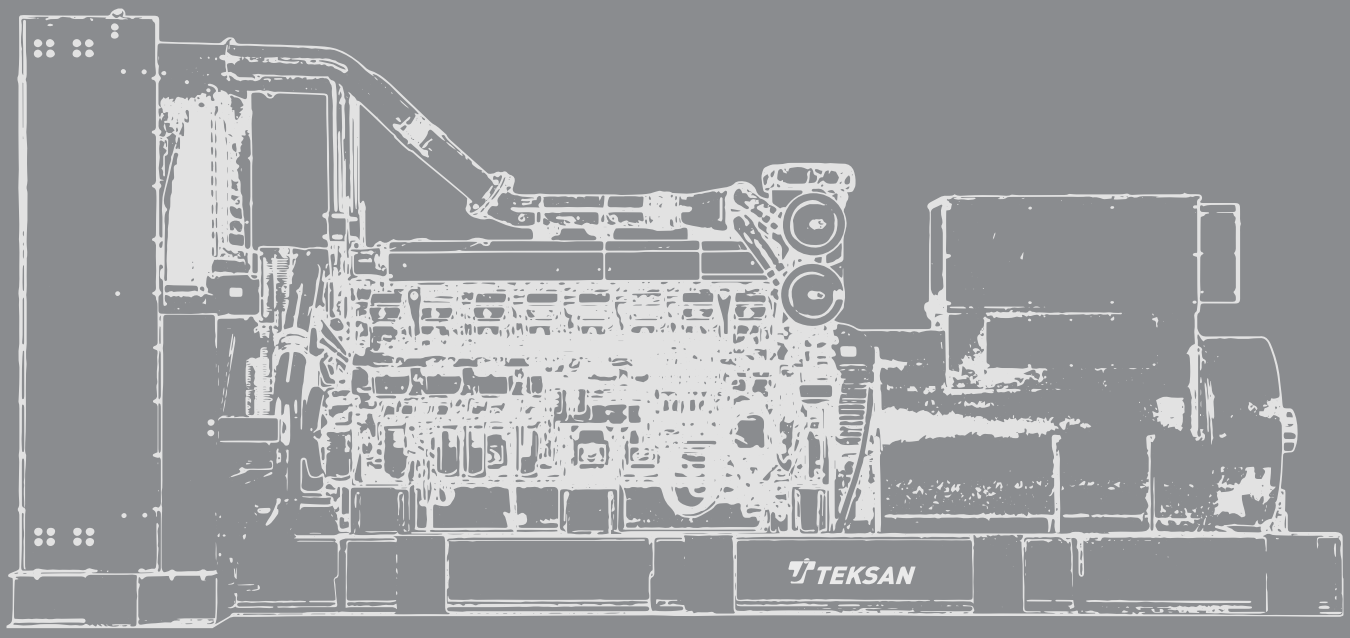
OPERATION AND MAINTENANCE MANUAL FOR DIESEL GENERATOR SETS



EVERLASTING COMPANY

TEKSAN

Dear User

First of all, thank you for preferring our product and company.

TEKSAN, sustains all its activities at its modern facilities, according to its principle of providing reliable products and services at high quality with CE norms and "ISO 9001:2000; Quality Management System" certification. Your generator set is subjected to several test and quality controls at every stage of production. There are several test and control procedures carried out on the time interval between the very first "assembling" step and the very last "delivery" step. TEKSAN products are also manufactured environment friendly at norms with "ISO 14001; 2004 Environment Management System" certification.

Our documents are being prepared carefully with the help of the academic education we have received and also the knowledge and experience we have obtained from being in this business for the last 25 years. As a standard TEKSAN documentation, the "Operation and Maintenance Manuals" for your "Diesel Engine", "Alternator" and "Generator Set" must have been delivered to you together with your generator set. Your duty as our customer, is to read, understand and remember all information shared in these documents before using your generator set. This will help you avoid any possible accidents that may be harmful for you, people around you or the generator set itself.

You may also sign for a "Periodical Maintenance Agreement" and get regular, complete and economical maintenance and reparation services from TEKSAN Dealers, and receive good quality service for your product.

Please let us know about your wishes and suggestions in order to contribute to our product and service quality.

TS ISO 8528-5 CERTIICATE

ISO 9001 QUALITY MANAGEMENT SYSTEMS CERTIFICATE

ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEMS CERTIFICATE

OHSAS 18001 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEMS CERTIFICATE

EAC EURASIA CUSTOMS UNION CERTIFICATE

CONFORMITY OF EUROPE

ISO 27001 Information security management system Certificate

ISO 10002 Customer atisfaction

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1.SAFETY PRECAUTIONS

1.1.General Instructions

Before installing or running the generator set, it is a responsibility for the user or operator to read the whole documentation that is included within the generator set. ("Generator Set Operation and Maintenance Manual", "Diesel Engine Operation and Maintenance Manual" and "Alternator Operation and Maintenance Manual"). All the safety instructions stated in these manuals must be provided in order for a safe operation.

The person who is in charge for installing, maintaining or using the generator set, is the only responsible for anything that risks the safety of operation. For this reason, these people must follow and obey all the instructions stated in all provided documentation, so that the risk of accident shall be minimized.

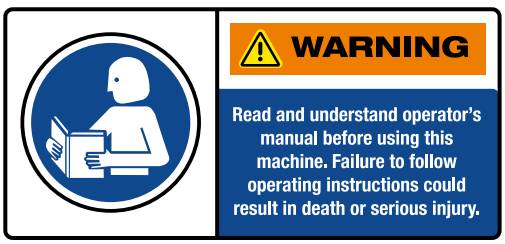
Because of this responsibility to take, the people who will install, maintain or use the generator set, must be trained and authorized about the procedures for installation, usage and maintenance. Any disorder or disobeying about these procedures, rules, instructions, methods or measures in manuals, will increase the probability of failure and accidents that may end up with injuries or maybe death.

Pay attention to all labels and warnings on the generator set. Install and operate the generator set fully in conformity with the related standards, rules and regulations. Furthermore, the local rules and regulations should be followed too.

Make sure that the generator set is at OFF position before performing any maintenance, repair or setting activity. In this way, you will be isolating the generator set from any unauthorized access.
Do not start the generator set until you are definitely sure that it is absolutely safe to run it. Under any unsafe condition, disconnect all the battery cables.

Use required safety equipment during periodical inspections and maintenances

This manual and the appendices are integral in total. All safety instructions are clearly stated in the relevant sections of this manual. Also remember that you can always get in contact with TEKSAN and ask for advice about any issue that is not understood clearly.



1.2.Lifting and Handling

1.2.1.Using Slings

Use the lifting lugs located on the generator set, while you are trying to lift or move the generator set.

Before lifting the generator set, be sure that you have checked all the lifting lugs or any connection points for any welding cracks, breakages, twists or rust that may cause any problem during the lifting process.

Make sure that all lifting equipment and supporting components are in a good condition, so that they can resist a load 10% more than the gross weight of the generator set as a minimum (extra margin for any snow, ice, mud or attached spare parts/equipment on set).

