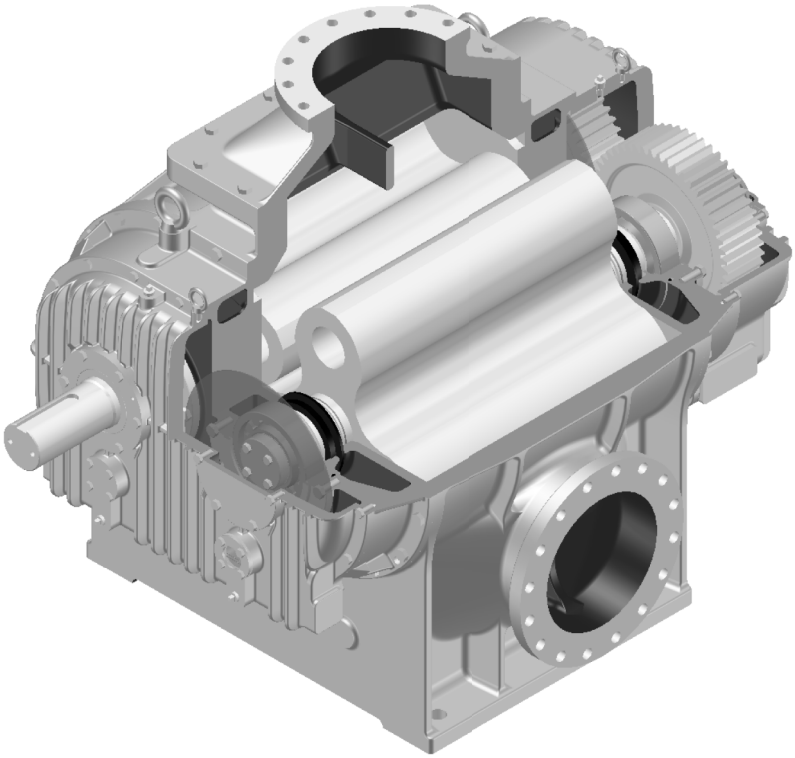
BLOWER & VACUUM PUMP



INSTRUCTION MANUAL

IRS(IRT)-300C • IRS(IRT)-300D • IRS(IRT)-350C • IRS(IRT)-350E

IRS(IRT)-400B • IRS(IRT)-400C • IRT-400D • IRT-450B

IRT-450A • IRT-500B • IRT-600A

- Hand this manual to actual blower users.
- Read and understand this manual before using ITO blowers.
-

Document No. MH1007-00

Foreword

Thank you for purchasing ITO products.

This manual is a user`s guide for the following ITO blower models: IRS(IRT)-300C, IRS(IRT)-300D, IRS(IRT)-350C, IRS(IRT)-350E, IRS(IRT)-400B, IRS(IRT)-400C, IRT-400D, IRT-450B, IRT-450A, IRT-500B, and IRT-600A.

Blowers are designed so that atmospheric pressure is maintained on the suction side, and pressure higher than the atmospheric one is maintained on the discharge side; for vacuum pumps, pressure lower than the atmospheric one is maintained on the suction side, and atmospheric pressure is maintained on the discharge side. Hereafter in this manual, blowers and vacuum pumps are collectively called “Blowers.” Before using the ITO blower, read this manual thoroughly to understand its structure, functions, and procedures for its long, safe, and trouble-free operation.

General Precautions

- Read and understand this manual before using ITO blowers.
- For safety, read and understand safety precautions.
- Hand this manual to actual blower users.
- Keep this manual in a convenient place for quick and easy reference at all times.
- For safety, follow instructions in this manual.
- The contents of this manual are subject to change without notice.
-
- If there are missing or incorrectly collated pages, contact your ITO dealer or office.
- If this manual is lost, contact your ITO dealer or office.

Contents

This manual consists of the following chapters. When a reference is made, read and follow it carefully.

Signal Words

Safety precautions are categorized into “WARNING” or “CAUTION” as follows.

⚠ **WARNING**	if not avoided, can result in death or injury.
⚠ **CAUTION**	if not avoided, may result in incidents of property damage.

Safety Symbols


indicates a prohibited action to avoid a hazard.


prohibits from use in a combustible area or near open flame.


prohibits from touching.


indicates an action to avoid a hazard.


indicates an action to ground earth lug.


indicates a possibility of an electrical shock.


indicates a caution of rotating parts.


indicates a caution of high temperature.

Safety Precautions - Read First -

Installation

⚠ WARNING

Wear a helmet, safety shoes, protective glasses, earplugs, and electrostatic preventive work clothes. Fix long hair and remove jewelry.
Falling objects, noise, getting caught between rotating parts, and static charge can result in severe injury.

In case of natural disaster such as earthquake and tsunami, stop working on the blower immediately.

Operate a crane only by a licensed operator.
Operation mistake can lead to a drop or a crash, resulting in serious injury.

Before operating a crane, notify people around the crane verbally and with notices, “Crane is in operation.”

When unpacking, be careful not to drop contents and tools on your feet.
Your feet can be injured.

When unpacking, use tools carefully.
Injury can result.

Keep your feet and so on away from an electrical drill.
Serious injury can result.

Ground earth lug.
You can get an electrical shock.

Do not touch cable joints.
You can get an electrical shock.

Wiring must be installed only by suitably qualified personnel.
You can get an electrical shock.

Safety Precautions - Read First -

⚠ CAUTION

After all protective covers are removed from blower openings, make sure that foreign objects do not enter the blower.
Foreign objects may result in blower seize or damage in the casing.

Foundation must be constructed by experienced personnel.
Improper foundation may cause blower vibration and noise.

To install multiple blowers on the common floor, isolate blowers separately by different foundations.
The common foundation for multiple blowers may cause blower resonance and more noise.

Connect a silencer as close to the blower suction or discharge port as possible.
Resonance inside pipings may occur, resulting in noise.

Install a safety valve and a pressure gauge closer to the blower than a gate valve and a check valve.
Blower may be damaged.

For a safety valve with its discharge side facing upstream of the blower, attach a cooler.
Hot gas may lead to damage in the casing.

For blowers conveying air or gas containing a lot of dust, mount a filter on the suction side to prevent a blower from blocking.
Foreign objects may enter the blower resulting in blower seize or damage in the casing.

If the suction side piping is curved, install a drain separator or drain puller.
Clogged drain may cause water hammer phenomena, resulting in blower damage.

For blowers equipped with an aftercooler, install a drain separator.
Condensed water may enter the piping line.

Support the piping adequately so that it does not apply much load to the blower and the piping.
Blower or piping may be damaged.

Safety Precautions - Read First -

Before installing accessories and the piping, remove all protective covers and vaporization rust inhibitors from the blower openings.
Operation with them inside the blower may cause blower damage.

For blowers with the piping on the suction side, mount a metallic strainer with 30 to 40 mesh on the suction port to prevent foreign objects such as spatter from entering the blower. After trial run, remove the strainer.
Foreign objects may result in blower seize or damage in the casing.

Install wiring following a motor manual.
Motor may be damaged.

Operation

⚠ WARNING

Wear a helmet, safety shoes, protective glasses, earplugs, and electrostatic preventive work clothes. Fix long hair and remove jewelry.
Falling objects, noise, getting caught between rotating parts, and static charge can result in severe injury.

In case of natural disaster such as earthquake and tsunami, stop working on the blower immediately.

During operation and for 1 hour after a blower stops, do not touch the blower casing, the piping, rotating parts, and accessories.
Any part of your body or clothes can get caught between rotating parts, resulting in burn or injury.

Do not operate the blower with the belt cover or coupling cover removed.
Any part of your body or clothes can get caught between rotating parts, resulting in injury.

In case of an accident during operation, stop the blower immediately.
Do not restart operation until the trouble is identified and remedied.

During operation, wear earplugs and instruct people around the blower to wear earplugs.
Noise can cause hearing damage.

During operation, make sure that there are no tools, cloth, and other objects on the blower unit, accessories, and piping.
Vibration can drop objects from above, resulting in serious injury.

Safety Precautions - Read First -

While discharging gas into the atmosphere from the safety valve, keep away from the discharge side.

Hot gas can cause burn or serious injury.

Before checking or repairing, turn off the electric power supply, and warn people around the blower verbally and with notices, “Work Ahead. Do not turn on the electric power supply.”

If the blower is operated while work is being done on it, serious injury can result.

Before turning V-belts or the blower shaft manually, turn off the electric power supply to prevent fingers from being caught.

Your fingers can get caught between V-belts or into the blower, resulting in serious injury.

Before removing a drain plug, remove an oil feed plug carefully to release pressure inside the oil case.

If the drain plug is removed before the oil feed plug is removed, oil can be splashed, resulting in serious burn.

Before operation, notify people around the blower verbally and with notices, "Blower is in operation.”

While checking from the inspection door on the belt cover or coupling cover, do not reach into the door.

Your hand can get caught between rotating parts, resulting in serious injury.

⚠ CAUTION

Do not start a blower with drain or seal water left inside the casing.

Water hammer phenomena may cause blower damage.

Operate the blower with an appropriate amount of clean lubricant.

An excessive lubricant level may cause abnormal temperature rise due to stirring heat. A lack or dirt of lubricant may cause blower seize or damage.

For blowers with the piping on the suction side, mount a metallic strainer with 30 to 40 mesh on the suction port to prevent foreign objects such as spatter from entering the blower. After trial run, remove the strainer.

Foreign objects may result in blower seize or damage in the casing.

Do not adjust the air capacity by using valves on the suction or the discharge side.

The pressure may increase rapidly and blower may be damaged.

Safety Precautions - Read First -

In areas where temperature drops to 0 degree C or lower, drain all the water in the blower when stopping cooling water or seal water.
Water may freeze, resulting in blower damage.

For soundproof boxes with a fan, operate the fan during blower operation.
Blower may be damaged.

Use ITO recommended lubricant, and follow recommended replacement cycle and quantity.
Blower may be damaged.

Adjust V-belt tensions properly.
Improper V-belt tensions may cause V-belt slip and damage.

To adjust V-belt tensions, use a hydraulic lifter. Never use a jack bolt that is supplied with the motor.
The jack bolt may be deformed or damaged.

