



Operation Manual

Hydraulic Power Unit

Diesel Engine

Document Number

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Document Control

Revision History

Rev	Date	Reason
B	01/23/15	Revised format
C	3/19/15	Added Hi/Low option
D	06/29/18	Added Appendix G and H
E	05/06/2021	Added warning note to Page 5 per CAR 2020-002

Description of Change

Rev	Change
B	Combined Hydraulic and Engine Troubleshooting, incorporated Safety Issues into other sections, removed appendix "Metaris Pump", added Appendix F, removed reference to using lift eyes for lifting entire unit, and added Spare Parts List.
C	Added 1) Hi/Low option, 2) Sentinel system, 3) emergency shut off valve (Figure 6), 4) manifold (Figure 5 & Table 3), 5) hose kit (Figure 17, 18, & 19, Table 19), 6) Depressurization Air System section, and 7) Figures 11 & 12. Renumbered Tables and Figures. Changed 8) number of Table 8 & 12 9) term 'hydraulic oil' to hydraulic fluid, 10) cooler p/n from 060015, and 11) BOM Item 1 from TFB914-KIT. Revised Troubleshooting section and Spare Parts List (Table 20). The turbo unit is no longer offered. Updated unit pictures.
D	Added Figure 12 and Appendix G & H. Updated Table 3, Table 8, and Figure 5 and 10. Removed notes re: turbo including Table 18.
E	Added warning note to Page 5 per CAR 2020-002

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GENERAL

Note!!

Operation, Maintenance, and/or Adjustments to any part of the Hydraulic Power Unit must be accomplished by trained and knowledgeable personnel only!

Contact TIOT for assistance if malfunctions or other issues with the equipment occur.



Figure 1: Power unit shown with electric start

Texas International Oilfield Tools (TIOT) offers two (2) styles of Power Units which operate many types of hydraulic equipment. Each unit is mounted on a skid for easy transport and has the following attributes:

Item	Features	
Skid	ASTM A36 steel construction	
	Lift eyes on top to lift basket only	
	Fully welded belly pan	
	Removable drain plug	
	Full length forklift tubes	
	Removable top/basket	
Return Filter on tank	Sight gauge	Dirty element
		No element
		Operation OK
	Full flow return line	

Table 1



Extreme forces are involved in using this device. Operate this equipment with the utmost caution

Diesel Engine	Start		Pump
	Air	Electric	
	TIOT Part No.		
Naturally Aspirated	TFBD914-AIR	TFBD914-ELEC	single stage
Naturally Aspirated	TFBD914-AIR-**-HL	TFBD914-ELEC-**-HL	dual stage

** See Table 3

Table 2

Manifold Options	Pump
V1 Tubing/Casing **	40/40
V2 Casing	40/20

**See Appendix G for port layout

Table 3

The Hi/Low (HL) has a naturally aspirated diesel engine and a dual stage (either 40/40 or 40/20) pump, allowing the power unit to operate at a lower flow (gallon per minute) for tubing and a higher for casing. The single stage pump is also offered. All units are available with an air or electric start.

CONVENTIONS




IMPORTANT SYMBOL IDENTIFICATION	
	WARNING to Operators / Users
	CAUTION to Operators / Users
	NOTIFICATION to Operators / Users

Table 4

SAFETY

Texas International's equipment is used and installed in controlled rig environments involving hazardous operations and situations.

All personnel performing installation, operations, repair or maintenance on this Power Unit must have knowledge of rig procedure. All crew in the vicinity of operations should be trained on rig safety and tool operation.

SPECIFICATIONS

Item	Size (inches)			Dry weight (lbs)	Full weight (lbs)
	L	W	H		
Power Unit*	96	52	63	3897	5009

Table 5

Item	Power (hp)	Speed (rpm)	Torque (ft/lbs)	Oil/filter change (hrs)	Fuel consumption
Deutz Air Cooled Diesel Engine*	116	2300	225	500**	6 gph***
	77	1300	277		

*Air or Electric Start

** under severe condition - do every 250 hours

*** approximate at maximum output

Table 6

Item	Group type	Volt	Size			Cold cranking amps @ 0F	Cold cranking amps @ 32F	Reserve capacity minutes @ 25 amps
			L	W	H			
Battery*	24	12	10-3/4"	6-3/4"	9"	675	850	115

* Electric Start only

Table 7

Pump							
Stage	Gear	Displacement (cu in/rev)	Mount	Speed (rpm)	Flow rate (GPM)	Pressure (psi)	Max operating pressure
Single	Heavy Duty	6.35	SAE B	2200	60	1000	2500 psi at 1800 rpm
				1800	27	2500	
Dual*		10.8		1500	65	1000	
				1800	27	2500	

* for Hi/Low units

Table 8

Tanks	Features	Volume (gal)	Working (gal)	Recommended operating temp (°F)
Hydraulic	Sight and temperature gauges	135	118	100 - 130
	Filtered breather			
	Top access hatch			
	Fully welded steel construction			
Diesel	Top access filler	35	33	N/A
	Fully welded steel construction			

Table 9

Item	Features	Max operating pressure	Min. pressure	Oil flow required
Oil Cooler	Oil/air type	2000 psi	675 psi	3.3 GPM
	Brazed bar & plate construction			
	Oversized for hot climates			
	Adjustable fan speed			
	Low press drop (<18 psi) at max flow			

Table 10

Item	Factory set
Relief valve - adjustable	2500 psi

Table 11

Standard gauges
Output Pressure 0 - 3000 psi oil filled
Tank Temp
Tank Level
Filtration status

Table 12

Optional	Gauges	Voltmeter
		Engine Temp
		Engine Oil Press
		Engine Hour Meter
	Tachometer	
	Remote Start/Stop	

Table 13



Do not exceed the system's rated pressure or over tighten fittings

INSTALLATION

- 1) Find the best location for the unit – away from hazardous vapors
- 2) place the unit, connect power, and make hydraulic connections
- 3) test the unit for proper operation

The diesel hydraulic power unit requires a location where adequate air flow and exhaust removal are available.