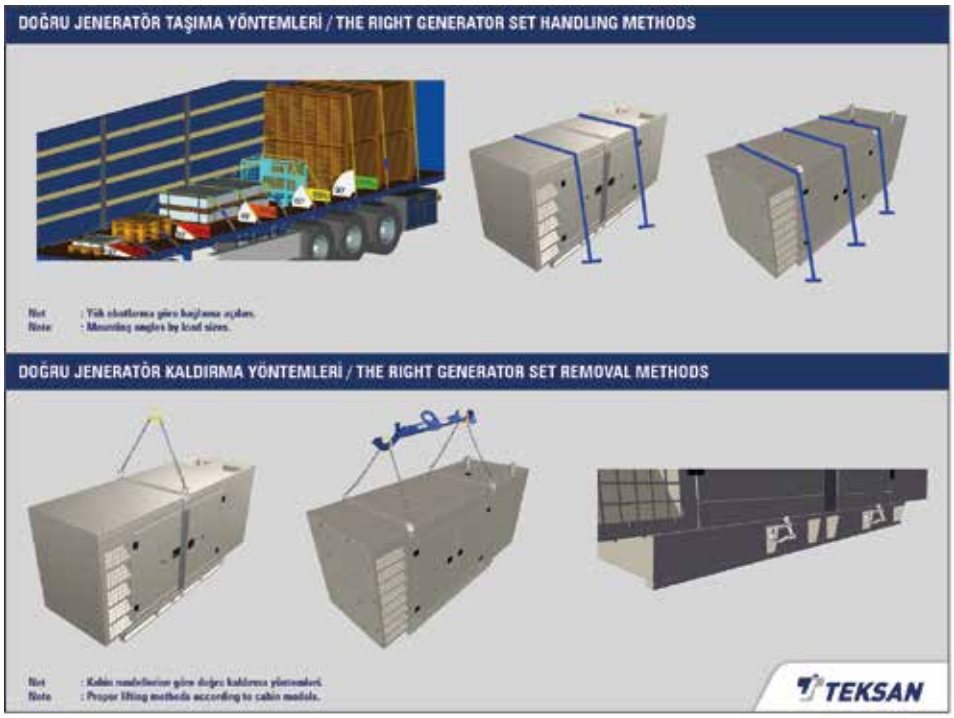
Make sure that all the lifting hooks or locks have functional safety clips and all of them are connected correctly. Be sure to use guide ropes or equivalents in order to prevent any rotation or swing action, when the machine is lifted and there is no contact left between the machine and the ground.

Do not try to lift the generator set if there is a strong blowing wind around.

Once the generator set is lifted, be careful about the people around and keep them at a safe distance.
Once the generator set is lifted, also be sure that the operator of the lifting machine is always ready to handle any case of emergency.

Always be sure that the generator set is placed on a flat surface. This surface to be selected, has to be able to resist a weight 10% more than the gross weight of the generator set. Also be sure that there is not any risk of sliding, after you put down the generator set.

Before closing and locking the doors of the generator set, be sure that there is nobody left inside the canopy or container.



1.2.2. Using Forklift

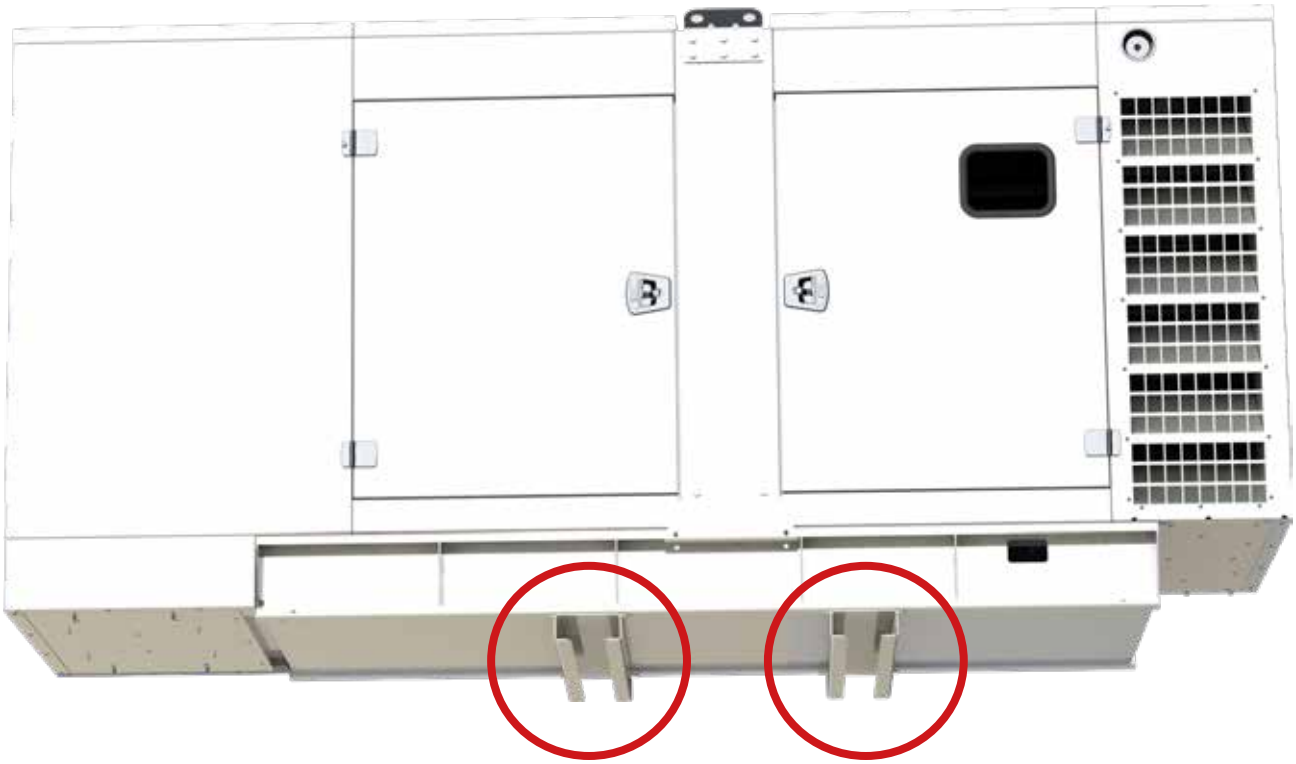
Unauthorized personnel shall not ride on forklifts.

Only trained and qualified personnel shall operate forklifts. All forklifts shall be strictly maintained in accordance with the manufacturer's recommendations.

Ensure that forklift has enough capacity to handle the generator set safely and properly.

Then firstly lower the forklift forks to minimum/ground level and drive the forklift forks into the forklift pockets under the baseframe of the generator set slowly and carefully. Once the forklift forks are completely inside the pockets, then raise the level of forklift forks slowly around 15-20 cm and so the generator set shall be lifted from the ground. After being completely sure that the lifted generator set has no contact with the floor, then drive the forklift carefully to the place that the generator set will be dropped off.

For unloading the forklift and putting the generator set to its place safely, lower the forks once again slowly and safely and then remove the forks carefully out from the pockets so the generator set shall sit on its place safely.



** Forklift pockets are offered as a sales option.

1.2.3. Towing Trailer Mounted Generator Sets

Be sure that there is nothing wrong about the towing system including the towing bar, connection points, hooks, pins, etc... Check the chain, brake or electrical interconnections if there is available. Also check the moving parts, connection or interlock points of the generator set. Be sure that they will not cause any problem during this transportation process.