When a suction strainer or a filter is clogged, clean it.
The suction pressure may fall into a vacuum state, leading to blower seize.

As for cooling water or seal water quality, conform to standard established by the Japan Refrigeration and Air Conditioning Industry Association (JRA).
Piping may be clogged or the blower may be damaged.

Before turning on the electric power supply, open valves for piping fully.
Turning on the electric power supply with valves closed may cause damage in the casing.

For blowers with gas purges such as one mechanical seal type, follow the design purge pressure specified in specifications.
Purge pressure exceeding the rated value may increase pressure abnormally in the side cover and the oil case, and cause blower seize or damage in the casing.

Open the cock of the pressure gauge only when reading it.
Operating with the cock opened may cause damage to the pressure gauge.

Maintenance

⚠ WARNING

Wear a helmet, safety shoes, protective glasses, earplugs, and electrostatic preventive work clothes. Fix long hair and remove jewelry.
Falling objects, noise, getting caught between rotating parts, and static charge can result in severe injury.

In case of natural disaster such as earthquake and tsunami, stop working on the blower immediately.

During operation and for 1 hour after a blower stops, do not touch the blower casing, the piping, rotating parts, and accessories.
Any part of your body or clothes can get caught between rotating parts, resulting in burn or injury.

Do not operate the blower with the belt cover or coupling cover removed.
Any part of your body or clothes can get caught between rotating parts, resulting in injury.

Before checking or repairing, turn off the electric power supply, and warn people around the blower verbally and with notices, “Work Ahead. Do not turn on the electric power supply.”
If the blower is operated while work is being done on it, serious injury can result.

During operation, wear earplugs and instruct people around the blower to wear earplugs.
Noise can cause hearing damage.

During operation, make sure that there are no tools, cloth, and other objects on the blower unit, accessories, and piping.
Vibration can drop objects from above, resulting in serious injury.

While discharging gas into the atmosphere from the safety valve, keep away from the discharge port.
Hot gas can cause burn or serious injury.

In case of an accident during operation, stop the blower immediately.
Do not restart operation until the trouble is identified and remedied.

Before operating a crane, notify people around the crane verbally and with notices, “Crane is in operation.”

Safety Precautions - Read First -

Operate a crane only by a licensed operator.
Operation mistake can lead to a drop or a crash, resulting in serious injury.

While checking from the inspection door on the belt cover or coupling cover, do not reach into the door.
Your hand can get caught between rotating parts, resulting in serious injury.

Before turning V-belts or the blower shaft manually, turn off the electric power supply to prevent fingers from being caught.
Your fingers can get caught between V-belts or into the blower, resulting in serious injury.

Before removing a drain plug, remove an oil feed plug carefully to release pressure inside the oil case.
If the drain plug is removed before the oil feed plug is removed, oil can be splashed, resulting in serious burn.

While handling lubricant, keep fire away.
Fire can occur, resulting in burn.

Before adding or changing oil, turn off the electric power supply.
Oil can be splashed, resulting in serious burn.

⚠ CAUTION

Adjust V-belt tensions properly.
Improper V-belt tensions may cause V-belt slip and damage.

To adjust V-belt tensions, use a hydraulic lifter. Never use a jack bolt that is supplied with the motor.
The jack bolt may be deformed or damaged.

Operate the blower with an appropriate amount of clean lubricant.
An excessive lubricant level may cause abnormal temperature rise due to stirring heat. A lack or dirt of lubricant may cause blower seize or damage.

Safety Precautions - Read First -

In areas where temperature drops to 0 degree C or lower, drain all the water in the blower when stopping cooling water or seal water.

Water may freeze, resulting in blower damage.

For blowers with gas purges such as one mechanical seal type, follow the design purge pressure specified in specifications.

Purge pressure exceeding the rated value may increase pressure abnormally in the side cover and the oil case, and cause blower seize or damage in the casing.

Open the cock of the pressure gauge only when reading it.

Operating with the cock opened may cause damage to the pressure gauge.

When a suction strainer or a filter is clogged, clean it.

The suction pressure may fall into a vacuum state, leading to blower seize.

Replace V-belts with new ones all from the same manufacturer.

V-belts may be applied with uneven load, resulting in earlier wear or cut.

Use ITO recommended lubricant, and follow recommended replacement cycle and quantity.

Blower may be damaged.

While removing accessories or piping from the blower unit, make sure that foreign objects do not enter the piping and the blower inside.

Foreign objects may result in blower seize or damage in the casing.

Table of Contents

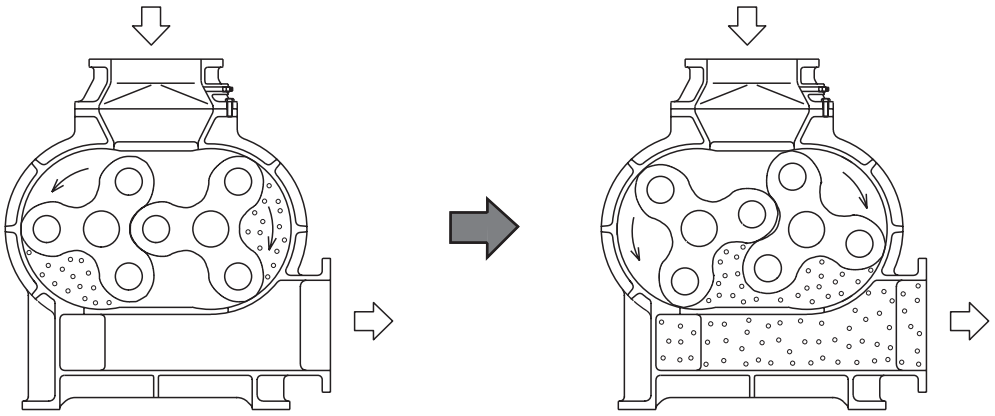
MEMO

Chapter 1 General

This chapter provides blower basic information.

1.1 Operating Principle

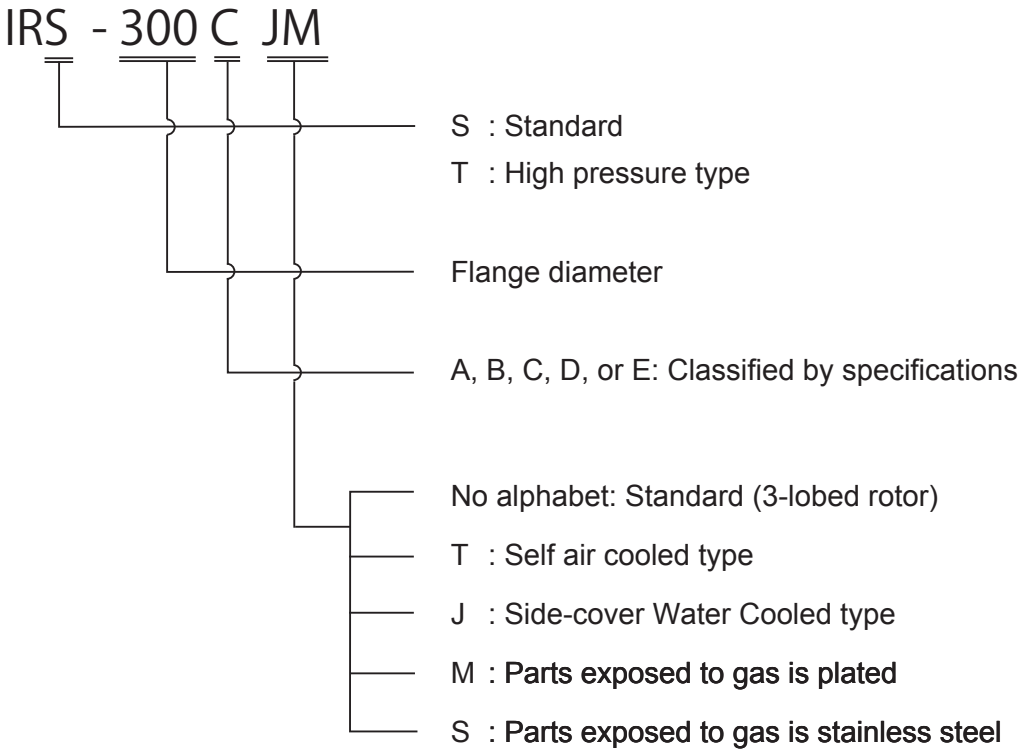
Two rotors in the casing rotate in opposite directions (in the direction shown by the arrows) to suck gas from the suction port. The gas is first trapped in spaces between the casing and the rotors, then pushed out of the discharge port.



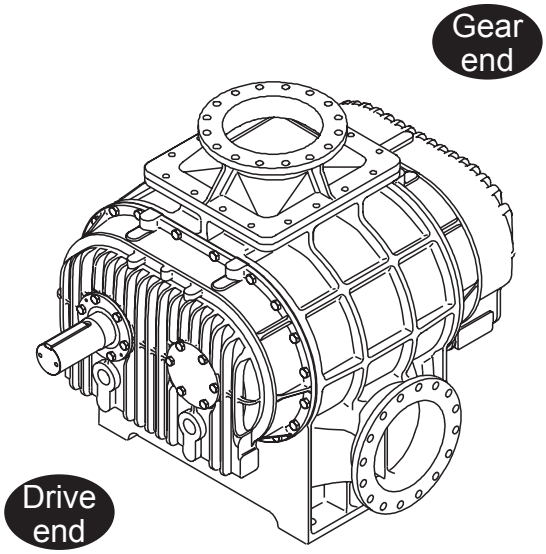
ex: IRS-300C

1.2 Models

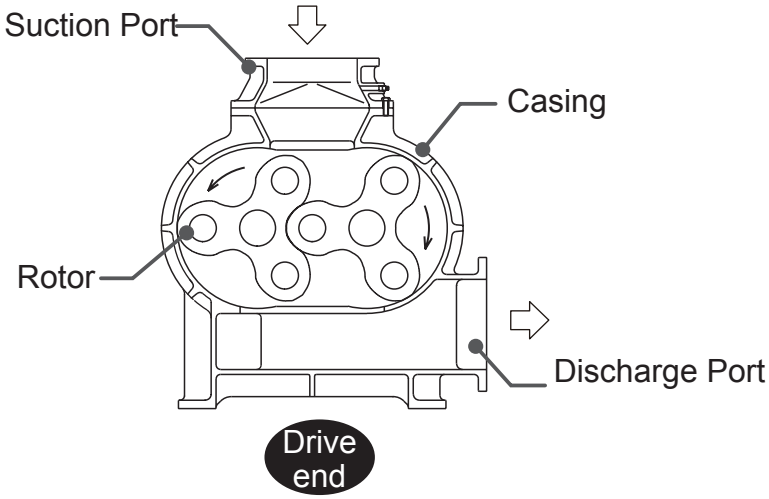
Various models are available for a wide range of applications.
Following explains meanings of your ITO blower models.