Ensure that ventilation can carry away the exhaust fumes – diesel exhaust can be lethal

It's important to consider hydraulic line losses from size, length and pressure in choosing where to place the unit. The sizes of the hydraulic lines should be large enough to limit friction losses to 300 psi or less. This may mean using hoses larger than the connections on the unit. For connection instructions, see Hydraulic section page 11.



Proper hose connection is required to fully open the check valves in the hose couplings

Ideally, the unit will be located in a non-hazardous location, with excellent ventilation, as close as possible to the equipment to be powered.

Installation continued

Location:

- Requires at least three (3) feet between the oil cooler fan and any wall or obstruction. In the best conditions, the fan will be facing open air
- Ensure power cables are placed where they won't be cut, nicked, or squeezed
- Allow distance around the accessory drive on the front of the engine so personnel can pass easily



The engine develops almost 300 foot-pounds of torque and at 1800 rpm; foreign objects (i.e. loose clothing, long hair, etc.) can be drawn in - with disastrous results

Transport the power unit using **only** the forklift tubes provided shown in Figure 2.



Figure 2



Use top lift eyes, shown in Figure 2, to remove the top basket from the frame/skid – NOT designed to lift the entire skid

If the unit is full of hydraulic fluid the center of mass is approximately in the center of the forklift tubes. If the unit is empty, the center of mass is still between the forklift tubes but biased to the engine end.



Positioning forklift forks in other positions can damage the unit and can be dangerous to personnel

Ensure the unit does not shift or move from its intended location.

HYDRAULIC

The power unit during operation heats the hydraulic fluid. If the reservoir temperature exceeds 150 degrees Fahrenheit (°F), shut down the unit and let it cool. If this happens regularly, have unit repaired.



Be careful not to expose skin to hot hydraulic fluid – it can scald

Time and Temperature Relationship to Severe Burns

<i>Water temperature</i>	<i>Time for a third degree burn to occur</i>
155° F 68° C	1 second
148° F 64° C	2 seconds
140° F 60° C	5 seconds
133° F 56° C	15 seconds
127° F 52° C	1 minute
124° F 51° C	3 minutes
120° F 48° C	5 minutes
100° F 37° C	safe temperature for bathing

Figure 3*

*American Burn Association SCALD INJURY PREVENTION, Educator's Guide

The hydraulic fluid may be under pressures as high as 2500 psi. Fluid can be sprayed some distance, creating a slip hazard. If a leak occurs, shut down the power unit immediately and repair. Hydraulic fluid can irritate the skin – for skin contact, wash and rinse the affected area. If fluid comes in eye contact, use an emergency eyewash or flush with saline solution. If not available, flush with distilled or lastly, tap water. Seek medical attention after flushing.



Avoid the hydraulic fluid spray– it can be injected through the skin at high pressures

The power unit is equipped with Snaptite 78 series quick disconnect couplings (or equivalent), one (1) inch for the supply line and one and a quarter (1-1/4) inch for the return line. These couplings contain check valves to prevent the loss of hydraulic fluid during connection and disconnection.



Proper connection is required to fully open the check valves in the couplings

Connect the hoses as follows:

1. Wipe the connections clean as needed to remove dirt and dust.
2. Connect the one (1) inch pressure hose to the one (1) inch coupling on the unit by engaging the mating coupling halves and forcing the connectors together while rotating the threaded sleeve on the hose connector.
3. Using the same method as above, connect the one and a quarter (1-1/4) inch return hose.



Put the selector switch in Start position to connect hoses



If either the pressure or return fittings are not fully tightened, the check valve will cause a restriction in the flow. This can result in overheating the fluid, poor tool operation and damage to equipment

Hoses, connections and fittings should be chosen carefully so as not to cause excessive restriction. Restriction in a hydraulic system equals pressure drop and pressure drop equals heat. Improper connection or restrictive circuits can cause a serious loss of power and will generate heat uselessly. Choose short, large inside diameter hoses whenever possible over long, skinny ones.



High temperatures decrease the useful life of the hydraulic fluid, the hoses and the seals in the equipment being powered

Low hydraulic fluid level can cause overheating, or in worst cases severe damage to the pump and even the associated tools it's driving. Keep fluid up to at least the

minimum on the sight gauge. Observe the return filtration monitor to be sure it's operating in the green (OK) range. Change the filter if it's not.