Make sure that all tires on the trailer are in conformity with norms and standards and in good condition. Also be sure that the air pressure inside these tires, is at a specified level depending on the gross weight of the trailer and generator set. Do not change the size or type of tire without the confirmation of manufacturer. Furthermore, make sure that all the bolts, nuts and parts are tightened with an appropriate torque.

If there are any available, make sure that all the headlights, signal lights, brake lights or the fog lights are running properly and their covering lenses or glasses are clean and in good condition.

Do not let people to stand on the towing bar or travel on the generator set. Keep your hands and fingers away from the tightening points. Do not attempt to pull the trailer by manpower.

If possible, choose a dry place for parking or placing the trailer. Also it is important to use wheel chocks for fixing all the wheels.

Act in accordance with all laws and regulations that define the traffic rules. Especially be sure not to not exceed the allowed speed limit while travelling with the trailer.

Do not drive in traffic with uncertified trailer.

** Trailer is not a standard product but a sales option.

1.3.Moving Parts

Keep your body (especially hands, arms and hair) and clothes away from gearwheels, pulleys, belts or other moving and rotating parts.

Do not attempt to run the generator set, if any protection cover of fans or other moving parts is removed.

Be sure that your clothes completely fit on you, if you are working around a generator set that is running. Also tie your hair if it is long.

Keep all the access doors closed, excluding the cases of starting up, control, maintenance, repair or service. Before starting the generator set, be sure that everyone around is at a definite safety distance.

In order to minimize the risk of accidents due to sliding or falling, keep your hands, feet or the ground clean of fluids like fuel, diesel, grease, anti-freeze or water.

1.4.Hot Surfaces, Sharp Edges and Corners

Avoid anyone from touching the hot grease, hot coolant, any hot surface, sharp edge and corners.

Keep your hands or any part of your body, at a safe distance to the hot exhaust pipes and gases

While working inside, outside or around a generator set, wear protective clothes and accessories like gloves, boots and helmets.

Keep a first aid kit close to you and seek for medical help urgently in case of any personal injury. Do not neglect any small cuts or injuries.

1.5.Fire and Explosion

Be sure that the fuel that will be used is a well-designed combination of appropriate ingredients, according to its purpose of use and all related norms and standards.

Keep the floor clean around the generator set in order not to face any accidents due to slippery floor covered with grease, battery electrolyte or coolant.

Shut down the generator set long before any maintenance activity like refuelling it, checking the battery electrolyte level, checking or changing the lubrication oil. So that the engine can get cooled before doing any maintenance on it.
Keep any spark, flame or other combustibles away from the generator set. Do not smoke and allow smoking around the generator set.

Do not let any formation of waste oil or fuel layer on the generator set. Clean any dirt on the engine, alternator, base frame or canopy with an industrial cleaner. Be sure not to use combustive chemicals for cleaning purposes.

Before connecting or disconnecting the batteries, be sure to remove the charger connections on batteries.

Remove the connections from negative (-) poles of the batteries before any maintenance. Also place a warning on the battery for preventing any short-circuit accidents.

In order for preventing any possible incorrect connections that may be done by anyone unauthorized, be sure to attach a warning notice on the battery connections.

Keep any cables, battery terminals or other electrical equipment in a good condition. Replace any cracked, broken or defective cables, terminals, isolators or any electrical equipment.

Provide a proper grounding for all the conductors and electrical equipment that is directly exposed to electricity. This will prevent the accidents due to any arc or spark occurrences caused by the electrical current flowing through or around them.

If any leakage has been inspected on or around the fuel tank or pipes, never start the generator set before resolving the leakage problem. Do not attempt to repair the damaged fuel tanks or pipes but change them directly with the new ones.

Always keep in mind that the temperature of the exhaust gas, exhaust manifold and the exhaust outlet pipes is up around 550oC. Due to this fact; provide the necessary insulation to all hot surfaces and keep yourself and any flammable material away from these hot points.

Be sure to keep any flammable material away from the generator set before doing any welding work on the generator set. Also take any dirty (oil, fuel, etc...) cloth pieces, chemical waste, leaf, garbage or any other flammable material away from the generator set.

Before any maintenance or service activity, be sure that there is at least one full and well-maintained fire extinguisher around the generator set.

If there are any trees or wood around the generator set, avoid contacts of leaves and branches with the generator set's hot exhaust system.

Do not install or run the generator sets in places that are not approved or prescribed as dangerous.

1.6.Hazardous and Corrosive Substances

The generator set must be installed and operated in outdoor or well-ventilated areas.

Do not install or operate the generator set, unless there is a proper ventilation. Also be sure that the ventilation windows stated in the previous sections of this manual are provided.

If the generator set will be operating at an indoor place, be sure to provide a proper exhaust outlet system so that the exhaust gases can be released outdoor. Also provide a proper ventilation window for any natural gas leakage emergency case.

Be careful that the exhaust gas outlet is not redirected to indoor places, living areas, ventilation or fresh air suction points of any machine.

Any material used for the engine (lubrication oil, grease, coolant, battery electrolyte, etc…) are industrial chemicals, so any of them must be kept away from any part of your body. If there is any of these chemicals on any part of your body by accident or somehow, you have to wash this exposed part/area using plenty of soap and water.

Wear a uniform that is resistant to acid and a glass for covering you face while maintaining the batteries. If any part of your clothes or skin is exposed to the acidic electrolyte solution inside the batteries, then wash this exposed part using plenty of soap and water.

1.7. Environmental Protection

Generator sets have some potential risks for the environment such as lubrication oil, fuel, exhaust gas, battery.

There may be local set of rules, regulations or limitations about the usage of diesel generator sets and also about the disposal of the environment-risky materials listed above.

It is the customer's / user's responsibility to be aware of these rules or regulations and also to obey and conform with these rules while using and maintaining diesel generator sets.

Disposal Of Waste / Risky Material For Environment

- Be sure that there is no lubrication oil spilled around while changing the engine oil or keeping the used oil in your stocks.
- Keep the engine lubrication oil that has been drained, at a safe place and be sure to deliver it to authorized organizations for properly disposal.
- Keep also the oil and fuel filters that have been replaced from the engine, at a safe place and again be sure to deliver it to authorized organizations for properly disposal.
- Do not throw the damaged or dead batteries to trash and again be sure to deliver them also to the authorized organizations for properly disposal.
- Be sure to collect and keep all these wastes and damaged parts inside an isolated and fireproof waste tank.
- Be sure to prevent any fuel or oil from leaking and spilling around to environment.
- Be sure to check and conform with your "Local Environmental Regulations" before getting your generator set started and operated.

1.8.Electrical Equipment and Connections

Cable classification and connections of a generator set should be made and checked by only trained and qualified electricians.

Do not touch the electrical hardware of the generator set directly with you bare hands or with the help of any conducting material.

Before connecting or disconnecting power cables, or before starting the generator set, make sure that the generator set is properly grounded in accordance with all related rules and regulations.

Do not run, connect or disconnect the generator set underwater or on a wet ground. Remind the conductivity of water.