1.3 External View



External View



Section View

ex: IRS-300C

1.4 Main Parts and Features

Main parts and their features are as follows:

Casing
The discharge port is located on the right-hand viewing from the drive end. For an option, the discharge port is located on the left-hand viewing from the drive end.

Rotor
A rotor is not a solid part with shafts cooling-fitted to both ends of the rotor body.

Gear
Gears keep definite clearances between two rotors in the casing, and transmits rotation from the drive rotor to the driven rotor.

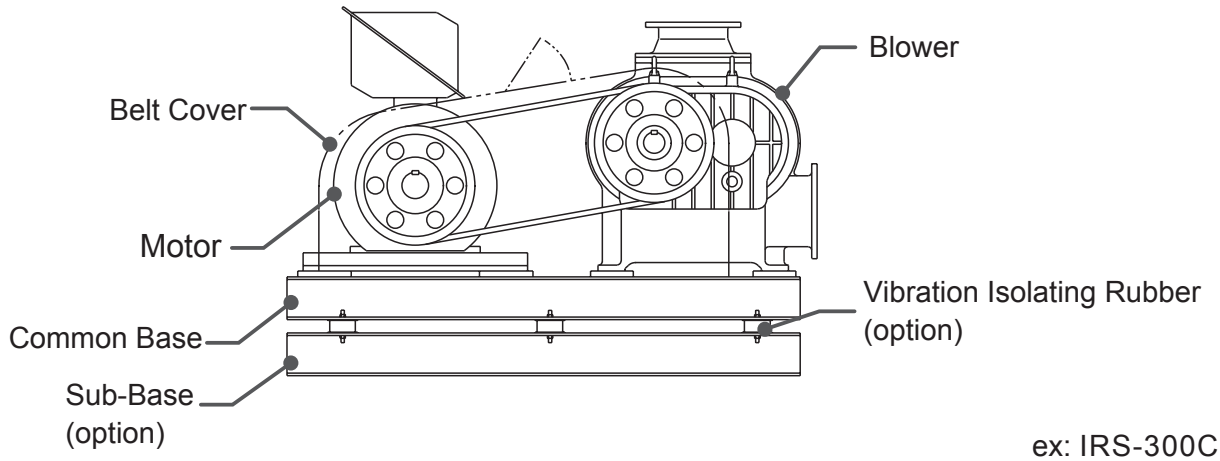
Lubrication
Gears and bearings are lubricated with oil.

Drive System
The blower and the motor are connected by driving V-belts or couplings. For the belt drive system, pulleys are set on the blower and motor shafts, and then V-belts are set over the pulleys. For the coupling drive system, the blower and the motor shafts are connected by couplings.

Sealing System
Shafts are sealed with labyrinth and oil seals. For blowers conveying corrosive gas, shafts are sealed with optional mechanical seals.

1.5 Unit

A blower unit is assembled as shown in the illustration below. It is shipped with oil filled.

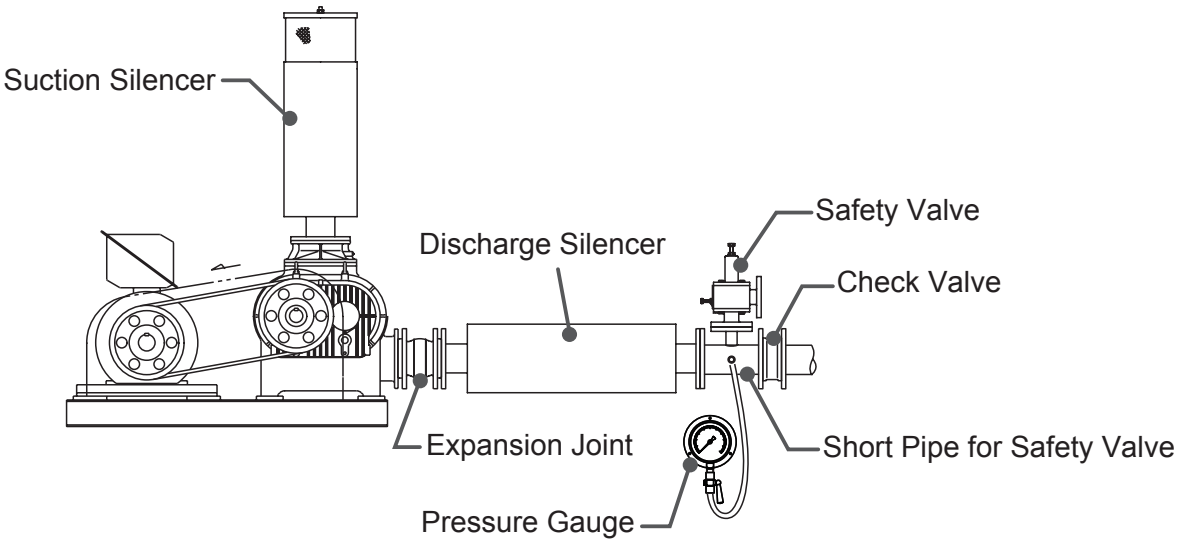


ex: IRS-300C

1.6 Standard Layout of Accessories

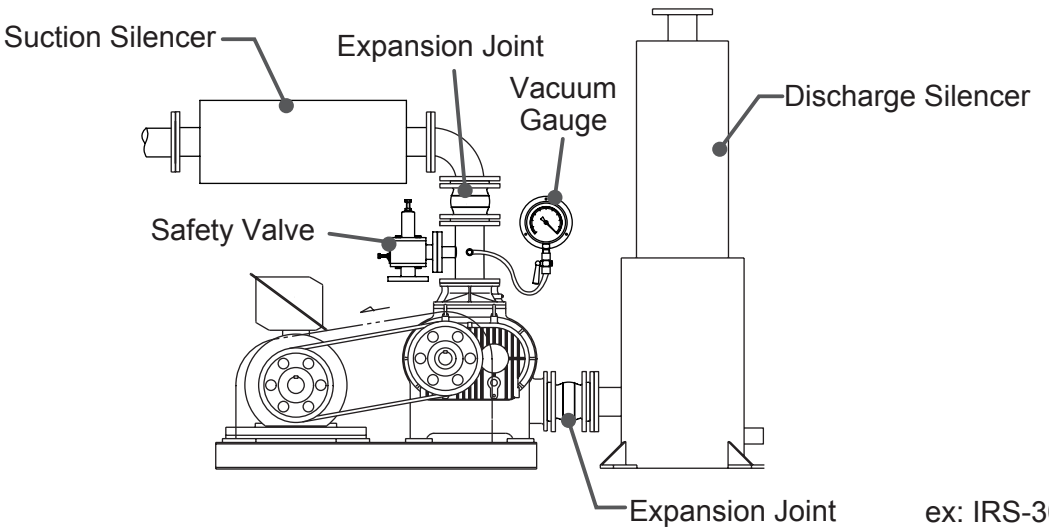
The standard layout of accessories is shown in the illustrations below.

Blower



ex: IRS-300C

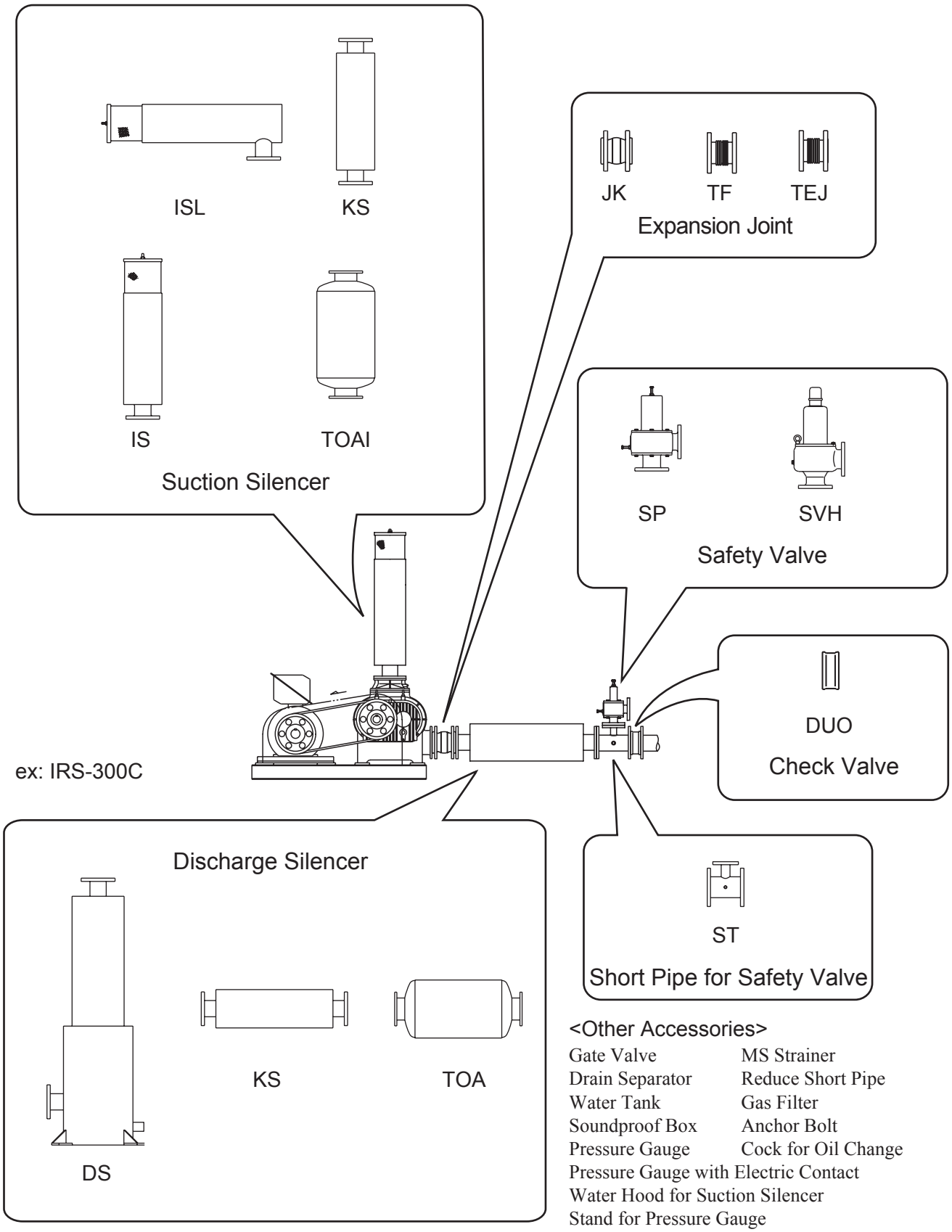
Vacuum Pump



ex: IRS-300C

1.7 Lineup of Accessories

Main blower accessories are shown in the illustrations below.



