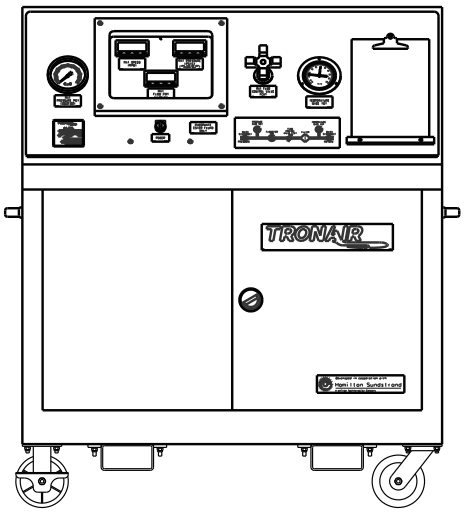
OPERATION & SERVICE MANUAL



Model: 13-6600-3600
Ram Air Turbine
(RAT) Test Unit

CE

01/2021 – Rev. 03

Tronair, Inc.
1 Air Cargo Pkwy East
Swanton, OH 43558

Phone: (419) 866-6301 | 800-426-6301
Web: www.tronair.com
Email: sales@tronair.com

REVISION	DATE	TEXT AFFECTED
01	06/2013	Original Release
02	09/2016	Modified 10.4.1 Self-Calibration
03	01/2021	Major revision

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This product can not be modified without the written approval of Tronair, Inc. Any modifications done without written approval voids all warranties and releases Tronair, Inc., it suppliers, distributors, employees, or financial institutions from any liability from consequences that may occur. Only Tronair OEM replacement parts shall be used.

1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

1.1.1 Ram Air Turbine (RAT) Test Unit

Model Number:13-6600-3600
Fluid Type:Aviation Phosphate Ester, Type IV (Skydrol or Hyjet)

Components**:**

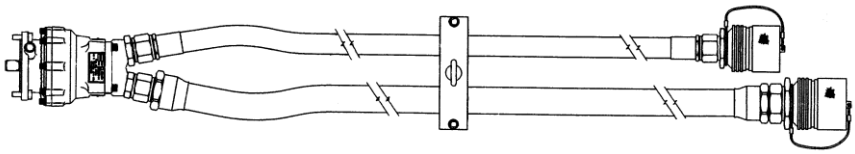
- Ram Air Test Unit
- Hose, Pressure
- Hose, Return
- Cable 1 (A330, A340)
- Cable 2 (A319, A320, A321)

1.1.2 Ground Test Tool (GTT)

Model Number: AGE10600 ***not included – storage only**
Fluid Type: Aviation Phosphate Ester, Type IV

Components:

- Hydraulic Motor
- Two (2) Hydraulic Motor Hoses



Ground Test Tool (GTT)

1.2 MODEL & SERIAL NUMBER

Reference nameplate on unit.

1.3 MANUFACTURER

TRONAIR, Inc.
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.tronair.com

1.4 FUNCTION

The Ram Air Turbine (RAT) test unit is designed to test the emergency RAT on the Airbus A319, A320, A321, A330 and A340 aircraft during scheduled maintenance checks. This is a stand-alone unit with two separate systems. A flow test system and a RAT feedback verification system. The flow test system consists of a filter, flow control valve, pressure gauge, flow and temperature sensors. The feedback verification system receives data signals from the emergency RAT through a cable link that displays the RAT rpm and pressure on the digital displays. Storage is provided inside the cabinet for the RAT Ground Test Tool, AGE10600 *****.

1.5 REQUIREMENTS

The test unit requires DC electrical supply from the aircraft. Additionally requires speed and pressure signals from aircraft for A319, A320 and A321 RAT testing.

2.0 SAFETY INFORMATION

2.1 USAGE AND SAFETY INFORMATION

The RAT test unit accepts high pressure hydraulic fluid from the aircraft during RAT ground testing.

To insure safe operations please read the following statements and understand their meaning. Also refer to your aircraft maintenance manual (AMM) for other important safety information. This manual contains safety precautions, which are explained below. Please read carefully.

WARNING! Warning is used to indicate the presence of a hazard that *can cause severe personal injury, death, or substantial property damage* if the warning notice is ignored.

CAUTION! Caution is used to indicate the presence of a hazard that will or can cause minor personal injury or property damage if the caution notice is ignored.

2.2 EXPLANATION OF WARNING & DANGER SIGNS

Accidental Starts! Before servicing the HPU or equipment, always disconnect electrical power supply to prevent accidental starting.

Pressurized Fluid! Before servicing the HPU or equipment, always open the bypass valve to relieve any residual pressure in the hydraulic system.

2.3 PERSONAL PROTECTION EQUIPMENT

Safety glasses must be worn when operating the RAT test unit.

Additional equipment recommended by the fluid manufacturer (gloves, etc). Reference Material Safety Data Sheet (MSDS) pertaining to fluid(s).

2.4 SAFETY GUIDELINES

1. Operator must be properly trained prior to operating the RAT test unit.
2. The RAT test unit is intended to be operated by personnel trained in the proper use in conjunction with the Aircraft Maintenance Manual (AMM).
3. The RAT test unit must be used in accordance with this Operator Manual and the AMM.

3.0 PREPARATION PRIOR TO FIRST USE

3.1 GENERAL

Prior to operating the RAT test unit, the user should become familiar with this Technical Manual, along with the Operator Manual.

4.0 TRAINING

4.1 TRAINING REQUIREMENTS

The employer of the operator is responsible for providing a training program sufficient for the safe operation of the RAT test unit.

4.2 TRAINING PROGRAM

The employer provided operator-training program should cover safety procedures concerning use of the RAT test unit in and around the intended aircraft at the intended aircraft servicing location.

4.3 OPERATOR TRAINING

The operator training should provide the required training for safe operation of the RAT test unit.

NOTE: Maintenance and trouble shooting are to be performed by a skilled and trained technician.

5.0 OPERATION

5.1 OPERATING PARAMETERS

- The user shall use the RAT test unit in accordance with the aircraft manufacturer instructions.
- The user shall operate the RAT test unit in accordance with Operator Manual.
- The employer of the operator shall provide all necessary training.

5.2 DETAILS

5.2.1 Fluid Type

Aviation Phosphate Ester, Type IV (Skydrol or Hyjet)

5.2.2 Physical

Dimensions:

Depth .....23 in (58.42 cm)
Width.....52 in (132.08 cm)
Height.....57-1/2 in (146.05 cm)
Weight.....600 lbs (272.2 kg)
Cable 1.....50 ft (15.2 m) Standard Length (for A330 and A340)
Cable 2.....25 ft (7.60 m) Standard Length (for A319, A320, A321)
Pressure Hose .....20 ft (6.10 m) Standard Length
-12 (19.05mm, 3/4 in) Working diameter with Aeroquip® quick disconnects
Return Hose: .....20 ft (6.10 m) Standard Length
-20 (31.75mm, 1¼ in mm) Working diameter with Aeroquip® quick disconnects

5.2.3 Filter

3 micron rating, 3000 psi (207 bar) microglass type
Non-cleanable element. Non-bypass filter Delta-P indicator

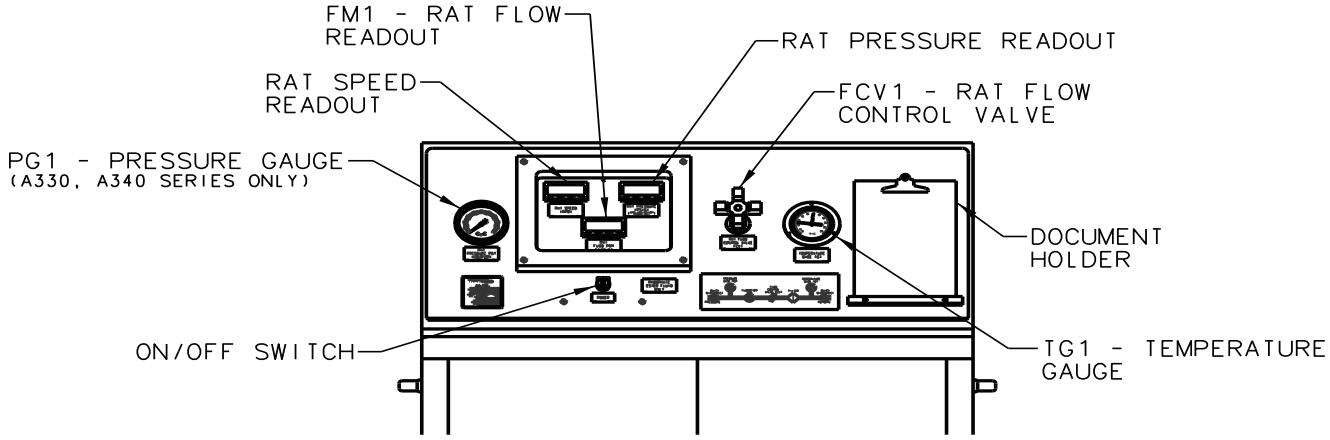
5.2.4 System

Maximum operating pressure..... 3500 psi (241.3 bar)
Ambient Operating Temperature Range ..... 10º to 120° F (-23.3º to 48.9° C)
PG1 - Pressure Gauge..... 0-5000 psi (0-344.7 bar) ±1.0% of full scale
FM1 – Flowmeter ..... 0-30 gpm (0-114 lpm) ±0.25%
TG1 – Temperature Gauge..... 32□ to 240□ F (0□ to 115□ C) ±0.8% of full scale
RAT Speed Readout ..... 0-9999 rpm ± 0.25%

5.2.5 Electrical

Voltage..... 28 VDC ± 1 VDC
Phase..... 1
Full Load Amps 0.25
Kw..... 0.007
Interrupt Amps..... 10,000A

5.3 LOCATION & LAYOUT OF CONTROLS



5.3.1 Control Panel:

On/Off Switch/Power "On" Light: ..... Power control for all electrical devices. Light is illuminated when power is being supplied to the electrical components in the RAT test unit

Electrical Connector (for CAB 1 or CAB 2) ..... Provides connection to cable that connects between RAT test unit and aircraft's RAT stow panel using Cable 1 or Cable 2

PG1 - Pressure Gauge ..... Reads RAT pressure (psig) on an analog fluid dampened (A330, A340 series only) gauge

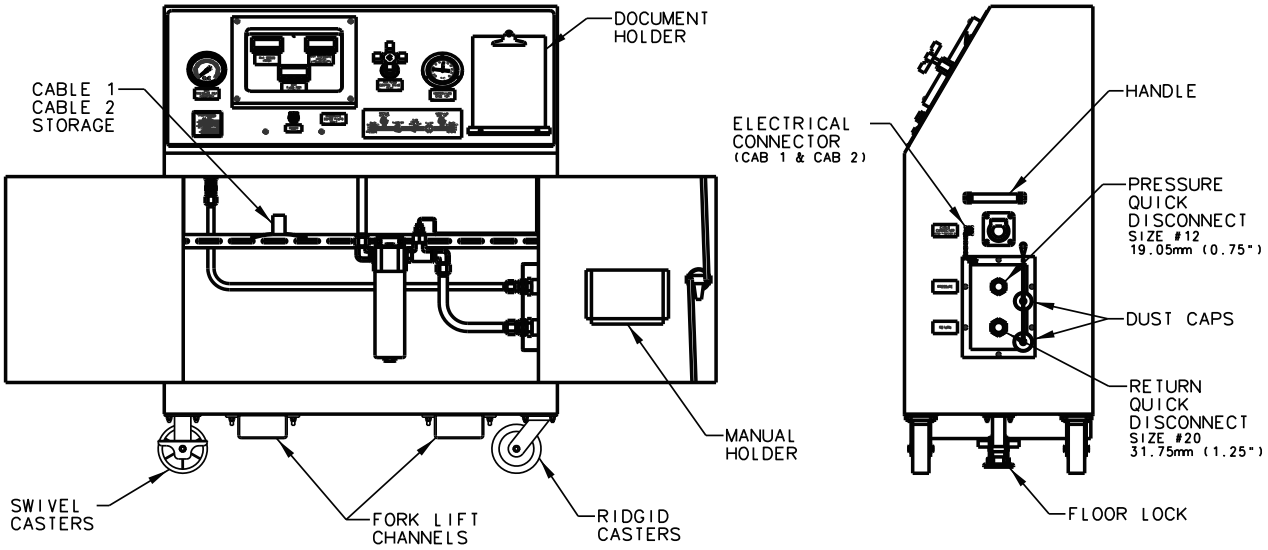
RAT Speed Readout ..... Displays RAT speed (rpm) during test. (Inactive for A330, A340 Series)

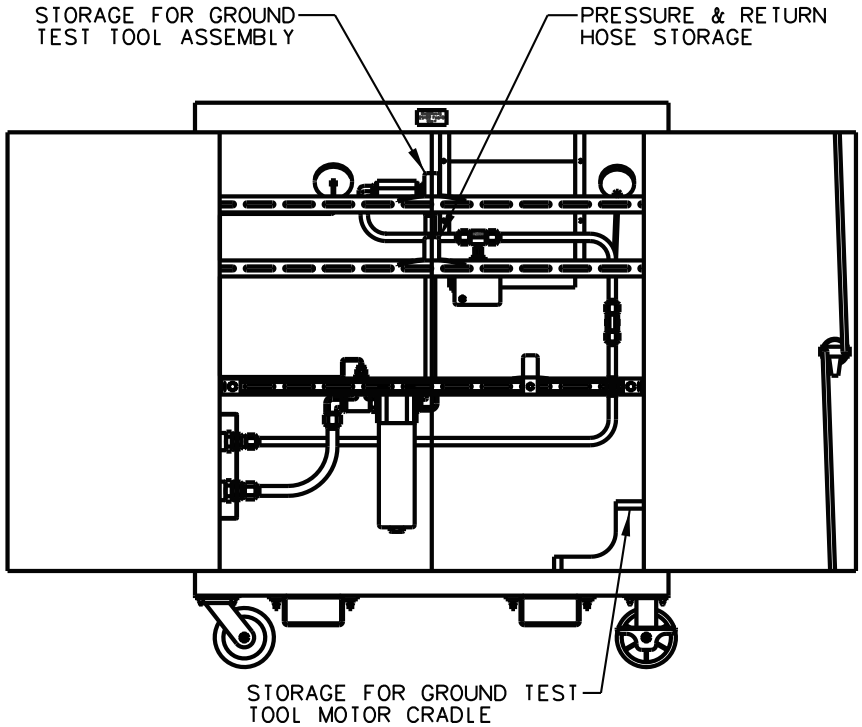
FM1 - RAT Flow Readout: ..... Displays RAT hydraulic (lpm) during test

RAT Pressure Readout ..... Displays RAT pressure (psig) during test. (Inactive for A330, A340 Series)

FCV1 - RAT Flow Control Valve ..... Controls RAT flow during test

TG1 – Temperature Gauge ..... Displays the fluid temperature in the system on an analog gauge. A warning indicator preset to 140º F (60º C) warns of high operating temperature





REAR VIEW

5.5 DATA/POWER CABLES

1. Cable 1 – A330, A340
2. Cable 2 – A319, A320, A321

Cable - 1

Cable - 2

5.6 OPERATION OF THE RAT TEST UNIT

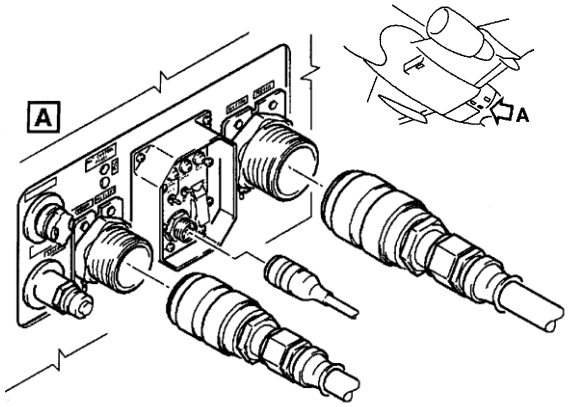
(For All Aircraft)

1. The RAT test unit is to be used in accordance with the aircraft maintenance manual (AMM) of aircraft being tested.
2. Operator must be familiar with this manual and be properly trained prior to starting the RAT Test Unit.
3. Remove pressure and return hose from inside the unit. Reference ***5.4 - Location & Layout of Features*** for location.
4. Connect the Pressure and Return hoses to the cart via the quick disconnects.

