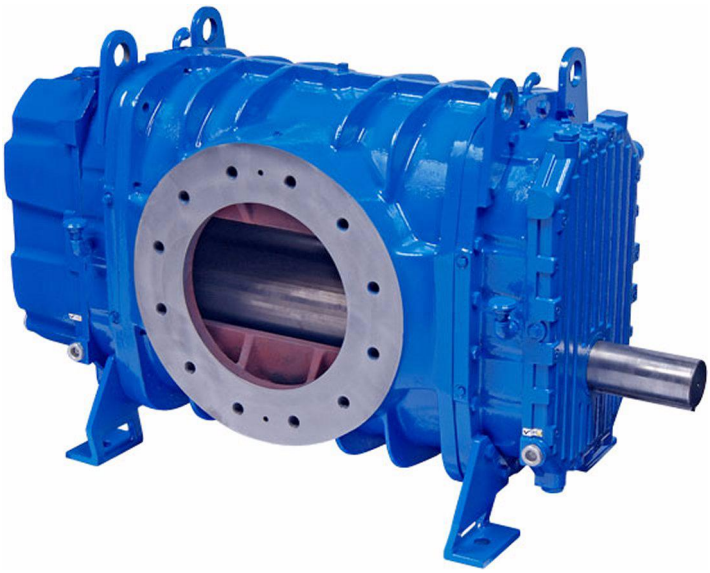
Instruction Manual

TS32V18 and TS56V18 Truck Blowers



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1 INTRODUCTION

1.1 Scope and definitions

This manual provides installation, operation and maintenance instructions for the Ingersoll Rand TS32V18 and TS56V18 Truck Blowers, abbreviated to "blowers" in the remainder of this manual. You must use the blower as specified in this manual.

Read this manual before you install the blower. Important safety information is highlighted as WARNING and CAUTION instructions; you must obey these instructions. The use of WARNINGS and CAUTIONS is defined below.

WARNING

Warnings are given where failure to observe the instruction could result in injury or death to people.

CAUTION

Cautions are given where failure to observe the instruction could result in damage to the equipment, associated equipment and process.

US imperial units are used throughout this manual.

An identification and rating plate will be fitted to the top of the blower body casing, or to the gear end cover. This plate provides specific details about the blower, such as its Item Number and so on.

The following warning and other symbols are on the blower:

Warning - refer to accompanying documentation.

Warning - hot surfaces.

1.2 Description

Refer to Figure 1. The TS32V18 and TS56V18 blowers are positive displacement blowers, cooled by ambient air circulation.

The blowers are supplied in 'bareshaft' form. You must connect your own coupling or belt drive system (see Section 3.7) to the drive shaft in order to operate the blower.

The blowers are available in two different versions:

- 'H' version blowers (which can be supplied with the drive shaft at the left or right) are installed horizontally, and provide for a vertical gas flow through the blower.
- 'V' version blowers (which can be supplied with the drive shaft at the top or bottom), are installed vertically, and provide for a horizontal gas flow through the blower.

Refer to Section 2.8 for the Item Numbers of the different blower versions.

1.3 Applications

The blowers are suitable for pumping ambient air, and non-flammable gases, gas mixtures and dusts. The blowers are **not** suitable for pumping flammable or pyrophoric gases, gas mixtures and dusts.

The materials of construction of the blowers are specified in Section 2.7. Before you use the blower, you must ensure that these materials are compatible with the gases and vapours which you will pump or which may exist in the external atmosphere.

You must ensure that your blower is suitable for your application.

If you have any doubts as to the suitability of the blower for your application, contact your supplier or Ingersoll Rand for advice.

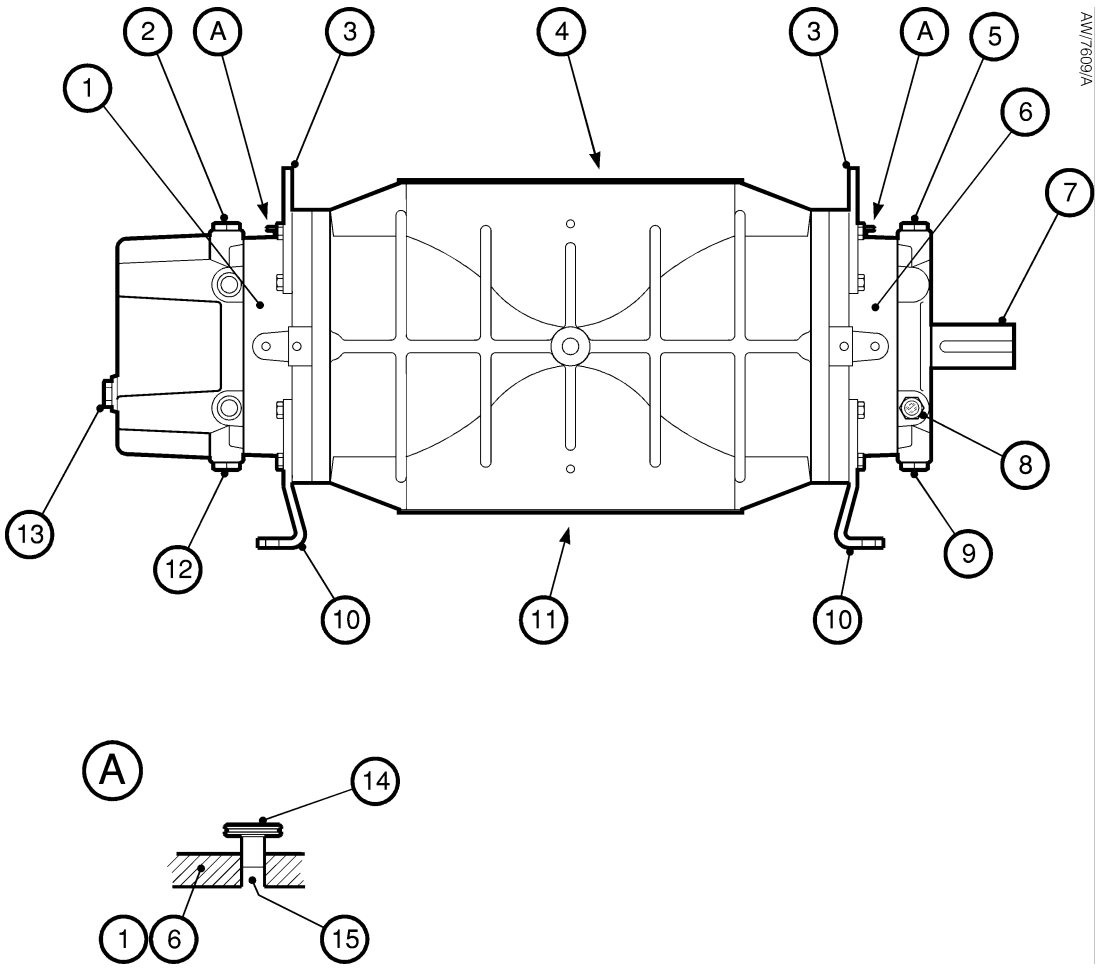
1.4 Principle of operation

The blowers incorporate a pair of two-lobe contra-rotating rotors. One of the rotors is driven by the drive shaft. The other rotor is maintained in the correct phase relation by timing gears in the gear end cover.