<Other Accessories>

Gate Valve	MS Strainer
Drain Separator	Reduce Short Pipe
Water Tank	Gas Filter
Soundproof Box	Anchor Bolt
Pressure Gauge	Cock for Oil Change

Pressure Gauge with Electric Contact
Water Hood for Suction Silencer
Stand for Pressure Gauge
Elbow Pipe for Safety Valve
Vacuum Gauge
Low Pressure Gauge
Thermometer for Bearing
Thermometer with Electric Contact

1.8 Precautions for Inverter Operation

To use an inverter, please observe precautions below.

1 Select a special motor for the inverter to be used.

2 Operate the blower within the frequency range specified by ITO.

3 During an inverter operation, resonance resulting in abnormal sound and/or vibration may occur especially to blowers with vibration isolating rubbers. Change frequency to where resonance does not occur.

4 To prevent problem, select a motor and an inverter from the same manufacturer.

Chapter 2 Installation

Before installing a blower unit to the foundation, read and perform sections 2.1 “Unpack and Confirm a Purchase” and 2.2 “Check Installation Requirements.”
To install the blower, follow the steps in this chapter.

Tools & Materials Needed

- □ Specifications
- □ Common Tools
- □ Pinch Bar
- □ Scissors
- □ Cutter

Chapter 2 Safety Precautions - Read First -

⚠ WARNING

Wear a helmet, safety shoes, protective glasses, earplugs, and electrostatic preventive work clothes. Fix long hair and remove jewelry.
Falling objects, noise, getting caught between rotating parts, and static charge can result in severe injury.

In case of natural disasters such as earthquake and tsunami, stop working on the blower immediately.

Operate a crane only by a licensed operator.
Operation mistake can lead to a drop or a crash, resulting in serious injury.

Before operating a crane, notify people around the crane verbally and with notices, “Crane is in operation.”

2.1 Unpack and Confirm a Purchase

⚠ WARNING

When unpacking, be careful not to drop contents and tools on your feet.
Your feet can be injured.

When unpacking, use tools carefully.
Injury can result.

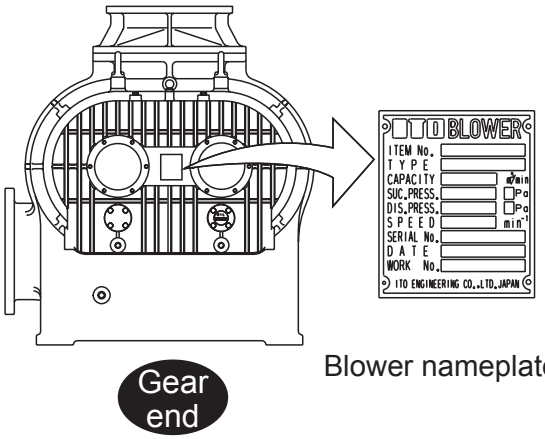
⚠ CAUTION

After all protective covers are removed from blower openings, make sure that foreign objects do not enter the blower.
Foreign objects may result in blower seize or damage in the casing.

1 Unpack all packages.

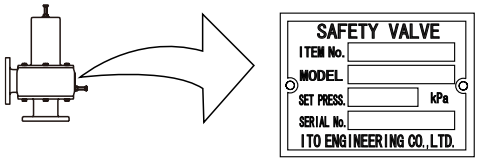
2 Check that you have received everything listed in the specifications.

3 Check that values on nameplates of the blower and the safety valve are the same as those in the purchace order.



Blower nameplate

ex :IRS-300C



Safety Valve

Safety valve nameplate

ex: SP

4 Check all parts for shipping damage.

5 Store all the unpacked packages in a place where they do not interrupt works.

2.2 Check Installation Requirements

Before installation, check that all the following installation requirements are met.

Check	Installation Requirements
	The ground for foundation is level and steady.
	Floor space is 400 mm or wider from all round the blower base and accessories.
	There are no explosives and combustibles in and around the installation area.
	The installtion area is light enough to work on a blower. (It is light enough to read oil level clearly.)
	For indoor installation, there are air vents with enough capacity.
	For blowers using cooling water or seal water, there are facilities for water supply and drainage.
	A crane is available with more load capacity than blower unit weight.

2.3 Foundation Construction

Foundation design and construction require its specialized knowledge. So, foundation must be constructed by experienced personnel. To construct the foundation, meet all requirements described below.

⚠ CAUTION

Foundation must be constructed by experienced personnel.
Improper foundation may cause blower vibration and noise.

To install multiple blowers on the common floor, isolate blowers separately by different foundations.
The common foundation for multiple blowers may cause blower resonance and more noise.

1 Calculate foundation load, soil bearing capacity, area of base, and concrete compressive strength, using calcuation formulas below.

- Foundation load M_S (kg)

  $M_S \geqq 3 \times M_B$

  M_B: Blower unit weight (kg)

- Soil bearing capacity fe (ton/㎡)

  $fe \geqq 20$

- Area of base A (㎡)

  $$A \geq \frac{K \times (M_B + M_S)}{fe \times 10^3}$$

  K: Safety factor for each model
  Blower with large load change: 4
  Blower with small load change: 2

- Concrete compressive strength Fc (kg/c㎡)

  $Fc \geq 210$

2 Construct the foundation with capacities of foundation load, soil bearing capacity, area of base, and concrete compressive strength calculated in step 1.
Level and steady the foundation.

3 Cure and dry the concrete completely.

2.4 Install Blower Unit to Foundation

⚠ WARNING

Keep your feet and so on away from an electrical drill.
Serious injury can r esult.

⚠ CAUTION

Foundation must be constructed by experienced personnel.
Improper foundation may cause blower vibration and noise.

1 Make the levelness on the surface of flanges or the common base, 1 mm or less than 1 mm per 1 m.

2 Pouring grout into the common base space is recommended for reducing vibration.

- To pour grout,
  - Do not include air into grout.
  - Cure tightening bolts so that the blower and the motor can be removed from the common base for future use.

3 Align pulleys or couplings, referring to 4.2 or 4.3.

Although pulleys or couplings have been factory set, they may be misaligned during transportation or affected by the foundation condition.

2.5 Attach Accessories and Pipes to Blower

⚠ CAUTION

Connect a silencer as close to the blower suction or discharge port as possible.
Resonance inside pipings may occur, resulting in noise.

Install a safety valve and a pressure gauge closer to the blower than a gate valve and a check valve.
Blower may be damaged.

For a safety valve with its discharge side facing upstream of the blower, attach a cooler.
Hot gas may lead to damage in the casing.

For blowers conveying air or gas containing a lot of dust, mount a filter on the suction side to prevent a blower from blocking.
Foreign objects may enter the blower resulting in blower seize or damage in the casing.

If the suction side piping is curved, install a drain separator or drain puller.
Clogged drain may cause water hammer phenomena, resulting in blower damage.

For blowers equipped with an aftercooler, install a drain separator.
Condensed water may enter the piping line.

Support the piping adequately so that it does not apply much load to the blower and the piping.
Blower or piping may be damaged.

Before installing accessories and the piping, remove all protective covers and vaporization rust inhibitors from the blower openings.
Operation with them inside the blower may cause blower damage.

After all protective covers are removed from blower openings, make sure that foreign objects do not enter the blower.
Foreign objects may result in blower seize or damage in the casing.

For blowers with the piping on the suction side, mount a metallic strainer with 30 to 40 mesh on the suction port to prevent foreign objects such as spatter from entering the blower. After trial run, remove the strainer.
Foreign objects may result in blower seize or damage in the casing.

1 Remove all protective covers and vaporization rust inhibitors from the blower suction and discharge ports.

2 Check the arrangement of your blower, referring to the outline drawing and section 1.6 "Standard Layout of Accessories."

- Before connecting accessories to the blower, check that the flow directions in accessories are correct.
- For blowers with pipes on the suction side, clean the inside of the pipes, and attach a metallic strainer with 30 to 40 meshes to the blower suction port.

3 Using a crane, carefully lift the previously connected suction accessories and connect them to the blower suction port.

Connect and support pipes so that too much load will not be applied to the blower.

4 Using a crane, carefully lift the previously connected discharge accessories and connect them to the blower discharge port.

Connect and support pipes so that too much load will not be applied to the blower.

5 Connect pipes for cooling water or seal water to the blower.

< Pipes Needed >

Type	Number of Pipes Needed
Wet-type vacuum pump	Piping for seal water Inlet: 1
Oil cooled type	Piping for cooling water Inlet: 1 Outlet: 1
Side-cover water cooled type	Piping for cooling water Inlet: 1 Outlet: 1

6 For blowers with gas purges, connect pipes for gas purges.

< Pipes Needed >

Type	Number of Pipes Needed
Standard	Inlet: 2 (Drive end: 1, Gear end: 1)
Side-cover water cooled type	Inlet: 4 (Drive end: 2, Gear end: 2)

2.6 Install Wiring

⚠ WARNING

Ground earth lug.
You can get an electrical shock.

Do not touch cable joints.
You can get an electrical shock.

Wiring must be installed only by suitably qualified personnel.
You can get an electrical shock.