Before establishing any electrical connection to the generator set; first stop the engine, then remove the supply connection from the charger input, then remove all battery connections and finally remove all non-grounded conductor connections at the load side.

Avoid touching the electrical and moving parts of the generator set with bare hands or any tool. Also be sure that you are standing on a dry and insulated ground if you have to touch them (electrical installation or equipment) for any repair or maintenance purposes.

Be sure to keep the insulators at the alternator output on their places. Put them back to their places right after any connection or disconnection activity. Do not run the generator set if these insulators are not mounted on their places.

Close and lock all the doors if the generator set is out of service, so nobody unauthorized can get in the generator set.

Keep the towing truck and equipment at least 3 meters away from the generator set and the power cables.

Perform any repair, maintenance or service activity in clean, dry, well illuminated and ventilated areas.

Be sure that the load connected is proper, according to the loading characteristic and capacity of the generator set. Do not load the generator set more than its loading capacity. Also ensure that the power cables used between the load side and generator set are at proper rating and specifications in accordance with related rules and regulations.

Never connect or disconnect electrical cables or equipment in case of gas leakage on supply line or the generator set.

1.8.1. First Aid In Case Of Possible Electrical Shock Accidents

If you witness an electrical accident it is important to respond quickly but with caution at the same time. So do not touch the victim until being sure that the electricity is switched off, otherwise you may receive an electric shock too. If you are not able to switch off the electricity, you can try to rescue the victim by using some dry and dielectric equipment as an alternative.

After taking the patient to a safe place far from the electrical installation;

1. Call for emergency service or any medical support.
2. Keep patient lying down at a prone position. (A) Put the head on arms and turn it to one side for allowing any possible fluid drainage.
3. Remove all objects like denture, tobacco or chewing gum out from the patient's mouth in order to provide an ease on breathing or any possible fluid drainage. Using your palms, firmly press between the shoulders of patient. Be sure that the patient's tongue is released.
4. Kneel down in such a position that your knee is near the patients head and your other foot is close to his/her shoulder. (B)
5. Put your hands on the patient's shoulders and place your palms on his/her scapula.
6. Push your arms forward in a vertical position. Slightly apply pressure (10-15 kg.) on the patient's scapula for 2,5 seconds.

A

B

7. Release the pressure by sliding your hands over the patient's shoulder to his/her elbows in around 1 second. Then lift up the patient's arms and shoulders slightly by holding from his/her elbows. Just after holding the arms and shoulders for a short time, push them backwards for around 2,5 seconds for stretching (C). After all, release the patient's arms back (D) and put your hands back onto the patient's scapula.

C

D

8. Repeat all these steps in order to help the patient for breathing.
9. At the meantime someone is doing these movements for helping the patient to breathe, anyone else must;

a. Loose the clothes on the patient for making the patient breathe easier,

b. Keep the patient warm until the patient feels better.

10. If the patient stops breathing, apply artificial respiration and go on doing it until the patient breathes again. It may take up to 4 hours.

DO NOT GIVE ANY LIQUID IF THE PATIENT IS STILL UNCONSCIOUS

2. GENERAL DEFINITIONS

2.1.Identifying Sets

Generator sets and its main pieces (engine, alternator) do have nameplates on them for easing the identification process for the user.
A brief information about the generator set (model codes, serial numbers, etc...) can be found on these identification nameplates.

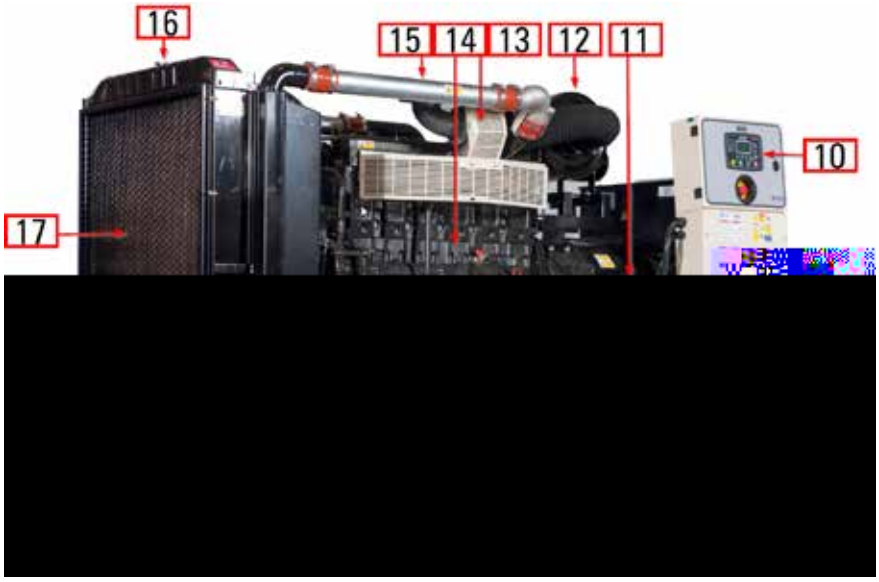
An example of “generator set nameplate” can be seen in the picture on the right.

The customer / user has to provide the supplier the “serial number” of the subjected generator set while requesting any spare parts or while applying for a warranty case about that generator set.

2.2.Generator Set

TEKSAN produces reliable generator sets at high quality in accordance with ISO8528 standards. Generator set specifications, options, electrical and mechanical drawings are all recorded and followed under the unique serial number of the generator set.

Main components of the generator set are shown in the figure below.



1	Lifting Lug	6	Earthing point	12	Turbocharger
2	Jacket Water Heater	7	Lifting Lug	13	Engine
3	Fuel Tank	8	Connection Box	14	Exhaust Outlet
4	Starter Motor	9	Control Panel	15	Radiator Cap
5	Batteries	10	Alternator	16	Radiator
6	Vibration Isolators	11	Air Filter	17	Baseframe

Figure: Main components of a diesel generator set.

5.6.Fuel

The fuel to be used on your generator set, should be complying with the standards and specifications below in order for a reliable and environment friendly operation.

* EN590 * ASTM D975 NO 1-D, 2-D
* JIS K2204 TYPE 1,2,3 * ISO 8217 DMX-CLASS
* DIN 51601 DIESEL FUEL * BS 2869 CLASS-A1, A2

The temperature of the fuel to be used, should not be exceeding 40˚C.

NOTE: More details about the required fuel specification can be found in the Engine Operation and Maintenance Manual.

Sulphur content of fuel must meet the legal norms in each country. If the Sulphur content exceeds 0.5%, then the engine oil must be changed more frequently.

Fuel Sulphur Content (%)	Oil Change Interval
<0,5	NORMAL
0,5 - 1,0	0,75
<1,0	0,5

5.7.Maintenance of Batteries

Different types of batteries can be used in generator sets. Maintenance free batteries are used in TEKSAN products. They are completely enclosed and does not require any pure water addition.

Discharge duration is long for batteries on TEKSAN products, because their internal resistance is very low (5 milliohm).

Since the batteries are completely based on oxygen recombination principle, no waste gas is formed and there is no gas release on these batteries. They are also equipped with special low-pressure safety valves for this same reason.

Operating temperature range for these batteries is very wide (approximately between -20°C and 60°C).

Chemical energy is converted to electric energy in batteries, so there are several chemical reactions in battery cells. Since these chemical reactions are reversible, the batteries can be charged and discharged many times.