As the rotors turn, gas which enters the inlet is trapped in the chambers which form between the rotors and the body casing, and is eventually forced out of the blower at the discharge (outlet).

The rotors can operate (rotate) in either direction. The direction of gas flow through the blower is therefore determined by the direction of rotation of the drive shaft, as shown in Figure 2.

You must ensure that your drive system (connected to the drive shaft) is correctly configured for your system design.



A Gear end cover/drive end cover vent filters

1. Gear end cover
2. Oil filler plug (gear end)
3. Lifting brackets
4. Inlet/outlet
5. Oil filler plug (drive end)
6. Drive end cover
7. Drive shaft
8. Oil-level sight-glass (drive end)
9. Oil drain plug (drive end)
10. Mounting feet
11. Inlet/outlet
12. Oil drain plug (gear end)
13. Oil-level sight-glass (gear end)
14. Vent filter
15. Gear end/drive end vent port

Figure 1 - Components of the blower

2 TECHNICAL DATA

2.1 Operating and storage conditions

Ambient operating temperature range	-4 to 104 ^{o}F
Ambient storage temperature range	-4 to 176 ^{o}F
Maximum ambient operating humidity	90%
Maximum operating altitude *	3280 ft

Table 1 - Operating and storage conditions

* The blowers may be suitable for operation at higher operating altitudes, depending on your installation and application: contact your supplier or Ingersoll Rand for advice.

2.2 Mechanical data

Dimensions	See Figure 3
Mass	
TS32V18	1036 lb
TS56V18	1466 lb

Table 2 - Mechanical data

2.3 Noise and vibration data

Note: The noise and vibration data values given below are maximum values, with pipelines connected to the blower inlet and outlet. The actual values will depend on the installation and the operating conditions.

Noise level	95 dB(A)
Vibration level	0.71 inch s^{-1}

Table 3 - Noise and vibration data

2.4 Performance

Note 1: The "given vacuums" specified in Tables 4 and 5 are the differential pressures across the blower (that is, the differential pressures between the blower inlet and outlet).

Note 2: In Tables 4 and 5, 18 inch Hg is the maximum differential pressure at which the blower can operate. If you operate the blower for extended periods at this maximum differential pressure, the blower will overheat: see Section 4.3.

Note 3: The "r.p.m./r min^{-1} " rotation speeds specified in Tables 4 and 5 are provided for information only, to identify blower performance at the specified speed. During operation, the rotation speed of the blowers need not be limited to these specified speeds.

Note 4: Contact your supplier or Ingersoll Rand for details of pressure operation performance.

r.p.m./ r min^{-1}	Throughput (cfm) and absorbed power (h.p.) at given vacuum													
	3 inch Hg		6 inch Hg		9 inch Hg		12 inch Hg		15 inch Hg		16 inch Hg		18 inch Hg	
	cfm	h.p.	cfm	h.p.	cfm	h.p.	cfm	h.p.	cfm	h.p.	cfm	h.p.	cfm	h.p.
1200	1140	10	1020	20	950	28	840	36	*	*	*	*	*	*
1700	1690	15	1620	28	1500	40	1400	65	*	*	*	*	*	*
2200	2300	17	2220	35	2110	50	1990	68	1910	83	1870	89	*	*
2400	2530	20	2450	38	2360	55	2220	73	2150	89	2100	95	2020	110
2700	2880	22	2800	43	2700	65	2590	85	2500	103	2460	110	2380	123
3200	3490	27	3400	50	3300	75	3180	93	3080	120	3050	129	2960	146

* Contact your supplier or Ingersoll Rand for details.

Table 4 - TS32V18 performance data

r.p.m./ r min^{-1}	Throughput (cfm) and absorbed power (h.p.) at given vacuum													
	3 inch Hg		6 inch Hg		9 inch Hg		12 inch Hg		15 inch Hg		16 inch Hg		18 inch Hg	
	cfm	h.p.	cfm	h.p.	cfm	h.p.	cfm	h.p.	cfm	h.p.	cfm	h.p.	cfm	h.p.
1000	1800	13	1660	28	1550	42	1400	55	*	*	*	*	*	*
1350	2520	20	2360	37	2280	58	2120	73	1960	88	*	*	*	*
1700	3240	24	3080	49	2980	70	2840	92	2680	112	2520	119	*	*
2050	3960	30	3800	58	3720	85	3560	112	3400	135	3080	144	3080	160
2400	4680	35	4520	65	4400	100	4280	130	4120	160	3960	170	3800	185

* Contact your supplier or Ingersoll Rand for details.

Table 5 - TS56V18 performance data

2.5 Lubrication data

Recommended oil	Mobil SHC 630, or equivalent 220 cST oil	
Oil capacity	**TS32V18**	**TS56V18**
Drive end cover	0.32 US gal	0.5 US gal
Gear end cover	0.63 US gal	1.11 US gal

Table 6 - Lubrication data

2.6 Connections

Inlet/outlet	
TS32V18	8 inch ANSI
TS56V18	12 inch ANSI

Table 7 - Connections data

2.7 Materials of construction

Body casing	EN GJL 200 cast iron
End covers	EN GJL 200 cast iron
Rotors	EN GJS 400-15 ductile iron
Shafts	EN GJS 400-15 ductile iron
Gears	817 M 40 carbon steel
Gaskets	CAFF (Klingerit®)
Main lip seals	Viton®
Shaft lip seals	Nitrile rubber

Table 8 - Construction materials data

® Klingerit is a registered trademark of Klinger AG.
Viton is a registered trademark of Dupont.