⚠ CAUTION

Install wiring following a motor manual.
Motor may be damaged.

1 Turn off the electric power supply.

2 Open the cover of the motor terminal box and install wiring following a motor manual.

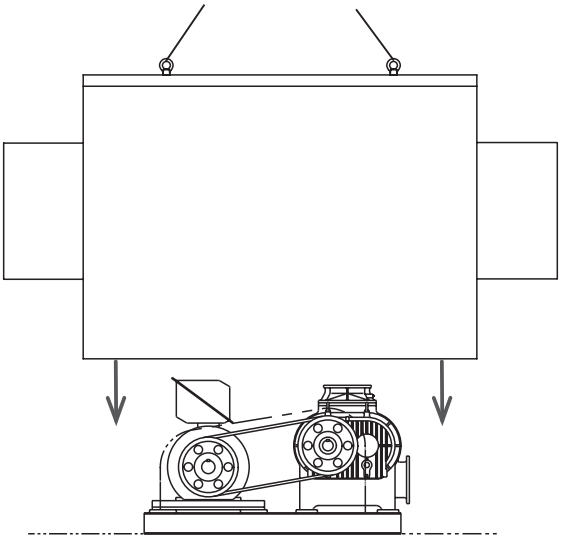
3 Ground earth lug.

4 Close the cover of the motor terminal box securely.

2.7 Place Soundproof Box

1 Lift the soundproof box using a crane, and place it over the blower unit slowly.

- Each soundproof box has its own size and shape.
- As for structure and assembly procedure of split type soundproof boxes, see its drawing or assembly instruction.



ex: IRS-300C

2 Secure the box to the foundation.

Chapter 3 Operation

Before operation, perform section 3.1 “Check before Operation.” Perform section 3.4 “Operation Check (Daily).” This chapter is essential to maximize safety and performance of a blower, and to minimize trouble. Before first operation after installation, perform section 3.3 “Trial Run.”

Tools & Materials Needed

- □ Common Tools
- □ Ammeter
- □ Thermometer
- □ Vibrometer
- □ Voltmeter
- □ Listening rod

Chapter 3 Safety Precautions - Read First -

⚠ WARNING

Wear a helmet, safety shoes, protective glasses, earplugs, and electrostatic preventive work clothes. Fix long hair and remove jewelry.
Falling objects, noise, getting caught between rotating parts, and static charge can result in severe injury.

In case of natural disaster such as earthquake and tsunami, stop working on the blower immediately.

During operation and for 1 hour after a blower stops, do not touch the blower casing, the piping, rotating parts, and accessories.
Any part of your body or clothes can get caught between rotating parts, resulting in burn or injury.

Do not operate the blower with the belt cover or coupling cover removed.
Any part of your body or clothes can get caught between rotating parts, resulting in injury.

In case of an accident during operation, stop the blower immediately.
Do not restart operation until the trouble is identified and remedied.

During operation, wear earplugs and instruct people around the blower to wear earplugs.
Noise can cause hearing damage.

During operation, make sure that there are no tools, cloth, and other objects on the blower unit, accessories, and piping.
Vibration can drop objects from above, resulting in serious injury.

While discharging gas into the atmosphere from the safety valve, keep away from the discharge port.
Hot gas can cause burn or serious injury.

⚠ CAUTION

Do not start a blower with drain or seal water left inside the casing.
Water hammer phenomena may cause blower damage.

Operate the blower with an appropriate amount of clean lubricant.
An excessive lubricant level may cause abnormal temperature rise due to stirring heat. A lack or dirt of lubricant may cause blower seize or damage.

For blowers with the piping on the suction side, mount a metallic strainer with 30 to 40 mesh on the suction port to prevent foreign objects such as spatter from entering the blower. After trial run, remove the strainer.
Foreign objects may result in blower seize or damage in the casing.

Do not adjust the air capacity by using valves on the suction or the discharge side.
The pressure may increase rapidly and blower may be damaged.

In areas where temperature drops to 0 degree C or lower, drain all the water in the blower when stopping cooling water or seal water.
Water may freeze, resulting in blower damage.

For soundproof boxes with a fan, operate the fan during blower operation.
Blower may be damaged.

3.1 Check before Operation

⚠ WARNING

Before checking or repairing, turn off the electric power supply, and warn people around the blower verbally and with notices, “Work Ahead. Do not turn on the electric power supply.”
If the blower is operated while work is being done on it, serious injury can result.

Before turning V-belts or the blower shaft manually, turn off the electric power supply to prevent fingers from being caught.
Your fingers can get caught between V-belts or into the blower, resulting in serious injury.

Before removing a drain plug, remove an oil feed plug carefully to release pressure inside the oil case.
If the drain plug is removed before the oil feed plug is removed, oil can be splashed, resulting in serious burn.

⚠ CAUTION

Use ITO recommended lubricant, and follow recommended replacement cycle and quantity.
Blower may be damaged.

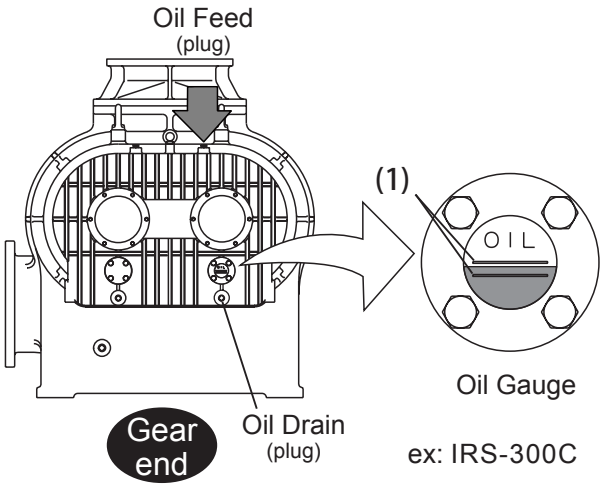
Adjust V-belt tensions properly.
Improper V-belt tensions may cause V-belt slip and damage.

To adjust V-belt tensions, use a hydraulic lifter. Never use a jack bolt that is supplied with the motor.
The jack bolt may be deformed or damaged.

When a suction strainer or a filter is clogged, clean it.
The suction pressure may fall into a vacuum state, leading to blower seize.

1 See the oil gauge on the drive end and gear end, and check that the oil level is between the two red lines (1).

- **If the oil level is below the lower line,** remove the oil feed plug, and pour oil until its level is between the two lines. (see section 4.5.)
- **If the oil level is above the upper line,** remove the oil feed plug to release inside pressure, and then remove the oil drain plug to decrease the oil level until its level is between the two lines.
- **If the oil is dirty,** change oil (see section 4.5).
- **If the oil is leaking,** contact your ITO branch or office.



ex: IRS-300C

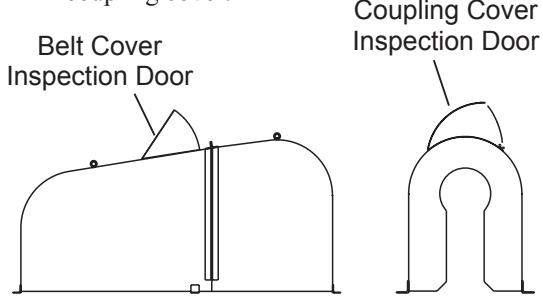
2 Open the inspection door, and check V-belt tensions and smooth rotations.

□ Check that the V-belt tensions are proper. (see section 4.2.)

- **If the V-belt tensions are not proper,** adjust the V-belt tensions properly.

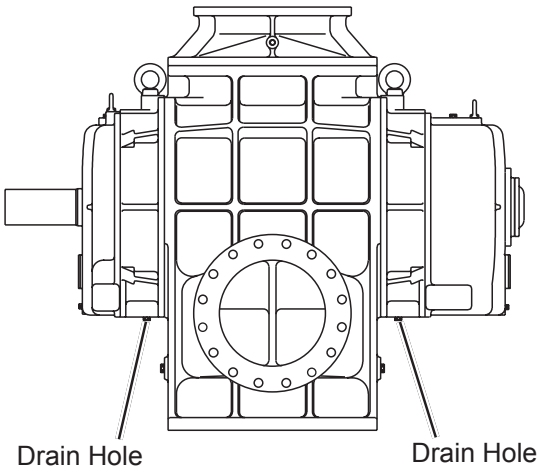
□ Rotate V-belts or coupling manually in the operating direction several revolutions. If the V-belts or coupling can be rotated smoothly, it means there are no troubles such as damage in the casing, contacts, or entering of foreign objects.

• If necessary, remove the belt cover or the coupling cover.



3 Check the drain holes under the side covers.

- **For Vacuum Pump**
  Check that the drain holes are opened.
- **For Blower**
  Check that the drain holes are closed.



ex: IRS-300C

4 Check that there are no tools, cloth, and other objects on the blower unit, accessories, and pipings.

5 Check that no bolts are loosened using wrenches.
Tighten loose bolts securely.

3.2 Turn ON Electric Power Supply

⚠ WARNING

Before operation, notify people around the blower verbally and with notices, "Blower is in operation."

While checking from the inspection door on the belt cover or coupling cover, do not reach into the door.
Your hand can get caught between rotating parts, resulting in serious injury.

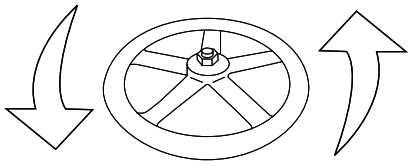
⚠ CAUTION

As for cooling water or seal water quality, conform to standard established by the Japan Refrigeration and Air Conditioning Industry Association (JRA).
Piping may be clogged or the blower may be damaged.

Before turning on the electric power supply, open valves for piping fully.
Turning on the electric power supply with valves closed may cause damage in the casing.

For blowers with gas purges such as one mechanical seal type, follow the design purge pressure specified in specifications.
Purge pressure exceeding the rated value may increase pressure abnormally in the side cover and the oil case, and cause blower seize or damage in the casing.

1 For blowers with a gate valve, turn the handle counterclockwise (in the direction shown by the arrows) slowly to open the valve fully.



2 For blowers using cooling water or seal water, flow it in the design quantity.
As for the water quality and quantity, see the table below.

