and strong electric arc is established. This air gap is adjusted by the bush and the flame in zone C is released from the igniter.

Conclusion

Two light receivers are provided for each combustion chamber. Each detector is placed on a paralyzed tube that is welded to the shell of the combustion chamber. Two quartz lenses are placed on the plates in a row and together with the sealing washers and the screws connecting with the flanges and the end plate form the components of this set. The optical receiver or flame detector is screwed to the insulator plate with thermal insulators.

This plate is also connected to the end plates with eight screws with SPACERs. This set is designed so that the flame detector, which contains circuits and electronic components, is not exposed to excessive heat. The space between two plates is connected to the atmosphere through a small radial groove so that the space between two lenses or quartz glass is not compressed. If the quartz glass is not completely sealed, hot air enters the chamber between the quartz glass and enters the atmosphere through the circular space (X). Even in this case, the optical detector is not exposed to hot air. In order to test the performance of the flame detector, a thin metal plate or heat-resistant cardboard can be disconnected between the radiant energy of the flame and the detector by placing a thin sheet of heat-resistant cardboard and the result can be tested through the control system. During unit operation, optical detectors (only one detector) can be installed from outside or at home. For this purpose, first the relevant cable should be disconnected from the flame detector, then the mechanical connections between the detector and the heat-insulating plate should be disconnected.

Gas or liquid fuel is injected into turbine burners and ignited in combustion chambers. The function of the flame monitoring system is to detect the actual combustion of the fuel and the presence of the flame. If the fuel is not injected but ignited, it can lead to further dangerous accidents in the gas turbine. In this case, as soon as the presence of a flame is detected, the monitoring system cuts off the fuel inlet to the turbine by closing the emergency shut-off valves.

This causes the turbine to automatically trip. The monitoring system is able to detect the difference between the situation where the flame is cut off during normal operation of the unit or is not established at all during the start of the flame turbine. In case the unit is working and the flame is cut off for any reason, the unit trips and in the second case, when the flame is not established, the operation of the unit starts. Special safety measures must be taken to ensure automatic shut-off of the fuel source when the flame is extinguished on the one hand and the unit is not tripped due to the failure of the flame monitoring system on the other hand (when the flame is fully established and only the monitoring system is defective) and high availability should be considered in the flame monitoring system.

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