These batteries can be used (charged/discharged) up to approximately 4 years, they must be replaced after then.

Another widely used battery type is lead acid type, which is formed of positive and negative electrodes immersed into the electrolyte (sulphuric acid) inside cells between sheet plates.

Check the density of battery liquid with a hydrometer. The proper readings should be around 1,27 under nominal conditions and temperature (15°C).

Pure or distilled water is used in electrolyte solution, so the water to be added into the battery must also be pure water.

Keep the batteries clean for a better performance.

Clean the top cover of the battery before lifting it for any purpose. Add pure or distilled water up to a height 5-10 mm above plates, close and tighten the top cover. Dry the top cover and keep it clean and dry.

Check the operation range of batteries before installation, especially in terms of temperature (between -5°C and 50°C). Inappropriate selections will affect the operation, performance and lifetime of battery due to freezing or boiling issues.

ATTENTION

- Do not smoke or have any spark/flame around the batteries, they may be releasing flammable gases.
- Handle batteries with care and wash your hands after touching them for protection against acid burns.
- Wear protective clothes before changing or maintaining the batteries.
- Keep anyone unauthorized, away from the batteries and its charging system.
- Do not forget to check the charging system together with the batteries.
- Batteries should always be kept under a buffer charge. Batteries that are not charged for a long time, may break.

5.8.Maintenance of Radiator

The radiator installed on your generator set is designed and manufactured for functioning properly for long years, if the necessary and recommended maintenance activities are performed properly and periodically.
Here are some recommendations about the operation and maintenance of your radiator;

- The coolant liquid inside the radiator is at high pressure and temperature, so be careful when opening the cap or any draining points.
- Do not perform any repair or maintenance activity on the radiator until it is cooled down to a safe temperature.
- Do not perform any repair or maintenance activity on the radiator while the cooler fan is running or the any protective covers on it are removed.
- Corrosion is the very first reason for many problems seen on radiators, be sure to check it in case of any failure.
- Be sure that there is no leakage on the radiator, any inlet/return line or any hose connections.
- Radiators should be filled and kept completely full. This will prevent any failures due to corrosion. Partially filling radiators may cause corrosion inside the radiator. For this same reason, all the liquid must be drained if the radiator will not be running or will be stored for a long time.
- The water to be used in a radiator, must be pure, distilled or soft for preventing corrosion. Also additive chemicals can be used in the coolant mixture for preventing corrosion.
- If the radiator is running at a dirty and dusty ambient, then its cells may be blocked with dust, dirt, steam or different particles. This will affect the operation, performance and the lifetime of the radiator and cause overheating issues.

- The radiator must be cleaned properly and periodically for the reason above. Low pressure steam should be used for this cleaning purpose. The radiator can be immersed into an alkaline solution in case of any stronger sediments. The radiator must be washed with hot water after waiting at least 20 minutes inside this solution.

5.9.Low Load Operation

Besides overloading, running a generator set under too light loading conditions can also be harmful for the generator set. Running the generator set below a specified loading rate may cause damage on engine and reduce its reliability. This fact must be taken into consideration, especially in higher capacity generator set applications.

Any generator set to be used in a standby application must be loaded not less than 30% of its full capacity.

Any generator set must not be running under no-load or low-load conditions for a long time. If you really have to run it in such conditions, then the duration shall be minimized. For example; if the weekly test will be performed without load, then it should not take more than 10 minutes.

Any engine which has operated under a 30% or less loading condition for 1 hour, must be operated with a 60% load for 30 minutes in order for the engine to re-gain its performance.

For burning and cleaning any remaining carbon compounds inside the engine and exhaust system, any generator set must be operated with a 75% load and for a 4 hours duration every year. The load level must be increased gradually. If the sufficient loading rate cannot be provided for the generator set, then a dummy load can be connected to it.

Maintenance intervals must be more frequent for the generator sets running under low loading conditions. For example the air filter must be replaced every year, the oil filters must be changed every 6 months if a generator set is running in standby mode and under low loading conditions.

Here are some problems that may occur in case of running the generator set under low loading conditions;

Oil Leakage at Exhaust or Air Inlet Systems

- Since the temperature inside cylinders will be less than normal level, the fuel delivered to cylinders cannot be combusted properly. Unburned fuel and oil steam become condensed in the exhaust system.
- Also the turbocharger oil seals cannot function properly due to this lower temperature, so the oil will be leaking with air to the air inlet and exhaust systems.
- Due to these two reasons above, oil leakage problems can be seen on air inlet and exhaust manifolds and so the oil consumption of the engine will be higher than normal.

This situation is faced especially on Standby(ESP) generator sets which are operated with no load during weekly test running.

Carbon Accumulation on Cylinder Covers and Exhausts Manifolds

In case of operating the diesel engine under low load for a long time, the combustion process is performed under low temperature. As a result of this low quality combustion, there may be oil steam and soot contaminated at cylinder covers, valves, piston rings, exhaust manifold and injector nozzles. This all will lead up to a lower engine performance and possibly a serious damage on the engine later.

Corrosive Damage

If the temperature of the engine body is not at a proper value, then the lubrication inside the engine will not be done properly so this will cause more corrosion on moving components.

Deterioration Of Lubrication Oil

Due to loss of combustion performance, unburned fuel mixing with oil in the cylinder makes the oil deteriorated. Spoiled oil causes early abrasion of the moving parts and bearings.
Abrasion will firstly affect the bearings of turbocharger operating at very high speed and this situation results in oil leakage and damage.
By this operation, oil consumption in the engine dramatically raises.

White Smoke

If the fuel cannot be combusted in cylinders properly, then it can be thrown out from the exhaust line as a white smoke.

5.10.Long Term Storage

If the generator set will not be used or will be stored for a long time, some protective precautions must be taken since this non-operating or storage duration will have negative effects on engine, alternator and other equipment. Running the generator set directly without any controls after this long duration, may cause damage on all these main parts.

There must be taken some additional precautions if the generator set will be stored for a duration more than 3 months. However if the storage duration is 3 months or less, then it will be enough to cover the generator set with a protective packing material and store it in a dry and clean place. It also should be operated at least once in every 15 days.

In order not to face any problems on re-commissioning after this storage duration, the generator set must be operated for a while (until it reaches to its nominal operating temperature; 75°C) and checked for any failures before storage.

The procedures to be followed (by an authorized technician) before any long storage duration are as follows;

Storage Between 3 And 6 Months

- Change the engine oil and oil filters,
- Check the coolant level and rating in cooling system, re-fill or re-rate if necessary,
- Change the fuel filter. Drain the water or any residue from the fuel tank and fill with fuel up to maximum level.
- Test the generator set for a final time and stop it after the test is finished,
- Remove all battery connections, clean and remove the batteries. Be sure to keep the batteries under charge,
- Clean generator set completely with a damp cloth. Do not use pressurized water for cleaning purposes,
- Check all the electrical connections and apply moisture repellent spray on all electrical system and equipment,
- Apply protective (moisture repellent) spray/oil to electrical system and its components.
- Apply protective (moisture repellent) spray/oil to air intake canals.
- Loosen the V-belts,
- Close/block the air intake and exhaust outlet channels,
- Pack the generator set properly and place a warning label on it.
- Keep the packed generator set at a dry, clean place and ensure that it will not be directly exposed to harmful environmental conditions like dust, wind, sun, rain, snow and sudden temperature changes.