2.8 Item Numbers

Blower	Shaft position	Figure 2 detail	Item Number
TS32V18V	Bottom	A, B	HB7310032
	Top	C, D	HB7315032
TS32V18H	Left-hand side	G, H	HB7305032
	Right-hand side	E, F	HB7310032
TS56V18V	Bottom	A, B	HB7310056
	Top	C, D	HB7315056
TS45V18H	Left-hand side	G, H	HB7305056
	Right-hand side	E, F	HB7310056

Table 9 - Item Numbers

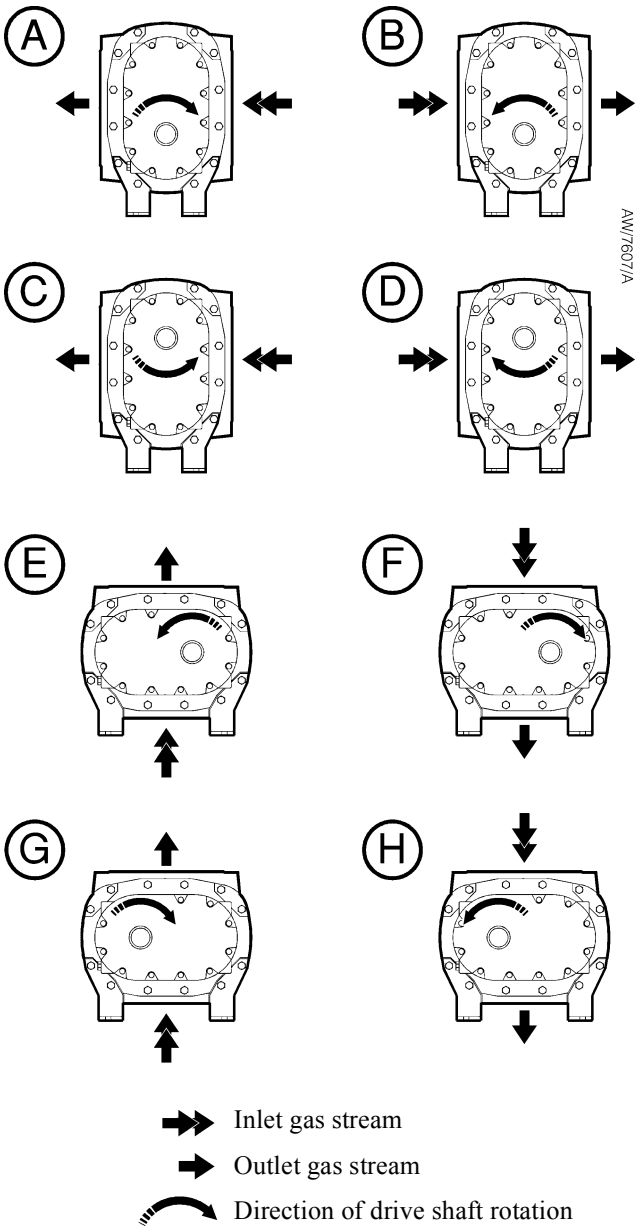
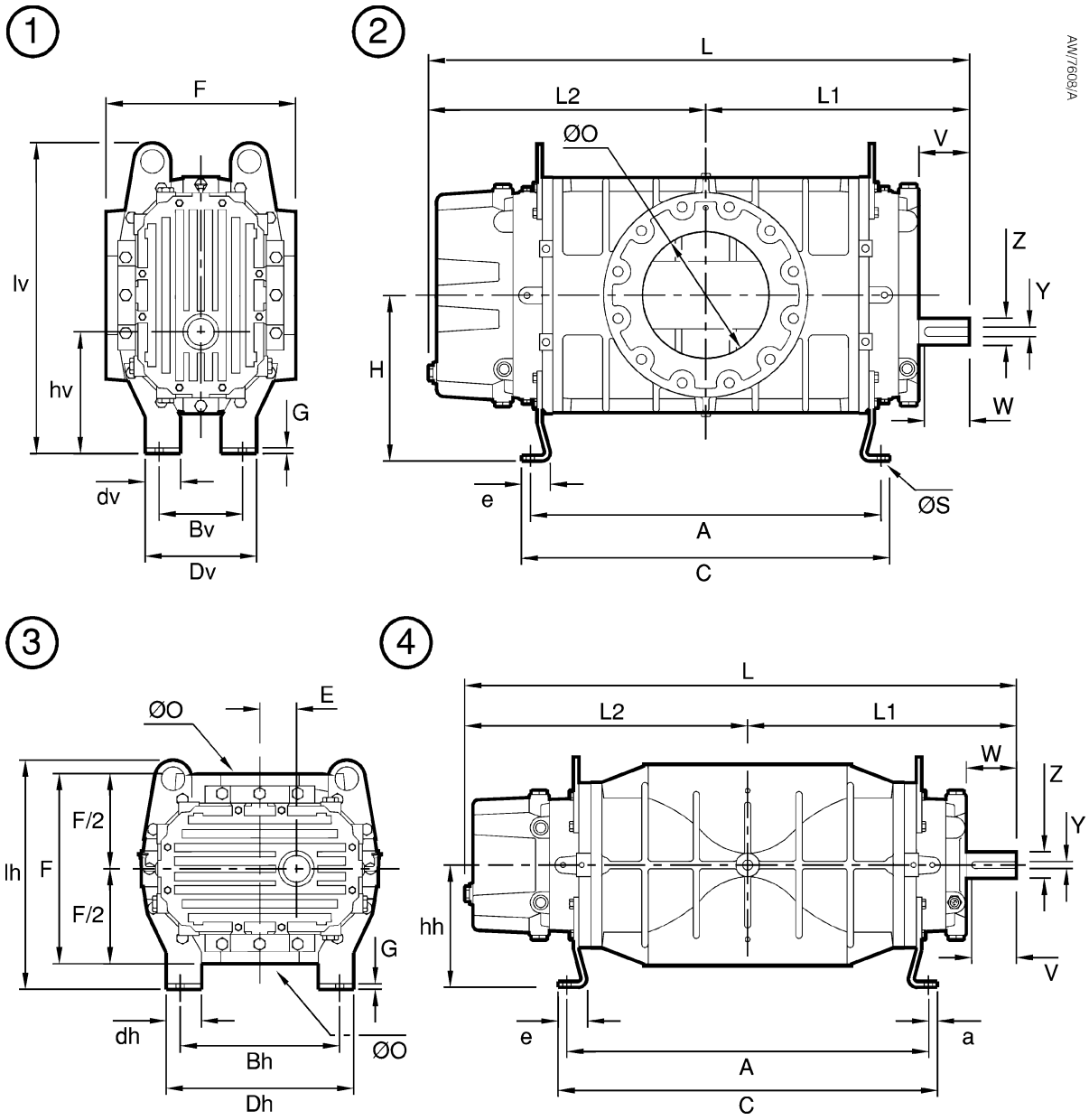