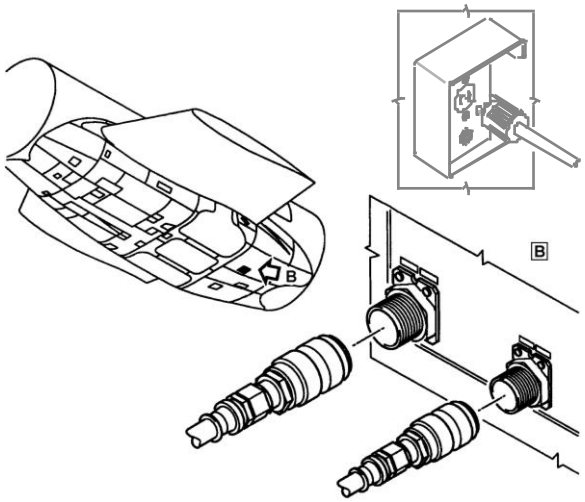
WARNING!

Both hoses must be securely attached to the aircraft to prevent injury.

5. Connect the Pressure and Return hoses to the aircraft hydraulic service panel via the quick disconnects. Reference Figure**,**



Blue Hydraulic Ground Service Panel



Green Hydraulic Ground Service Panel

(Aircraft connection will differ per aircraft.)

WARNING!

Both hoses must be securely attached to the aircraft to prevent injury.

6. Determine the correct cable for the particular aircraft being tested. Connect the cable to the aircraft per the AMM.
7. Turn RAT Test Unit power switch to “On”. Power “On” light will be illuminated. The digital display readouts will also be illuminated.

NOTE: If cable 1 for the A330 and A340 aircraft is used, the RAT Speed Display and RAT Pressure Display will not be illuminated.

CAUTION!

Keep all access doors on the RAT Test Unit closed when operating unit.

8. Determine the correct cable for the particular aircraft being tested. Connect the cable to the aircraft per the AMM.
9. Turn RAT Test Unit power switch to “On”. Power “On” light will be illuminated. The digital display readouts will also be illuminated.
10. Turn RAT Flow Control Valve – FCV1 to match requirements of aircraft maintenance manual for aircraft being tested.
11. The flow through the RAT Test Unit will be adjusted by turning the RAT Flow Control Valve – FCV1 counter-clockwise to increase the flow rate and clockwise to decrease the flow rate. The flow rate will be displayed on the RAT Flow Readout.
12. For A330 and A340 aircraft only, the system pressure will be displayed on an analog pressure gauge - PG1 (Reference 5.3.1 - Control Panel).
13. For A319, A320 and A321 aircraft only, the system pressure will be displayed on the RAT Pressure Readout (Reference 5.3.1 - Control Panel).
14. For A319, A320 and A321 aircraft only, the RAT speed will be displayed on the RAT Speed Readout (Reference 5.3.1 - Control Panel).
15. System temperature will be displayed on an analog temperature gauge - TG1 (Reference 5.3.1 - Control Panel).

5.7 SHUTDOWN OF THE RAT TEST UNIT

1. Open the flow RAT Flow Control Valve – FCV1 by turning counter-clockwise until valve is full open.
2. Depressurize hydraulic systems
3. Turn RAT Test unit power switch to “off”.
4. Disconnect data/power cable and store inside unit.
5. Disconnect pressure and return hoses from the aircraft.
6. Disconnect pressure and return hoses from the RAT Test Unit.
7. Store pressure and return hoses inside the RAT Test Unit.

6.0 PACKAGING AND STORAGE

6.1 PACKAGING REQUIREMENTS

1. Block up the unit on a pallet so the wheels are not touching the pallet or shipping container.
2. Strap unit to pallet or shipping container using the tie down rings located on the sides of the unit.

NOTE: Use at least four (4) straps with a minimum 1,000 lb (340 kg) capacity each.

6.2 HANDLING

The unit is designed to be moved by hand using the handles located on the sides of the unit. The unit can be lifted by means of a fork truck through the fork channels underneath the unit.

Note: Be sure the forks are long enough to reach through the fork channels during lifting.

6.3 PACKAGING PROTECTION

No special packaging material for cushioning or suspension is required.

6.4 LABELING OF PACKAGING

Packaging should be labeled as follows: **DO NOT DROP**
THIS SIDE UP
DO NOT STACK

6.5 STORAGE COMPATIBILITY

No special considerations for short term storage (less than three months). For storage periods greater than three months, drain hydraulic fluid from all hoses and the unit.

6.6 STORAGE ENVIRONMENT

If storing outside, protect unit from freezing water, sand, dirt, and direct sunlight. Cover RAT Test Unit with a suitable, non-abrasive tarp.

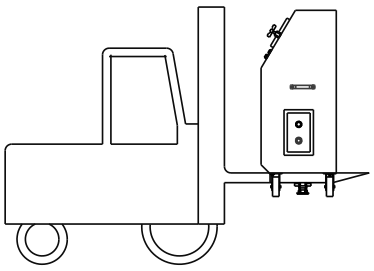
6.7 STORAGE SPACE AND HANDLING FACILITIES

Weight: ..... 600 lbs (272.2 kg)
Dimensions: .... Width: 52 in (132.08 cm)
Height: 57-1/2 in (146.05 cm)
Depth: 23 in (58.42 cm)

7.0 TRANSPORTATION

- Do not stack RAT Test Units.
- The unit can be lifted by means of a fork truck from the front or rear of the RAT Test Unit.

NOTE: Be sure the forks are long enough to reach through the fork channels during lifting.



RAT Test Unit on Forklift

- Weight requirement 600 pounds (272.2 kg)

8.0 TROUBLE SHOOTING

The following is a guide to solutions of common problems and associated with the RAT Test Unit. See related Appendix for Hydraulic and Electrical Schematics.

If the problem is not resolved using the trouble shooting information, call the manufacturer for Technical Assistance (See Section 1.3 Manufacturer).

8.1 HAS NO POWER

POSSIBLE CAUSE	SOLUTION
Power switch is in the “OFF” position.	Turn power switch to “ON” position.
Main fuse is blown.	Check and replace.
No power from aircraft.	Turn power “ON” from aircraft.
Cable is not connected between the RAT Test Unit and the aircraft.	Connect the cable to the RAT Test Unit and aircraft.

8.2 NO FLOW DISPLAYED

POSSIBLE CAUSE	SOLUTION
The RAT Test Unit has no power.	See Section 8.1
Loose cable connection.	Check connection at RAT test unit and aircraft.
RAT Flow Control Valve - FCV1 is closed.	Open FVC1 valve.

8.3 UNIT VALUES OUT OF RANGE

POSSIBLE CAUSE	SOLUTION
Flow meter out of calibration.	Re-calibrate (see Section 10.0).
Digital readouts out of calibration.	Re-calibrate (see Section 10.0).
Pressure gauge - PG1 out of calibration.	Re-calibrate (see Section 10.0)
Temperature gauge - TG1 out of calibration.	Re-calibrate (see Section 10.0)
Contact Airframe Manufacturer.	Follow Airframe manufacturer’s recommendations.

8.4 HYDRAULIC LEAKS

POSSIBLE CAUSE	SOLUTION
Loose flare type fitting.	Tighten until leak stops.
Bad O-rings in quick disconnects.	Replace quick disconnects.
Improper connection of the hoses to the quick disconnects on the RAT Test Unit.	Push on quick disconnects straight without pulling back on release collar.
Damaged fitting or hose.	Replace damaged component.

9.0 MAINTENANCE

9.1 GENERAL

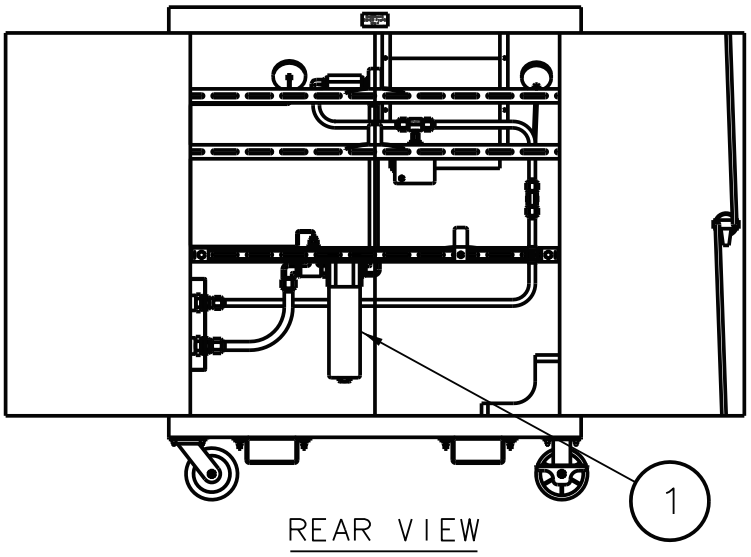
Periodically inspect the RAT Test Unit for loose fasteners, hose fittings, damaged hoses, and worn data/power cables. Make repairs as needed for safe operation.

9.2 FILTER

Replace the filter element every 200 RAT tests depending on condition of fluid or annually, whichever comes first.

Part List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
1	K-1418	Filter, Filter Element and O-ring	1
	HC-1448	Filter Assembly	1

9.3 HYDRAULIC FLUID

Any time an unusual color or smell is noticed with the hydraulic fluid, a sample analysis should be performed to determine the condition of the fluid.

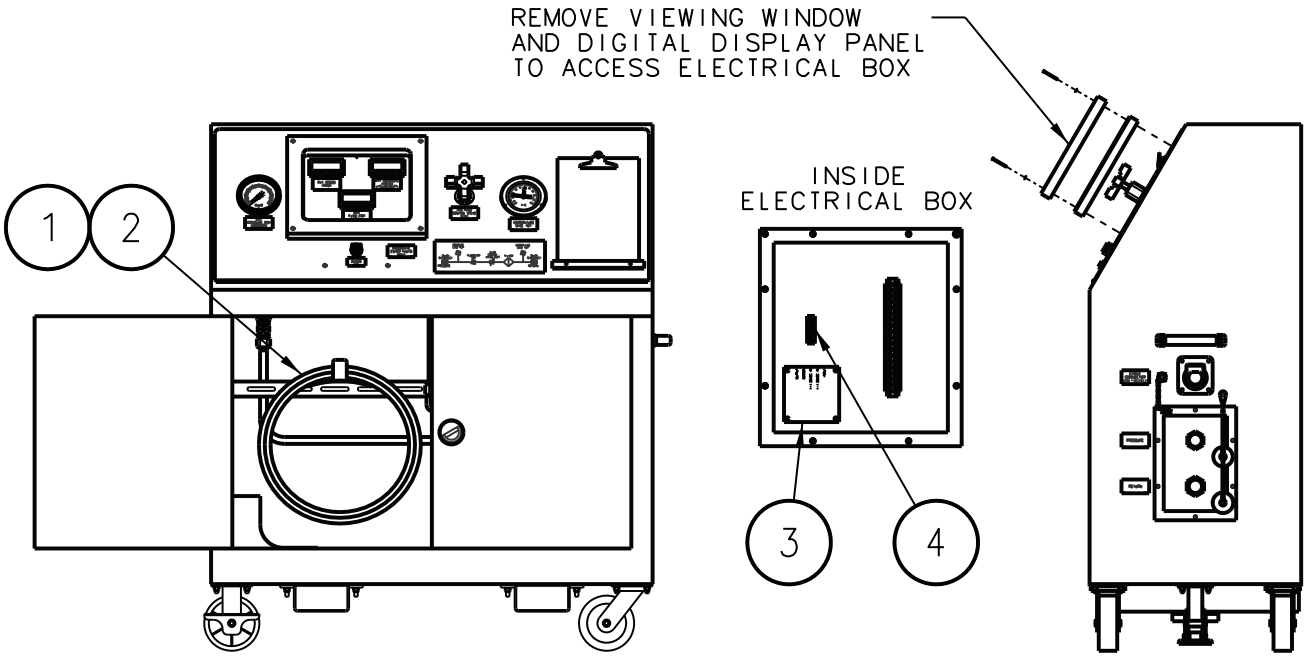
Refer to the manufacturer of the specific fluid for your unit to obtain additional information:

Fluid Type: Aviation Phosphate Ester, Type IV (Skydrol, Hyjet)

9.4 ELECTRICAL COMPONENTS

Part List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

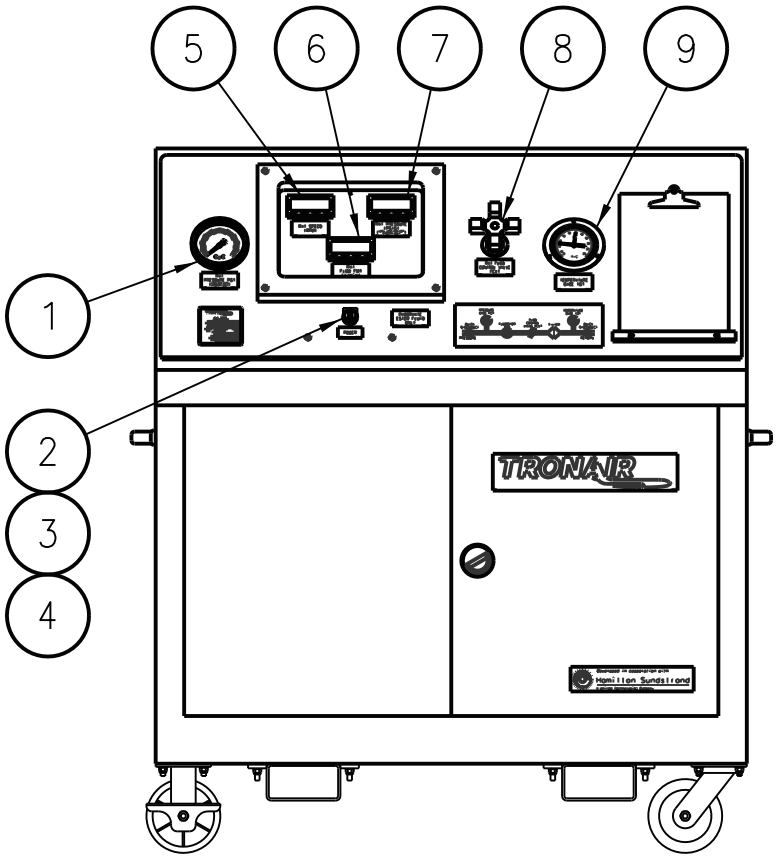


Item	Part Number	Description	Qty
1	EC-1680	Cable One Assembly (A330, A340)	1
2	EC-1706	Cable Two Assembly (A319, A320, A321)	1
3	EC-1741	Conditioning Circuit Board	1
4	EC-1726-06	Fuse, Class CC, 600 V ¾ A	1

9.5 CONTROL PANEL

Part List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

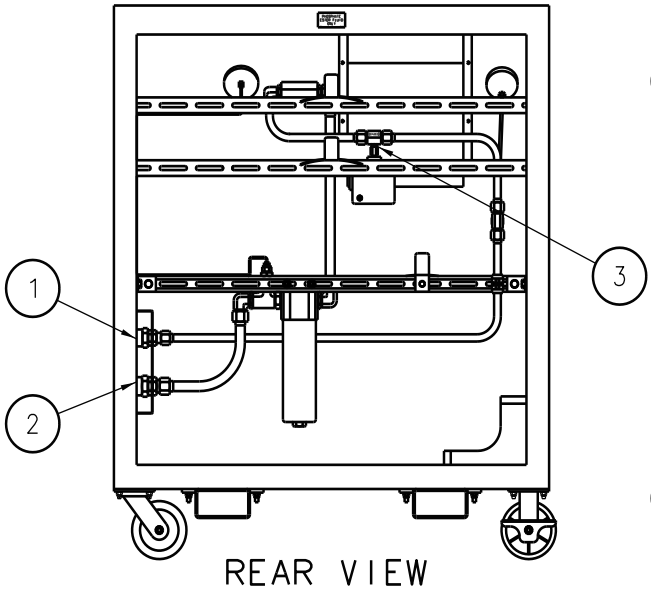


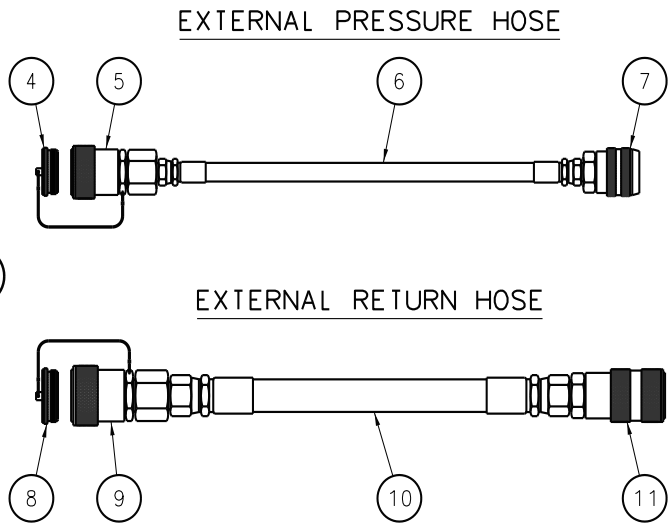
Item	Part Number	Description	Qty
1	HC-1399	5000 psi Pressure Gauge	1
2	EC-1681	Two Position Maintained Switch	1
3	EC-1684-03	IEC Pilot Light Contact Block	1
4	EC-1583	IEC Contact	2
5	SRP-1002	Speed Display Digital Meter	1
6	Z-8218	Flow Display Digital Meter (Must be calibrated with Flow Meter)	1
7	SRP-1003	Pressure Display Digital Meter	1
8	HC-1972-02	Needle Valve	1
9	HC-2268-02	Temperature Gauge	1