Storage More Than 6 Months (Up To 2 Years)

- Drain the engine oil.
- Fill with diesel engine protective oil up to maximum level of the oil dipstick.
- Immerse the fuel intake and return canals to a pot which contains 1/3 protective oil (JIS K2246 NP9) and to a pot that contains 2/3 diesel oil mixture.
- Run the engine until it consumes 2 litres of this mixture and then stop.
- Drain the fuel system and connect the fuel intake and return canals to their normal location.
- Drain the fuel tank and clean.
- Drain the protective oil from the engine and filter.
- Spray protective oil to air intake manifold.
- Spray protective oil to compressor side of the turbocharger.
- Disassemble the cylinder head covers. Spray protective oil to valve, valve spring, valve guide, cylinder head and rocker arm, then close the cylinder head cover again.
- Seal air inlet and exhaust outlet.
- Loosen the V-belts.
- Disconnect the battery cables. Clean the battery and leave it under charge continuously.
- Clean the generator completely with a wet cloth. Do not use pressurized water.
- Check the electrical connections and terminals.
- Spray the moisture repellent to electrical system and its components.
- Cover the entire generator and post a warning sign on it.
- Store the generator in a dry place where there is no temperature changes. Generator should be protected from sun light and rain.

Re-Commissioning After Storage

- Remove the cover from the generator and remove sealing from air inlet and exhaust outlet.
- Inspect all sections of the engine.
- Pay attention that the installation made basis on the rules and the commissioning procedures are completed before running the generator.
- Refresh the engine oil and filter.
- Clean the fuel tank and fill with new fuel.
- Replace fuel filter.
- Clean the air filter, if necessary replace it.
- Control and tighten the V-belt and pulleys.
- Disassemble the turbo lubricating pipe and lubricate the bearings. Then, rotate the turbo manually.
- Control valve tip clearances, if necessary adjust them. (For storage more than 6 months)
- Disassemble the cylinder head covers. Lubricate the valve, valve spring, valve guide, cylinder head and rocker arm, then close the cylinder head covers again.
- Check all the hoses and pipes, tighten clamps and screws.
- If there is any disjointed screw or plug, assemble them.
- Check the coolant level and ratio of anti-freeze. If it is drained before the storage, then fill it with a mixture of new 50% anti-freeze and 50% water.
- If it is realized that there is moisture in the storage ambient, stator winding isolation test should be done before operating the alternator. Before this process, AVR cable connections should be disconnected. If the measured value is less than 5 megaohm, then alternator should be cleaned, dried and tested again.
- Before the cranking, rotate the engine 2-3 cycles manually.
- Check that batteries are fully charged.
- Disconnect the fuel solenoid connection and rotate the engine for a short term via starter.
- Run the generator under no load until it warms.
- Check for excessive vibration, noise, oil-fuel-water leakage.
- Run the generator set under load and test it again.

5.11. General Maintenance Schedule

				Periodically (Engine Running Hours)				At Least	
DIESEL GENERATOR SET GENERAL MAINTENANCE SCHEDULE	Daily	Start up	First Maintenance (50 hours / 6 months)	200 hours	400 hours	1000 hours	2000 hours	Every Year	Every 2 Years
ENGINE LUBRICATION SYSTEM									
Check the Oil Level	✓	✓		✓					
Change Oil			✓	✓				✓	
Change Oil Filters			✓	✓				✓	
Check whole Lubrication System for any Oil Leakage	✓	✓						✓	
ENGINE COOLING SYSTEM									
Check the water heater blocks		✓	✓	✓					
Check whole Cooling System for any Coolant Leakage	✓	✓						✓	
Check the Coolant Level	✓	✓		✓					
Check the Antifreeze / Water Ratio		✓		✓				✓	
Check the Cleanliness of Radiator				✓				✓	
Change the Coolant						✓			✓
Check the hose and clamp connections				✓				✓	
AIR INLET AND EXHAUST SYSTEM									
Check whole Air System for any Leakage (hoses, clamps, etc..)		✓		✓				✓	
Check the Turbocharger						✓			✓
Clean or Change Air Filters					✓				✓
Check whole Exhaust System for any Leakage (pipes, spiral, etc.)		✓		✓				✓	
Check the Colour of Exhaust Smoke		✓		✓				✓	
FUEL SYSTEM									
Check the Fuel Level	✓								
Change the Fuel Filter			✓	✓				✓	
Check whole Fuel System for any Fuel Leakage	✓							✓	
Drain the Water inside "Water Seperator Filter"			✓	✓				✓	
Clean the Fuel Tank					✓			✓	
Check the Injector Nozzles						✓			✓
ELECTRICAL SYSTEM									
Check the Batteries and their Charge Levels		✓	✓	✓				✓	
Clean the Batteries and their Poles			✓	✓				✓	
Check the Battery Charger and Charging Alternator		✓	✓	✓				✓	
Check all the Pressure, Temperature Sensors and Gauges		✓	✓	✓				✓	
Check the Settings of AVR Card and Governor Card		✓	✓	✓				✓	
Check the Power Cables, Transfer Panel and its Connections		✓	✓	✓				✓	
Check the Control Panel and Generator Set Controller Unit		✓	✓	✓				✓	
MISCELLANOUS									
Check the Tensions of V-belts		✓		✓				✓	
Check the Radiator Fan and its Blades				✓				✓	
Check any Screws or Bolts used for Assembling Purposes		✓				✓		✓	
Check the Compression Pressure (if necessary)							✓		
Check the settings of Valve Gaps						✓			✓
Check the Vibration Insulators		✓				✓		✓	
Perform a General Cleaning on whole Generator Set	✓		✓	✓				✓	
Check for any Strange Noise when the Engine is Running	✓	✓	✓	✓				✓	
Check and Clean the Oil Pan Breather Hose				✓				✓	

- This table shows basic maintenance activities, please check the engine and alternator maintenance manuals for more details.
- Test your generator set on load for a 15 minutes duration, at least once in every week.
- You must definitely get the first maintenance (at 50 hour/6 months) done, in order for the continuity of your warranty coverage.
- The maintenance periods may change due to reasons about ambient, lubricant or fuel quality or operating category.

6-TROUBLESHOOTING

6.1.General

- The following inspections and corrective actions should be performed by a well-trained and authorized staff, by using appropriate equipment.
- Do not change any settings or replace any part without a full-knowledge on related issues.
- You can find any further details in the troubleshooting sections of "Operation and Maintenance Manuals" supplied with the engine, alternator and any other equipment used on generator set.
- If you cannot get a solution by using the table below, feel free to contact TEKSAN or its authorized dealers any time.