Figure detail	Blower Orientation	Shaft position	Rotation direction
A	Vertical	Bottom	Clockwise
B	Vertical	Bottom	Anticlockwise
C	Vertical	Top	Anticlockwise
D	Vertical	Top	Clockwise
E	Horizontal	Right	Anticlockwise
F	Horizontal	Right	Clockwise
G	Horizontal	Left	Clockwise
H	Horizontal	Left	Anticlockwise

Figure 2 - Blower orientations, shaft positions and gas flow

Key	Dimensions: inches	
	TS32V18	TS56V18
A	27.50	28.00
a	1.00	2.00
Bv	7.00	15.00
Bh	13.00	23.00
C	28.74	30.47
Dv	8.97	20.70
Dh	14.97	28.07
dv	2.50	5.00
dh	2.50	5.00
E	3.00	4.00
e	2.00	2.62
F	15.75	18.90
G	0.39	0.47
H	12.00	14.00
hv	9.00	10.00
hh	9.00	10.00
Iv	23.13	28.11
Ih	17.70	20.11
L	42.35	46.78
L1	20.70	22.45
L2	21.65	24.33
O∅	10.00	12.00
S∅	0.55	1.00
V	3.74	4.48
W	3.90	4.70
Y	0.50	0.625
Z∅	2.00	2.75

Figure 3 - Blower dimensions: key



1. Vertical blowers: end view
2. Vertical blowers: side view
3. Horizontal blowers: end view
4. Horizontal blowers: side view

Figure 3 - Blower dimensions

3 INSTALLATION

CAUTION

Ingersoll Rand will accept no liability or warranty claims if your installation includes any modifications or additions to the blower without the prior written approval of Ingersoll Rand, or if the blower is incorrectly installed.

3.1 Installation safety

WARNING

Obey the safety instructions listed below and take note of appropriate precautions when you install the blower.

- A suitably trained and supervised technician must install the blower.
- Ensure that debris and dust does not get into the blower when you install it.
- Check that all of the required components and tools are available and of the correct type before you start to install the blower.
- Where applicable, use suitable new gaskets/ seals to connect the blower into your system. Do not reuse old gaskets/seals.
- If you will fit the blower into an existing system, disconnect the power from the drive system before you start installation, so that the drive system cannot be operated accidentally.

3.2 System design

Your system must be suitably designed for correct operation of the blower. Note that:

- You must design suitable pipelines to fit the blower inlet/outlet connections. Refer to Section 2.6 and to Figure 3 for the dimensions of the blower inlet and outlet connections.
- Your system design must ensure that, when the blower is in its final operating location, you can see the oil-level sight-glasses and can access the oil filler and drain plugs.
- Your system design must ensure that the blower cannot be operated with the inlet or outlet pipelines obstructed.

We also recommend that your system incorporates an emergency stop facility which, once activated, must be manually reset before the blower can be operated again.

Also note the following when you design your system:

- We recommend that you incorporate a filter in the inlet pipeline to the blower, to prevent the entry of particles or debris into the blower.
- The blower must be level (within 15° in any of the horizontal mounting axes) for correct operation.
- We recommend that you incorporate silencers, to attenuate the pulsations in the inlet/outlet gas streams.
- There must be sufficient free space around the blower, for adequate cooling-air circulation.
- If required, install your own acoustic enclosure around the blower. If you do install such an enclosure, ensure that there is sufficient space for cooling-air flow around the blower: see above.

3.3 Unpack and Inspect

WARNING

Use suitable lifting equipment to move the blower. If you do not, you can injure yourself or damage the blower. Refer to Section 2.2 for the mass of the blower.

1. Attach a suitable fork-lift truck or pallet truck to the lifting brackets on the blower and move the blower, on its pallet, close to where you will install it.
2. Remove all packing materials and protective covers and check the blower. If the blower is damaged, notify your supplier and the carrier in writing within three days; state the Item Number of the blower together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the blower if it is damaged.
3. Check that you have received the items listed in Table 10. If any item is missing, notify your supplier in writing within three days
4. Look at the blower rating and identification plate and check that the blower is suitable for use in your system. If the blower is not suitable for use in your system, do not continue to install the blower: contact your Supplier or Ingersoll Rand.

If the blower is not to be used immediately, replace the protective covers. Store the blower in suitable conditions, as described in Section 6.1.

3.4 Locate the blower

WARNING

Use suitable lifting equipment to move the blower. If you do not, you can injure yourself or damage the blower. Refer to Section 2.2 for the mass of the blower.

Ensure that the operating location is clean and free from debris and oil.

You must ensure that when the blower is in its required operating location, all of the mounting feet are in the same plane, flat on the mounting platform. The platform must be firm and level, with a maximum flatness deviation less than 0.026 inch ft^{-1}.

Do **not** use shims or spacers under the mounting feet to level the blower.

Use the following procedure to locate the blower:

1. Use the lifting equipment to move the blower to its required operating location: use the method given in Step 1 of Section 3.3.
2. Disconnect your lifting equipment from the blower.
3. Fit suitable bolts through the fixing holes in the mounting feet (Figure 1, items 10), to secure the blower in position.

Quantity	Description	Check (3)
1	Blower	o
*	Gear end cover/drive end cover oil	o

* If you have ordered oil, you will receive sufficient quantity of the correct oil to fill the blower: see Section 2.5.

Table 10 - Checklist of items

3.5 Connect the blower into your system

3.5.1 Introduction

Take note of the following when you connect the blower into your system:

- For optimum performance, ensure that the system pipelines connected to the blower are as short as possible.
- Support your system pipelines and other components, to prevent loading of the inlet and outlet ports on the blower.
- Incorporate flexible components in your system, to minimise noise and vibration.
- Where necessary, use gaskets/seals which are compatible with the gases which will be pumped, and with the operating conditions.
- The leak tightness of your system connections must be in accordance with the requirements of your applications.