9.6 HYDRAULIC COMPONENTS

Part List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



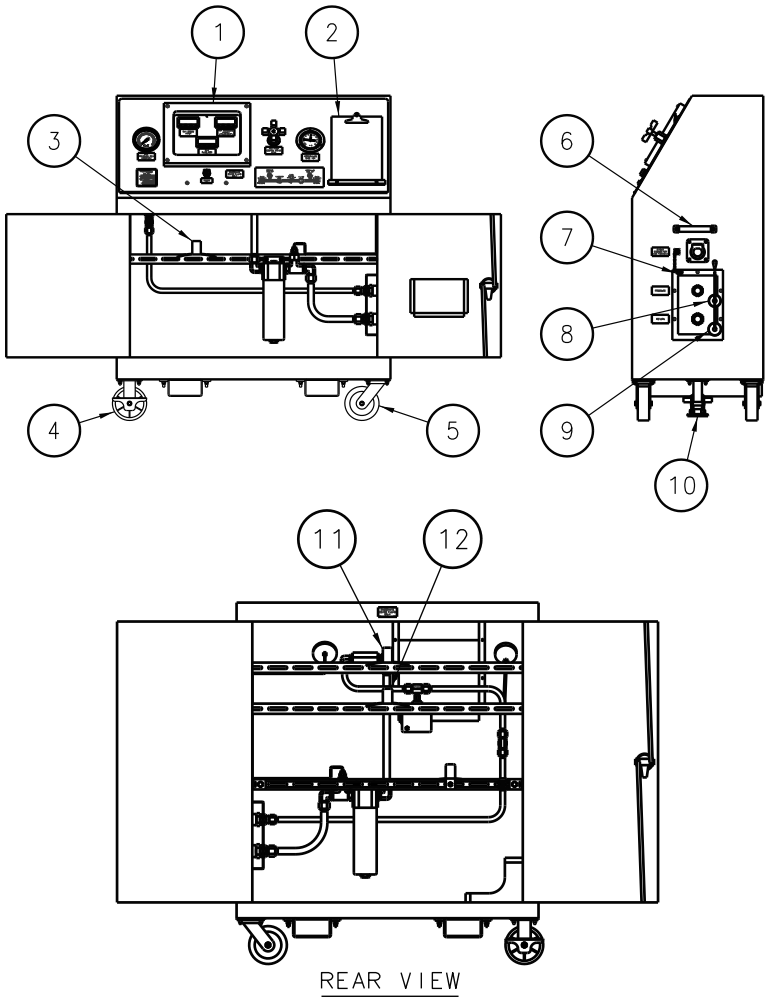


Item	Part Number	Description	Qty
1	N-2581-1212	Nipple, Quick Disconnect (Pressure)	1
2	N-2581-1616	Nipple, Quick Disconnect (Return)	1
3	Z-8218	Flow Meter Assembly (Must be calibrated with Flow Meter)	1
4	N-2474-04	Plug, Quick Disconnect (Pressure, Aircraft end)	1
5	N-2479	Quick Disconnect (Pressure, Aircraft end)	1
6	TF-1040-01*240	Assembly, Hose (Pressure)	1
7	N-2580-1212	Quick Disconnect (Pressure, Test Unit end)	1
8	N-2474-05	Plug, Quick Disconnect (Return, Aircraft end)	1
9	N-2480	Quick Disconnect (Return, Aircraft end)	1
10	TF-1041-03*240	Assembly, Hose (Return)	1
11	N-2580-1616	Quick Disconnect, (Return, Test Unit end)	1

9.7 MECHANICAL COMPONENTS

Part List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Item	Part Number	Description	Qty
1	J-3315	Viewing Window Glass	1
2	H-2582	Clipboard	1
3	S-1797	Hose/Cable Hanger	1
4	U-1056	Rigid Caster	2
5	U-1057	Swivel Caster	2
6	H-1780	Handle	2
7	EC-1701	Receptacle Cap	1
8	Z-5385	Pressure Dust Cap	1
9	Z-5384	Return Dust Cap	1
10	H-1175	Floor Lock	1
11	S-1797	Hose/Cable Hanger	1
12	S-1797	Hose/Cable Hanger	1

10.0 CALIBRATION OF INSTRUMENTATION

All gauges on the RAT test unit can either be returned to the manufacturer for calibration or certified on the unit if the proper calibration equipment is available. Tronair recommends calibration of instrumentation at yearly intervals, but actual calibration dates may be based upon frequency of use and the end users quality system. See ***11.2 - Recommended Spare Part*** List for recommended test cable. For information on returning gauges for calibration, Reference ***10.1 - Source of Calibration***.

10.1 SOURCE OF CALIBRATION

TRONAIR, Inc.
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.tronair.com

10.2 RAT FLOWMETER (FMI)

The RAT flowmeter assembly (Z-8218, Reference *Figure 9.6 - Hydraulic Components*) must be calibrated in conjunction with the RAT flow display digital meter for accurate calibration. (EC-1737, Reference ***Figure 9.5 - Control Panel***)

10.2.1 Self-Calibration

A flow calibration unit can be attached to the RAT test unit to calibrate the flowmeter without removal of the equipment from the unit. Follow the necessary steps listed below:

a. Attach **Flow Calibration Unit Output** to the RAT test unit **Pressure** hose.
b. Reference ***5.4 - Location & Layout of Features***.
b. Attach **Return Flow to the Calibration Unit** to the RAT test unit **Return** hose.
a. Reference ***5.4 - Location & Layout of Features***.
c. Open the RAT flow control valve (FC1) fully open (counter-clockwise). Reference ***5.3.1 - Control Panel***).
d. Provide +28 V DC to data/power connector. EC-1777 Test Cable recommended. Reference ***10.2.1 - Electrical Connector***.
e. PIN D = +28 V DC
f. PIN E = 28 V DC Return
g. e. Calibration physical properties of fluid to be: 12.5 centistroke (67.8 SUS @ 100º F /37.8º C)

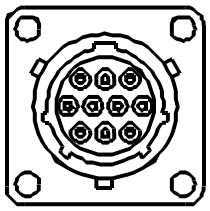


FIGURE 10.2.1
Electrical Connector

The Flow Values Must Be:

RAT FLOWMETER DIGITAL DISPLAY (liter/minute)	**MINIMUM ACCEPTABLE** (liter/minute)	**MAXIMUM ACCEPTABLE** (liter/minute)	**FLOW CALIBRATION UNIT** (liter/minute)
0.0	0.00	0.00	
20.0	19.90	20.10	
30.0	29.85	30.15	
40.0	39.80	40.20	
50.0	49.75	50.25	
60.0	59.70	60.30	
70.0	69.65	70.35	
80.0	79.60	80.40	
90.0	89.55	90.45	
100.0	99.50	100.50	
114.0	113.43	114.57	

10.3 RAT PRESSURE GAUGE

10.3.1 Self -Calibration

An accurate 0-6V DC power supply is required for calibration of the RAT pressure gauge without removal of the equipment from the unit. Follow the necessary steps listed below:

a. Provide +28V DC to data/power connector. EC-1777 Test Cable recommended.
   Reference ***5.3.1 - Control Panel*** and ***10.2.1 - Electrical Connector***.
   PIN J & PIN K = JUMPED TOGETHER
   PIN D = +28V DC
   PIN E = 28V DC RETURN
b. Attach 0-6V DC power supply to the data/power connector.
   Reference ***5.3.1 - Control Panel*** and ***10.2.1 - Electrical Connector***.
   PIN G = +0-6V DC
   PIN H = DC RETURN

The Pressure Readings Must Be:

INPUT VOLTAGE (volt DC)	MINIMUM ACCEPTABLE (psig)	MAXIMUM ACCEPTABLE (psig)	RAT PRESSURE DISPLAY (psig)
1.00 ± .01	-4	4	
2.00 ±.01	721	729	
3.00 ± .01	1443	1457	
4.00 ± .01	2164	2186	
5.00 ± .01	2886	2915	
6.00 ± .01	3616	3634	

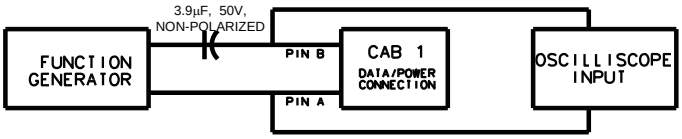
10.4 RAT SPEED DISPLAY

The RAT speed display digital meter EC-1704 (Reference ***Figure 9.5 - Control Panel***) must be calibrated in conjunction with the speed display conditioning board (Reference ***Figure 9.5 - Control Panel***) for accurate calibration.

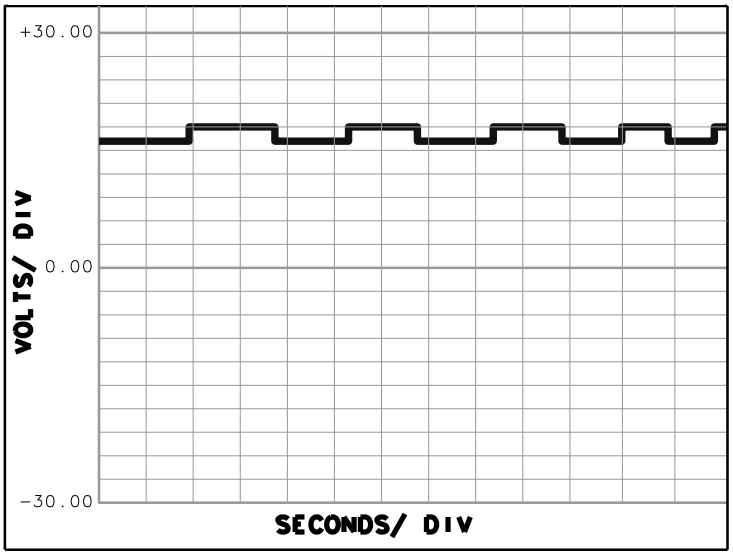
10.4.1 Self-Calibration

A frequency generator, an oscilloscope and a 3.9µF, 50V non-polarized capacitor are required for calibration of the RAT speed display. See ***10.4.1*** for correct wiring. Follow the necessary steps listed below.

a. Provide +28V DC to CAB1 data/power connector. EC-1777 Test Cable recommended.
   Reference ***5.3.1 - Control Panel*** and ***10.2.1 - Electrical Connector***.
   PIN J & PIN K = JUMPED TOGETHER
   PIN D = +28V DC
   PIN E = 28V DC RETURN
b. Attach output of the frequency generator to CAB1 data/power connector.
   Reference ***5.3.1 - Control Panel*** and ***10.2.1 - Electrical Connector***.
   PIN A =SIGNAL RETURN
   PIN B = + SIGNAL
c. The waveform must be:
   DC VALUE: +15V DC ±1V DC (supplied by conditioning board)
   AC VALUE: Square wave, peak-to-peak value: 0.5V ±0.1V
   FREQUENCY: 0-1800 HERTZ (cycles per second)
   Reference ***10.4.1.c - Frequency Generator Output Chart***.



Wiring



Frequency Generator Output Chart

10.4.1 Self-Calibration *(continued)*

The Speed Values Must Be:

INPUT FREQUENCY (hertz)	MINIMUM ACCEPTABLE (rpm)	MAXIMUM ACCEPTABLE (rpm)	RAT SPEED DISPLAY (rpm)
0	0	0	
200 ± 1	663	670	
400 ± 1	1327	1340	
600 ± 2	1990	2010	
800 ± 2	2653	2680	
1000 ± 3	3317	3350	
1200 ± 3	3980	4020	
1400 ± 4	4643	4690	
1600 ± 4	5307	5360	
1800 ± 5	5970	6030	

10.5 ANALOG PRESSURE GAUGE (PG1)

10.5.1 Self-Calibration

An accurate pressure calibration gage is required for calibration of the analog pressure gauge (PG1). Follow the necessary steps listed below.

a. Remove the pressure hose from the back connection of the analog pressure gauge pg 1. Reference ***9.6 - Hydraulic Components***.
b. Connect pressure calibration gage to back connection of analog pressure gauge pg 1.

The Pressure Values Must Be:

ANALOG PRESSURE DISPLAY (psig)	MINIMUM ACCEPTABLE (psig)	MAXIMUM ACCEPTABLE (psig)	GAUGE MOVEMENT (direction)	PRESSURE CALIBRATION GAGE (psig)
0	-50	0	Rising	
1000	990	1050	Rising	
2000	1950	2050	Rising	
3000	2950	3050	Rising	
4000	3950	4050	Rising	
5000	4950	5050	Falling	
4000	3950	4050	Falling	
3000	2950	3050	Falling	
2000	1950	2050	Falling	
1000	950	1050	Falling	
0	-50	50	Falling	

10.6 ANALOG TEMPERATURE GAUGE (TG1)

10.6.1 Self-Calibration

An accurate temperature calibration gage is required for calibration of the analog temperature gauge (TG1). Follow the necessary steps listed below.

a. Remove the temperature bulb from the tee fitting located on the side of the filter.
b. Connect temperature calibration gage to bulb of analog temperature gauge.

The Temperature Value Must Be:

ANALOG TEMPERATURE DISPLAY (EF)	MINIMUM ACCEPTABLE (EF)	MAXIMUM ACCEPTABLE (EF)	TEMPERATURE CALIBRATION GAGE (EF)
140	139	141	

11.0 PROVISION OF SPARES

11.1 SOURCE OF SPARE PARTS

TRONAIR, Inc.
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.tronair.com

11.2 RECOMMENDED SPARE PART LIST

Part Number	Description	Qty-on-Hand
K-1418	Filter Element	1
EC-1726-06	Power Input Fuse	1
EC-1777	Test Cable	1
H-2590	Protective Cover	1

12.0 IN SERVICE SUPPORT

Contact Tronair, Inc. for technical services and information. Reference ***1.3 - Manufacturer***.

13.0 GUARANTEES/LIMITATION OF LIABILITY

Tronair products are warranted to be free of manufacturing or material defects for a period of one year after shipment to the original customer. This is solely limited to the repair or replacement of defective components. This warranty does not cover the following items:

a) Parts required for normal maintenance
b) Parts covered by a component manufacturers warranty
c) Replacement parts have a 90-day warranty from date of shipment

If you have a problem that may require service, contact Tronair immediately. Do not attempt to repair or disassemble a product without first contacting Tronair, any action may affect warranty coverage. When you contact Tronair be prepared to provide the following information:

a) Product Model Number
b) Product Serial Number
c) Description of the problem

If warranty coverage is approved, either replacement parts will be sent or the product will have to be returned to Tronair for repairs. If the product is to be returned, a Return Material Authorization (RMA) number will be issued for reference purposes on any shipping documents. Failure to obtain a RMA in advance of returning an item will result in a service fee. A decision on the extent of warranty coverage on returned products is reserved pending inspection at Tronair. Any shipments to Tronair must be shipped freight prepaid. Freight costs on shipments to customers will be paid by Tronair on any warranty claims only. Any unauthorized modification of the Tronair products or use of the Tronair products in violation of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied.