Recommended Fluids
Mobil DTE 24
Castrol Hyspin VG 32
Royal Purple Syndraulic 32
Shell Tellus 32
PetroCanada Environ AW 32
ISO viscosity grade 46*

* for warmer climates

Table 14

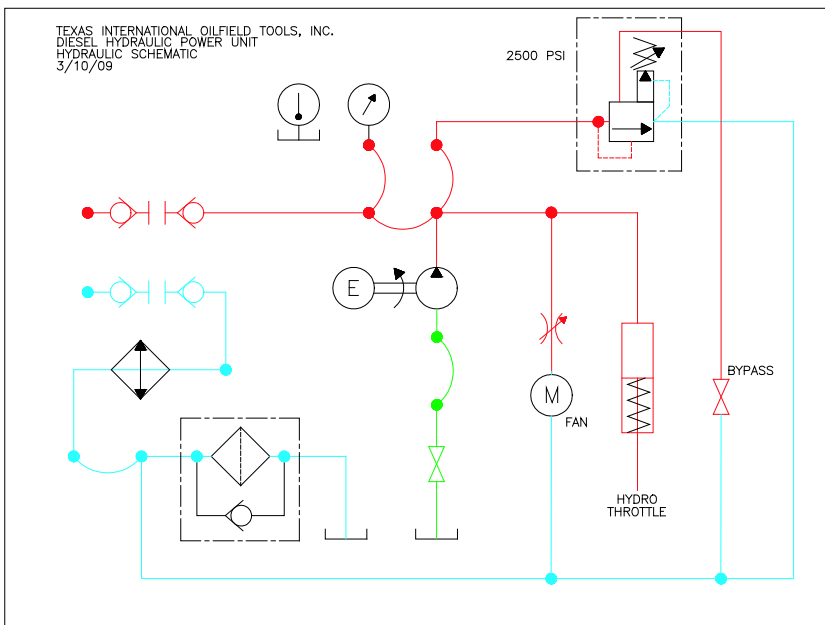


Figure 4 – Standard unit

Color Line	Function
Red	Pressure
Aqua (blue)	Return
Green	Suction

Table 15 – Standard unit

Item No	Qty	Description
1	1	Manifold Body
2	1	Check Valve
3	1	Relief Style Logic Element
4	1	Flow Control
5	1	2-way, pilot-to-shift directional valve
6	1	Poppet Style Check valve
7	2	Removable Orifice
8	1	Relief Valve
9	1	Logic Element Relief
10	1	SAE -10 Plug
11	2	SAE -8 Plug
12	5	SAE -2 Plug
13	2	SAE -4 Plug

Figure 5 – Hi/Low manifold **See Appendix G for port layout

OPERATION

On all units, the pump draws hydraulic fluid from the tank and delivers hydraulic fluid up to 2500 psi on the pressure line, adjustable at the relief valve (preset at 2500 psi). See the Adjustment section on page 18 for how to change the relief valve setting. The 2500 psi setting is the maximum recommended output pressure. Theoretically the unit could produce more at full engine rated output, but pump life will be shortened, possibly dramatically.

On the standard power unit, a diesel engine drives the single stage pump at a setting of 1800 rpm. The pump delivers 27 GPM at 1800 rpm and 60 GPM at the engine's maximum speed of 2200 rpm.

The Hi/Low power unit has a dual stage pump, which delivers 65 GPM at 1500 rpm and 27 GPM at 1800 rpm.



The unit is slightly overpowered for long service life. Exceeding the factory set pressures is not recommended.

Review the Deutz engine manual, Appendix A, for detailed instructions on startup, shut down and operation. The engine is controlled by the hydro-throttle, which opens the throttle as the load increases. The engine is protected from low oil pressure and high oil temperature by a Sentinel system. If the engine's oil temperature goes above 225°F or has an oil pressure of 0.50 psi or less, the Sentinel stops the fuel flow. An emergency shut off valve is shown in Figure 6. Press stop button on the valve to stop the engine in an emergency. On newer engines, the stop button is added to LOFA control panel as shown in Figure 10. A remote stop switch is available for the electric start engine only.

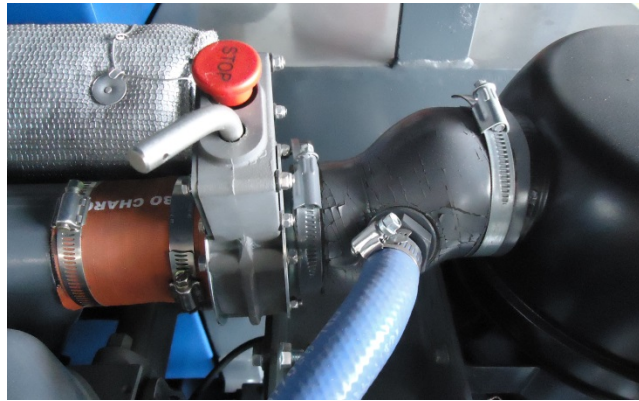


Figure 6



Open the valve by rotating the reset lever clockwise as far as possible before restarting the engine

- 1) Connect the battery (Figure 7) or air supply if disconnected (Figure 8).



Figure 7: Battery box

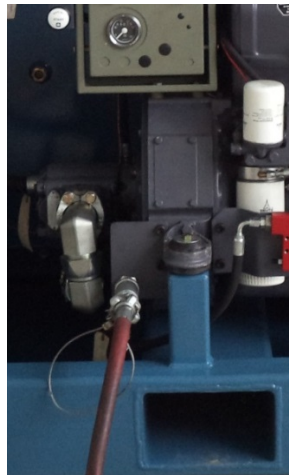


Figure 8: Air connection

- 2) Turn the key to the ON position and then the START position on the main enclosure or push the 'Engine Start' button for air start units.
- 3) To turn the unit off, turn the key to OFF (electric) or pull the throttle rod (air) to release the spring.