- **For wet type vacuum pump with water tank (WT),**
  open the valve fully.
  When the blower starts operation, the water in the tank starts to flow to the blower.
- **For wet type vacuum pump feeding seal water directly,**
  to avoid water hammer phenomena, start the blower and then start feeding seal water.

<Water Quality Criteria> (Inlet temperature: 5 to 32℃)

Item		JRA Criteria
pH		6.5 to 8.2
Electrical Conductivity (25℃)	mS/m	80 or less
Chloride ion	mgCl^-/ L	200 or less
Sulfate ion	mgSO_4^{2-}/ L	200 or less
Acid consumption	mg$CaCO_3$/ L	100 or less
Total hardness	mg$CaCO_3$/ L	200 or less
Calcium hardness	mg$CaCO_3$/ L	150 or less
Ionic silica	mgSiO_2/ L	50 or less

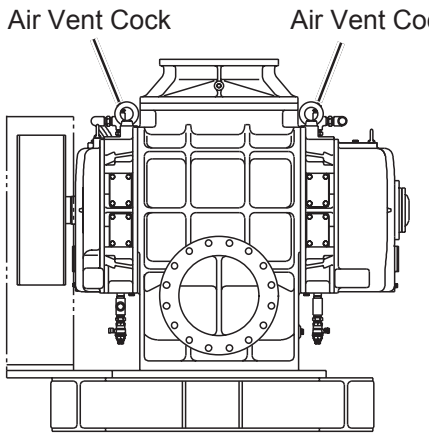
※ JRA stands for the Japan Refrigeration and Air Conditioning Industry Associateion.

<Needed Water Quantity> Unit: L/h

Model	Wet type Vacuum Pump	Oil Cooled Type	Side-Cover Water Cooled Type
300C	1800	500	2500
300D	1800	500	2500
350C	1800	500	2500
350E	2100	600	4100
400B	2100	600	4100
400C	2100	1000	4100
400D	2400	1000	4100
450B	2400	1000	4100
450A	2700	1000	4100
500B	2700	1000	4100
600A	2700	1000	4100

※ Needed water quantity differs depending on each blower specifications.

3 For Jacket type and side-cover water cooled type, open the air vent cocks, check all the air has been released from them, and close them.



ex: IRS-300CJ

4 For blowers using purge gas, adjust the gas to the design purge pressure and purge quantity.

As for the purge pressure and purge quantity, see the specifications.

5 Quickly turn the electric power supply on and off in order to ensure that the blower rotation direction corresponds to the one shown on the rotating direction seal (found on either the belt cover or the coupling cover).

- **If the blower rotates in the opposite direction of the design one,**
  install wiring again, following the motor manual.

6 Turn on the electric power supply again.

7 Check for abnormal sounds and vibrations.

- **If there are any abnormal sounds or vibrations,**
  turn off the electric power supply and identify the trouble source by checking whether the installation procedures have been correctly followed and whether any foreign objects didn`t enter the blower.
- **If there are no improper installation procedure and no foreign objects in the blower**,
  see Chapter 5 "Troubleshooting."
  Do not restart operation until the trouble is solved.
- **If the trouble is not solved,**
  contact your ITO branch or office.

8 For blowers using purge gas, check that the purge puressure is the rated value.

Purge quantity may decrease during operation. This is not a failure.

9 For the first operation after installation, go to section 3.3 "Trial Run."

3.3 Trial Run (Only First Time after Installation)

⚠ WARNING

While checking from the inspection door on the belt cover or coupling cover, do not reach into the door.

Your hand can get caught between rotating parts, resulting in serious injury.

1 Operate the blower for ten minutes at no load.

Oil will be spread through gears and bearings.

2 Check for abnormal sounds and vibrations during step 1.

Gears generate some noise until oil is spread all through gears and bearings. This is not a failure.

- **If there are any abnormal sounds or vibrations,**
  turn off the electric power supply and identify the trouble source by checking whether the installation procedures have been correctly followed and whether any foreign objects didn`t enter the blower.
- **If there are no improper installation procedure and no foreign objects in the blower**,
  see Chapter 5 "Troubleshooting."
  Do not restart operation until the trouble is solved.
- **If the trouble is not solved,**
  contact your ITO branch or office.

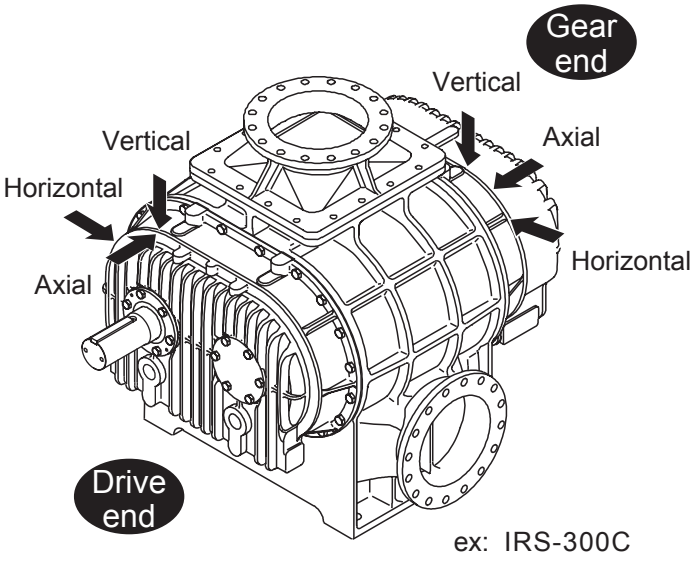
3 Operate the blower under rated load and perform steps 4 through 7.

4 Measure the current, and check that it is the motor rated value or less.

- **If the current is more than the motor rated value,**
  see Chapter 5 "Troubleshooting."
  Do not restart operation until the trouble is solved.
- **If the trouble is not solved,**
  contact your ITO branch or office.

5 Measure vibration with a vibrometer, and check that it is the allowable vibration value or less described below.

Measure total amplitude (μm(p-p)) of vibration at 6 points as shown in the illustration below.



ex: IRS-300C

Allowable Vibration Value
$\leqq 114591 / N$ [μm(p-p)]
N = Blower rotating speed
(ITO Standard)

※ The formula above is not applied to special specifications.

- **If the vibration value is more than the allowable vibration value above,**
  see Chapter 5 "Troubleshooting."
  Do not restart operation until the trouble is solved.
- **If the trouble is not solved,**
  contact your ITO branch or office.

6 Measure temperature on the bearings of the blower, and check that the value is the allowable value or less.

Continue the operation for at least one hour to check abnormalities.

An initial rapid rise in temperature is not a failure.

Bearing temperature allowable value
: Ambient temperature + 55 degrees C or less
(ITO standard)

- **If the temperature on the bearings are more than the allowable value,**
  contact your ITO branch or office.

7 Check for abnormal sounds.

Continue the operation for at least one hour to check abnormalities.

- **If there are any abnormal sounds,**
  see Chapter 5 "Troubleshooting."
  Do not restart operation until the trouble is solved.
- **If the trouble is not solved,**
  contact your ITO branch or office.

3.4 Check Operation (Daily)

⚠ WARNING

While checking from the inspection door on the belt cover or coupling cover, do not reach into the door.

Your hand can get caught between rotating parts, resulting in serious injury.

⚠ CAUTION

For blowers with gas purges such as one mechanical seal type, follow the design purge pressure specified in specifications.

Purge pressure exceeding the rated value may increase pressure abnormally in the side cover and the oil case, and cause blower seize or damage in the casing.

Open the cock of the pressure gauge only when reading it.

Operating with the cock opened may cause damage to the pressure gauge.

1 Check following items during operation once a day.

- **If there are any abnormal conditions, turn off the electric power supply immediately, and see Chapter 5 "Troubleshooting."**
- **Do not restart operation until the trouble is solved.**
- **If the trouble is not solved, contact your ITO branch or office.**

Check the followings using instruments	
	Current is the motor rated value or less. (Ammeter)
	Vibration is ≦ 114591 / Blower rotating speed (ITO standard).(Vibrometer) As for measuring points, see step 5 in section 3.3.
	Bearing temperature is the ambient temperature + 55 degrees C or less. (Thermometer)
	Suction and discharge pressures are the rated values or less. (Pressure gauge or Vacuum gauge) To change the air capacity or the specified pressure, contact your ITO branch or office.
	Purge pressure is the rated value. (Pressure gauge)
Check the followings visually	
	There are no cut or loose on V-belts. (V-belts tend to stretch during the initial operation.)
	There are no oil leakages. Initial oil ooze is not a leakage but a normal condition.
	Cooling water or seal water is flowing without cloggings.
Check the following by hearing	
	There are no abnormal sounds. (Hearing or Listening rod)
Check the following by sense of odor	
	There is no strange odor.

3.5 Turn OFF Electric Power Supply

1 For wet-type vacuum pumps, close the water feed valve, and operate the blower for 30 minutes at no load.

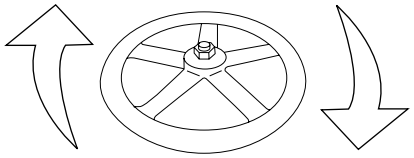
All the remaining water will be dried out.

2 Turn off the electric power supply.

3 Check for any abnormal sounds while the blower is decreasing its rotating speed.

- **If there are any abnormal sounds,**
  see Chapter 5 "Troubleshooting."
  Do not restart operation until the trouble is solved.
- **If the trouble is not solved,**
  contact your ITO branch or office.

4 For blowers with a gate valve, turn the handle clockwise (in the direction shown by the arrows) slowly to close the valve.



5 Close the valve for cooling water or seal water to stop water running.

- **If the ambient temperature drops to 0 degree C or lower,**
  drain water from the blower completely.
  For blowers other than wet-type vacuum pumps, leaving water running is no problem to prevent freezing.

6 Stop the purge gas.

3.6 Store Blower

If a blower is not used for a long time, protect the blower as follows:

⚠ WARNING

Before turning V-belts or the blower shaft manually, turn off the electric power supply to prevent fingers from being caught.
Your fingers can get caught between V-belts or into the blower, resulting in serious injury.

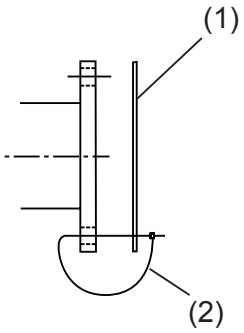
1 For blowers using cooling water or seal water, drain water completely.