The obligations of Tronair expressly stated herein are in lieu of all other warranties or conditions expressed or implied. **Any unauthorized modification of the Tronair products or use of the Tronair products in violations of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately *void any warranty, express or implied* and Tronair *disclaims any and all liability for injury (WITHOUT LIMITATION and including DEATH), loss or damage arising from or relating to such misuse*.**

14.0 APPENDICES

APPENDIX I	Hydraulic Schematic, INS-1659
APPENDIX II	Electrical Schematic, INS-1658
APPENDIX III	Wiring Diagram, EC-1680 Cable 1 Assembly Diagram, EC-1706 Cable 2 Assembly Diagram
APPENDIX IV	Safety Data Sheet (MSDS)
APPENDIX V	Certification of Cleanliness
APPENDIX VI	Declaration of Conformity
APPENDIX VII	Hamilton Sundstrand Bulletin 1024 Operation & Maintenance Manual

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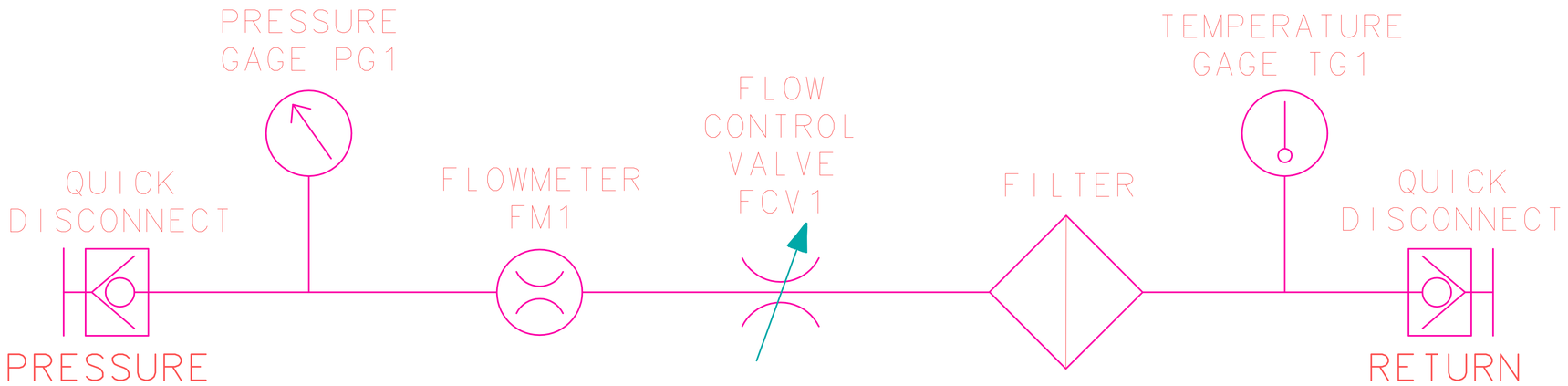
APPENDIX I

Hydraulic Schematic
INS-1659

LET	REVISION	ECN	DWN	CHK	DATE
-	ORIGINAL RELEASE	11440	-	-	04-01-01



MAKE FROM: N / A

MATERIAL: N / A TYPE: N / A

FINISH: N / A

REFERENCE: N / A

SCALE: N.S.R. DO NOT SCALE DRAWING

SIZE B

BREAK ALL SHARP EDGES AND CORNERS

TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMAL	.X	± .100
	.XX	± .030
	.XXX	± .010
FRACTION	X/XX	± 1/16
ANGLES: ± 1/2 DEGREE		

( ) INDICATES REFERENCE DIMENSIONS

TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT

DWN BY MAH | CKD BY MAB | 04-04-01

SCHEMATIC, HYDRAULIC

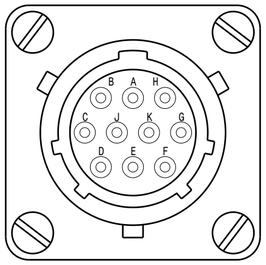
13 INS-1659 REV -

APPENDIX II

Electrical Schematic
INS-1658

LET	REVISION	ECN	DWN	CHK	DATE
-	ORIGINAL RELEASE	11754	-	-	08-06-01
A	ADDED WIRE COLORS	11817	WCG	MAB	02-06-02
B	B1 WAS (2) B2 ADDED GROUND B3 WAS 0.5	17269	JMB	PEH	10-19-09
C	UPDATED LINEAR LINK FOR "LA" VERSION	19025	JMB	PEH	06-26-13
D	REMOVE CIRCUIT DETAILS. NEW BLACK BOX	19660	KAK	PEH	01-21-15

SPEED CONDITIONING CIRCUIT



CABLE CONNECTOR

(CABLE 1 AND CABLE 2)

MAKE FROM: N / A		BREAK ALL SHARP EDGES AND CORNERS	TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT
MATERIAL: N / A	TYPE: N / A	TOLERANCES UNLESS OTHERWISE SPECIFIED DECIMAL .X ± .100 .XX ± .030 .XXX ± .010 FRACTION X/XX ± 1/16 ANGLES: ± 1/2 DEGREE	DWN BY MAH · CKD BY MAB · 08-06-01
FINISH: N / A		< > INDICATES CRITICAL DIMENSIONS ( ) INDICATES REFERENCE DIMENSIONS	SCHEMATIC, ELECTRICAL
REFERENCE: N / A	SIZE C		13 · INS-1658 · REV D
SCALE: N.S.R.	DO NOT SCALE DRAWING		

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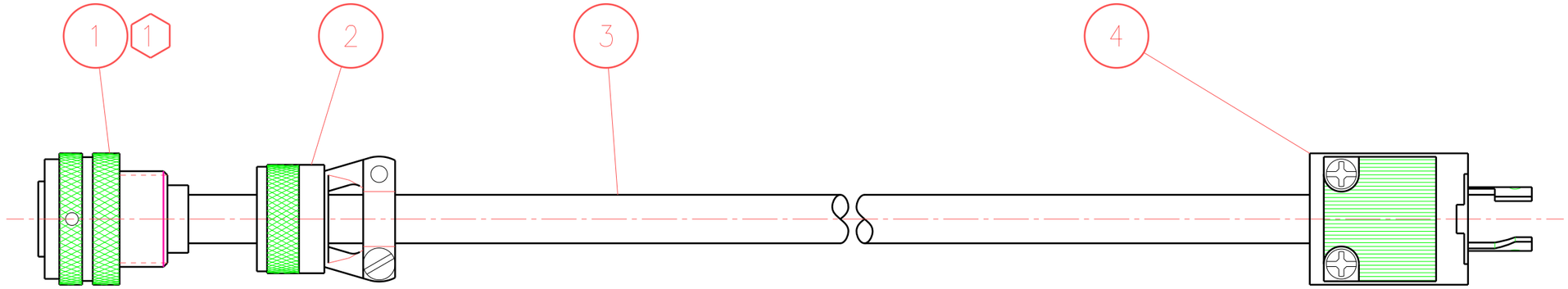
APPENDIX III

Wiring Diagram
EC-1680
Cable 1 Assembly Diagram
EC-1706
Cable 1 Assembly Diagram

LET	REVISION	ECN	DWN	CHK	DATE
-	ORIGINAL RELEASE	11440	-	-	06-12-01



INSTRUCTIONS:

1. STRIP 1/4" OF INSULATION OFF THE END OF EACH WIRE.
2. CRIMP WIRES TO CONTACTOR PINS INCLUDED WITH ITEM 1 USING CRIMPING TOOLS T-218 & T-219.
3. INSERT ALL CONTACTOR PINS INCLUDED WITH ITEM 1.
4. THIS END IS NOT CONNECTED. TRIM OFF WIRE.
5. BLACK WIRE CONNECTS TO BRASS TERMINAL ON PLUG EC-1702

ITEM	PART NUMBER	DESCRIPTION	QTY.
4	EC-1702	PLUG, 2 POLE TWIST-LOCK	1
3	EC-1170-06*600	CABLE, ELECTRICAL 18/3 AWG X 600 LG	1
2	EC-1700	CLAMP, STRAIGHT CABLE	1
1	EC-1698	CONNECTOR, INSULATED MALE CABLE	1

BILL OF MATERIALS

MAKE FROM: SEE B.O.M.

MATERIAL: N / A TYPE:

FINISH: MILL

REFERENCE: N / A

SIZE: B

SCALE: FULL DO NOT SCALE DRAWING

BREAK ALL SHARP EDGES AND CORNERS

TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMAL	.X	± .100
	.XX	± .030
	.XXX	± .010
FRACTION	X/XX	± 1/16
ANGLES:	±	1/2 DEGREE

< > INDICATES CRITICAL DIMENSIONS

( ) INDICATES REFERENCE DIMENSIONS

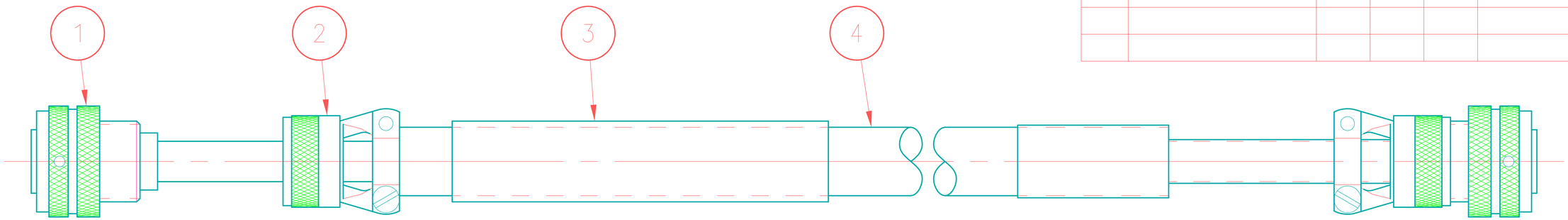
TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT

DWN BY MAH | CKD BY MAB | 06-12-01

ASSEMBLY, CABLE 1

13 EC-1680 REV -

LET	REVISION	ECN	DWN	CHK	DATE
-	ORIGINAL RELEASE	11440	-	-	06-13-01



INSTRUCTIONS:

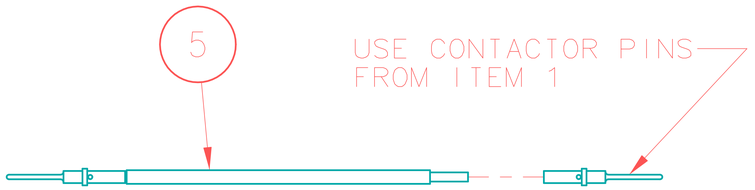
1 STRIP $2\frac{3}{4}$" OF THE JACKET OFF EACH END OF ITEM 4 TO EXPOSE WIRES.

2 STRIP $\frac{1}{4}$" OF INSULATION OFF THE END OF EACH WIRE.

3 CRIMP WIRES TO CONTACTOR PINS INCLUDED WITH ITEM 1 USING CRIMPING TOOLS T-218 & T219.

4 ITEMS 2 AND 3 ARE TO BE LOOSE ON ITEM 4 BEFORE INSERTING CONTACTOR PINS INTO ITEM 1.

5 RED AND ORANGE/BLACK WIRES ARE NOT USED. TRIM THEM OFF.



JUMPER

WIRING DIAGRAM

ITEM	PART NUMBER	DESCRIPTION	QTY.
5	EC-1568-01*02.0	WIRE, ELECTRICAL 18 AWG BLACK X 2 LG	2
4	EC-1743-05*300	CABLE, MULTI-CONDUCTOR, 18 AWG	1
3	EC-1057-01*03.5	TBG, HEAT SHRINK-BLACK X $3\frac{1}{2}$ LONG	2
2	EC-1700	CLAMP, STRAIGHT CABLE	2
1	EC-1698	CONNECTOR, INSULATED MALE CABLE	2

BILL OF MATERIALS

MAKE FROM: SEE B.O.M.

MATERIAL: N / A TYPE: N / A

FINISH: MILL

REFERENCE: N / A

SCALE: FULL DO NOT SCALE DRAWING

SIZE B

BREAK ALL SHARP EDGES AND CORNERS
TOLERANCES UNLESS OTHERWISE SPECIFIED

DECIMAL	.X	± .100
	.XX	± .030
	.XXX	± .010
FRACTION	X/XX	± 1/16

ANGLES: ± 1/2 DEGREE

< > INDICATES CRITICAL DIMENSIONS

( ) INDICATES REFERENCE DIMENSIONS

TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT

DWN BY MAH | CKD BY MAB | 06-13-01

ASSEMBLY, CABLE 2

13 EC-1706 REV -

TRONAIR®

APPENDIX IV

Safety Data Sheet (SDS)
Hydraulic Fluid

Skydrol® LD4 Fire Resistant Hydraulic Fluid

Version	Revision Date:	SDS Number:	Date of last issue: 06/02/2015
2.2	08/09/2016	150000093409	Date of first issue: 10/24/2013

SDSUS / PRD / 0001

SECTION 1. IDENTIFICATION

Product name : Skydrol® LD4 Fire Resistant Hydraulic Fluid

Product code : P3410201

Manufacturer or supplier's details

Company name of supplier : Eastman Chemical Company

Address : 200 South Wilcox Drive
Kingsport TN 37660-5280

Telephone : (423) 229-2000

Emergency telephone number : CHEMTREC: +1-800-424-9300, +1-703-527-3887 CCN7321
For emergency transportation information, in the United States: call CHEMTREC at 800-424-9300 or call 423-229-2000.

Recommended use of the chemical and restrictions on use

Recommended use : Hydraulic fluids

Restrictions on use : None known.

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Skin irritation : Category 2

Carcinogenicity : Category 2

GHS label elements

Hazard pictograms :

Signal word : Warning

Hazard statements : H315 Causes skin irritation.
H351 Suspected of causing cancer.

Precautionary statements : **Prevention:**
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response:
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P362 Take off contaminated clothing and wash before reuse.
Storage:
P405 Store locked up.
Disposal:
P501 Dispose of contents/ container to an approved waste disposal plant.

Other hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Components

Chemical name	CAS-No.	Concentration (% w/w)
Tributyl phosphate	126-73-8	55 - 65
Dibutylphenylphosphate	2528-36-1	20 - 30
Butyl diphenyl phosphate	2752-95-6	5 - 10
7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester	62256-00-2	< 10
butylated hydroxytoluene	128-37-0	1

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
If breathing is difficult, give oxygen.
Consult a physician if necessary.

In case of skin contact : Wash off immediately with plenty of water for at least 15 minutes.
Get medical attention if symptoms occur.
Wash contaminated clothing before reuse.

In case of eye contact : In case of contact, immediately flush eyes with plenty of water for at least 15 minutes.
Get medical attention if symptoms occur.

If swallowed : Call a physician or poison control centre immediately.
Do not induce vomiting without medical advice.
Rinse mouth.
Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed : Causes skin irritation.
Suspected of causing cancer.

Notes to physician	:	Treat symptomatically.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Water spray Carbon dioxide (CO2) Dry chemical Foam
Unsuitable extinguishing media	:	Do not use a solid water stream as it may scatter and spread fire.
Hazardous combustion products	:	carbon dioxide, carbon monoxide oxides of phosphorus
Further information	:	Use a water spray to cool fully closed containers. Do not allow run-off from fire fighting to enter drains or water courses.
Special protective equipment for firefighters	:	Wear an approved positive pressure self-contained breathing apparatus in addition to standard fire fighting gear.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Ventilate the area. Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray. Avoid contact with skin and eyes. Material can create slippery conditions. Wear appropriate personal protective equipment. Local authorities should be advised if significant spillages cannot be contained.
Environmental precautions	:	Clear up spills immediately and dispose of waste safely. Avoid release to the environment. Collect spillage.
Methods and materials for containment and cleaning up	:	Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a container for disposal according to local / national regulations (see section 13).

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	Do not breathe vapours or spray mist. Handle product only in closed system or provide appropriate exhaust ventilation at machinery. In case of insufficient ventilation, wear suitable respiratory equipment. Wear appropriate personal protective equipment. Avoid contact with skin, eyes and clothing.

Wash thoroughly after handling.
Wash contaminated clothing before reuse.
Drain or remove substance from equipment prior to break-in or maintenance.
Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage : Store locked up.
Keep container tightly closed in a dry and well-ventilated place.
Keep in a cool place away from oxidizing agents.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
Tributyl phosphate	126-73-8	TWA (Inhalable fraction and vapor)	5 mg/m3	ACGIH
		TWA	0.2 ppm 2.5 mg/m3	NIOSH REL
		TWA	5 mg/m3	OSHA Z-1
		TWA	0.2 ppm 2.5 mg/m3	OSHA P0
Dibutylphenylphosphate	2528-36-1	TWA	0.3 ppm	ACGIH
butylated hydroxytoluene	128-37-0	TWA (Inhalable fraction and vapor)	2 mg/m3	ACGIH
		TWA	10 mg/m3	NIOSH REL
		TWA	10 mg/m3	OSHA P0

Hazardous components without workplace control parameters

Components	CAS-No.
7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester	62256-00-2

Engineering measures : Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal protective equipment

Respiratory protection : Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary.

Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable.
If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.

Hand protection

Remarks	:	Wear suitable gloves. Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion, and the contact time. After contamination with product change the gloves immediately and dispose of them according to relevant national and local regulations.
Eye protection	:	Wear safety glasses with side shields (or goggles).
Skin and body protection	:	Wear suitable protective clothing.
Protective measures	:	Ensure that eye flushing systems and safety showers are located close to the working place.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	oily
Colour	:	purple
Odour	:	odourless
pH	:	No data available
Melting point/range	:	< -62 °C
Flash point	:	160 °C Method: Cleveland open cup
Vapour pressure	:	0.27 hPa (25 °C)
Relative density	:	1.004 - 1.014 (25 °C)
Viscosity		
Viscosity, kinematic	:	< 2000 mm2/s (-54 °C)
		11.15 mm2/s (38 °C)
		3.83 mm2/s (99 °C)

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	None reasonably foreseeable.
Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	None known.
Conditions to avoid	:	None known.
Incompatible materials	:	Strong oxidizing agents
Hazardous decomposition products	:	Emits acrid smoke and fumes when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute toxicity

Not classified based on available information.

