Tefol

AUXILIARY POWER UNIT (APU)

USER MANUAL

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CONTENTS

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1.0. SAFETY INFORMATION

The following points should be considered the minimum requirements necessary for safe operation and maintenance of the system.

Note: Information in this guide shall not be construed to waive or modify any obligation imposed under the Work Health and Safety Act, Regulations, Australian Standards, Codes of Practice, site safety and/or maintenance procedures.

- Ensure all parts of section 2.0 PRE-OPERATION INFORMATION are read and understood, and the applicable steps from section 4.0 PERIODIC MAINTENANCE have been completed and documented prior to commencing start up.
- Ensure a comprehensive visual pre-inspection is conducted for the system, looking for any cracks, wear, leaks, electrical damage and/or any other potential defects that may impede the safe operation of the system.
- Report defects immediately to your supervisor and do not operate the system if unsafe to do so.
- The system should always be kept clean and free of excess grease, oils and other foreign debris.
- Ensure hands and fingers are away from moving parts and pinch points during operation.
- Never assume the system is in the same condition as when you last used it. Another authorized or unauthorized person may have used it. It is your responsibility to ensure the system is safe before use.
- If any fault is a safety hazard, isolate the system and place an 'out of service tag' with the relevant information documented. Do not use the system again until appropriate clearance has been given.

If you need to disconnect, dismantle, or repair any parts connected to the system, before you start work, remember:

1. Personnel are required to conduct full job hazard analysis and risk assessment to identify and control all potential hazards associated with the task.
2. Only suitably trained personnel are allowed to perform maintenance on the system.
3. Ensure that you have all the correct replacement parts available.
4. Always wear appropriate personal protective equipment.
5. Ensure all isolation and tag out procedures are followed before commencing any maintenance on the system. Test for dead.
6. The hydraulic supplies must be treated as hazardous energy sources.
7. Ensure the system is fully on safe level ground and fundamentally stable before commencing work.
8. Take care to prevent any foreign materials from entering the hydraulic circuit when carrying out repairs and/or replacing parts.
9. Never check for leaks with your hand, as this may result in burns and/ or high-pressure injection injuries. Seek immediate medical treatment should an injury occur.
10. Do not stand and/or walk on any electrical harnesses or hydraulic hoses.

2.0. PRE-OPERATION INFORMATION

Before Starting Engine

For the initial start-up of an engine that is new, serviced or repaired, always make provision to shut the engine off to stop overspeed. This may be accomplished by shutting off the air and/or fuel supply to the engine. Overspeed shutdown should occur automatically for engines that are controlled electronically. If automatic shutdown does not occur, press the emergency stop button to cut the fuel and/or air to the engine.

Inspect the engine for potential hazards.

Before starting the engine, ensure that no one is on, underneath, or close to the engine. Ensure that the area is free of personnel.

Ensure that the engine control system for the engine is suitable for the conditions.

Ensure that all lights work correctly.

All protective guards and all protective covers must be installed if the engine must be started to perform service procedures. To help prevent an accident that is caused by parts in rotation, work around the parts carefully.

Do not bypass the automatic shutoff circuits. Do not disable the automatic shutoff circuits. The circuits are provided to help prevent personal injury. The circuits are also provided to help prevent engine damage.

Engine Starting

If a warning tag is attached to the engine start switch or to the controls, DO NOT start the engine or move the controls. Consult with the person that attached the warning tag before the engine is started.

All protective guards and all protective covers must be installed if the engine must be started to perform service procedures. To help prevent an accident that is caused by parts in rotation, work around the parts carefully.

Start the engine from the operator's compartment or from the engine start switch.

Always start the engine according to the procedure that is described in the Operation and Maintenance Manual, "Starting the Engine" topic in the Operation Section. Knowing the correct procedure will help to prevent major damage to the mechanical components. Knowing the procedure will also help to prevent personal injury.

Engine exhaust contains products of combustion which can be harmful to your health. Always start the engine and operate the engine in a well-ventilated area. If the engine is started in an enclosed area, vent the engine exhaust to the outside.

The 400 Series engines are equipped with a glow plug starting aid in each individual cylinder that heats the intake air to improve starting.