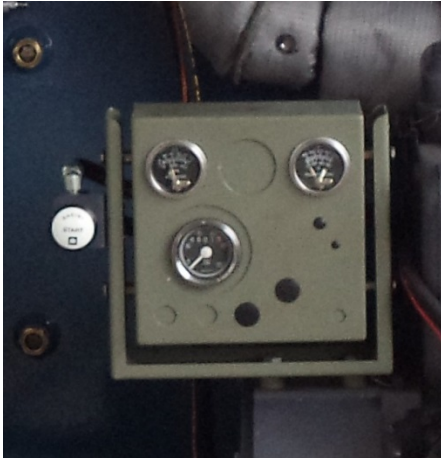


Figure 9: Air start control panel



Figure 10: Electric LOFA control panel



If the power unit shuts down prematurely, check fuel tank for diesel. If the Sentinel system caused the shutdown, allow the engine to cool and check the oil level – add as needed. If this happens repeatedly, there is an abnormal condition which must be found and fixed before continuing operation

The standard unit's 'Start' position registers pressure (and generates heat in the hydraulic fluid) and the 'Run' position sends fluid out to the equipment.

The 'Start' position on the Hi/Low unit will allow the engine to warm and dump the fluid back into the tank. It also permits the system to operate at a lower flow for running tubing and a higher flow for casing. See lever example in Figure 11.

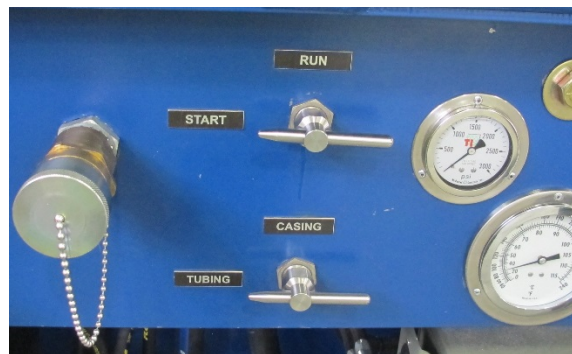


Figure 11

Hydraulic fluid cooling is provided on the return line with an oversized air to oil cooler (item 21 on Figure 17). The cooler is capable of removing nearly half the entire horsepower rating in heat, so hydraulic temperatures can be kept low for safety and for

system longevity with a reasonable flow of cooling air. On the standard unit, control the temperature by manually adjusting the speed of the oil cooler fan motor while observing the thermometer. The Hi/Low unit manifold automatically adjusts the cooler fan's speed. A needle valve can be added to the cooler fan for colder climates. See Figure 12 for correct fan rotation.

The suction line has a 149 micron filter in the hydraulic tank. Full filtration is equipped on the return line. The filter (item 3 on Figure 17) is mounted on the top of the tank and has a filter condition indicator mounted on the side of the filter housing. The condition indicator shows when the filter is operating properly, is bypassing (dirty filter), or is missing. Keeping the filter in good condition is strongly recommended, as dirt in the system will increase wear in the pump, valves and connected hoses or other hydraulic tools.

Hoses and fittings have JIC swivel connections, SAE flange connections, or NPT connections. A shutoff valve (Figure 13) is on the tank so it can be drained and serviced.



Figure 12

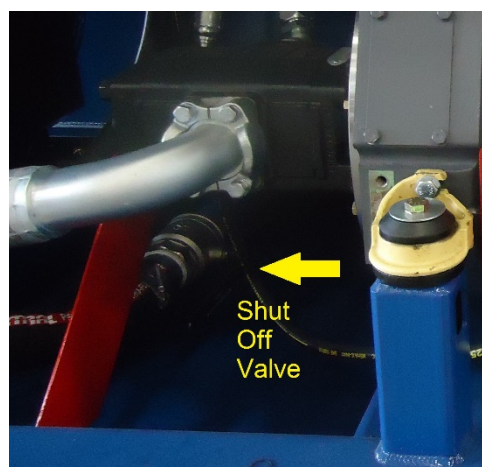


Figure 13

Be sure the equipment being operated is an 'open center' hydraulic circuit – meaning that in the neutral position the circuit has full flow from the inlet to the outlet. If not, a 'closed center' adapter must be installed.

ADJUSTMENTS

To adjust the relief valve, turn the adjustment screw clockwise (in) to raise the relief pressure and turn it counterclockwise to lower the relief pressure. The valve is set at 2500 psi. The relief valve, shown in Figure 14, requires a 5/32" Allen wrench (screw) and 9/16" wrench (locknut). The relief valve in the Hi/Low manifold, can be adjusted using an Allen wrench and is shown in Figure 16.



Adjustments should be made with the fluid at normal operating temperature of 80 to 130 degrees F

The relief valve setting can be determined by operating the unit without equipment connected to the quick disconnects, in 'Start', and observing the pressure reading on the panel gauge.



Do not operate the unit with equipment disconnected for over five (5) minutes. Keep temperature at or below 130 degree F

If installed, the oil cooler fan motor needle valve (shown in Figure 15) can be adjusted by rotating the needle clockwise (viewed from the top) to slow down and counterclockwise to speed up the fan. On Hi/Low units, the fan speed is controlled automatically by the manifold. A needle valve can be added to the fan for colder climates.