Product:

Acute oral toxicity	:	LD50 (Rat, Male and Female): 2,100 mg/kg
Acute inhalation toxicity	:	LC50 (Rat, male): > 5.8 mg/l Exposure time: 4 h Test atmosphere: dust/mist Assessment: The substance or mixture has no acute inhalation toxicity Remarks: (highest concentration tested)
Acute dermal toxicity	:	LD50 Dermal (Rabbit, Male and Female): > 3,160 mg/kg Assessment: The substance or mixture has no acute dermal toxicity

Components:

Tributyl phosphate:

Acute oral toxicity	:	LD50 Oral (Rat, Male and Female): 1,553 mg/kg Method: Acute Oral Toxicity Assessment: Harmful if swallowed.
Acute inhalation toxicity	:	LC50 (Rat, Male and Female): > 4.242 mg/l Exposure time: 4 h Test atmosphere: dust/mist Assessment: The substance or mixture has no acute inhalation toxicity
Acute dermal toxicity	:	LD50 Dermal (Rabbit, Male and Female): > 3,100 mg/kg Assessment: The substance or mixture has no acute dermal toxicity

Dibutylphenylphosphate:

Acute oral toxicity	:	Acute toxicity estimate (Rat, Male and Female): 2,400 - 3,000 mg/kg Assessment: Not classified
Acute inhalation toxicity	:	LCLo (Rat, Male and Female): > 5 mg/l Exposure time: 4 h Test atmosphere: dust/mist LC50 (Rat, Male and Female): > 5 mg/l Exposure time: 4 h Test atmosphere: dust/mist Assessment: Not classified
Acute dermal toxicity	:	LD50 Dermal (Rabbit, Male and Female): > 5,000 mg/kg Assessment: Not classified

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Acute oral toxicity	:	LD50 Oral (Rat, Male and Female): 4,470 mg/kg
Acute dermal toxicity	:	LD50 Dermal (Rabbit, Male and Female): > 7,940 mg/kg

butylated hydroxytoluene:

Acute oral toxicity	:	LD50 Oral (Rat): > 6,000 mg/kg
Acute dermal toxicity	:	LD50 Dermal (Guinea pig): > 20,000 mg/kg

Skin corrosion/irritation

Causes skin irritation.

Product:

Species: Rabbit
Exposure time: 24 h
Assessment: irritating
Result: moderate irritation

Components:

Tributyl phosphate:
Species: Rabbit
Exposure time: 4 h
Assessment: Causes skin irritation.
Method: Acute Dermal Irritation / Corrosion
Result: irritating

Dibutylphenylphosphate:
Species: Rabbit
Assessment: Not classified

Species: Humans
Exposure time: 24 h
Assessment: Not classified

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:
Species: Rabbit

Exposure time: 24 h
Assessment: Not classified as hazardous.
Result: slight to moderate irritation

butylated hydroxytoluene:
Species: Rabbit
Exposure time: 24 h
Result: very slight

Serious eye damage/eye irritation

Not classified based on available information.

Product:

Species: Rabbit
Result: slight
Exposure time: 24 h
Assessment: Not classified

Components:

Tributyl phosphate:
Species: Rabbit
Result: slight irritation
Exposure time: 24 h
Assessment: Not classified
Method: Acute Eye Irritation / Corrosion

Dibutylphenylphosphate:
Species: Rabbit
Result: slight
Assessment: Not classified

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:
Species: Rabbit
Result: slight irritation
Exposure time: 24 h
Assessment: Not classified

butylated hydroxytoluene:
Species: Rabbit
Result: none

Respiratory or skin sensitisation

Skin sensitisation: Not classified based on available information.
Respiratory sensitisation: Not classified based on available information.

Product:

Test Type: Human experience
Assessment: Not classified
Method: Human Repeat Insult Patch Test
Result: Does not cause skin sensitisation.

Components:

Tributyl phosphate:
Test Type: Skin Sensitization
Species: Guinea pig
Assessment: Not classified
Result: Does not cause skin sensitisation.

Test Type: Skin Sensitization
Species: Humans
Assessment: Not classified
Result: Does not cause skin sensitisation.

Dibutylphenylphosphate:
Test Type: Human experience
Species: Humans
Assessment: Not classified
Result: non-sensitizing

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:
Test Type: Skin Sensitization
Species: Guinea pig
Result: May cause sensitisation by skin contact.

butylated hydroxytoluene:
Test Type: Skin sensitisation
Species: Guinea pig
Result: non-sensitizing

Germ cell mutagenicity

Not classified based on available information.

Product:

Genotoxicity in vitro	:	Test Type: Salmonella typhimurium assay (Ames test) Metabolic activation: +/- activation Result: negative
	:	Test Type: Mutagenicity - Mammalian Metabolic activation: +/- activation Method: In vitro Mammalian Chromosome Aberration Test Result: negative

Components:

Tributyl phosphate:

Genotoxicity in vitro	:	Test Type: Mutagenicity - Bacterial Metabolic activation: +/- activation Method: Bacterial Reverse Mutation Assay Result: negative
	:	Test Type: Mutagenicity - Mammalian Metabolic activation: +/- activation Method: In vitro Mammalian Chromosome Aberration Test Result: equivocal
Genotoxicity in vivo	:	Species: Rat (Male and Female)

Application Route: oral: gavage
Method: Mammalian Bone Marrow Chromosome Aberration Test
Result: negative

Dibutylphenylphosphate:

Genotoxicity in vitro : Test Type: Salmonella typhimurium assay (Ames test)
Metabolic activation: +/- activation
Method: Bacterial Reverse Mutation Assay
Result: negative

: Test Type: Mutagenicity - Mammalian
Metabolic activation: +/- activation
Method: In vitro Mammalian Cell Gene Mutation Test
Result: negative

: Test Type: Chromosome aberration test in vitro
Metabolic activation: +/- activation
Method: In vitro Mammalian Chromosome Aberration Test
Result: negative

: Test Type: Mutagenicity - Mammalian
Metabolic activation: - activation
Method: Genetic Toxicology: DNA Damage and Repair, Unscheduled DNA Synthesis in Mammalian Cells In Vitro
Result: negative

Genotoxicity in vivo : Species: Rat (Male and Female)
Application Route: intraperitoneal injection
Result: negative

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Genotoxicity in vitro : Test Type: Salmonella typhimurium assay (Ames test)
Metabolic activation: +/- activation
Method: Bacterial Reverse Mutation Assay
Result: negative

: Test Type: Mutagenicity - Mammalian
Metabolic activation: +/- activation
Method: In vitro Mammalian Chromosome Aberration Test
Result: equivocal

: Test Type: Mutagenicity - Mammalian
Metabolic activation: +/- activation
Method: In vitro Mammalian Cell Gene Mutation Test
Result: negative

Genotoxicity in vivo : Species: Rat (Male and Female)
Application Route: intraperitoneal injection
Method: Mammalian Bone Marrow Chromosome Aberration Test
Result: equivocal

Carcinogenicity

Suspected of causing cancer.

Components:

Tributyl phosphate:
Species: Rat, (Male and Female)
Application Route: Ingestion
Method: EPA OTS 798.3300
Remarks: Limited evidence of a carcinogenic effect.
May cause cancer.

IARC	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
NTP	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

Reproductive toxicity

Not classified based on available information.

Components:

Tributyl phosphate:

Effects on fertility	:	Test Type: Two Generation Reproductive Toxicity Study Species: Rat Sex: Male and Female Application Route: Ingestion NOAEL: 225 mg/kg, Method: EPA OTS 798.4900
Effects on foetal development	:	Species: Rat Application Route: Oral 750 mg/kg Method: EPA OTS 798.4900

Dibutylphenylphosphate:

Effects on fertility	:	Species: Rat Sex: Male and Female Application Route: Ingestion NOAEL: 5 mg/l, F1: Lowest observed adverse effect level 50 mg/kg, F2: Lowest observed adverse effect level 50 mg/kg, Method: EPA OTS 798.4900
Effects on foetal development	:	Species: Rat Application Route: oral (gavage)

300 mg/kg
3 mg/kg

STOT - single exposure

Not classified based on available information.

Components:

Tributyl phosphate:
Assessment: Based on available data, the classification criteria are not met.

Dibutylphenylphosphate:
Assessment: Not classified

STOT - repeated exposure

Not classified based on available information.

Components:

Tributyl phosphate:
Assessment: Based on available data, the classification criteria are not met.

Dibutylphenylphosphate:
Exposure routes: inhalation (dust/mist/fume)
Target Organs: Respiratory system
Assessment: Not classified

Repeated dose toxicity

Product:

Species: Rat, Male and Female
NOAEL: 40 mg/m3
Application Route: Inhalation
Exposure time: 28 days
Target Organs: Blood, Respiratory system
Remarks: Irritating to eyes and respiratory system.

Components:

Tributyl phosphate:
Species: Mouse, Male and Female
NOEL: 75 mg/kg
Application Route: in feed
Exposure time: 90 days

Dibutylphenylphosphate:
Species: Rat, Male and Female
NOAEL: 5 mg/kg
LOAEL: 50 mg/kg
Application Route: oral (feed)
Exposure time: 90 days

Species: Rat, Male and Female
NOAEC: 5 mg/m3
Application Route: Inhalation

Exposure time: 90 days

Species: Rabbit, Male and Female
No observed adverse effect level: 100 mg/kg bw/day
Application Route: Dermal Study
Exposure time: 21 d

Aspiration toxicity

Not classified based on available information.

Product:

Not applicable

Components:

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:
Not applicable

Experience with human exposure

Product:

Inhalation	:	Remarks: None known.
Skin contact	:	Remarks: Causes skin irritation.
Eye contact	:	Remarks: Contact with the eyes may be very painful but does not cause damage.
Ingestion	:	Remarks: None known.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): 5.2 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	LC50 (Daphnia magna (Water flea)): 5.8 mg/l Exposure time: 48 h
Toxicity to algae	:	EC50 (Selenastrum capricornutum (green algae)): 8.2 mg/l Exposure time: 96 h

Components:

Tributyl phosphate:

Toxicity to fish	:	LC50 (Oncorhynchus mykiss (rainbow trout)): 4.2 mg/l Exposure time: 96 h
Toxicity to daphnia and other	:	EC50 (Daphnia magna (Water flea)): 1.8 mg/l

aquatic invertebrates		Exposure time: 48 h
Toxicity to algae	:	EC50 (Desmodesmus subspicatus (Scenedesmus subspicatus)): 1.1 mg/l Exposure time: 72 h
Toxicity to fish (Chronic toxicity)	:	NOEC (Oncorhynchus mykiss (rainbow trout)): 0.82 mg/l Exposure time: 95 d 1.7 mg/l
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOEC (Daphnia magna (Water flea)): 1.3 mg/l Exposure time: 21 d

Dibutylphenylphosphate:

Toxicity to fish	:	LL50 (Cyprinus carpio (Carp)): 1.8 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia magna (Water flea)): 1.4 mg/l Exposure time: 48 h
Toxicity to algae	:	EL50 (Selenastrum capricornutum (green algae)): 9.6 mg/l Exposure time: 72 h Method: EL50 method of the water accommodated fraction (W.A.F.) NOELR (Selenastrum capricornutum (green algae)): 3.5 mg/l Exposure time: 72 h Method: EL50 method of the water accommodated fraction (W.A.F.)
Toxicity to fish (Chronic toxicity)	:	NOEC (Oncorhynchus mykiss (rainbow trout)): > 0.11 mg/l Exposure time: 60 d
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	NOEC (Daphnia magna (Water flea)): 0.106 mg/l Exposure time: 21 d

butylated hydroxytoluene:

Toxicity to fish	:	LC50 (Fish): 0.199 mg/l Exposure time: 96 h
Toxicity to daphnia and other aquatic invertebrates	:	EC50 (Daphnia (water flea)): 0.48 mg/l Exposure time: 48 h
Toxicity to algae	:	EC50 (Chlorella pyrenoidosa (aglae)): 0.758 mg/l Exposure time: 96 h

Persistence and degradability

Product:

Biochemical Oxygen Demand (BOD)	:	Remarks: not determined

Chemical Oxygen Demand (COD) : Remarks: not determined

Components:

Tributyl phosphate:

Biodegradability : Result: Readily biodegradable

Dibutylphenylphosphate:

Biodegradability : Method: Ready Biodegradability: Manometric Respirometry Test
Remarks: Readily biodegradable

Method: Ready Biodegradability: Modified MITI Test (I)
Remarks: Not readily biodegradable.

7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 2-ethylhexyl ester:

Biodegradability : Concentration: 100 mg/l
Method: Ready Biodegradability: Modified MITI Test (I)
Remarks: Readily biodegradable

Bioaccumulative potential

Components:

Tributyl phosphate:

Bioaccumulation : Species: Cyprinus carpio (Carp)
Bioconcentration factor (BCF): 20
Exposure time: 56 d
Method: OECD Test Guideline 305

Bioconcentration factor (BCF): 35
Exposure time: 38 d

Partition coefficient: n-octanol/water : Pow: 10,100

Dibutylphenylphosphate:

Bioaccumulation : Species: Cyprinus carpio (Carp)
Bioconcentration factor (BCF): 35
Method: OECD Test Guideline 305

Mobility in soil

No data available

Other adverse effects

Product:

Ozone-Depletion Potential :

Regulation: 40 CFR Protection of Environment; Part 82 Protection of Stratospheric Ozone - CAA Section 602 Class I Substances

Remarks: This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : This product meets the criteria for a synthetic used oil under the U.S. EPA Standards for the Management of Used Oil (40 CFR 279). Those standards govern recycling and disposal in lieu of 40 CFR 260 -272 of the Federal hazardous waste program in states that have adopted these used oil regulations. Consult your attorney or appropriate regulatory official to be sure these standards have been adopted in your state. Recycle or burn in accordance with the applicable standards. Dispose of in accordance with local regulations.

SECTION 14. TRANSPORT INFORMATION

International Regulation

IATA-DGR
Not regulated as a dangerous good

IMDG-Code
Not regulated as a dangerous good

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable for product as supplied.

National Regulations

49 CFR
Not regulated as a dangerous good

SECTION 15. REGULATORY INFORMATION

EPCRA - Emergency Planning and Community Right-to-Know Act

SARA 311/312 Hazards : Acute Health Hazard
Chronic Health Hazard

SARA 302 : No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Clean Air Act

This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).
This product does not contain any hazardous air pollutants (HAP), as defined by the U.S. Clean Air Act Section 112 (40 CFR 61).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC's (40 CFR 60.489).

Clean Water Act

This product does not contain any Hazardous Substances listed under the U.S. CleanWater Act, Section 311, Table 116.4A.
This product does not contain any Hazardous Chemicals listed under the U.S. CleanWater Act, Section 311, Table 117.3.
This product does not contain any toxic pollutants listed under the U.S. Clean Water Act Section 307

The components of this product are reported in the following inventories:

DSL	:	All components of this product are on the Canadian DSL
AICS	:	On the inventory, or in compliance with the inventory
ENCS	:	On the inventory, or in compliance with the inventory
KECI	:	Not listed
PICCS	:	Not listed
IECSC	:	On the inventory, or in compliance with the inventory
TSCA	:	On TSCA Inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16. OTHER INFORMATION

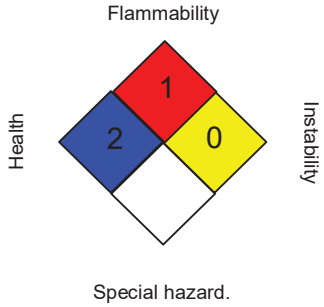
Full text of other abbreviations

AICS - Australian Inventory of Chemical Substances; ASTM - American Society for the Testing of Materials; bw - Body weight; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DOT - Department of Transportation; DSL - Domestic Substances List (Canada); ECx - Concentration associated with x% response; EHS - Extremely Hazardous Substance; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; ERG - Emergency Response Guide; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; HMIS - Hazardous Materials Identification System; IARC - International Agency for Research on Cancer; IATA - International Air Transport

Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; MSHA - Mine Safety and Health Administration; n.o.s. - Not Otherwise Specified; NFPA - National Fire Protection Association; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NTP - National Toxicology Program; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; RCRA - Resource Conservation and Recovery Act; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RQ - Reportable Quantity; SADT - Self-Accelerating Decomposition Temperature; SARA - Superfund Amendments and Reauthorization Act; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative

Further information

NFPA:



HMIS III:

HEALTH	2*
FLAMMABILITY	1
PHYSICAL HAZARD	0

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

Sources of key data used to compile the Safety Data Sheet	:	www.EastmanAviationSolutions.com
Revision Date	:	08/09/2016

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

US / EN

APPENDIX V

Certificate of Cleanliness

TRONAIR®

APPENDIX VI

Declaration of Conformity

DECLARATION of CONFORMITY

MOBILE RAM AIR TURBINE TEST UNIT
13-6606-3600

Relevant Directive:
2006/42/EC

Relevant standards complied with by the machinery:
EN 1915-1:2013
EN 60204-1:2006
ISO 4413:2010
SAE ARP 1247D

Identification of person empowered to sign on behalf of the Manufacturer:

Patrick Finch

Quality Assurance Representative

Tronair, Inc.
1 Air Cargo Pkwy East
Swanton, OH 43558

Phone: (419) 866-6301 | 800-426-6301
Web: www.tronair.com
Email: sales@tronair.com

TRONAIR®

APPENDIX VII

Hamilton Sundstrand
Bulletin 1024
Operation & Maintenance Manual

Hamilton Sundstrand
A United Technologies Company

OPERATION AND MAINTENANCE MANUAL
WITH ILLUSTRATED PARTS LIST

BULLETIN 1024

GROUND TEST TOOL

PART NUMBER

AGE10600 SERIES

Effective June 10, 1999, United Technologies Corporation (UTC) purchased all the stock of Sundstrand Corporation and combined Sundstrand and UTC's Hamilton Standard Division to form Hamilton Sundstrand Corporation.