Engine Stopping

To avoid overheating of the engine and accelerated wear of the engine components, stop the engine according to this Operation and Maintenance Manual, "Stopping the Engine" topic (Operation Section).

Use the Emergency Stop Button ONLY in an emergency. DO NOT use the Emergency Stop Button for normal engine stopping. After an emergency stop, DO NOT start the engine until the problem that caused the emergency stop has been corrected.

On the initial start-up of a new engine or an engine that has been serviced, make provisions to stop the engine if an overspeed condition occurs. This may be accomplished by shutting off the fuel supply and/or the air supply to the engine.

If equipped, to stop an electronically controlled engine, cut the power to the engine.

Electrical System

Never disconnect any charging unit circuit or battery circuit cable from the battery when the charging unit is operating. A spark can cause the combustible gases that are produced by some batteries to ignite.

To help prevent sparks from igniting combustible gases that are produced by some batteries, the negative "-" jump start cable should be connected last from the external power source to the negative "-" terminal of the starting motor. If the starting motor is faulting, the engine can be jump started from the 12v receptacle.

Check the electrical wires daily for wires that are loose or frayed. Tighten all loose electrical wires before the engine is started. Repair all frayed electrical wires before the engine is started. See the Operation and Maintenance Manual for specific starting instructions.

Lines, Tubes and Hoses

Do not bend high pressure lines. Do not strike high pressure lines. Do not install any lines that are bent or damaged.

Repair any lines that are loose or damaged. Leaks can cause fires.

Check lines, tubes and hoses carefully. Do not use your bare hand to check for leaks. Use a board or cardboard to check for leaks. Tighten all connections to the recommended torque.

Replace the parts if any of the following conditions are present:

- End fittings are damaged or leaking.
- Outer coverings are chafed or cut.
- Wires are exposed.
- Outer coverings are ballooning.
- Flexible part of the hoses is kinked.
- Outer covers have embedded armouring.
- End fittings are displaced.

Make sure that all clamps, guards, and heat shields are installed correctly. During engine operation, this will help to prevent vibration, rubbing against other parts, and excessive heat.

3.0. OPERATION

Starting the Engine

Use the following procedure to start the engine.

1. Ensure the "**TANK RETURN**" and "**SUCTION**" Ports are connected to the system, along with any other desired control functions.
2. To Start, press the "**GREEN**" button on the DSE controller (Figure 1).
    a. If the "**PUMP INLET VACUUM**" Gauge (Figure 2) spikes into the RED zone, immediately stop the engine, and check all the required ports are connected.

If the engine must be started with no ports connected (i.e. for pneumatic supply only or maintenance purposes), ensure the "**PORT FLAP**" is closed (Figure 4), and the limit switch is engaged to prevent a vacuum forming within the system. Generating a vacuum in the system will quickly diminish the pumps life span and potentially damage other components within the system.

The DSE this will control the crank attempts, glow and Engine RPM. If the engine fails to turn over, you will have a limited amount retries.

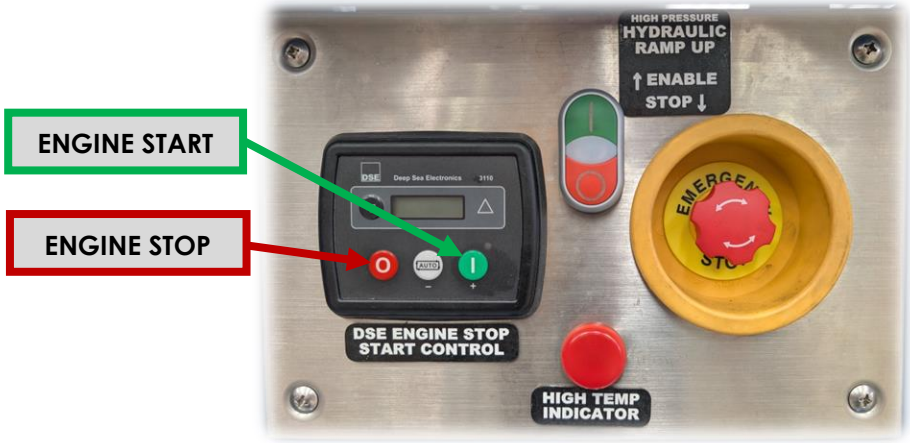


Figure 1

Figure 2

Stopping the Engine

Use the following procedure to start the engine.