3.5.2 Connect the blower inlet and outlet

Use the following procedure to connect the blower into your system:

1. Use a suitable gasket/seal to connect your inlet pipeline to the blower inlet (Figure 1, item 4 or 11).
2. Use a suitable gasket/seal to connect your outlet pipeline to the blower outlet (Figure 1, item 4 or 11).

3.6 Fill the blower with oil

CAUTION

Ensure that you use the correct grade of oil and that the oil levels are correct. If you do not, the blower may be damaged during operation, or its performance may be affected.

Before you commission and operate the blower, you must fill the blower with oil: refer to Section 5.4.

3.7 Fit the drive/transmission

WARNING

You must fit suitable guards to protect people from rotating/ moving parts.

You must use a suitable coupling or a belt drive and transmission system to connect your drive to the blower.

Your drive and transmission system design must ensure that the radial and axial loadings on the blower drive shaft are as low as possible. The radial and axial loadings **must** be below the maximum loadings specified in Table 11 (page 13).

Connect the components of the drive and transmission system to the blower drive shaft (Figure 1, item 7) as described in the manufacturer's instructions supplied with the components.

Blower	Radial *	Axial *
TS32V18	1.3×10^3 lbf	1.5×10^2 lbf
TS56V18	2.7×10^3 lbf	2.9×10^2 lbf

* These are the maximum loadings that can be applied to the **end** of the drive shaft.

Table 11 - Maximum drive shaft loadings

3.8 Check the direction of rotation

WARNING

If you remove a guard during the following procedure, ensure that you do not come into contact with the shaft, the coupling/belt or the drive system when you operate the blower. If you do, you may be injured by the rotating components.

CAUTION

Ensure that the blower rotates in the correct direction. If it does not, your system will not operate correctly.

After you have connected the drive/transmission, check the direction of rotation of the blower as follows:

1. If necessary (that is, to make it easier to see the blower drive shaft), temporarily remove any guard over the drive coupling or belt.
2. Refer to Figure 1. Watch the blower drive shaft (7) while you start up the blower (refer to Section 4.2), then shut down the blower (refer to Section 4.4) after two seconds or so.
3. Check that the blower drive shaft (7) rotated correctly in the expected direction. (This depends on your application and installation configuration: see Section 1.4.)
4. If the direction of rotation was incorrect:
   - Check the installation of the drive and transmission system and reconfigure as appropriate.
   - Perform the direction of rotation check from Step 2 again, to ensure that the blower now rotates in the correct direction.
5. If you have removed the guard over the drive coupling or belt (as in Step 1 above), refit the guard.

3.9 Commission the blower

CAUTION

Commission the blower as described below before you operate the blower as described in Section 4.

After you have installed the blower, use the following procedure to commission it and prepare it for subsequent operation:

1. Ensure that any valves in the inlet and outlet pipelines are open.
2. Engage your drive and transmission system to start the blower.
3. Operate the blower, with no gas load, for at least 15 minutes. During this time:
   - Monitor the external surfaces of the blower and check for 'hot spots' (that is, areas which are unusually hot).
   - If any hot spots persist at the end of the 15 minutes, contact your supplier or Ingersoll Rand for advice.
4. Continue to operate the blower with a representative gas load, and check that the pump operates correctly and provides the required performance.

   If necessary, refer to Section 5.9 if any fault conditions occur.
5. Disengage your drive and transmission system to stop the blower.

The blower is now ready for normal operation.

4 OPERATION

CAUTION

Ingersoll Rand will accept no liability or warranty claims if your blower is used on applications or in a way prohibited in this manual, or not specified in this manual.

4.1 General operational safety

WARNING

Obey the safety instructions and precautions listed below. If you do not, there may be a risk of injury or death to people, or damage to the blower.

- Do not operate the blower when the cooling-air flow around the blower is restricted (see Section 3.2). If you do, the blower may overheat.
- Do not operate the blower with the blower inlet or outlet ports open to the atmosphere. If you do, your fingers or other parts of your body or clothing may get trapped, and you may be injured by the rotating mechanisms in the blower.
- Do not operate the blower with the guards removed from the blower drive shaft, the coupling/belt or the drive system. If you do, your fingers or other parts of your body or clothing may get trapped, and you may be injured by the rotating components.
- Prevent accidental contact with the hot blower, and do not place flammable materials on the blower. During operation, the temperature of external parts of the blower can exceed 158 °F.
- Never disconnect any of the connecting pipelines (for example, the pipeline connected to the inlet) when the blower is operating.
- Do not expose any part of your body to vacuum. If you do, you may be injured.
- Do not attempt to use the blower to pump liquids. The blowers are not designed for this application.
- Where necessary (for example, if you have not fitted an acoustic enclosure), wear suitable ear defenders. The pump can be noisy during operation (refer to Section Note 4:).

4.2 Start-up

1. Check the oil-levels in the blower: refer to Section 5.4.
2. Ensure that any valves in the inlet and outlet pipelines are open.
3. Engage your drive and transmission system to start the blower.

You can now use the blower as required in your application.

4.3 Operation with maximum differential pressure

CAUTION

Do not operate the blower at the maximum differential pressure for longer than 15 minutes. If you do, the blower will overheat.

As specified in Section 2.4, the blower can operate with a maximum differential pressure (between the blower inlet and outlet) of 18 inch Hg. However, operation of the blower for extended periods at this differential pressure will cause the blower to overheat.

We therefore recommend that:

- You operate the blower for no longer than 15 minutes at the maximum differential pressure.
- After 15 minutes of operation at the maximum differential pressure, operate the blower for at least 10 minutes with a differential pressure of 15 inch Hg or less. You can then continue to operate the blower at the maximum differential pressure again.

4.4 Shut-down

Disengage the drive and transmission system to stop the blower.

5 MAINTENANCE

5.1 Safety information

WARNING

Obey the safety instructions given below and take note of appropriate precautions. If you do not, you can cause injury to people and damage to equipment.