HAMILTON SUNDSTRAND
OPERATION AND MAINTENANCE MANUAL
PART NUMBER AGE10600 SERIES

TO: Holders of Operation and Maintenance Manual, Bulletin 1024, for Hamilton Sundstrand Ground Test Tool, Part Number AGE10600, Used During Testing of Ram Air Turbine Module, Part Numbers 762973, 764239, 766351, 768084, 770379, and 770952, Used on Airbus Industrie A330/A340 Aircraft and Ram Air Turbine Assembly, Part Numbers 757739, 759998, 761618, 762320, and 766352, Used on A321 Aircraft.

Revision 1, dated June 15, 1999

HIGHLIGHTS

Effective June 10, 1999, United Technologies Corporation (UTC) purchased all the stock of Sundstrand Corporation and combined Sundstrand and UTC's Hamilton Standard Division to form Hamilton Sundstrand Corporation.

Shown below are highlights of the significant changes and the affected pages contained in this revision. Remove the used affected pages and put the new affected pages into the manual as shown on the List of Effective Pages.

We recommend that you put this revision into your manual without delay. Mark the Record of Revisions sheet with the new revision number and date, and write your initials on the Record of Revisions sheet in the appropriate spaces after you have put the revised pages in your manual.

Please call Lynda Shipley, (815) 226-6000, FAX: (815) 966-8525, or write to Hamilton Sundstrand, Technical Publications, Mail Stop 302-9, 4747 Harrison Avenue, P.O. Box 7002, Rockford, IL 61125-7002, if you have any questions about this revision.

Page Number	Description of Change
Introduction, Page 1	Revised to include additional equipment covered by this manual.
4-2, Pages 1 and 2	Revised the numerical index to reflect changes made to the parts list.
4-3, Pages 2 and 3	Revised parts list to add new configuration test tool and associated parts.

SAFETY ADVISORY

This manual has procedures that use chemicals, solvents, paints, and other commercially available materials.

Material safety data sheets [Occupational Safety and Health Act (OSHA) Form 20 or equivalent] from the manufacturers or suppliers of the materials used must be available to the operators. Follow the manufacturer/supplier procedures, warnings, and cautions to use, keep, and discard these materials safely.

WARNING: MAKE SURE YOU FOLLOW ALL OF THE MANUFACTURER OR SUPPLIER INSTRUCTIONS WHEN YOU USE THE MATERIALS SPECIFIED IN THIS MANUAL. FAILURE TO OBEY MANUFACTURER'S OR SUPPLIER'S INSTRUCTIONS CAN CAUSE INJURY OR DISEASE.

The materials used in this manual are given in the INTRODUCTION and at the beginning of each section of this manual.

The WARNINGS in this manual tell you about dangerous materials that can cause injury; they do not replace the manufacturer's instructions.

This Safety Advisory has all the WARNINGS included in this manual.

WARNING: ACETONE IS TOXIC AND FLAMMABLE. DO NOT BREATHE VAPORS. USE IN WELL VENTILATED AREA FREE FROM SPARKS, FLAME, OR HOT SURFACES. WEAR SPLASH GOGGLES, SOLVENT-RESISTANT GLOVES, AND OTHER PROTECTIVE GEAR. IN CASE OF EYE CONTACT, FLUSH WITH WATER AND SEEK MEDICAL ATTENTION. IN CASE OF SKIN CONTACT, WASH WITH SOAP AND WATER.

WARNING: NYLON VARNISH IS TOXIC AND FLAMMABLE. DO NOT BREATHE VAPORS. USE IN WELL VENTILATED AREA FREE FROM SPARKS OR FLAME. IN CASE OF EYE CONTACT, FLUSH WITH WATER AND SEEK MEDICAL ATTENTION. IN CASE OF SKIN CONTACT, WASH WITH SOAP AND WATER.

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SUNDSTRAND CORPORATION

OVERHAUL AND MAINTENANCE MANUAL
PART NUMBER AGE10600

RECORD OF REVISIONS

REV NO.	ISSUE DATE	DATE INSERTED	BY	REV NO.	ISSUE DATE	DATE INSERTED	BY	REV NO.	ISSUE DATE	DATE INSERTED	BY
1	6/15/99	8/10/99	SD								

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LIST OF EFFECTIVE PAGES

Subject	Page	Date	Subject	Page	Date
5-5	1	Oct 1/93			
	2	Oct 1/93			
5-6	1	Oct 1/93			
	2	Oct 1/93			

LIST OF ABBREVIATIONS

Abbreviation	Definition	Abbreviation	Definition
AMM	aircraft maintenance manual		
ASSY	assembly		
EFF	effectivity		
FIG.	figure		
ft	feet		
gpm	gallons per minute		
GTT	ground test tool		
in.	inch(es)		
lb-in.	pound inches		
lpm	liters per minute		
m	meter(s)		
max	maximum		
mm	millimeter(s)		
NO.	number		
N•m	Newton meters		
PN	part number		
psi	pounds per square inch		
RAT	ram air turbine		
REQ	required		
REV	revision		
RF	reference		
TTL	total		
°	degrees		

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TABLE OF CONTENTS

This Table of Contents lists the content of the entire manual. A detailed Table of Contents is provided at the beginning of each chapter.

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INTRODUCTION

1. General

A. This manual provides operation and maintenance procedures for the ground test tool (GTT), part number AGE10600 series. The GTT is manufactured by Hamilton Sundstrand, a United Technologies Company, 4747 Harrison Avenue, P.O. Box 7002, Rockford, IL 61125-7002.

2. Application

A. Equipment covered in this manual applies to the following end items.

End Item/Part Number	Application
Ram Air Turbine Module, Part Numbers 762973, 764239, 766315, 768084, 770379, and 770952	Airbus A330/A340
Ram Air Turbine Assembly, Part Numbers 757739, 759998, 761618, 762320, and 766352	Airbus A321

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CHAPTER 1

TABLE OF CONTENTS - GENERAL INFORMATION AND OPERATING INSTRUCTIONS

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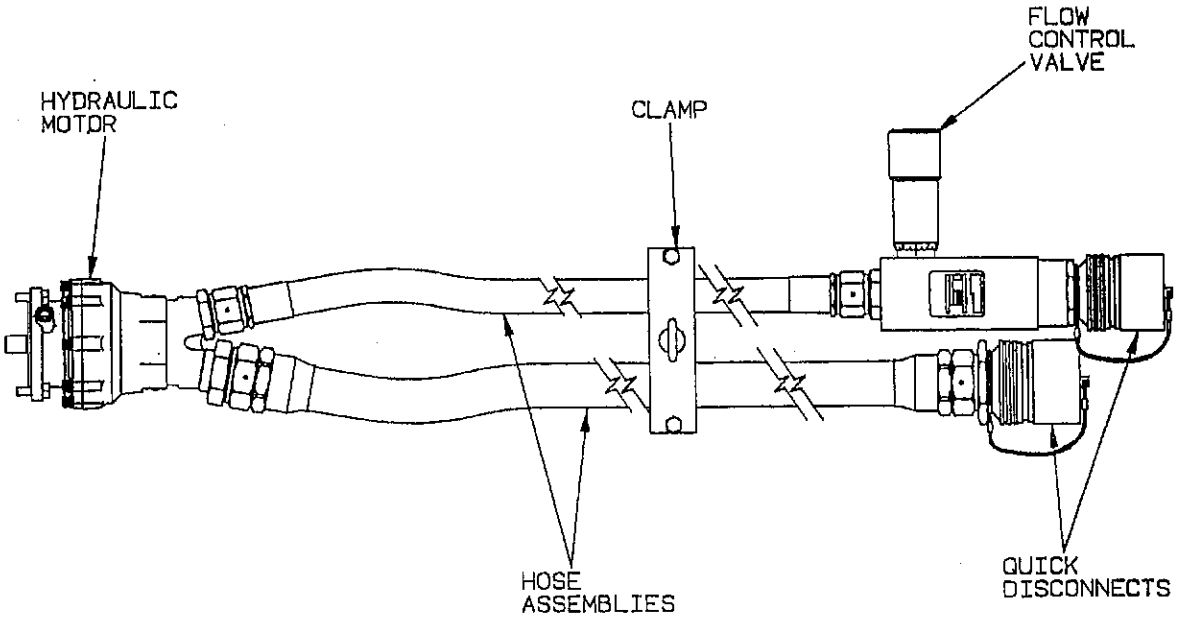
DESCRIPTION

1. General

This section contains a physical and functional description of the ground test tool (GTT). The GTT is used to convert fluid flow from a ground cart direct rotary power to drive the ram air turbine (RAT) systems, part numbers 758546, 759123, and 757739 during ground checkout of the systems.

2. Description

The GTT (refer to Figure 1) is made up of a hydraulic motor, two hydraulic hoses approximately 20 feet (6.1 meters) long, an in-line pressure compensated flow control valve, and quick disconnect fittings which connect the tool to the power supply. A two-piece clamp includes a ring for a supporting hook that is attached to the aircraft to support the weight of the hose.



Ground Test Tool
Figure 1

3. Operation

The GTT is used during the ground checkout of the ram air turbine (RAT) to connect the RAT to a power supply. A flow of 33 gallons per minute (gpm) [125 liters per minute (lpm)] at 2842 pounds per square inch (psi) (196 bars) is controlled by the flow control valve. This flow is sufficient for complete turbine, hydraulic pump, and RAT-hydraulic system ground checkout.

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OPERATION

1. General

This section gives the instructions necessary to use the ground test tool (GTT) during ground checkout of the ram air turbine (RAT)/hydraulic system.

2. Description of the Ground Test Tool Components

A. Hydraulic Motor

The hydraulic motor attaches to the lower gearbox of the strut and turns the turbine during ground checkout of the RAT.

B. Hoses

The hoses provide fluid flow to the GTT hydraulic motor. The quick disconnects attached to the hoses make it easy to attach and remove the hoses from the power supply.

C. Flow Control Valve

The in-line, pressure compensated flow control valve regulates the fluid flow to the hydraulic motor to control the turbine at the required speed for checkout of the system.

3. Setup Procedure

A. Attach the GTT to the power supply cart with quick disconnect coupling halves (200 and 210, Section 4–3, Figure 1).

B. Remove the lower gearbox cover from the RAT [refer to the aircraft maintenance manual (AMM)].

C. Attach the GTT to the lower gearbox with hexagon head screws (20) and flat washers (30) (refer to Figure 1). Torque the screws 86 to 95 pound inches (lb-in.) [9.72 to 10.73 Newton meters (N•m)].

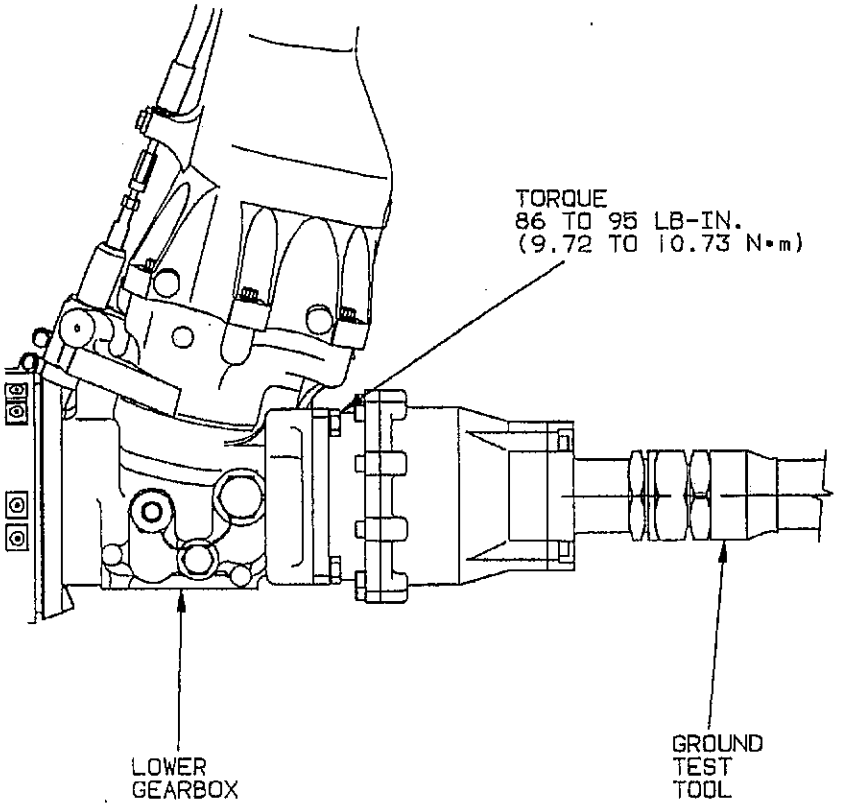
D. Attach eye nut (170, Section 4–3, Figure 1) to the aircraft to support the weight of the hoses (refer to the AMM for the location).

E. Turn on the power supply and adjust flow control valve (110) to supply the required fluid flow.

F. After the ground checkout has been done, close the flow control valve and turn off the power supply.

G. Remove hexagon head screws (20) and flat washers (30) and remove the GTT from the RAT.

H. Attach the lower gearbox cover (refer to the AMM).



A-65155

Installation of Ground Test Tool on Lower Gearbox
Figure 1

SPECIFICATIONS AND CAPABILITIES

1. General

The specifications and capabilities of the ground test tool are given in Table 1.

Part Number	AGE10600
Weight (approximate)	78 lb
Dimensions	
Length	22 ft (6.7 m) approx
Depth	5 in. (127 mm) approx
Spline Data	
Number of Teeth	12
Diametral Pitch	20/40
Pressure Angle	30°
Pitch Diameter	0.600 in. (15.24 mm)
Major Diameter	0.645 to 0.650 in. (16.38 to 16.51 mm)
Flow	33 gpm (125 lpm) at 2842 psi (196 bars) max

Specifications and Capabilities
Table 1

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SHIPPING

1. General

This section contains the instructions necessary to ship the ground test tool (GTT). Refer to Standard Practices Manual, 20-10-00, STORAGE, for general procedures used to ship equipment.

2. Shipping Procedure

A. Put the GTT in a waterproof bag.

B. Seal the open end of the bag.

C. Put the GTT in a corrugated box with packing.

NOTE: Use the original shipping container and packing. If the original shipping container and packing are not available, proceed with the following procedures.

D. Get a shipping container (corrugated box) large enough to hold the GTT surrounded by 4 inches (102 millimeters) of padding on all sides, including the top and bottom of the container.

E. Put 4 inches (102 millimeters) of padding in the bottom of the container.

F. Put the GTT in the container and put padding on all sides of it.

G. Put the packing slip and instructions in the container.

H. Put 4 inches (102 millimeters) of padding on top of the GTT and close the container.

I. Install plastic or metal strips around the container or use heavy tape made for shipping to seal the container.

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STORAGE

1. General

   This section contains the instructions necessary to store the ground test tool (GTT). Refer to Standard Practices Manual, 20-10-00, STORAGE, for general procedures used to store equipment.

2. Temporary Storage (Not to Exceed 6 Months)

   A. Put the GTT in a waterproof bag.

   B. Seal the open end of the bag.

   C. Store away from vibration and shock. Make sure the storage temperature is between -40 and +160 degrees Fahrenheit (-40 and +71 degrees Celsius) with relative humidity of zero to 85 percent.

3. Extended Storage (Not to Exceed Two Years)

   A. Put the GTT in a waterproof bag.

   B. Seal the open end of the bag.

   C. Put the GTT in a corrugated box with packing.

      NOTE: Use the original shipping container and packing. If the original shipping container and packing are not available get a shipping container that is large enough to hold the GTT and the packing.

   D. Close and seal the shipping container.

   E. Keep the GTT where the storage temperature is between -40 and +160 degrees Fahrenheit (-40 and +71 degrees Celsius) and the relative humidity is between zero and 85 percent.