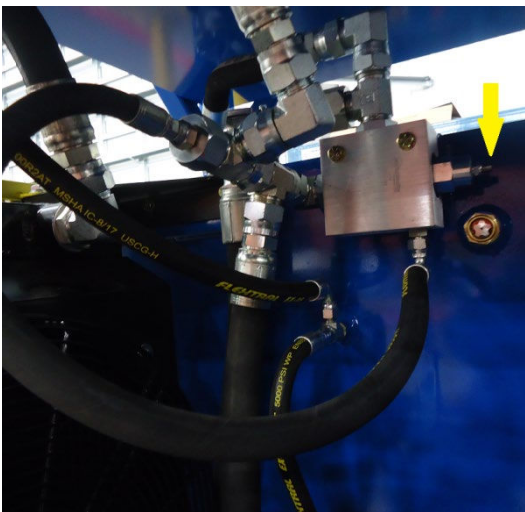


Figure 14: Without manifold

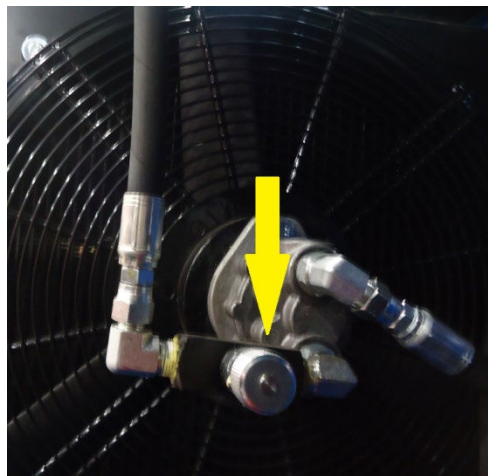


Figure 15: Oil cooler fan manual adjustment

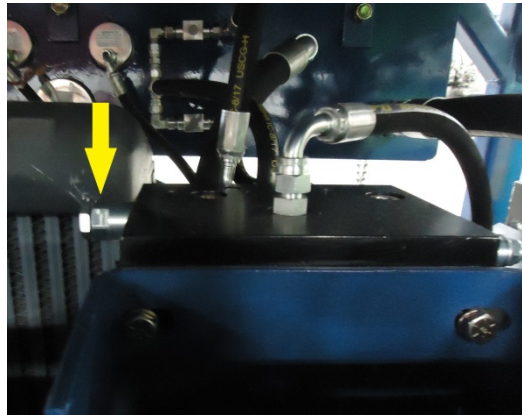


Figure 16: Relief valve on manifold on Hi/Low – view from tank side

To adjust hydro throttle (item 12 in Figure 17) see Appendix C.

DEPRESSURIZE AIR SYSTEM

When the air start power unit is disconnected from the supply air, remove air from unit by either using the pop-off valve (if supplied) or by pressing the air start button twice.

PREVENTIVE MAINTENANCE



This is a suggested PM schedule. The tool owner has the responsibility to adjust the program according to actual tool usage



Disconnect hydraulic lines and drain system's pressure before maintenance

Verify that the equipment to be operated is properly connected to the power unit as specified in the Hydraulic section on page 12. Cracks or the appearance of damage on the hydraulic hoses or electrical cabling can indicate the need for repair, even impending failure, and requires prompt attention. See Appendix A, Sections 5 and 6 for engine maintenance.

Daily – While in use

- Verify power unit is in a secure and safe location
- Inspect the hydraulic hoses for worn or scraped areas, bubbles, wrinkles or any other wear – if found, replace
- Verify power cables and hydraulic hoses are not a trip hazard and can't be pinched or cut
- Check for exposed wires and that electrical connections are secure
- Notice the hydraulic level using the sight gauges and ensure tank is filled to the proper level



Most items in the unit are lubricated by the hydraulic fluid and don't require other lubrication other than to ensure the fluid is clean

- Check the diesel tank has adequate fuel for the intended operation



Refuel safely with the engine OFF

- Verify cooling air can freely flow through the oil cooler fan and on standard units, the cooling fan is properly adjusted



Fluid temperature will increase 80°F in 20 minutes without air flow from the fan

- Ensure the shutoff valve to the pump inlet is fully open
- Once operating, check the return filter state



Run electric start power unit at least once every three (3) days so that the battery stays charged

Quarterly

- Replace filter element or earlier if the filter's indicator gauge shows a dirty element (before needle is in the red)
- Change the hydraulic fluid every three (3) to six (6) months – see recommended fluid on Table 14

TROUBLESHOOTING

Failure Mode	Possible Cause	Possible Solution
Pump excessively noisy	Pump inlet flow	Ensure that nothing in tank blocks tank outlet
		Verify suction shutoff valve is wide open
	Viscosity is too high	Change to a lower ISO VG grade
	Air	Pour fluid over suction side fitting - if noise stops, disassemble, retape and reassemble
	Loose or worn parts	Verify assembly is tight - replace worn out parts
Hydraulic system overheating	Cooling air - insufficient	Verify air flow is unobstructed
		Open needle valve fully
	Relief valve setting	Reset to a maximum of 2500 psi
	Fittings loose	Verify fittings fully tightened
	Fluid viscosity	Change fluid
	Excessive internal leakage	Check parts for wear - replace/repair
		Check for contamination
Excess friction	Look at moving parts inside pump for proper fit	
Valves not operating properly	Check pressure and check flow with flow meter. Repair/replace valves	
Excessive wear of moving parts	Fluid contaminated	Change fluid. Replace filter element. Clean breather.
	Engine/Motor to pump alignment	Verify fastener tightness. If OK, replace motor to pump housing and coupling
	Relief valve setting	Reset to a maximum of 2500 psi
	Air	Pour fluid over suction side fitting - if fluid disappears, disassemble, retape and reassemble
	Viscosity is too low	Change to a higher ISO VG grade
Flow rate (tool speed) is low	Pump inlet flow	Ensure the nothing blocks tank outlet
		Verify suction shutoff valve is wide open
	Pump	Inspect parts and replace as necessary
	Fittings	Confirm fittings are tight
	Viscosity	Change to a proper ISO VG grade
	Hoses	Use shorter or larger hoses
	Engine speed is low	Ensure hydro throttle is operational. RPM should be between 1800 and 2500
System pressure will not build up	Leak	Check hoses and fittings
	Relief valve setting	Adjust or replace