2 Protect blowers against corrosion as follows:

- □ Place a vaporization rust inhibitor in the suction or the discharge opening.
  The inhibitor must conform to JIS Z1519 and be in a bag of cloth.
- □ Cover the suction and discharge flanges with a waterproof plywood or a blind flange.

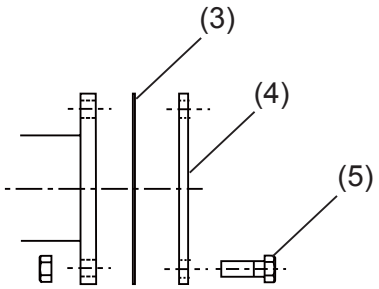
Waterproof plywood

- Apply antirust to the suction and discharge flanges.
- Secure the plywood (1) on the flange with wires (2) as shown in the illustration below.



Blind flange

- Apply antirust to the suction and discharge flanges.
- Secure the packing (3) and blind flange (4) with bolts (5) as shown in the illustration below.



3 Store blowers in a place where they are not exposed to rain and water, and rotate them every few weeks manually to prevent them from seizing.

Chapter 4 Maintenance

Maintain a blower following this chapter. Improper or any lack of maintenance will cause blower troubles.

Tools & Materials Needed

- □ Specifications
- □ Inspection Instructions
- □ Common Tools
- □ Listening rod
- □ Pinch Bar
- □ Tension Gauge
- □ Vibrometer
- □ Ammeter
- □ Voltmeter
- □ Thermometer

Chapter 4 Safety Precautions - Read First -

⚠ WARNING

Wear a helmet, safety shoes, protective glasses, earplugs, and electrostatic preventive work clothes. Fix long hair and remove jewelry.
Falling objects, noise, getting caught between rotating parts, and static charge can result in severe injury.

In case of natural disaster such as earthquake and tsunami, stop working on the blower immediately.

During operation and for 1 hour after a blower stops, do not touch the blower casing, the piping, rotating parts, and accessories.
Any part of your body or clothes can get caught between rotating parts, resulting in burn or injury.

Do not operate the blower with the belt cover or coupling cover removed.
Any part of your body or clothes can get caught between rotating parts, resulting in injury.

Before checking or repairing, turn off the electric power supply, and warn people around the blower verbally and with notices, “Work Ahead. Do not turn on the electric power supply.”
If the blower is operated while work is being done on it, serious injury can result.

During operation, wear earplugs and instruct people around the blower to wear earplugs.
Noise can cause hearing damage.

During operation, make sure that there are no tools, cloth, and other objects on the blower unit, accessories, and piping.
Vibration can drop objects from above, resulting in serious injury.

While discharging gas into the atmosphere from the safety valve, keep away from the discharge port.
Hot gas can cause burn or serious injury.

In case of an accident during operation, stop the blower immediately.
Do not restart operation until the trouble is identified and remedied.

Before operating a crane, notify people around the crane verbally and with notices, “Crane is in operation.”

Chapter 4 Safety Precautions - Read First -

Operate a crane only by a licensed operator.
Operation mistake can lead to a drop or a crash, resulting in serious injury.

4.1 Maintenance Checklist

Maintain blowers and accessories periodically, following a maintenance schedule in this section. If any trouble was found, remedy it following instructions in the Remedy item.

To disassemble or assemble a blower, contact your ITO branch or office. Defects caused by improper disassembly or assembly by personnel other than ITO or its dealers are not warranted by ITO.

⚠ WARNING

Before turning V-belts or the blower shaft manually, turn off the electric power supply to prevent fingers from being caught.
Your fingers can get caught between V-belts or into the blower, resulting in serious injury.

While checking from the inspection door on the belt cover or coupling cover, do not reach into the door.
Your hand can get caught between rotating parts, resulting in serious injury.

⚠ CAUTION

Adjust V-belt tensions properly.
Improper V-belt tensions may cause V-belt slip and damage.

To adjust V-belt tensions, use a hydraulic lifter. Never use a jack bolt that is supplied with the motor.
The jack bolt may be deformed or damaged.

Operate the blower with an appropriate amount of clean lubricant.
An excessive lubricant level may cause abnormal temperature rise due to stirring heat. A lack or dirt of lubricant may cause blower seize or damage.

In areas where temperature drops to 0 degree C or lower, drain all the water in the blower when stopping cooling water or seal water.
Water may freeze, resulting in blower damage.

For blowers with gas purges such as one mechanical seal type, follow the design purge pressure specified in specifications.
Purge pressure exceeding the rated value may increase pressure abnormally in the side cover and the oil case, and cause blower seize or damage in the casing.

Open the cock of the pressure gauge only when reading it.

Operating with the cock opened may cause damage to the pressure gauge.

When a suction strainer or a filter is clogged, clean it.

The suction pressure may fall into a vacuum state, leading to blower seize.

Maintenance before Operation

Blower State	Check off	How to	Check Item	Remedy	Refer to
Stop		Look	Check that oil level is proper and oil is clean and not leaking.	If oil is not enough, stop the blower and add oil to proper level. If oil is dirty, change oil. If oil is leaking, contact your ITO branch or office.	4.5
		Touch or Tension gauge	Check that V-belt tensions are proper.	If the V-belt tensions are not proper, stop the blower and adjust V-belt tensions.	4.2
		Touch	Check that the blower shaft can be rotated smoothly manually.	See Chapter 5 “Troubleshooting.”	5
		Look	For vacuum pumps, check that the drain holes on the side covers are opened. For blowers, check that they are closed.	For vacuum pumps, open drain holes on the side covers. For blowers, close them.	3.1
		Look	Check that there are no tools or cloth on the blower unit, accessoires, or piping.	Remove objects put on the blower unit, accessories, or piping.	—
		Touch	Check that there are no loose bolts on the belt cover and others.	Tighten loose bolts with a wrench.	—

Daily Maintenance

Blower State	Check off	How to	Check Item	Remedy	Refer to
Operation		Ammeter	Check that the current is the motor rated one or less.	See Chapter 5 “Troubleshooting.”	5
		Vibrometer	Check that the vibration is 114591/ blower rotating speed or less (ITO standard).	See Chapter 5 “Troubleshooting.”	5
		Thermo-meter	Check that the temperature on bearings is ambient temperature + 55 degrees C or less.	See Chapter 5 “Troubleshooting.”	5
		Pressure & Vacuum gauge	Check that suction and discharge pressures are the rated values or less.	See Chapter 5 “Troubleshooting.”	5
		Look	Open the inspection door, and check that there is no loose and cut on the V-belts.	Stop the blower, and adjust V-belt tensions, or replace V-belts.	4.2
		Look	Check that there are no oil leakages.	Contact your ITO branch or office.	5
		Look	Check that cooling water or seal water is flowing without cloggings.	See Chapter 5 “Troubleshooting.”	5
		Pressure gauge	Check that the purge pressure is the rated value.	Adjust the purge pressure to the rated value.	3.2
		Listen or Listening rod	Check that there are no abnormal sounds.	See Chapter 5 “Troubleshooting.”	5
		Smell	Check that there are no strange odor.	See Chapter 5 “Troubleshooting.”	5

Maintenance after first 500 operating hours

Blower State	Check off	How to	Check Item	Remedy	Refer to
Stop		—	(for the first time after installation or after overhaul)	Stop the blower and change lubricant.	4.5

Monthly Maintenance

Blower State	Check off	How to	Check Item	Remedy	Refer to
Operation		Vacuum gauge or Look	Check that he filter on the suction side is not clogged.	Check with vacuum gauge or visually. If the filter is clogged, stop the blower, and clean or replace the filter.	4.6
		Vacuum gauge or Look	Check that the strainer on the suction side is not clogged.	Check with vacuum gauge or visually. If the strainer is clogged, stop the blower, and clean the strainer.	—
Stop		Look	Check that there are no loose bolts on the belt cover and others.	Tighten any loose bolts with a wrench.	—
		Tension gauge	Check that V-belt tensions are proper.	If the V-belt tensions are not proper, stop the blower and adjust V-belt tensions.	4.2
		Look	Check that lubricant level is proper.	Adjust the lubricant level.	3.1 4.5

Maintenance every 3 months

Blower State	Check off	How to	Check Item	Remedy	Refer to
Stop		—	—	Stop the blower and change lubricant.	4.5

Annual Maintenance

Blower State	Check off	How to	Check Item	Remedy	Refer to
Stop		Look	Perform the periodic overhaul of blowers. ・Check the replacement cycle of comsumables in the table below. ・Check that there are no damaged or deteriorated parts.	Contact your ITO branch or office.	—
		Look	Check the replacement cycle of accessories in the table below.	Contact your ITO branch or office.	—

Replacement Cycle of Consumables and Accessories

Cycle	Blower	Accessories
1 year	Bearing, Oil Seal, O-ring, V-ring, Labyrinth ring, Flinger, Mechanical Seal	Coupling rubber, V-belt
2 year	Power-Lock	Rubber expansion joint, Check valve
5 year	Gear	Pulley, rubber cooling water pipes, Safety valve, silencer with sound absorbing material

4.2 Adjust V-belt Tensions

⚠ WARNING

Before turning V-belts or the blower shaft manually, turn off the electric power supply to prevent fingers from being caught.
Your fingers can get caught between V-belts or into the blower, resulting in serious injury.

⚠ CAUTION

Adjust V-belt tensions properly.
Improper V-belt tensions may cause V-belt slip and damage.

To adjust V-belt tensions, use a hydraulic lifter. Never use a jack bolt that is supplied with the motor.
The jack bolt may be deformed or damaged.

Replace V-belts with new ones all from the same manufacturer.
V-belts may be applied with uneven load, resulting in earlier wear or cut.