- A suitably trained and supervised technician must maintain the blower. Obey your local and national safety requirements.
- Ensure that the maintenance technician is familiar with the safety procedures which relate to the gases pumped by the system in which the blower is installed.
- Allow the blower to cool to a safe temperature before you start maintenance work.
- Isolate the blower from the drive system so that it cannot be operated accidentally.
- Recheck the blower rotation direction (see Section 3.8) if the drive and transmission system has been disconnected and then reconnected.
- Take care to protect inlet/outlet port sealing faces from damage.
- Do not reuse seals/gaskets if they are damaged.
- Do not touch or inhale the thermal breakdown products of fluorinated materials which may be present if the blower has been heated to 500 °F and above. These breakdown products are very dangerous. Fluorinated materials in the blower include seals. The blower may have overheated if it was misused, if it malfunctioned or if it was in a fire. Ingersoll Rand Material Safety Data Sheets for fluorinated materials used in the blower are available on request: contact your supplier or Ingersoll Rand.
- Check the leak tightness of the system connections after maintenance work is complete if you have connected or disconnected the blower inlet or outlet joints. The leak tightness of the system connections must be in accordance with the requirements of your applications.

5.2 Maintenance plan

Note: The maintenance frequencies given in Table 12 are based on a maximum blower usage of 2000 hours per year. If your blower usage exceeds this, you must adjust the maintenance frequencies for your blower accordingly

The plan in Table 12 details the maintenance operations required to maintain the blower in normal operation. Instructions for each operation are given in the section shown.

When you maintain the blower, use Ingersoll Rand spares: refer to Section 7.3.

Operation	Frequency	Refer to Section
Inspect the oil-level sight-glasses	Weekly	5.3
Check the oil-levels	Weekly	5.4
Inspect the system installation	Monthly	5.5
Change the oil	Yearly	5.6
Replace a vent filter	When necessary	5.7
Overhaul the blower	5 yearly or when necessary	5.8

Table 12 - Maintenance plan

5.3 Inspect the oil-level sight-glasses

1. Refer to Figure 1. Look at the gear end oil-level sight-glass (13):
   - If the sight-glass is dirty, use a suitable cloth to wipe it clean.
   - If the sight-glass is damaged (that is, scratched, cracked or corroded), or if there are signs of oil leakage from the sight-glass, you must replace it: contact your supplier or Ingersoll Rand.
2. Refer to detail B. Look at the drive end oil-level sight-glass (8):
   - If the sight-glass is dirty, use a suitable cloth to wipe it clean.
   - If the sight-glass is damaged (that is, scratched, cracked or corroded), or if there are signs of oil leakage from the sight-glass, you must replace it: contact your supplier or Ingersoll Rand.

5.4 Check the oil levels

CAUTION
Ensure that you use the correct grade of oil and that the oil levels are correct. If you do not, the blower may be damaged during operation, or its performance may be affected.

5.4.1 Gear end cover

Refer to Figure 1 and use the following procedure to check the oil level in the gear end cover. The oil level is correct when it is just below the centre line of the sight-glass (13).

1. Refer to Figure 1. Look at the oil level in the gear end sight-glass (13):
   - If the oil level is not visible in the sight-glass, or is too far below the centre line of the sight-glass, continue at Step 2 to add more oil.
   - If the oil level is above the centre line of the sight-glass, drain oil from the blower until the level is correct: refer to Section 5.6.
2. Remove the oil filler-plug (2) from the filler port on the top of the gear end cover (1).
3. Pour new oil of the correct type (see Section 2.5) through the filler port and into the end cover until the oil-level is just below the centre line of the sight-glass. If the oil level goes above the centre line of the sight-glass, drain oil from the blower until the level is correct: refer to Section 5.6.
4. Refit the oil filler-plug (2) to the filler port on the top of the gear end cover (1).

5.4.2 Drive end cover

Refer to Figure 1 and use the following procedure to check the oil level in the drive end cover. The oil level is correct when it is just below the centre line of the sight-glass (8).

1. Refer to Figure 1. Look at the oil level in the drive end sight-glass (8):
   - If the oil level is not visible in the sight-glass, or is too far below the centre line of the sight-glass, continue at Step 2 to add more oil.
   - If the oil level is above the centre line of the sight-glass, drain oil from the blower until the level is correct: refer to Section 5.6.
2. Remove the oil filler-plug (5) from the filler port on the top of the drive end cover (6).
3. Pour new oil of the correct type (see Section 2.5) through the filler port and into the end cover until the oil-level is just below the centre line of the sight-glass. If the oil level goes above the centre line of the sight-glass, drain oil from the blower until the level is correct: refer to Section 5.6.
4. Refit the oil filler-plug (5) to the filler port on the top of the drive end cover (6).

5.5 Inspect the system installation

Note: Where possible, we recommend that you investigate the cause of any damage or corrosion, and implement corrective measures to prevent any future damage of components.

Use the following procedure to inspect the system connections:

1. Inspect all of the system pipelines and connections and check that they are not damaged or corroded and that they are sufficiently leak-tight. Repair or replace any damaged or corroded component and seal any leak found.
2. Inspect the drive/transmission system and adjust, repair or replace as necessary: refer to the manufacturer's instructions supplied with your drive/transmission system.

5.6 Change the oil

> CAUTION
>
> Ensure that you use the correct grade of oil and that the oil levels are correct. If you do not, the blower may be damaged during operation, or its performance may be affected.

5.6.1 Gear end cover

1. Refer to Figure 1. Remove the oil filler-plug (2) from the filler port on the gear end cover (1).
2. Place a suitable container under the drain plug (12). The container must have a maximum capacity as specified in Table 6.
3. Remove the oil drain plug (12), and allow the oil to drain from the blower into the container.
4. Refit the oil drain plug (12).
5. Dispose of the oil: refer to Section 6.2.
6. Fill the gear end cover with new oil of the correct type and grade: refer to Section 3.6.

5.6.2 Drive end cover

1. Refer to Figure 1. Remove the oil filler-plug (5) from the filler port on the drive end cover (6).
2. Place a suitable container under the drain plug (9). The container must have a maximum capacity as specified in Table 6.
3. Remove the oil drain plug (9), and allow the oil to drain from the blower into the container.
4. Refit the oil drain plug (9).
5. Dispose of the oil: refer to Section 6.2.
6. Fill the drive end cover with new oil of the correct type and grade: refer to Section 3.6.

5.7 Replace a vent filter (when necessary)

Refer to Figure 1, detail A. A vent filter (13) is fitted to the vent port (15) in the gear end cover (1) and in the drive end cover (6).

If there is oil in the gas stream from the blower, the vent filter may be blocked and you must replace it: contact your supplier or Ingersoll Rand.

5.8 Overhaul the blower

The blower must be regularly overhauled, as specified in Table 12. As part of the overhaul, the bearings in the blower must be replaced.