Table 16

Failure Mode	Possible Cause		Possible Solution
Hot or noisy operation	Fan		Remove interference with fan cover
			Tighten hold down bolts
	Misalignment		See engine vibrates below
	Insufficient oil		Lubricate per engine manual
	Deterioration of oil		Change
	Excess oil		Drain excess oil
	Engine/Motor loose		Check mounting bolts are tight
Engine will not start	Electric	Connections	Verify wiring connections/tighten
			Check voltage
	Battery dead		Recharge then find source of drain
	Air		Bleed fuel system
Engine stalls	Electric	Connections	Verify wiring connections/tighten
	Air		Bleed fuel system
	Both	Fuel filter	Dirty - replace
Engine runs and then slows/stops	Electric	Connections	Verify wiring connections/tighten
	Air		Bleed fuel system
	Sentinel system		Check oil level - if good - check oil pump operation
	Both	Overload	Adjust or replace hydraulic valves
		Fuel filter	Dirty - replace
Engine overheats	Overload		Adjust or replace hydraulic valves
	Air		Check for clogged air vents. Remove and clean
Engine vibrates	Loose pump mounting bolts		Tighten

Table 16 continued

For additional engine troubleshooting, see Appendix A, Section 7.

STORAGE AND TRANSPORTATION

- Unpainted surfaces should be coated with rust preventing agent
- Prevent excessive exposure to water and moisture
- Clean the tool after use - steam clean as needed; remove mud, debris and any other substances
- For long term storage, 1) depressurize the system and 2) flush hydraulic fluid. The fuel tank level indicates when the diesel contains water. 3) Drain tank as necessary