PROBLEM	POSSIBLE CAUSES	REMEDY
• **Engine turns slow, but does not start**	Batteries are de-charged	Charge/Replace
	Defective starter	Repair/Replace
	Oil specification is not suitable	Replace with suitable oil
	No fuel in tank	Refuel
	Air in the fuel system	Eliminate air
	Fuel selenoid is inoperative	Repair/Replace
	Clogged oil filter	Replace
	Defective manual fuel lift pump	Repair/Replace
	Defective fuel injection pump	Adjust/Repair/Replace
	Poor compression	Measure/Engine revision
	Engine mechanical fault (piston, piston ring etc.)	Engine revision
	Defective control unit	Adjust/Replace
	Problem in control panel	Repair/Replace
	Problem with electrical connections	Repair
• **Engine does not start**	Batteries are de-charged	Charge/Replace
	Defective starter	Repair/Replace
	Defective starter relay	Replace
	Defective control unit	Adjust/Replace
	Emergency button is pressed	Switch to normal position
	Generator in OFF position	Switch to normal position
	No fuel in tank	Refuel
	Problem in fuel system	Repair/Replace
	Air in the fuel system	Eliminate air
	Fuel specification is not suitable	Use suitable fuel
	Clogged air intake	Open valve
	Clogged air filter	Replace
	Poor compression	Measure/Engine revision
	Engine mechanical fault (piston, piston ring etc.)	Engine revision
	Ambient temperature is too low	Warm up Ambient/Engine
	Problem with electrical connections	Repair
• **Generator does not stop**	Mains supply problem	Measure mains voltage
	Defective DC fuses	Repair
	Defective control unit	Adjust/Repair/Replace
	Defective fuel selenoid	Adjust/ Replace
	Generator is cooling down	Wait/Check the timer

PROBLEM	POSSIBLE CAUSES	REMEDY
• **Engine overheating**	Clogged air filter	Replace
	Defective injectors	Adjust/ Replace
	Wrong type injectors	Replace
	Inadequate fresh air inlet	Make it suitable
	Inadequate hot air outlet	Make it suitable
	Unsuitable blinds and paddle box	Make it suitable
	Radiator is too dirty or clogged	Clean/Replace
	Clogged Intercooler	Clean/Replace
	Inadequate Coolant level	Refill
	Cooling fan is not working properly	Repair
	Belts are worn or loosen	Adjust/Replace
	Excessive lubricating oil	Replace
	Clogged water hoses	Check/Repair
	Defective water pump	Repair/Replace
	Defective engine thermostat	Check/Replace
	Leakage in cooling system (water-air)	Repair/Replace
	Overload	Decrease load level
	Excessive exhaust back pressure	Make it suitable
• **Lubricating oil pressure is too high**	Oil specification is not suitable	Replace with suitable oil
	Defective sensor	Replace
	Defective display	Replace
• **Too much blue smoke**	Oil specification is not suitable	Replace with suitable oil
	Excessive lubricating oil	Replace
	Low or no load operation	Load higher than 30%
	Excessive oil consumption	Check/Engine revision
	Poor compression	Measure/Engine revision
	Engine mechanical fault (piston, piston ring etc.)	Engine revision
• **Too much white smoke**	Problem in cold start system	Check/Replace
	Engine is too cold	Warm up Ambient/Engine
	Defective engine thermostat (temperature is not increasing)	Check/Replace
	Oil specification is not suitable	Replace with suitable oil
	Defective fuel injection pump	Adjust/Repair/Replace
	Defective injectors	Adjust/Replace
• **Too much black smoke**		
	Wro	
	Defective injectors	
	Defective manual fuel lift pump	
	Defective fuel injection pump	
	Poor compression	
	Clogged air filter	
	Inadequate fresh air inlet	
	Charge air is not cooled	

PROBLEM	POSSIBLE CAUSES	REMEDY
• **Fuel consumption too high**	Fuel leakage	Repair
	Defective manual fuel lift pump	Repair/Replace
	Fuel specification is not suitable	Use suitable fuel
	Poor compression	Measure/Engine revision
	Charge air is not cooled	Check/Repair
	Clogged air filter	Replace
	Defective injectors	Adjust/Replace
• **Not enough power**	High viscosity grade of oil	Replace with suitable oil
	Fuel specification is not suitable	Use suitable fuel
	Clogged air filter	Replace
	Engine is too cold	Warm up Ambient/Engine
	Inadequate fuel	Provide enough fuel flowing
	Clogged fuel filter	Replace
	Inadequate fresh air inlet	Make it suitable
	Inadequate hot air outlet	Make it suitable
	Defective manual fuel lift pump	Repair/Replace
	Defective fuel injection pump	Adjust/Repair/Replace
	Defective injectors	Adjust/Replace
	Overload	Decrease load level
	Defective turbocharger	Repair/Replace
	Charge air is not cooled	Check/Repair
	Poor compression	Measure/Engine revision
• **Alternator does not produce output voltage (No load voltage is lower than the 10% of nominal voltage)**	Connections are loose	Check/Repair
	Defective rotating diodes or suppressor	Check/Replace
	Excitation circuit is disconnected or short circuited	Check/Repair
	Insufficient residual voltage	Apply external excitation
• **Alternator does not produce output voltage** (No load voltage is lower than the 20-30% of nominal voltage. Output voltage is not effected from the rotation of AVR potentiometer)	Fuse (in AVR line) is broken	Replace
	Defective AVR	Check/Adjust/Replace
	Broken off exciter stator connection	Check/Repair
	Wrong connection of Exciter stator.	Check
• **Output voltage is 50-70 % of the nominal voltage**	Speed is lower than nominal	Check engine speed
	Voltage potentiometer is not adjusted	Adjust
	Fuse is broken	Replace
	Defective AVR	Check/Adjust/Replace
	Over excitation limitation	Adjust AMP pot
• **Output voltage is too high**	Voltage potentiometer is not adjusted	Adjust voltage pot
	Capacitive load	Eliminate Condenser load
	Defective AVR	Check/Adjust/Replace
• **Unstable output voltage**	Engine speed is variable	Adjust engine speed
	Stability potentiometer is not adjusted	Adjust STAB pot
	Defective AVR	Check/Adjust/Replace

7-WARRANTY

Duration

This warranty applies to new Teksan Diesel Generator Sets to be free from defects in material and workmanship in production for 24 months or 1.000 hours from the date of delivery to first user (which occurs first). Warranty period is limited by 30 months from the date of shipment ex-works Teksan

Teksan Responsibilities

If a defect in material or workmanship is found during the warranty period (provided that Buyer/Owner has fulfilled its due contractual obligations), Teksan Generator will, during normal working hours and through a place of business of a Teksan Dealer or other source approved by Teksan:

- Replace or repair the defective parts, at Teksan's discretion
- Provide for reasonable repair costs to correct the defect as agreed with Teksan
- Provide for the cost of oil and filters which are made unusable by the defect

Teksan either will dispatch parts to the Buyer/Owner free or to repair at the factory or on site. If the repair is decided to perform at the factory by Teksan, the Buyer/Owner is responsible to disconnect the product from and reconnect the product to its attached equipment, mounting and supporting systems as well as transporting the product from the site to the factory and from factory to the site.
If the repair is decided to perform at site, travel expenses are not covered by Teksan.
Parts of complete products replaced will become the property of Teksan and they shall be forwarded to Teksan (if requested), carriage-paid by Buyer/Owner.
Any parts repaired or replaced shall be under warranty, until the original warranty period for the diesel generator set expires.