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CHAPTER 2

TABLE OF CONTENTS - MAINTENANCE

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SERVICING

1. General

The ground test tool does not require any special servicing.

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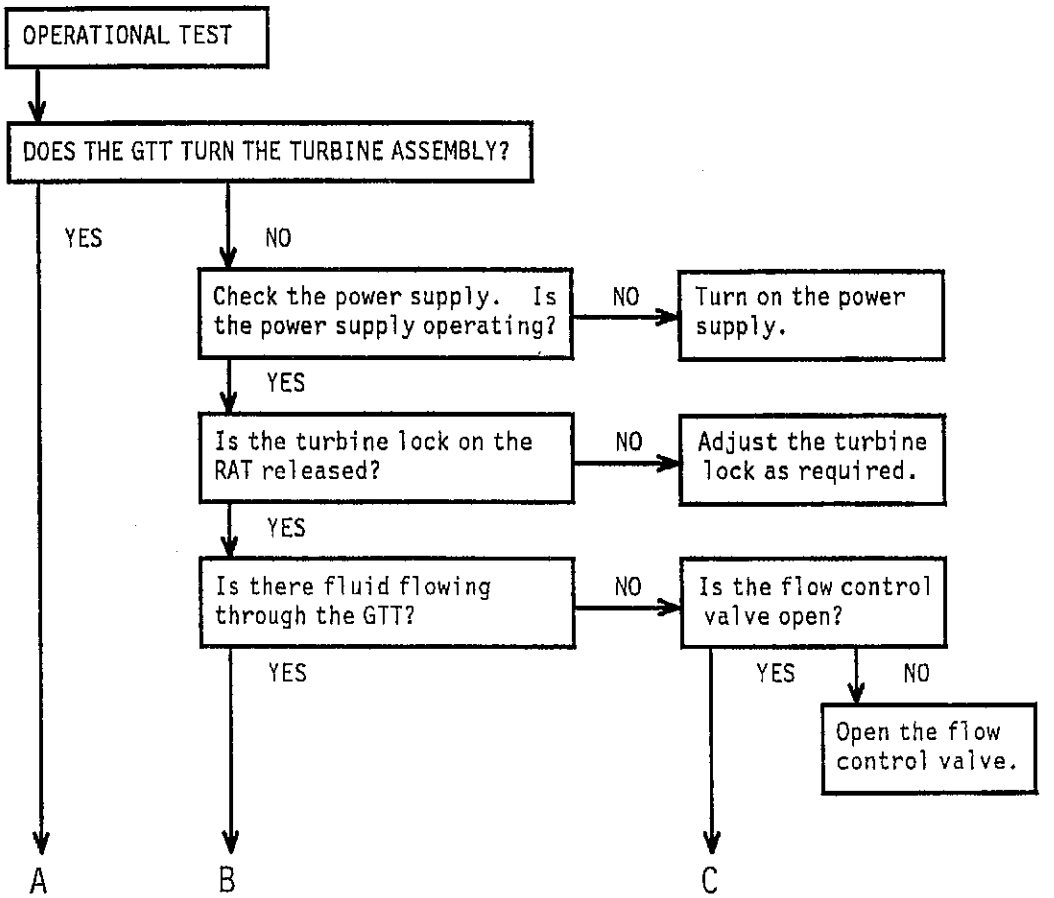
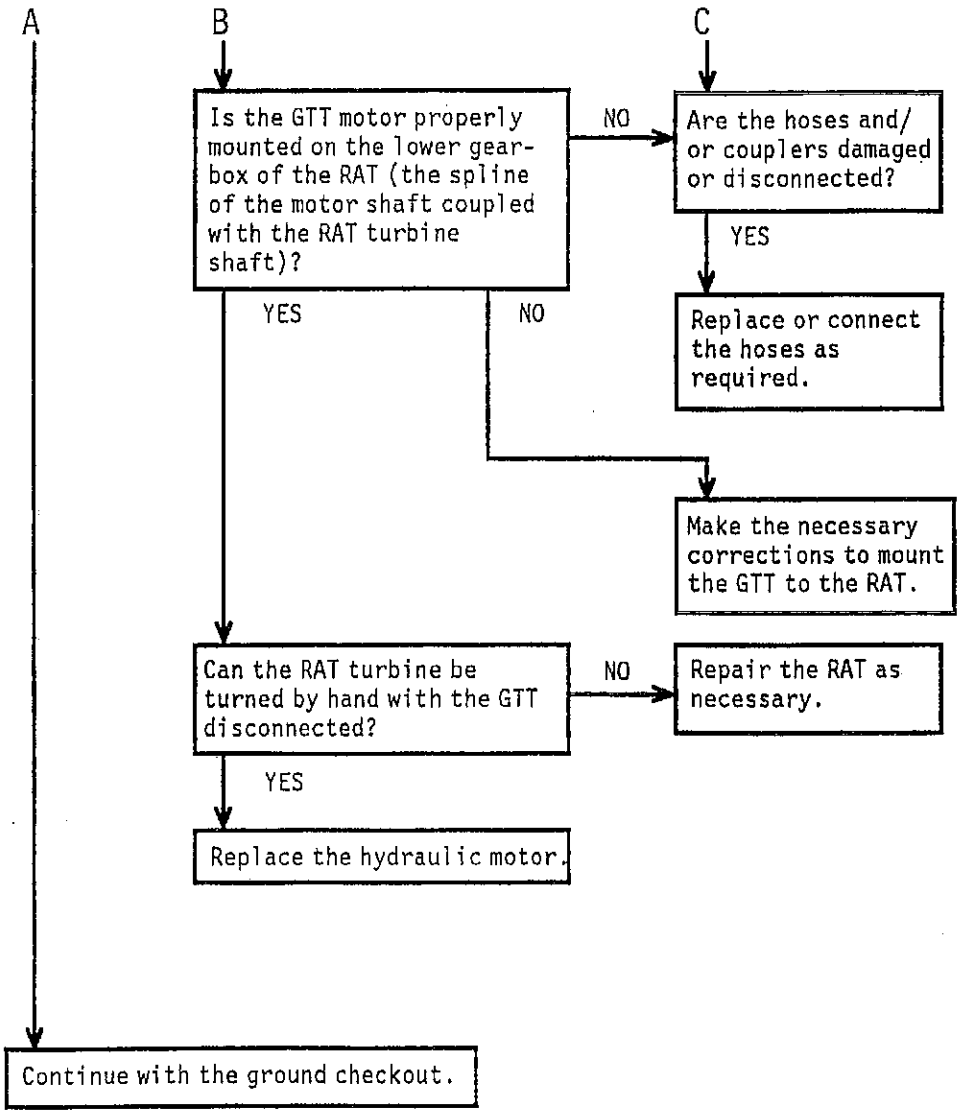
TROUBLESHOOTING

1. General

This section provides the troubleshooting procedures for the ground test tool (GTT) (refer to Figure 1). No special tooling or test equipment is required to troubleshoot the GTT.



Troubleshooting
Figure 1 (Sheet 1 of 2)



Troubleshooting
Figure 1 (Sheet 2 of 2)

REMOVAL/INSTALLATION

1. General

This section contains component removal/installation procedures for the ground test tool (GTT). Item numbers in the procedures and illustrations are the same as those in the ILLUSTRATED PARTS LIST (IPL).

NOTE: Alpha-variant items can replace an item when permitted by the effect code for that item. For example, procedures that apply to item (10) also apply to alpha-variant items (-10A, -10B, and -10C).

The manual contains complete instructions for component replacement. These instructions are only to be used to the extent necessary to correct a fault or incorporate a modification.

An alphabetical index to specific procedures is given in Table 1.

Component	Paragraph
Flow Control Valve	4
Hoses	3
Hydraulic Motor	2
Identification Plate	6
Quick Disconnect Coupling Halves	7
Two-piece Clamp	5

Component Replacement Index
Table 1

2. Removal/Installation of Hydraulic Motor (Refer to Section 4-3, Figure 1)

A. Remove hose assemblies (40 and 50) from reducers (70 and 80).

B. Remove reducers (70 and 80) from hydraulic motor (10).

C. Remove O-rings (60) from reducers (70 and 80). Discard the O-rings.

D. Install O-ring (60) on reducer (70) and install the reducer in the inlet port of hydraulic motor (10). Torque the reducer 150 to 200 pound inches (lb-in.) [17.0 to 22.6 Newton meters (N•m)].

E. Install O-ring (60) on reducer (80) and install the reducer in the outlet port of hydraulic motor (10). Torque the reducer 150 to 200 lb-in. (17.0 to 22.6 N•m).

F. Install hose assembly (40) on reducer (70). Torque the hose assembly fitting 150 to 200 lb-in. (17.0 to 22.6 N•m).

G. Install hose assembly (50) on reducer (80). Torque the hose assembly fitting 150 to 200 lb-in. (17.0 to 22.6 N•m).

3. Removal/Installation of Hose Assemblies (Refer to Section 4-3, Figure 1)

   A. Remove hose assemblies (40 and 50) from reducers (70 and 80).

   B. Remove hose assembly (40) from union (100).

   C. Remove O-rings (60) from reducers (70 and 80). Discard the O-rings.

   D. Remove O-ring (90) from union (100). Discard the O-ring.

   E. Remove quick disconnect coupling half (210) from hose assembly (50).

   F. Remove screws (130) and remove two-piece clamp (120) and associated parts from hose assemblies (40 and 50).

   G. Attach quick disconnect coupling half (210) to hose assembly (50). Torque the quick disconnect 150 to 200 lb-in. (17.0 to 22.6 N•m).

   H. Install hose assembly (50) on reducer (80). Torque the fitting on the hose 150 to 200 lb-in. (17.0 to 22.6 N•m).

   I. Install hose assembly (40) on reducer (70). Torque the fitting on the hose 150 to 200 lb-in. (17.0 to 22.6 N•m).

   J. Install hose assembly (40) on union (100). Torque the fitting on the hose 150 to 200 lb-in. (17.0 to 22.6 N•m).

   K. Attach two-piece clamp (120) and associated parts on hose assemblies (40 and 50) (refer to Figure 1) with screws (130). Torque screws 150 to 180 lb-in. (17.0 to 20.3 N•m).

4. Removal/Installation of Flow Control Valve (Refer to Section 4-3, Figure 1)

   A. Remove quick disconnect coupling half (200) from flow control valve (110).

   B. Remove O-ring (90) from quick disconnect coupling half (200). Discard the O-ring.

   C. Remove hose assembly (40) from union (100).

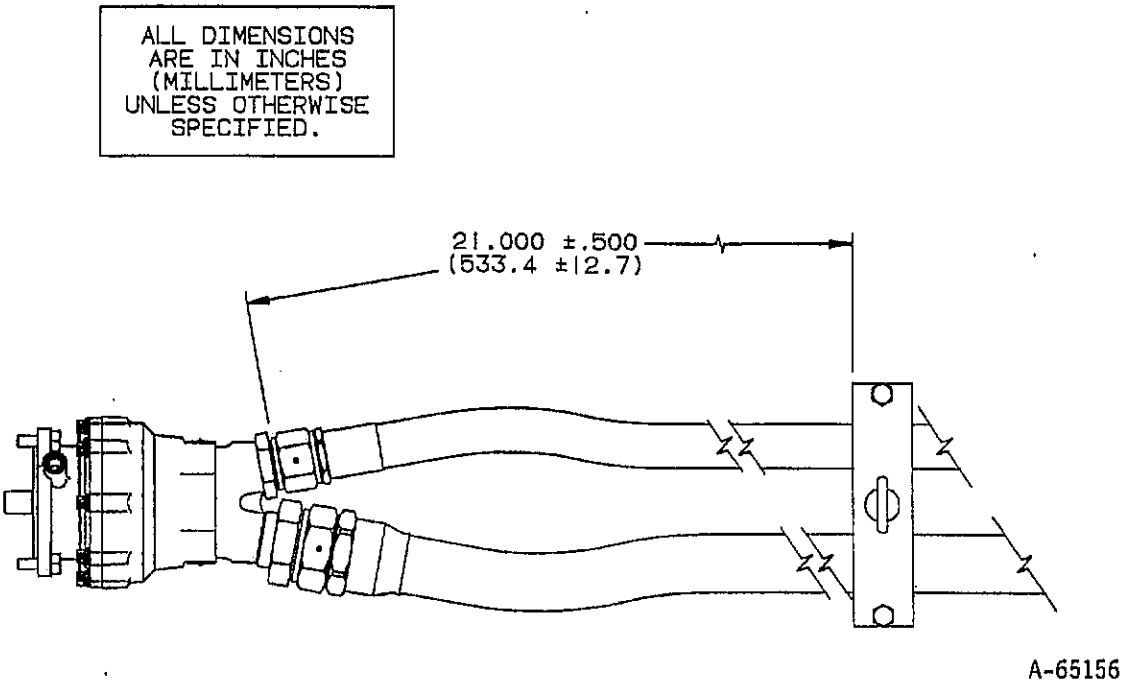
   D. Remove union (100) from flow control valve (110).

   E. Remove O-ring (90) from union (100). Discard the O-ring.

   F. Install O-ring (90) on union (100) and install the union in flow control valve (110). Torque the union 150 to 200 lb-in. (17.0 to 22.6 N•m).

   G. Install hose assembly (40) on union (100). Torque the fitting on the hose 240 to 300 lb-in. (27.1 to 33.9 N•m).

   H. Install O-ring (90) on quick disconnect coupling half (200).



Installation of Two-piece Clamp
Figure 1

I. Install quick disconnect coupling half (200) on flow control valve (110). Torque the quick disconnect 240 to 300 lb-in. (27.1 to 33.9 N·m).

5. Disassembly/Assembly of Two-piece Clamp (Refer to Section 4-3, Figure 1)

A. Remove three screws (130) and three spring lockwashers (180) from one side of two-piece clamp (120). Remove the two-piece clamp and associated parts from hose assemblies (40 and 50).

B. Remove split bushings (150 and 160) from two-piece clamp (120).

C. Remove the remaining two screws (130), associated spring lockwashers (180), and stacking nuts (140) from two-piece clamp (120).

D. Remove eye nut (170), spring lockwasher (180), threaded adapter (190), and stacking nut (140) from two-piece clamp (120).

E. Install stacking nut (140) in threaded adapter (190) and install in two-piece clamp (120).

F. Install spring lockwasher (180) and eye nut (170) on threaded adapter (190) and two-piece clamp (120). Torque the eye nut 150 to 180 lb-in. (17.0 to 20.3 N·m).

G. Install split bushings (150 and 160) on hose assemblies (40 and 50).

H. Install two-piece clamp (120) and associated parts on hose assemblies (40 and 50) over split bushings (150 and 160) (refer to Figure 1).

I. Install screws (130, Section 4-3, Figure 1) and stacking nuts (140) in two-piece clamp (120). Torque five screws (130) 150 to 180 lb-in. (17.0 to 20.3 N•m).

6. Removal/Installation of Identification Plate (Refer to Section 4-3, Figure 1)

A. Write the data from the old identification plate (220) on a new identification plate.

B. Remove identification plate (220) from flow control valve (110).

WARNING: ACETONE IS TOXIC AND FLAMMABLE. DO NOT BREATHE VAPORS. USE IN WELL VENTILATED AREA FREE FROM SPARKS, FLAME, OR HOT SURFACES. WEAR SPLASH GOGGLES, SOLVENT-RESISTANT GLOVES, AND OTHER PROTECTIVE GEAR. IN CASE OF EYE CONTACT, FLUSH WITH WATER AND SEEK MEDICAL ATTENTION. IN CASE OF SKIN CONTACT, WASH WITH SOAP AND WATER.

C. Clean the surface of flow control valve (110) with acetone where identification plate (220) is to be installed.

D. Let the solvent evaporate for a minimum of five minutes after you have cleaned the area.

E. Remove the paper backing from new identification plate (220).

F. Attach identification plate (220) to flow control valve (110). Push down with a hard rubber (or similar) faced roller to remove air pockets from under the identification plate.

G. Clean identification plate (220) surface and the surrounding mounting area with a clean lint-free cloth soaked with acetone. Let the solvent evaporate for a minimum of five minutes after you have cleaned the area.

WARNING: NYLON VARNISH IS TOXIC AND FLAMMABLE. DO NOT BREATHE VAPORS. USE IN WELL VENTILATED AREA FREE FROM SPARKS OR FLAME. IN CASE OF EYE CONTACT, FLUSH WITH WATER AND SEEK MEDICAL ATTENTION. IN CASE OF SKIN CONTACT, WASH WITH SOAP AND WATER.