PARTS LIST

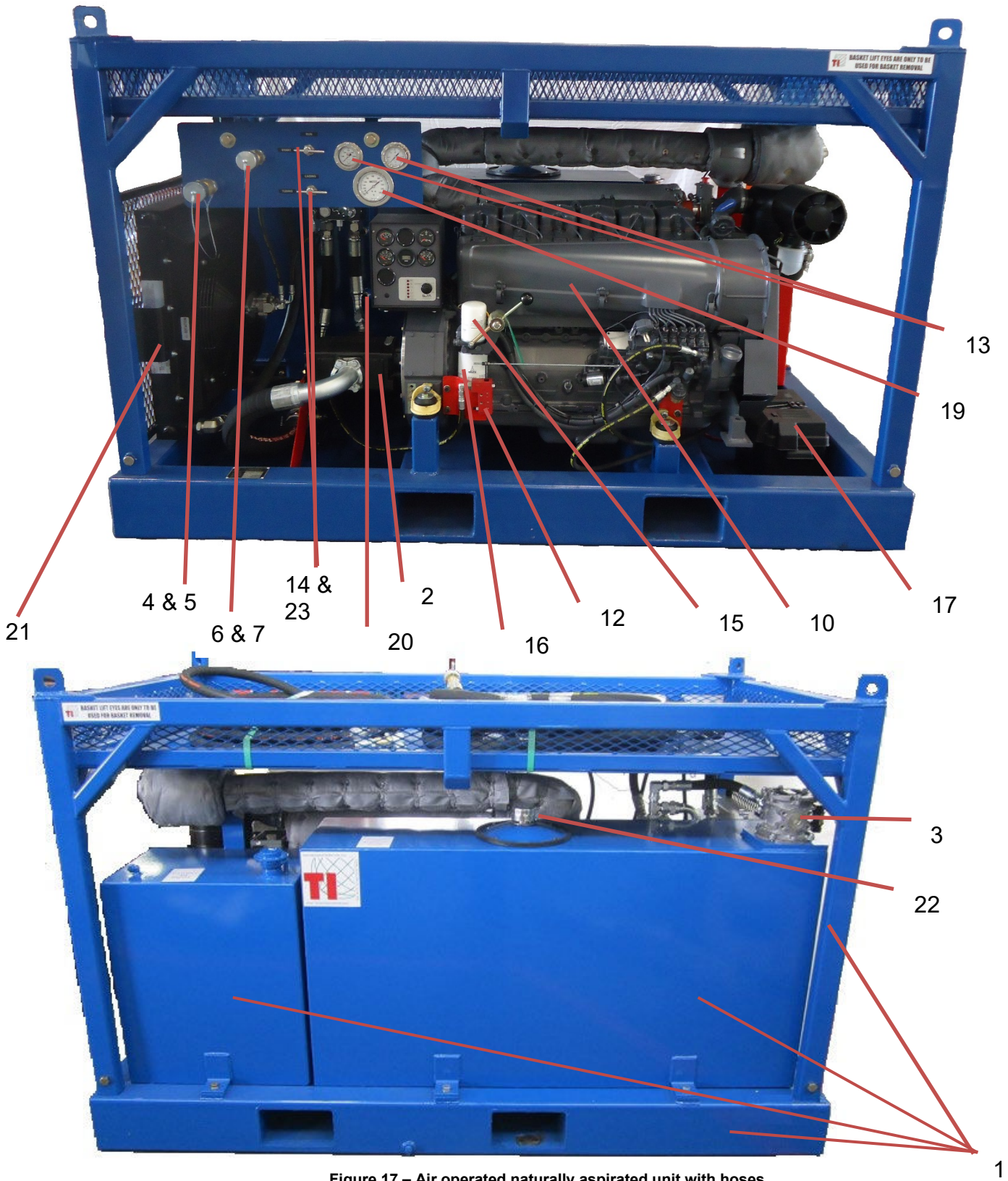


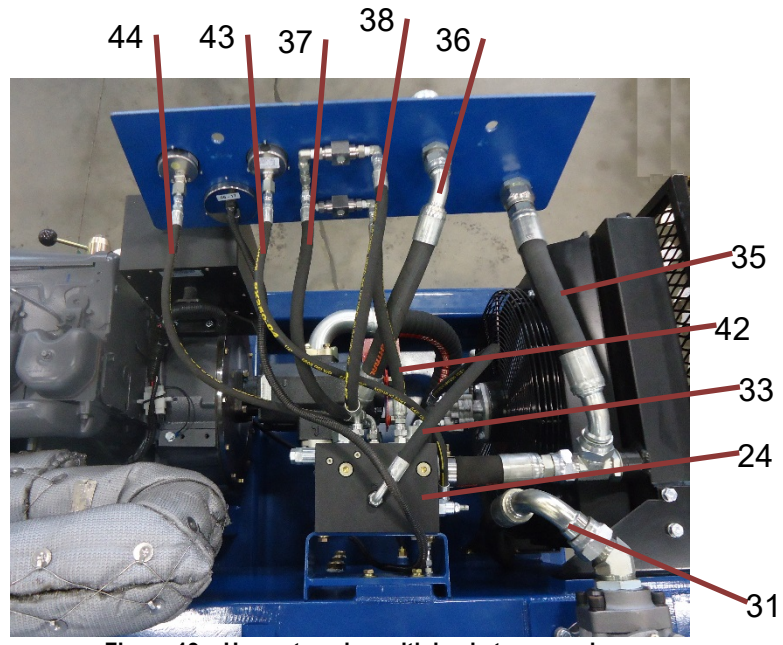
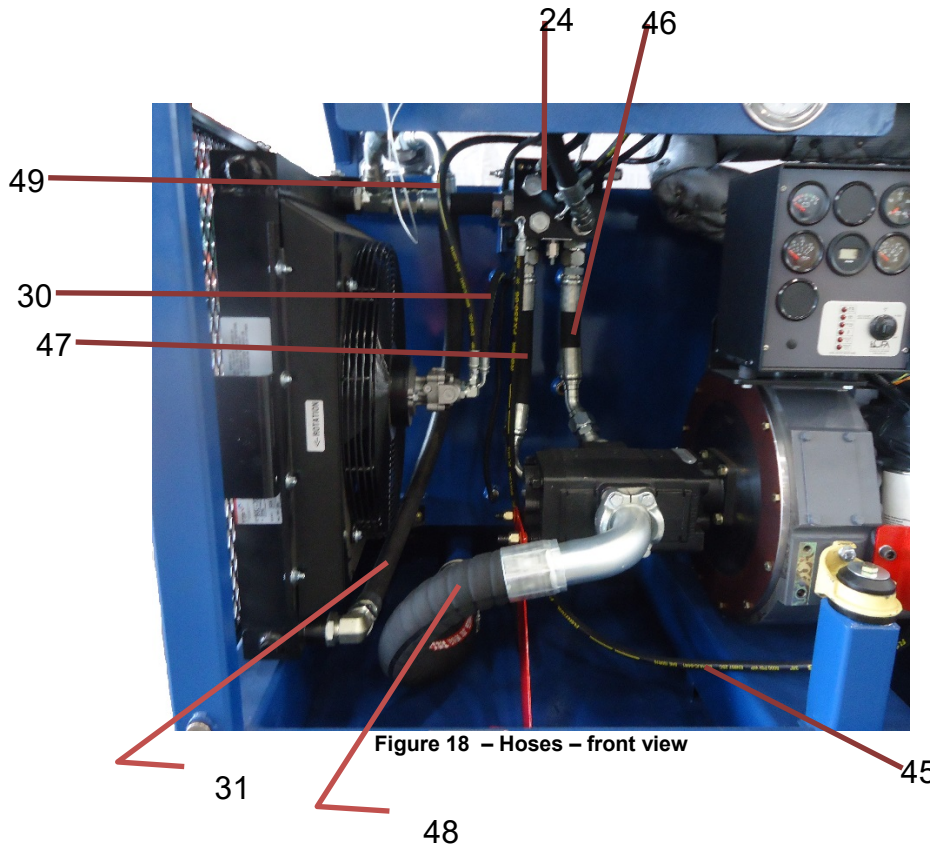
Figure 17 – Air operated naturally aspirated unit with hoses