We recommend that you contact your supplier or Ingersoll Rand to arrange for an overhaul of the blower.

5.9 Fault finding

A guide to fault conditions and their possible causes is provided in Table 13 to assist you in basic fault finding.

If you are unable to rectify a fault when you use this guide, call your supplier or your nearest Ingersoll RandIngersoll Rand Service Centre for advice.

Note: If you have been approved to carry out strip-down, repair and reassembly of your blower, refer to the Service Manual supplied separately for detailed procedures.

Symptom	Check	Actions
The blower will not start, or seizes during operation.	Are the rotors touching ?	Check the rotor clearances and adjust as necessary.
	Has the blower been overloaded ?	Check the required operating conditions and specified performance of the blower (see Section 2).
	Has debris or foreign material entered the blower ?	Strip down, clean and repair the blower as necessary.
	Is the drive/transmission system faulty ?	Check that your drive and transmission system is operating correctly, and that it is correctly fitted to the blower: refer to Section 3.7 and to the manufacturer's instructions.
The blower is noisy during operation.	Are the rotors touching ?	Check the rotor clearances and adjust as necessary.
	Are the gear and/or bearing clearances incorrect ?	Check the clearances and adjust as necessary.
	Are the rotors unbalanced ?	Clean the rotors and rotor housing, then check the rotor clearances and adjust as necessary.
The blower overheats.	Is the blower being operated at the maximum differential pressure for too long ?	Operate the blower with a reduced differential pressure: see Section 4.3.
	Is the inlet filter blocked ?	Clean or replace the filter.
	Is an oil level too high, or has the incorrect grade of oil been used ?	Check the oil levels (refer to Section 5.4) or drain the blower and fill with the correct grade of oil (refer to Section 5.6).
	Are the rotor or rotor/casing clearances incorrect ?	Contact your supplier or Ingersoll Rand for advice.
	Is there inadequate clearance around the blower ?	Ensure that there is sufficient clearance around the blower to provide for free circulation of ambient cooling air.
The blower overheats (continued).	Does your enclosure provide inadequate cooling ?	If you have fitted an acoustic enclosure around the blower: • Ensure that the enclosure cooling vents/louvres are unobstructed. • Ensure that the enclosure cooling/ extraction fan is operating correctly. • Ensure that there is sufficient clearance for cooling-air flow around the blower: refer to Section 3.2.

Table 13 - Fault finding (Sheet 1 of 2)

Symptom	Check	Actions
There is oil in the gas stream from the blower.	Is an oil level too high ?	Check the oil levels and if necessary drain oil from the blower: refer to Section 5.4.
	Have the sealing rings failed ?	Contact your supplier or Ingersoll Rand for advice.
	Is vent filter blocked ?	Replace the vent filter as necessary: refer to Section 5.7.
Oil leaks from the drive shaft.	Have the lip seals failed ?	Inspect the lip seals and replace if necessary.
There is a low volume flow through the blower.	Is the inlet filter blocked ?	Clean or replace the filter.
	Is the blower worn or damaged ?	Contact your supplier or Ingersoll Rand for advice.
	Is the blower unsuitable for your application ?	If necessary, redesign your system to comply with the capabilities of the blower, or fit a different blower which provides the necessary performance.
Absorbed power is too high.	Is the blower unsuitable for your application ?	If necessary, redesign your system to comply with the capabilities of the blower, or fit a different blower which provides the necessary performance.
	Is the inlet filter blocked ?	Clean or replace the filter.
The blower rotates in reverse direction when you stop it.	Is the non-return valve defective ?	If you have fitted a non-return valve in your outlet pipeline, check that the non-return valve operates correctly. Repair or replace as necessary.
-	-	If you have made the checks/actions as described above and you still cannot identify the cause of a fault, or if you cannot rectify a fault, contact your supplier or Ingersoll Rand for advice.

Table 13 - Fault finding (Sheet 2 of 2)

6 STORAGE AND DISPOSAL

6.1 Storage

6.1.1 Preparation

1. Shut down the blower as described in Section 4.4.
2. If necessary, disconnect the drive and transmission system from the blower drive shaft: refer to the manufacturer's instructions supplied with your transmission system.
3. If necessary, purge your system and the blower with dry air, and disconnect the blower from your system pipelines.
4. If you will store the blower for longer than six weeks, refer to the additional requirements in Section 6.1.2.
5. Place and secure protective covers over the blower inlet and outlet connections.
6. Use suitable lifting equipment to move the blower to its storage area: refer to Section 3.4.
7. Store the blower in clean, dry conditions in a well-ventilated place that is free from vibration or shocks.

6.1.2 Preparation for long-term storage

If the blower is to be stored for longer than six weeks:

1. Drain the oil from the blower: refer to Section 5.6.
2. Fill the gear end cover and drive end cover with a suitable protective oil (see Table 14): use the method in Section 5.4.
3. Turn the blower drive shaft by hand through three or four revolutions, to turn the blower and prevent seizure.
4. Spray a suitable protective oil (see Table 14) through the inlet/outlet and into the blower.
5. If required, spray a suitable protective oil (see Table 14) on the bare metal surfaces of the blower inlet and outlet flanges, to inhibit corrosion.

During storage, every 14 days or less, turn the blower drive shaft by hand through at least one quarter of a revolution, to turn the rotors and prevent seizure or degradation of the bearings.

6.1.3 Preperation for use after long-term storage

When the blower is required for use after storage:

1. Drain the protective oil from the gear end cover and the drive end cover, then fill the blower with new oil: refer to Section 5.6.
2. Use a suitable cleaning solution (such as alcohol or white spirit) to clean the rotors:
   - Moisten a suitable clean, lint-free cloth with the cleaning solution, and clean the parts of the rotors which are visible through the inlet port.
   - Turn the blower drive shaft as necessary to access the other parts of the rotors.
3. Prepare and install the blower as described in Section 3.

External components	Internal components
Rust Ban 324 (Esso)	Mobilarma 523/524 (Mobil)
V Product 9703 (Shell)	Esso Lub MZ 20E/20 (Esso)
Mobilarma 778 (Mobil)	Ensis Motor Oil 20 (Shell)

Table 14 - Suitable protective oils

6.2 Disposal

WARNING

Ensure that you wear the appropriate Personal Protective Equipment (PPE) when you handle contaminated oil or contaminated cleaning materials or components.