1. To Stop, press the **RED** button on the DSE controller (Figure 1).

Hydraulic System

To avoid damaging the hydraulic pump, only operate hydraulic functions after the machine tank reservoir has been connected to the systems **"TANK RETURN"** port. The system does not have onboard oil and thus requires a connection to the machines oil reserve. Ensure the "**PUMP INLET VACUUM**" gauge is continually monitored to detect if a vacuum is forming.

a) To enable the control functions, the system must be in "**HIGH PRESSURE**" mode. Press the "**HYDRAULIC RAMP UP ENABLE**" button to activate (Figure 1).
b) To disable "**HIGH PRESSURE**" mode, Press the "**HYDRAULIC RAMP UP STOP**" button.

Pneumatic System

The system is fitted with a belt-driven air compressor with a maximum free air delivery (FAD) of 545 l/min. Compressed air is available at the ½" Nitto and ¾" Minsup fittings installed in the port tray (Figure 4). Air feeds to the port tray fittings via the compressor - tank - unloader - regulator - pressure safety valve (PSV). The PSV is set at 145psi to avoid over pressurisation and maintain equipment pressure at a safe operating level.

Electrical System

The electrical system is limited to a single 12V battery / engine control system circuit, and a 24V battery jump start. Two 240V inlets are available.

The DSE engine stop start control module automatically controls the engine. The temperature Switch will be normally open from 75°C, with a "RED" pilot light to indicate high hydraulic oil temperature (Figure 1). The DSE will automatically switch the engine off at 85°C oil temperature.

Press and hold the "**ENABLE BATTERY STATUS INDICATOR**" (Figure 3) button to display the current battery charge level for both the 24V and 12V batteries simultaneously. The batteries can be charged using the onboard 8-stage automatic switchmode battery charger by connecting the "**CHARGE INLET**" to AC mains power.

Figure 3

Control Functions

From left to right, the coupler functions seen in the port tray (Figure 4) are as follows:

1. **SUCTION**: FFH BSPP ½" F, MAX 210 l/min.
2. **TANK RETURN** : Flat face coupling (FFH) BSPP 1" F, MAX 280 l/min.
3. **BRAKE** : FFH BSPP ½" F, 0-600 psi, MAX 210 l/min.
4. **PILOT** : FFH BSPP ½" F, 0-1500 psi, MAX 210 l/min.
5. **STEERING** FFH BSPP ½" F, MAX 210 l/min.
6. **AUXILIARY** : FFH BSPP ½" F, MAX 210 l/min.
7. **TIP UP** : FFH BSPP 1" F, MAX 280 l/min.
8. **TIP DOWN** : FFH BSPP 1" F, MAX 280 l/min.
9. **AIR SUPPLY :** ¾" Minsup, Available 145 psi, MAX 500 psi.
10. **AIR SUPPLY** : ½" Nitto, Available 145 psi, MAX 280 psi.

Generally, there will only be enough flow to operate one function at a time. All function speeds will be reduced when trying to operate multiple functions simultaneously.

The relief valves situated below each function gauge will control said functions pressure. Turn the knob counterclockwise (Out) for higher pressure/ more flow, and clockwise (In) for less pressure/ reduced flow. The currently set adjustment for each function can be locked by fully tightening the locknut behind the knob against the valve body.