Parts List continued

ASSEMBLY P/N		TFBD914-AIR-V1-HL	TFBD914-ELEC-V1-HL
#	Component	Qty	P/N
1	SKID, BASKET, TANKS	1	TFBD914-FKIT
2	PUMP, HI/LO	1	060201
3	RETURN FILTER - RFP	1	060017
4	FEMALE QUICK DISCONNECT RETURN	1	030061
5	RETURN CAP	1	030060
6	FEMALE QUICK DISCONNECT PRESSURE	1	030063
7	PRESSURE CAP	1	030062
8	BALL VALVE, SHUT OFF*	1	060070
10	DIESEL ENGINE	1	D914L06 - AIR START D914L06 - ELECTRIC
11	SIGHT LEVEL GAUGE/TEMP	1	060066
12	THROTTLE	1	080005
13	GAUGE, PRESSURE	2	060012
14	START/RUN BALL VALVE	2	060013
15	FUEL FILTER	1	DEU1181917
16	OIL FILTER	1	DEU1183574
17	BATTERY	1	N/A TFBD914-BATKIT
19	ANALOG PANEL THERMOMETER	1	060064
20	SIGHT GAUGE PLUG	5	060065
21	OIL COOLER	1	060075
22	FILLER CAP/FILLER BREATHER	1	T17567-38
23	HANDLE SS	2	060113
24	MANIFOLD	1	060071

* Not shown

Table 17: Figure 17/18 BOM



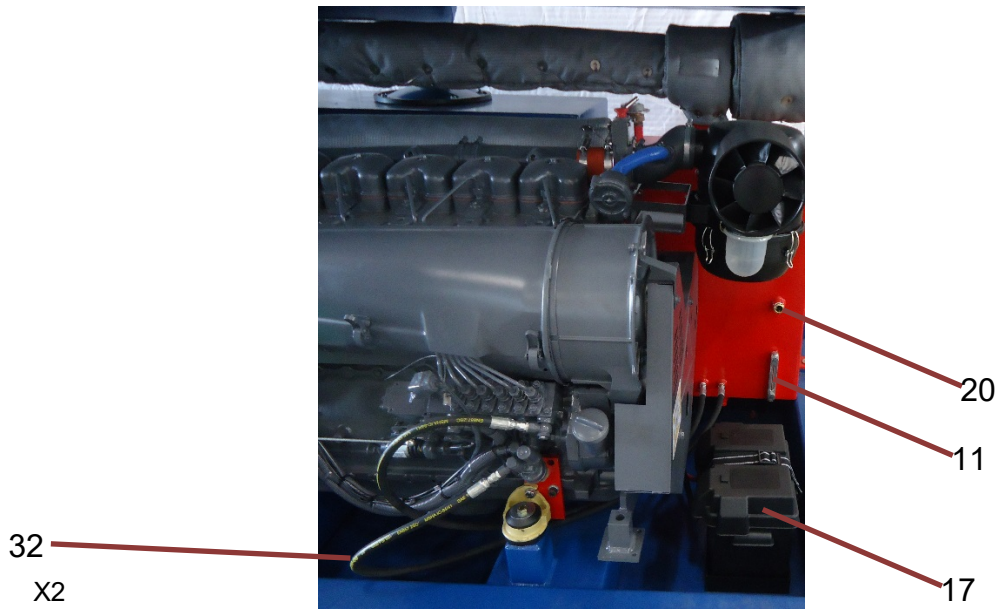


Figure 20 – Right Side

#	P/N	Description	Qty
30	050018	COOLER TO TANK	1
31	050027	RETURN LINE	1
32	050053	FUEL LINES	2
33	050061	MANIFOLD TO COOLER	1
35	050111	TO COOLER INLET	1
36	050113	RETURN 1" INLET TO MANIFOLD	1
37	050020	SWITCH TEE TO MANIFOLD	1
38	050112	START/RUN SWITCH TO MANIFOLD	1
42	050004	TUBING/CASING SWITCH TO MANIFOLD	1
43	050123	SYSTEM PRESSURE	1
44	050124	UNLOADING PRESSURE	1
45	050125	THROTTLE SETTING	1
46	050127	PUMP RELIEF	1
47	050126	PUMP UNLOADING	1
48	050128	PUMP RETURN	1
49	050129	MANIFOLD TO COOLER	1

Table 18 - Hoses Figure 18, 19 and 20

SPARE PARTS LIST

Component	Req	P/N
Element for Return Filter	2	060040
Fuel Filter	1	DEU1181917
Oil Filter	1	DEU1183574
Hose Kit	1	TFBD914-V1-HKIT
100' Return Hose (1")	1	050055
100' Hose (1-1/4")	1	050054
Suction Filter	1	060039
Pump (single)	1	060022
Pump (dual 40/40)	1	060201

Table 19

**DEUTZ ENGINE INSTALLATION, OPERATION, MAINTENANCE
INSTRUCTION**

**LOFA ENGINE PANEL OPERATION, TROUBLESHOOTING,
CIRCUIT DIAGRAMS**

**MUNCIE HYDRO-THROTTLE INSTALLATION, ADJUSTMENT,
PARTS LIST AND TROUBLESHOOTING**

PARKER FILTER DATA

ISO FLUID CLEANLINESS LEVELS

LEAD ACID BATTERY MSDS

HI/LO MANIFOLD PORT DIAGRAM

E-M SERIES SHUT DOWN VALVE

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