H. Use a brush to apply a thin coat of nylon varnish to the edges of identification plate (220).

I. Let the nylon varnish cure at a room temperature of 75 ± 5 degrees Fahrenheit (24 ± 3 degrees Celsius) for 72 hours.

7. Removal/Installation of Quick Disconnect Coupling Halves (Refer to Section 4–3, Figure 1)

   A. Remove quick disconnect coupling halves (200 and 210) from flow control valve (110) and hose assembly (50).

   B. Remove O-ring (90) from quick disconnect coupling half (200). Discard the O-ring.

   C. Install O-ring (90) on quick disconnect coupling half (200).

   D. Install quick disconnect coupling half (200) in flow control valve (110). Torque the fitting 240 to 300 lb-in. (27.1 to 33.9 N·m).

   E. Install quick disconnect coupling half (210) in hose assembly (50). Torque the fitting 240 to 300 lb-in. (27.1 to 33.9 N·m).

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REPAIRS

1. General

Repairs to the ground test tool consist of replacement of damaged items (refer to Chapter/Section 2-3).

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CHAPTER 3

TABLE OF CONTENTS - OVERHAUL/MAJOR REPAIR

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OVERHAUL/MAJOR REPAIR

1. General

Overhaul and major repair instructions are not applicable to the ground test tool.

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CHAPTER 4

TABLE OF CONTENTS - ILLUSTRATED PARTS LIST

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INTRODUCTION

1. General

This chapter contains a Numerical Index listing all parts that make up the ground test tool (GTT), and a Detailed Parts List consisting of illustrations and a breakdown of component part numbers and names.

2. Numerical Index

The purpose of the Numerical Index is to enable the user to locate any part in the GTT by part number. The figure, item number, and quantity required are listed with the part number. Parts are listed in alphanumerical order (letters followed by numbers).

3. Detailed Parts List

A. Arrangement of Items

The Detailed Parts List is presented in a general sequence of disassembly. Parts or assemblies that are most conveniently removed first are listed first.

B. Figure Item No. Column

(1) The numeral listed under FIG. at the top of each page of listed parts is the figure number of the illustration in which the listed parts can be found. The numerals in the Item No. column correspond to that part in the illustration.

(2) A hyphen (-) in front of the item number means that the part is not illustrated.

(3) A letter suffix represents a part that may be a modification or an alternate to the part immediately preceding it or it may be a completely new item. A check of the Effect Code column and the Nomenclature column will clarify the usage or relationship of that part to the other parts.

C. Part Number Column

The part number by which a part may be ordered or procured is listed in this column. Parts that cannot be purchased are also listed to complete a parts breakdown and to show the relationship of these parts to other parts of the assembly. Examples of nonprocurable parts would be one part of a matched set or a part that is permanently bonded to another part. These items will be listed as NP (nonprocurable) in the Units Per Assy column.

D. Nomenclature Column

(1) Part names are given in this column. Note the numbers 1 through 7 at top left-hand side of the column. This indicates that indentations are used to show the relationship of one part to another and answers the question, "Is it part of the main assembly or part of a subassembly?" An item with greater indentation will always be a part of a preceding item with one less indent. This system provides rapid determination of the parts making up an assembly or the next higher assembly for any particular part. In scanning for item relationship, remember that attaching parts follow the part attached and therefore may precede the breakdown of an assembly.

(2) Additional information in the Nomenclature column includes references to service bulletins affecting that part, other manuals for additional information, Federal vendor code numbers (V numbers) which may be used to identify the manufacturer of the part, and obsoleted part numbers that have been used to identify the part in the past. These obsoleted part numbers are usually Federally designated. (MS, NAS, and AN are examples.)

(3) When a part shows a vendor code in the Nomenclature column, it means that the part number in the Part Number column is that of the original manufacturer (other than Sundstrand). For convenience, the vendor code number and the name and address of the manufacturer are listed at the end of the introduction. The number following the vendor code number in the parts list is always the Sundstrand assigned number for the same part. It indicates that the part is supported by and obtainable from Sundstrand.

E. Effect Code Column

This column designates parts whose use is limited to specific configurations or models. A letter in this column means that that part can only be used on the model or configuration indicated by that same letter at the beginning of the parts list. If the column is blank, that part may be used on all configurations of the RAT GTT.

F. Units Per Assy Column

This column shows the quantity of any given part used in the immediately associated assembly. For example, if four screws are required to secure a cover plate, the number 4 will appear in the Units Per Assy column beside the description of the screw. Parts whose quantities vary as required are designated AR (as required). The abbreviation RF (reference) means the listing of the part or assembly refers to the end item or is being repeated for clarity, and the reader is referred to its previous listing. The abbreviation NP (nonprocurable) means the part may be purchased only as part of the next higher assembly or that the part has been superseded and is no longer supported.

G. Illustrations

The illustrations for the Detailed Parts List are a series of exploded views arranged in sequence of disassembly and showing each assembly and each part except that attaching parts are illustrated to the extent required to ensure proper assembly. Where it is not practical to completely explode a given assembly in any one illustration, the assemblies are carried over to another figure for complete illustration and listing. To aid in finding the other figure, a cross reference such as (REF FIG. 2 FOR DETAILS) or (REF FIG. 1 FOR NHA) will be found in the Nomenclature column.

4. Vendor Code

Listed below are the names, addresses, and codes of all vendors supplying items not having a Sundstrand part number.

CODE	VENDOR ADDRESS
V00624	Aeroquip Corp Aerospace Group 300 S. East Ave Jackson, MI 49203–1972
V09523	Parker-Hannifin Corp Aerospace Group Gas Turbine Fuel Systems Div 17325 Euclid Ave Cleveland, OH 44112–1209
V09990	Parker-Hannifin Corp Fluidpower Group Hydraulic Valve Div 520 Ternes Ave Elyria, OH 44035–6252
V3A054	McMaster-Carr Supply Co 9630 Norwalk Blvd Santa Fe Springs, CA 90670–2932
V90166	Dynapower/Stratopower Unit of General Signal Corp 3250 Power Drive North Charleston, SC 29418
V93835	Abex/NWL Aerospace 2220 Palmer Avenue Kalamazoo, MI 49001

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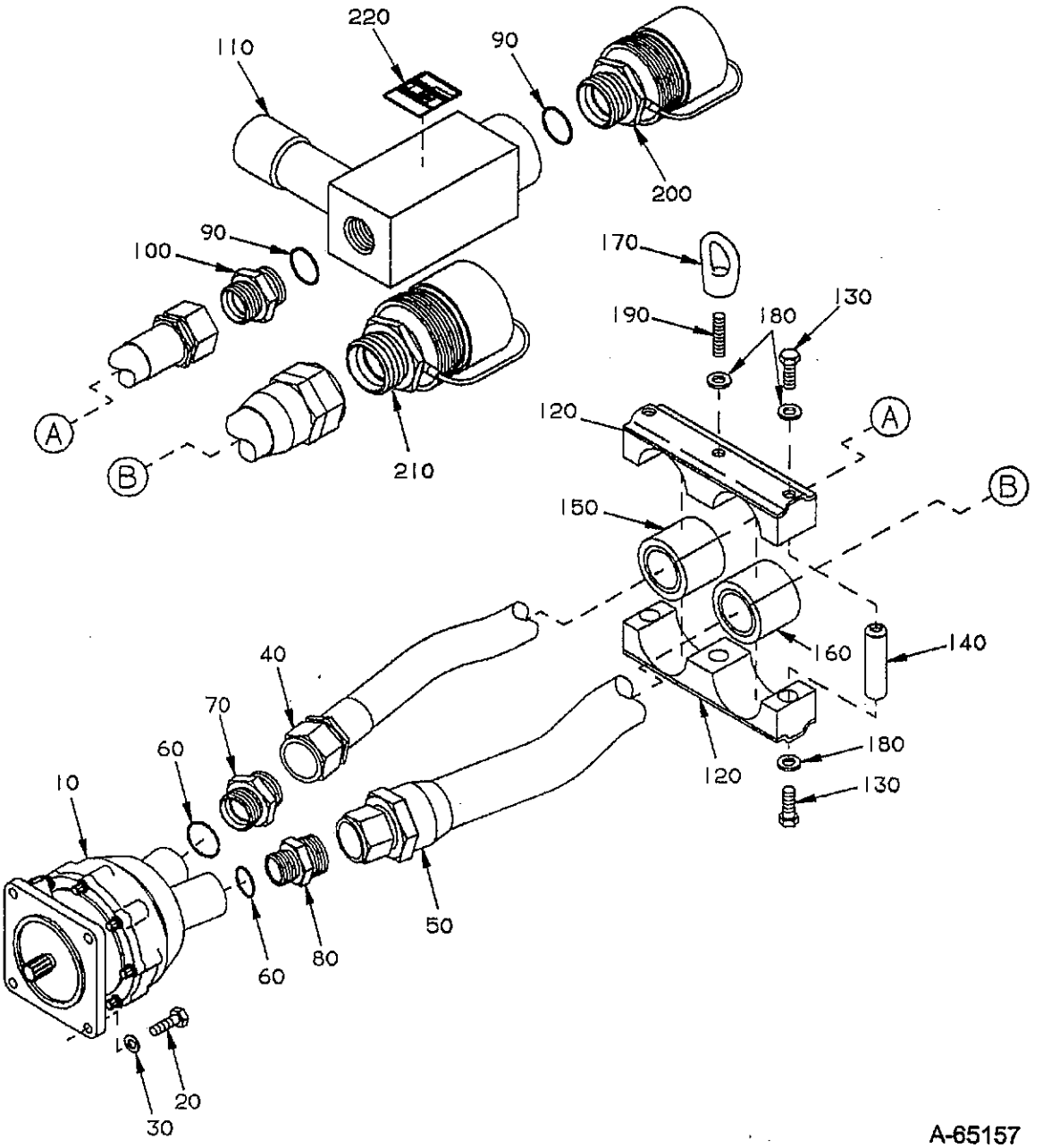
PART NUMBER	AIRLINE PART NO.	FIG.	ITEM	TTL REQ
AE1010735-M-2400		1	40	1
AE709814-1		1	50A	1
AE709814-2		1	50B	1
AE96996P		1	210	1
AE96997M		1	200	1
AGE10600		1	1	RF
AGE10600A		1	1A	RF
		1	1B	RF
		1	1C	RF
AGE10600B		1	1D	RF
AGE10690-1		SEE 53FE15004		
AGE10690-10		SEE C-SN-32		
AGE10690-12		SEE 3019T16		
AGE10690-13		SEE 68094		
AGE10690-14		SEE AE709814-1		
AGE10690-15		SEE AE709814-2		
AGE10690-16		SEE C-SB-32-24P		
AGE10690-2		SEE AE1010735-M-2400		
AGE10690-3		SEE M667014-24-2480		
AGE10690-4		SEE PCM1620S20-E		
AGE10690-5		SEE AE96997M		
AGE10690-6		SEE AE96996P		
AGE10690-7		SEE C-PH-32-2-3		
AGE10690-8		SEE C-SB-32-16P		
AGE10690-9		SEE C-SB-32-20P		
AGE11018		1	220	1
AGE11267		1	80A	1
AN960-516L		1	30	4
C-PH-32-2-3		1	120	1
C-SB-32-16P		1	150	1
C-SB-32-20P		1	160	1
C-SB-32-24P		1	160A	1
C-SN-32		1	140	3
C-TA-32		1	190	1
MS21902-12		1	80B	1
MS21902-16		1	100	1
		1	70	1
MS21916-16-12		1	70A	1
MS21916-24-16		1	80	1
MS35338-46		1	180A	6
MS9285-12		1	20	4
M667014-24-2480		1	50	1
M83248-1-916		1	60	2
		1	90	2
NAS1352-5-16		1	130A	5

PART NUMBER	AIRLINE PART NO.	FIG.	ITEM	TTL REQ
NAS1612-12		1	60A	2
NAS1612-16		1	90A	2
PCM1620S20-E		1	110	1
S472-3716		1	130	5
W556-37004		1	180	6
3019T16		1	170	1
53FE15004		1	10	1
68094		1	10A	1
755596		1	220A	1



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Ground Test Tool
Figure 1

FIG. ITEM	PART NUMBER	AIRLINE PART NUMBER	1 2 3 4 5 6 7 NOMENCLATURE	EFF CODE	UNITS PER ASSY
1					
-1	AGE10600		GROUND TEST TOOL (ASSEMBLY NO. AGE10690)	A	RF
-1A	AGE10600A		GROUND TEST TOOL (ASSEMBLY NO. AGE10690A)	B	RF
-1B	AGE10600A		GROUND TEST TOOL (ASSEMBLY NO. AGE10690B)	C	RF
-1C	AGE10600A		GROUND TEST TOOL (ASSEMBLY NO. AGE10690C)	D	RF
-1D	AGE10600B		GROUND TEST TOOL (ASSEMBLY NO. AGE10690D)	E	RF
10	53FE15004		· MOTOR - HYDRAULIC (V90166) (AGE10690-1)	A	1
-10A	68094		· MOTOR - HYDRAULIC (V93835) (AGE10690-13)	B-E	1
20	MS9285-12		· SCREW - HEXAGON HEAD		4
30	AN960-516L		· WASHER - FLAT		4
40	AE1010735-M-2400		· HOSE ASSEMBLY (V00624) (AGE10690-2)		1
50	M667014-24-2480		· HOSE ASSEMBLY (V00624) (AGE10690-3)	AB	1
-50A	AE709814-1		· HOSE ASSEMBLY (V00624) (AGE10690-14)	C	1
-50B	AE709814-2		· HOSE ASSEMBLY (V00624) (AGE10690-15)	DE	1
60	M83248-1-916		· O-RING	A	2
-60A	NAS1612-12		· O-RING	B-E	2
70	MS21902-16		· UNION - FLARELESS TUBE	A	1
-70A	MS21916-16-12		· REDUCER - EXTERNAL THREAD - FLARELESS	B-E	1
80	MS21916-24-16		· REDUCER - EXTERNAL THREAD - FLARELESS	A	1
-80A	AGE11267		· REDUCER - UNION	B	1
-80B	MS21902-12		· UNION - FLARELESS TUBE	C-E	1
90	M83248-1-916		· O-RING	A	2
-90A	NAS1612-16		· O-RING	BCD	2
100	MS21902-16		· UNION - FLARELESS TUBE	A-D	1
110	PCM1620S20-E		· VALVE - FLOW CONTROL (V09990) (AGE10690-4)	A-D	1
120	C-PH-32-2-3		· CLAMP - TWO-PIECE (V09523) (AGE10690-7)		1
130	S472-3716		· SCREW - CAP - HEX HEAD	A-D	5
-130A	NAS1352-5-16		· SCREW - CAP - SOCKET HEAD	E	5
140	C-SN-32		· NUT - STACKING - SOCKET HEAD (V09523) (AGE10690-10)		3

- ITEM NOT ILLUSTRATED

FIG. ITEM	PART NUMBER	AIRLINE PART NUMBER	1 2 3 4 5 6 7 NOMENCLATURE	EFF CODE	UNITS PER ASSY
1					
150	C-SB-32-16P		• BUSHING - SPLIT (V09523) (AGE10690-8)		1
160	C-SB-32-20P		• BUSHING - SPLIT (V09523) (AGE10690-9)	A-C	1
-160A	C-SB-32-24P		• BUSHING - SPLIT (V09523) (AGE10690-16)	DE	1
170	3019T16		• NUT - EYE (V3A054) (AGE10690-12)		1
180	W556-37004		• LOCKWASHER - SPRING	A-D	6
-180A	MS35338-46		• LOCKWASHER - SPRING	E	6
190	C-TA-32		• ADAPTER - THREADED		1
200	AE96997M		• COUPLING HALF - QUICK DISCONNECT (V00624) (AGE10690-5)		1
210	AE96996P		• COUPLING HALF - QUICK DISCONNECT (V00624) (AGE10690-6)		1
220	AGE11018		• PLATE - IDENTIFICATION	A-D	1
-220A	755596		• PLATE - IDENTIFICATION	E	1

- ITEM NOT ILLUSTRATED

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TABLE OF CONTENTS

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MANUFACTURER'S APPENDICES

INTRODUCTION

1. General

This chapter is made up of the various publications that are supplementary to the coverage elsewhere in this manual. The publications are those that are prepared by suppliers of equipment that has been purchased for use on the ground test tool.

This chapter contains sections that cover the equipment purchased from each supplier. The Table of Contents at the beginning of this chapter contains a list of these sections and the applicable supplier name. It also contains the supplier's part number and cross-reference to the applicable illustrated parts list.

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MANUFACTURER'S APPENDICES

ABEX (V93835)

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MANUFACTURER'S APPENDICES

AEROQUIP (V00624)

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MANUFACTURER'S APPENDICES

DYNAPOWER/STRATOPOWER (V90166)

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MANUFACTURER'S APPENDICES

PARKER HANNIFIN (V09523)

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MANUFACTURER'S APPENDICES

PARKER HANNIFIN (V09523)

(TO BE SUPPLIED)

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