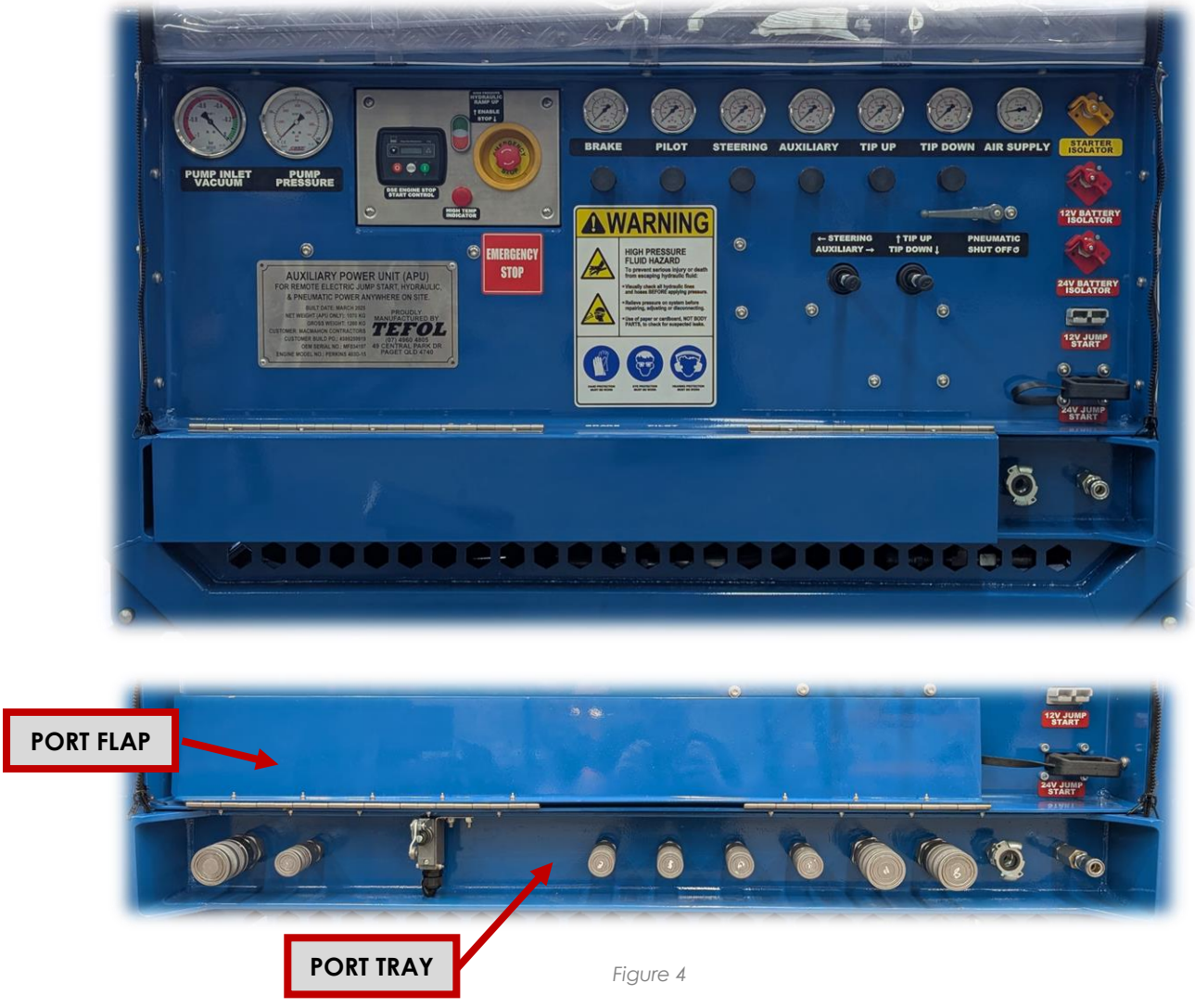


Figure 4

4.0. PERIODIC MAINTENANCE

Every Use

- Compressor oil level – check
- Cooling system coolant level – check
- Driven equipment – check
- Engine air cleaner service indicator – check
- Engine air pre-cleaner – check/ clean
- Engine oil level – check
- Fuel oil level – check
- Fuel system primary filter/ water separator – drain
- Pressure switch/ unloader valve function – check
- Walk around inspection – check for leaks, cracks, deterioration, etc.