Safely dispose of the blower, used oil, cleaning materials, and any components in accordance with all local and national safety and environmental requirements.

Take particular care with the following:

- Used oil that has been contaminated with dangerous substances.
- Cleaning materials that have been contaminated with dangerous substances.
- Components that have been contaminated with dangerous substances.

7 SERVICE AND SPARES

7.1 Introduction

Ingersoll RandIngersoll Rand products, spares and accessories are available from Ingersoll Rand companies in Belgium, Brazil, China, France, Germany, Israel, Italy, Japan, Korea, Singapore, United Kingdom, USA and a world-wide network of distributors. The majority of these employ service engineers who have undergone comprehensive Ingersoll Rand training courses.

Order spare parts and accessories from your nearest Ingersoll Rand company or distributor. When you order, please state for each part required:

- Model and Item Number of your equipment
- Serial number (if any)
- Item Number and description of the part

7.2 Service

Ingersoll Rand products are supported by a world-wide network of Ingersoll Rand Service Centres. Each Service Centre offers a wide range of options including: equipment decontamination; service exchange; repair; rebuild and testing to factory specifications. Equipment which has been serviced, repaired or rebuilt is returned with a full warranty.

Your local Service Centre can also provide Ingersoll Rand engineers to support on-site maintenance, service or repair of your equipment.

For more information about service options, contact your nearest Service Centre or other Ingersoll Rand company.

7.3 Spares

The spares available for the blowers are shown in Table 15.

Note that:

- The minor repair kits contain seals and associated gaskets.
- The major repair kits contain bearings, seals and associated gaskets.

Spare	Item Number
ISO 220 oil (20 litres, 5.28 US gal)	HH0107008
Minor repair kits	*
Major repair kits	*

* Contact your supplier or Ingersoll Rand for these spares kits.

Table 15 - Spares

Return of Ingersoll Rand Equipment - Procedure **(Form HS1)**

Introduction

Before you return your equipment you must warn your supplier if the substances you used (and produced) in the equipment can be dangerous. You must do this to comply with health and safety at work laws.

You must complete the Declaration (HS2) on the next page and send it to your supplier before you dispatch the equipment. If you do not, your supplier will assume that the equipment is dangerous and he will refuse to accept it. If the Declaration is not completed correctly, there may be a delay in processing your equipment.

Guidelines

Take note of the following guidelines:

- Your equipment is '**uncontaminated**' if it has not been used or if it has only been used with substances that are not dangerous. Your equipment is '**contaminated**' if it has been used with any dangerous substances.
- If your equipment has been used with radioactive substances, you must decontaminate it before you return it to your supplier. You must send independent proof of decontamination (for example a certificate of analysis) to your supplier with the Declaration (HS2). Phone your supplier for advice.
- We recommend that contaminated equipment is transported in vehicles where the driver does not share the same air space as the equipment.

PROCEDURE

Use the following procedure:

1. Contact your supplier and obtain a Return Authorisation Number for your equipment.
2. Turn to the next page(s), photocopy and then complete the Declaration (HS2).
3. Remove all traces of dangerous gases: pass an inert gas through the equipment and any accessories which will be returned to your supplier. Drain all fluids and lubricants from the equipment and its accessories.
4. Disconnect all accessories from the equipment. Safely dispose of the filter elements from any oil mist filters.
5. Seal up all of the equipment's inlets and outlets (including those where accessories were attached). You may seal the inlets and outlets with blanking flanges or heavy gauge PVC tape.
6. Seal contaminated equipment in a thick polythene bag. If you do not have a polythene bag large enough to contain the equipment, you can use a thick polythene sheet.
7. If the equipment is large, strap the equipment and its accessories to a wooden pallet. Preferably, the pallet should be no larger than 510mm x 915mm (20" x 35"); contact your supplier if you cannot meet this requirement.
8. If the equipment is too small to be strapped to a pallet, pack it in a suitable strong box.
9. If the equipment is contaminated, label the pallet (or box) in accordance with laws covering the transport of dangerous substances.
10. Fax or post a copy of the Declaration (HS2) to your supplier. The Declaration must arrive before the equipment.
11. Give a copy of the Declaration to the carrier. You must tell the carrier if the equipment is contaminated.
12. Seal the original Declaration in a suitable envelope; attach the envelope securely to the outside of the equipment package. **WRITE YOUR RETURN AUTHORISATION NUMBER CLEARLY ON THE OUTSIDE OF THE ENVELOPE OR ON THE OUTSIDE OF THE EQUIPMENT PACKAGE**.

Return of Ingersoll Rand Equipment - Declaration **(Form HS2)**

Return Authorisation Number:

You must:

Know about all of the substances which have been used and produced in the equipment before you complete this Declaration

- Read the Procedure (HS1) on the previous page before you attempt to complete this Declaration
- Contact your supplier to obtain a Return Authorisation Number and to obtain advice if you have any questions
- Send this form to your supplier before you return your equipment

Equipment model _____

Serial Number _____

Has the equipment been used, tested or operated?

yes O Go to Section 2no O Go to Section 4

FOR SEMICONDUCTOR APPLICATIONS ONLY :

Tool Reference Number _____

Process _____

Failure Date _____

Serial Number of
Replacement Equipment_____

Are any of the substances used or produced in the equipment

- Radioactive yes O no O
- Biologically active yes O no O
- Dangerous to human health and safety? yes O no O

If you have answered 'no' to all of these questions, go to Section 4.

Your supplier will not accept delivery of any equipment that is contaminated with radioactive substances, unless you:

- Decontaminate the equipment
- Provide proof of decontamination

YOU MUST CONTACT YOUR SUPPLIER FOR ADVICE BEFORE YOU RETURN SUCH EQUIPMENT

Substance name	Chemical symbol	Precautions required (for example, use protective gloves, etc.)	Action required after spillage or human contact
1			
2			
3			
4			
5			
6			

Reason for return and symptoms of malfunction: _____

_____

If you have a warranty claim:

- who did you buy the equipment from ? _____
- give the supplier's invoice number _____

Print your name:_____Print your job title: _____

Print your organisation:_____

Print your address:_____

_____

Telephone number:_____Date of equipment delivery: _____

I have made reasonable enquiry and I have supplied accurate information in this Declaration. I have not withheld any information.
I have followed the Return of Ingersoll Rand Equipment Procedure (HS1) on the previous page.

Signed: _____ Date _____

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