Buyer/Owner Responsibilities

- Buyer/Owner should install, operate and maintain the generator set in accordance with the maintenance and operation, diesel engine and alternator handbooks supplied with the genset. If these books are lost, Buyer/Owner is responsible to provide those books. In case of failures occurred due to not respecting to these books, the warranty will be invalid.
- Commissioning approval and start-up process should be made by Teksan dealers or its authorized representatives.
- Giving timely notice of a warrantable failure and making the equipment available for repair as the defect has become apparent.
- Accepting the Teksan's sole judgment as to whether the faulty is under warranty coverage or not.
- Any costs of investigations, unless a defect is accepted by Teksan as a warranty claim.
- Any costs in excess of the purchase price of the genset.
- Other miscellaneous costs such as courier, travel, mileage, lodging, taxes, telephone calls, overtime, etc.
- Buyer/Owner has the right of searching and asking for the ID card from the staff appointed for technical service.
- Disconnecting/Reconnecting the product from/to its attached equipment, mounting and support systems as well as to transport the product from the site to the factory and from factory to the site.
- Sufficient amount of lubricating oil, coolant or additives with specifications specified in the Maintenance and Operation Handbook should be used. In case of using lubricating oil and coolant that lost property or dirty or with different specifications and standards, warranty will be invalid.

- After Teksan's transportation responsibility (as stated in contract) is finished, transportation, loading and unloading is under Buyer/Owner's responsibility. The possible damages during these processes are not under the warranty coverage.
- The storage of the generator set during the time between the delivery or commissioning date and the first start-up date of the generator set. If this duration is longer than 3 months, then storage must be done with respect to storage principals as indicated in the Maintenance and Operation Handbook.
- Generator set control unit should be programmed, set or changed under Teksan approval.
- Run and stop the generator set stated as in the maintenance and operation handbook. Do not run or stop the generator set under load. This may damage engine valves and its components, alternator exciter windings, rotating diodes, suppressor and voltage regulator card.
- Commissioning approval is only valid for installation location. If the position of the generator set is desired to be changed, Teksan dealer or authorized representatives should be informed.
- Original spare parts and consumable items (oil, fuel, filter, belt etc.) approved by Teksan should be used.
- Completing any outstanding payments for the purchase of equipment, parts or services relating to the equipment under warranty.

Limitations

The warranty does not cover;

- Periodical maintenance, controls and settings should be made strictly according to maintenance and operation handbooks.
- Any interference to generator set by people not confirmed by Teksan.
- Any failures resulting from abuse, neglect and/or improper repair.
- Any failures resulting from Buyer/Owner's delay making the product available after being notified of a potential product problem.
- Normal wear, the spare parts that should be changed and consumable items such as lubricating oil, filters, coolant, V-belt, injector nozzles etc.
- Any failures in batteries or failures resulted from batteries.
- Any failures resulted from using biodiesel, jet fuels (JP), sub-kerosene fuel, fuel-oil, benzene, etc. and additionally dirty, water mixed, with chemical additives. Diesel fuel, specified in the handbooks should be used for the diesel generator sets.
- Any failures resulted from modifications and additions on Control panel systems – manual, automatic, synchronization panels, transfer panels, equipments, etc. – These are should be made by Teksan or authorized representatives.
- Any failures of switching devices resulted from high current, low or high voltage due to the fact that generator transfer panel is made suitable to generator output rating – contactor, motor circuit breaker - etc.
- Any failures resulted from erasing, removing or changing of the labels belonging to Generator Set.
- Any failures resulted from under no-load or low load as indicated in Maintenance and Operation handbook.
- Any failures resulted from operating the generator set in different operation mode, loads greater than rated power as stated on its label (Standby) and unbalanced load.
- Any failures emerged after warranty period expiration date will not be considered under warranty coverage.
- Any failures resulted from act of god, earthquake, snowstorm, avalanche, fire, flood or mains electricity are not under warranty coverage.
- In no event will Teksan be liable for loss of use, loss of profits, loss of or damage to other property, inconvenience, commercial loss or other special, incidental or consequential damages whatsoever.
- Any warranty of fitness for purpose shall not be effective unless explicitly confirmed by Teks an in writing. In case of an express confirmation of fitness for purpose, the provisions above shall apply accordingly.

Claim Submissions

- Warranty service requests should be claimed to Teksan dealer or authorized representative who made commissioning process.
- Buyer/Owner has to report failure without delay by "Warranty Claim Form" given in the documentation with the delivery of generator set. This form has to be filled in right way completely. Especially, genset model, serial numbers, engine running hours, description of the faulty, comments about the failure and defective parts information should be supplied. Additionally, sufficient pictures of the failure should be sent.
- Any required operations in purpose of correcting the failure should be done after the approval of Teksan in writing. Warranty claims must be done in 5 working days from date of failure.
- If requested, Buyer/Owner is responsible to present all kind of documents to prove the validity of the warranty period.

DIESEL GENERATOR SET			
GENSET MODEL		**GENSET S.NO**	
ENGINE MODEL		**ENGINE S.NO**	
ALTERNATOR MODEL		**ALTERNATOR S.NO**	
DEALER'S			
NAME			
ADDRESS			
TOWN		**COUNTRY**	
TELEPHONE		**FAX**	
INVOICE NUMBER		**DATE AND STAMP**	
INVOICE DATE			
OWNER'S			
NAME	TEKSAN JENERATÖR ELEKTRİK SANAYİ VE TİCARET A.Ş.		
ADDRESS	YENİDOĞAN MAH. EDEBALİ CAD. NO:12 34791 SANCAKTEPE		
TOWN	ISTANBUL	**COUNTRY**	TURKEY
TELEPHONE	+90 216 312 05 50	**FAX**	+90 216 312 69 09
E-MAIL	info@teksan.com		
DELIVERY PLACE		**DATE AND STAMP**	
DELIVERY DATE			

Declaration of Conformity

CE

We hereby confirm that, this machine has been manufactured in accordance with the Machinery Directive (2006/42/EC), Low Voltage Equipment Directive (2014/35/EC) and Electromagnetic Compatibility Directive (2014/30/EC).

TEKSAN JENERATÖR ELEKTRİK SANAYİ VE TİCARET A.Ş.
Yenidoğan Mah. Edebali Cad. No:12 34791 Sancaktepe / İstanbul – TURKEY
Tel: +90 216 312 05 50 (Pbx) +90 216 312 97 97
Fax: +90 216 312 69 09
http://www.teksan.com
info@teksan.com

Description of machine	**: Diesel Engine Powered Generating Set**
Type of machine	**: From 8 kVA to 3550 kVA**
The standards that the product complies with above EU directives	**: TS EN 12601, EN 60204, ISO 8528**
The CE mark was first applied in	**: 2004**

This declaration ceases to be valid if the maintenance and operating book is not read and caution marks on the machine are not obeyed; if a modification is made to the machine/equipment that has not been agreed with us, or if the machine equipment is not used in accordance with its designated purpose.

The technical documentation required to demonstrate that the product meets the requirements of the above mentioned directives has been complied by the signatory below and is available for inspection by the relevant enforcement authorities.

The product described above complies with the essential requirements of the directives specified.

Authorized representative;

Name :Yunus TEKSAN
Position :General Manager
Date and Place of the declaration: 02.01.2018-Istanbul/Turkey

02 04/12

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TEKSAN

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