1 MONTHLY

- Air receiver – drain
- Compressor body – clean
- Compressor oil – replace (thereafter at 12 monthly intervals)
- Fuel tank water and sediment – drain
- Suction filter – clean
- Tightness of nuts & bolts – check

6 MONTHLY

- Alternator and fan belts – inspect/ adjust
- Compressor belt tension – inspect/ adjust

12 MONTHLY

- Battery electrolyte level – check
- Cooling system supplemental coolant additive (SCA) – replace
- Engine air filer – replace
- Engine oil and filter – replace
- Fuel system filter – replace
- High pressure filter – replace
- Hoses and clamps – Inspect/ replace
- Radiator – Clean
- Suction filter – replace

24 MONTHLY

- Alternator and fan belts – replace
- Breather Gauze – replace
- Compressor oil – replace
- Engine valve lash – inspect/ adjust

5.0. PHOTOS

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

6.0. SPECIFICATIONS

403D-15 Industrial Open Power Unit

18.4-25.1 kW (24.7-33.7 hp) 2800-3000 rpm
EU Stage IIIA/U.S. EPA Tier 4 Interim equivalent

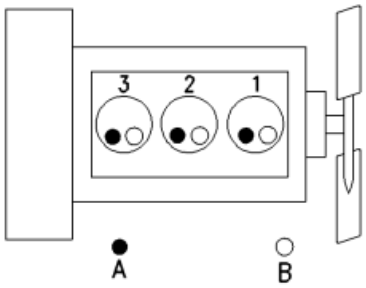
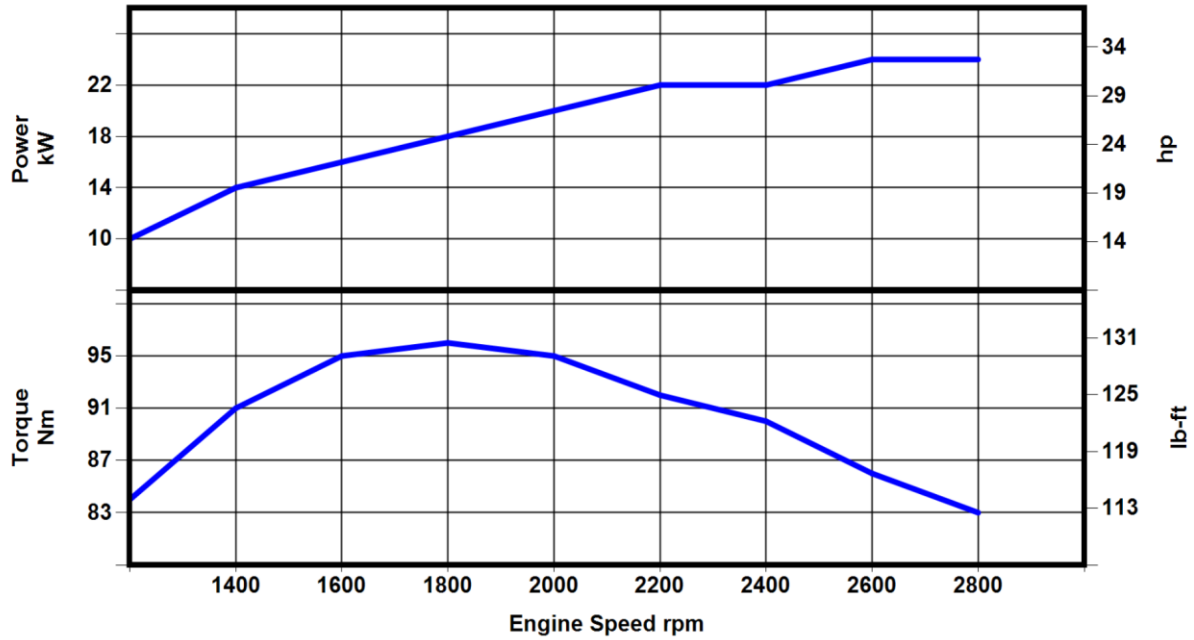


Illustration 16 g00852304

(A) Exhaust valves
(B) Inlet valves

403D-15 Engine Specifications	
Maximum Operating Speed (rpm)	3000 rpm
Cylinders and Arrangement	In-Line three cylinder
Bore	84 mm (3.31 inch)
Stroke	90 mm (3.54 inch)
Displacement	1.496 L (91.291 in^3)
Aspiration	NA(1)
Compression Ratio	22.5:1
Firing Order	1-2-3
Rotation that is viewed from the flywheel	Counterclockwise
Valve Lash Setting (Inlet)	0.20 mm (0.008 inch)
Valve Lash Setting (Exhaust)	0.20 mm (0.008 inch)
Injection	Indirect

(1) Naturally Aspirated



Power kW	Power hp	Rated Speed (rpm)	Torque Nm	Torque lb-ft	Speed (rpm)	Rating Type
24.5	32.9	2800	96.0	130	1800	Industrial C intermittent rating

7.0. SPARE PARTS

Print page and return to po@tefol.com.au with required parts checked:

Engine Service Items

- ☐ 1 x 403D-15 Engine (GK65797)
- ☐ 1 x Air Filter (5543091)
- ☐ 1 x Breather Gauze (110666060)
- ☐ 1 x Fan Belt (080109104)
- ☐ 1 x Fuel Filter (4326658)
- ☐ 1 x Oil Filter (140517050)
- ☐ 1 x Water Pump (U45011030)
- ☐ 1 x Water Pump Gasket (U45996990)
- ☐ 1 x Fuel Tank (1G291-41013 1G291-41013)
- ☐ 1 x Electric Clutch 7" (H28D200-24)
  - 1 x Mounting Bracket (11006145)
- ☐ 1 x Radiator Cap (TRICCB1390L)
  - 1 x Lever (TRICA15100L)

Hydraulic Service Items

- ☐ 1 x Direction Control Valve, Solenoid Operated (DFE052/3A-12VDC)
- ☐ 1 x Filter Regulator (AC40A-06DG-8-D)
- ☐ 1 x Gear Pump (PLP20-9D-82E2-GDGD)
- ☐ 1 x High Pressure Filter (HEK85-20.106-FG010-LC)
- ☐ 2 x Suction Filter (HEK45-30-210-SP025)
- ☐ 1 x Twin Head Suction (11005706)
- ☐ 2 x Hydraulic Filter (A121C25)
- ☐ 1 x Filter Assy (HF745-20.106-FG010-G)
- ☐ 1 x Remote Filter Mount (15780)
- ☐ 1 x Vacuum Gauge, -1-0 bar (11013700)
- ☐ 1 x Pressure Gauge, 0-230 psi (PG63PM-016)
- ☐ 1 x Pressure Gauge, 0-870 psi (PG63PM-060)
- ☐ 5 x Pressure Gauge, 0-3500 psi (PG63PM-250)
- ☐ 1 x Pressure Gauge, 0-5800 psi (PG100PM-400)
- ☐ 1 x Pressure Reducing Valve, 50-600 psi (PRRS-10-N-S-0-06)
- ☐ 1 x Pressure Reducing Valve, 50-1500 psi (PRRS-10-N-S-0-15)
- ☐ 1 x Relief Valve, 580-1450 psi (SRDP-141-UN-10-M10)
- ☐ 4 x Relief Valve, 50-3000 psi (RVPS-10-N-S-0-30)
- ☐ 6 x Hand Knob (60081)
- ☐ 2 x Spool Diverter Valve (DF5/3A-12-L)
- ☐ 2 x 3-Port Line Body, BSPP 3/8" F (B1030-06B-S1-AL)
- ☐ 4 x 2-Port Line Body, BSPP ½" F (B1020-08B-S1-AL)
- ☐ 3 x Flat Face Coupling, BSPP 1" F (FFH16 1GAS F)
- ☐ 5 x Flat Face Coupling, BSPP ½" F (FFH08 12GAS F)
- ☐ 1 x Custom Box Manifold

Pneumatic Service Items

- ☐ 1 x Air Compressor (SWAN SVU-205)
- ☐ 3 x Compressor Belt (A72)
- ☐ 1 x 2-Way Ball Valve, 1" BSPP, 40 bar (TEF-231-5168)
- ☐ 1 x Safety Valve, BSPT ¼", 145 psi (SRV250 145/1000)
- ☐ 1 x Air Tank (AB7609)
- ☐ 1 x Taper Fit Pully (SPA125X3)
- ☐ 2 x Ball Bearing (RLS 7-2RS1)
- ☐ 1 x HD Internal Circlip, 105mm (1300-105)
- ☐ 1 x Drive Shaft
- ☐ 1 x Shaft Coupler

Electric Service Items

- ☐ 1 x High Side Temperature Switch, *75C Rising, NPT 1/8"* (GTSTS-085-NC-15MM)
- ☐ 1 x Low Side Temperature Switch, *75C NO, NPT 1/8"*
- ☐ (GTSTS-075-NO-15MM)
- ☐ 1 x Coolant Level Switch, NO NPT ½" (FOZS285/213)
- ☐ 1 x Roller Level Limit Switch (TEF-RS334612)
- ☐ 1 x DSE3110 Manual & Auto Start Control Module (CR-DSE3110+MPU)
  - 1 x Facia Gasket (AC-DSE020-385)
- ☐ 3 x N100L 750CCA Battery (ALN100)
- ☐ 1 x Magnetic Pick-up M18X1.5 (KUSKE10065
- ☐ 2 x Battery Charger (HU6554)
- ☐ 1 x Circuit Breaker, 16A (TERDSRCB1630A)
- ☐ 1 x Circuit Breaker, 40A (CB185F-40)
- ☐ 1 x Circuit Breaker, 80A (CB185F-80)
- ☐ 5 x Mini Relay, NO, 12v 40A (ACX1940RBL)
  - 1 x Mini Relay Base (ACX1997)
  - 10 x Relay Base Plug (3334485045)
- ☐ 1 x Engine Shutdown Solenoid (ACX3332)
- ☐ 1 x Fuse 8-Way Blade (FB3008)
- ☐ 1 x Appliance Inlet (CLIPSAL 56AI315)
- ☐ 1 x CAT Jump Start Connector (JS001)
- ☐ 1 x Protective Plug, CAT (JS001-PC)
  - 1 x Protective Plug (JS001-PC)
- ☐ 1 x Anderson Connector (SB175-35)
  - 1 x Protective Plug (SB175-PC2)
- ☐ 1 x Contact Block, NC (216378 M22-K01)
- ☐ 3 x Contact Block, NO (216376 M22-K10)
- ☐ 1 x Fixing Adaptor (216374 M22-A)
- ☐ 1 x Pilot Light, Red (TEF-RS4548607)
- ☐ 1 x Light Block, White (216569 M22-CLED-W)
- ☐ 2 x Push Button, Blue (TEF-RS4548528)
- ☐ 1 x Push Button, Green (TEF-RS4548477)
- ☐ 1 x Momentary Push Button, Green, Red (216700 M22-DDL-GR-X1)
- ☐ 2 x Digital Voltmeter Display (TEF-RS1809261)
- ☐ 1 x 4-Pole RCD/MCB Cover (GEN3 CBC4PN)
- ☐ 1 x 3-Gang Industrial Enclosure (4C 040.000.0159)
- ☐ 1 x 4-Pole Distribution Board (NLS 30303)

Lockout Service Items

- ☐ 3 x Battery Master Switch (75910BX)
  - 2 x Red Lock Out Switch (BMS-18R)
  - 1 x Yellow Lock Out Switch (BMS-18Y)
- ☐ 2 x Emergency Stop Switch (TMS49)
  - 2 x Recessed E-Stop Mount (TMS54)
  - 2 x E-Stop Legend (TMS55)

Miscellaneous Service Items

- ☐ 1 x HDPE Battery Box w/ Lid
- ☐ 1 x Site Box (6120161)
- ☐ 1 x Terminal Box, 400x300x120 (AESSS-TB400X300X120)
- ☐ 1 x Terminal Box, 300x200x120 (SS-TB-300X200X120)

APPENDIX A: WIRING DIAGRAM

APPENDIX B: HYDRAULIC DIAGRAM

APPENDIX C: PERKINS 403D-15 OPERATION AND MAINTENANCE MANUAL

APPENDIX D: PERKINS 403D-15 PARTS BOOK

APPENDIX E: SWAN AIR COMPRESSOR OPERATION MANUAL

APPENDIX F: SMC AIR COMBINATION OPERATION MANUAL