1 Turn off the electric power supply.

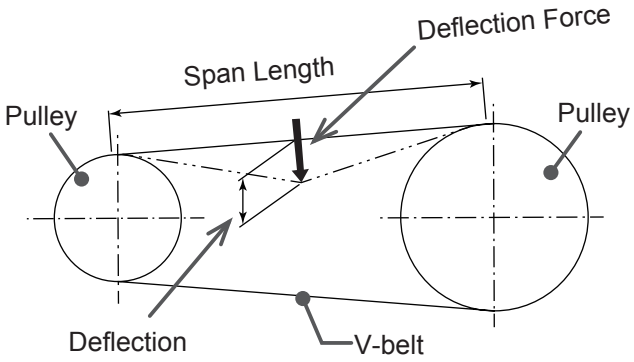
2 Loosen all tightening bolts on the belt cover, and remove the cover.

3 Measure a span length with a tape measure, and mark the middle of the length, referring to the illustration below.

4 Calculate a recommened deflection using the formula below.

Deflection (mm) = Span length (mm) X 0.016

5 Push the middle of the V-belt marked in step 3 straight down with a tension gauge, and measure a deflection force when the deflecion reaches the recommended value calculated in step 4.



6 Adjust the force to the values specified in the table below.

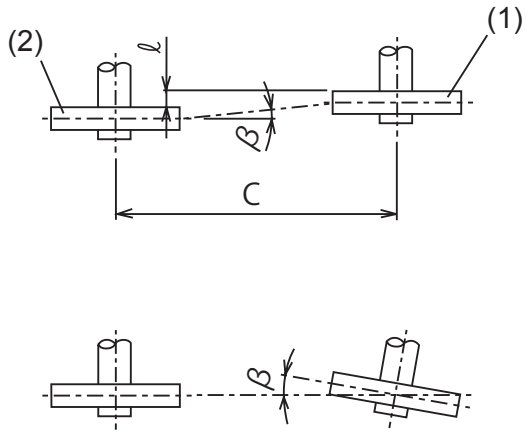
< Deflection Force >

V-belt (Type)	Smaller Pulley Outside Diameter (mm)	Deflection Force (N/one)
3 V	67 to 90	18
	91 to 115	20
	116 to 150	23
	151 to 300	26
5 V	180 to 230	58
	231 to 310	70
	311 to 400	82
8V	300 to 420	153
	421 to 520	172
	521 to 630	184

※ Deflection forces in the table above are just a reference. For your accurate force, contact your ITO branch or office.

7 Align the pulleys following steps below.

1. Measure the differential levels ℓ and β between the blower pulleys (1) and (2).



2. Adjust the differential levels measured in step 1 to the values specified in the table below.

< Allowable Differential Levels >

C≦1000 mm	ℓ < 1 mm
C>1000 mm	ℓ / C < 1/1000
β	β < 1/3°

8 Recheck the deflection force, referring to the steps 5 and 6.

9 Install and secure the belt cover with the tightening bolts.

10 Readjust V-belt tensions after a few days because V-belts tend to stretch during the initial operation.

4.3 Adjust Couplings

1 Check that coupling bolts have been tightened with the torque values specified in the table below.

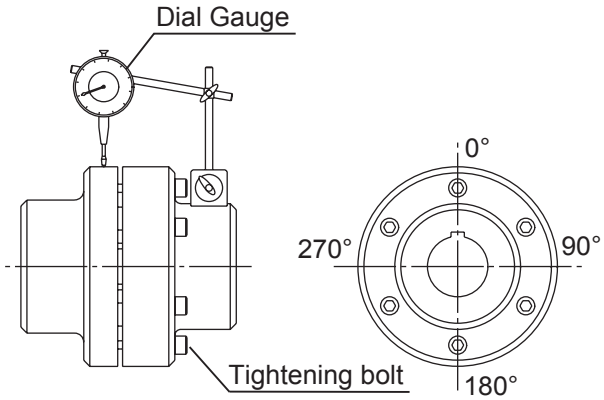
<Tightening Torque>

Coupling Type	Bolt size	Tightening Torque N・m (kg・m)
G 82 to 97	M6	9.8 (1.0)
G 112 to 128	M8	21.6 (2.2)
G 148 to 194	M10	47.0 (4.8)
G 214 to 240	M12	84.3 (8.6)
G 265 to 295	M14	186.0 (19.0)
G 330 to 415	M16	289.0 (29.5)
G 480 to 575	M20	568.0 (58.0)

2 Align the coupling so that the deviations Y and Z will be within the values specified in the table below.

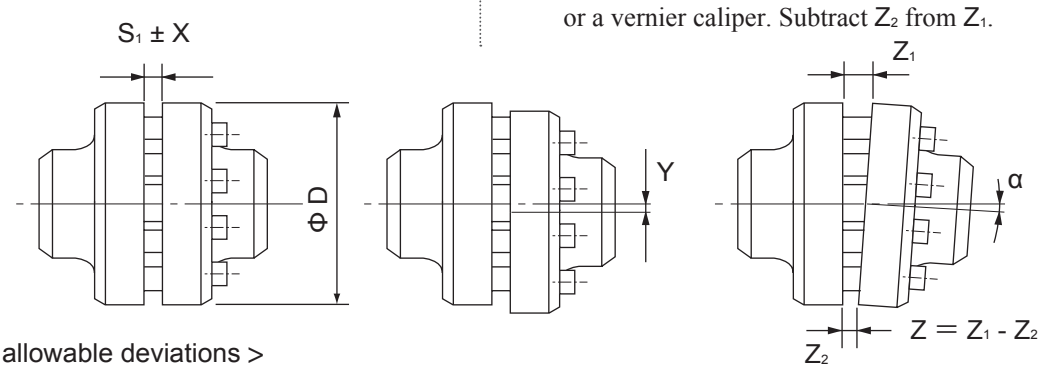
How to Obtain Deviation Y

Place a dial gauge as shown in the illustration below, and read the deviation Y on the dial gauge, at 0, 90, 180, and 270 degrees.



How to Obtain Deviation Z

Measure deviations Z_1 and Z_2 between flanges at 2 points of 180 degrees apart, with a thickness gauge or a vernier caliper. Subtract Z_2 from Z_1.

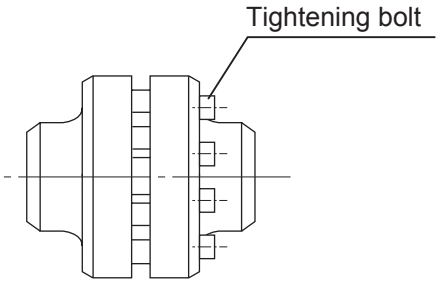


< Coupling allowable deviations >

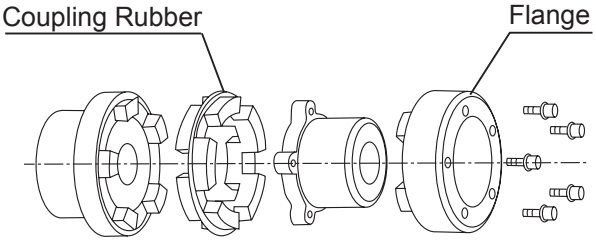
Coupling Type	Outside diameter for Coupling D (mm)	Distance between flanges $S_1 \pm X$ (mm)	Deviation Y (mm)	Deviation α (`)	Deviation Z (mm)
G82	82	3±1	0.05	3.0	0.07
G97	97	3±1	0.05	2.5	0.07
G112	112	3.5±1	0.07	2.5	0.08
G128	128	3.5±1	0.07	2.5	0.09
G148	148	3.5±1	0.07	2.0	0.09
G168	168	3.5±1	0.10	2.0	0.10
G194	194	3.5±1	0.10	2.0	0.11
G214	214	4±1	0.10	2.0	0.12
G240	240	4±1	0.10	2.0	0.13
G265	265	5.5±1	0.10	2.0	0.14
G295	295	8±2.5	0.12	2.0	0.14
G330	330	8±2.5	0.12	1.5	0.15
G370	370	8±2.5	0.12	1.5	0.16
G415	415	8±2.5	0.12	1.5	0.18
G480	480	8±2.5	0.12	1.5	0.20
G575	575	8±2.5	0.12	1.5	0.25

4.4 Replace Coupling Rubber

1 Loosen tightening bolts.

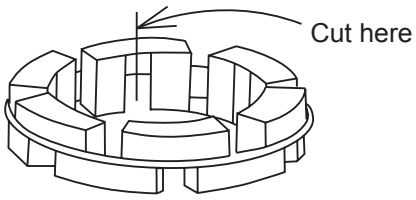


2 Slide the flange outwards.



3 Remove the coupling rubber.

4 Cut the new coupling rubber as shown in the illustration below.



5 Place a new coupling rubber.

6 Put the flange back in its original place.

7 Tighten all tightening bolts diagonally.
First, tighten the bolts lightely, then with the torque specified in step 1 of section 4.3.

4.5 Add or Change Oil

⚠ WARNING

Before removing a drain plug, remove an oil feed plug carefully to release pressure inside the oil case.
If the drain plug is removed before the oil feed plug is removed, oil can be splashed, resulting in serious burn.

While handling lubricant, keep fire away.
Fire can occur, resulting in burn.

Before adding or changing oil, turn off the electric power supply.
Oil can be splashed, resulting in serious burn.

⚠ CAUTION

Use ITO recommended lubricant, and follow recommended replacement cycle and quantity.
Blower may be damaged.

Operate the blower with an appropriate amount of clean lubricant.
An excessive lubricant level may cause abnormal temperature rise due to stirring heat. A lack or dirt of lubricant may cause blower seize or damage.

< Recommended Oils >

※ Recommended oil viscosity grade is ISO VG 100 or ISO VG 68.

Manufacturer	ISO VG 100	ISO VG 68
Showa Shell	Tellus Oil C100 (Morlina Oil 100) Turbo Oil T100	Tellus Oil C68 Turbo Oil T68
Exxon Mobil	DTE Oil heavy Teresso 100	DTE Oil heavy Medium Teresso 68
Nippon Oil	FBK Oil RO 100	FBK Oil RO 68 FBK Turbine RO 68
Japan Energy	Jomo Lathus 100 Jomo RIX Turbine 100	Jomo Hydro 68 Jomo RIX Turbine 68
Cosmo oil	Cosmo Allpus 100 Cosmo Turbine Super 100	Cosmo Allpus 68 Cosmo Turbine Super 68
Idemitsu kosan	Daphne Super Oil 100 Daphne Turbine 100	Daphne Mechanical Oil 68 Daphne Turbine 68

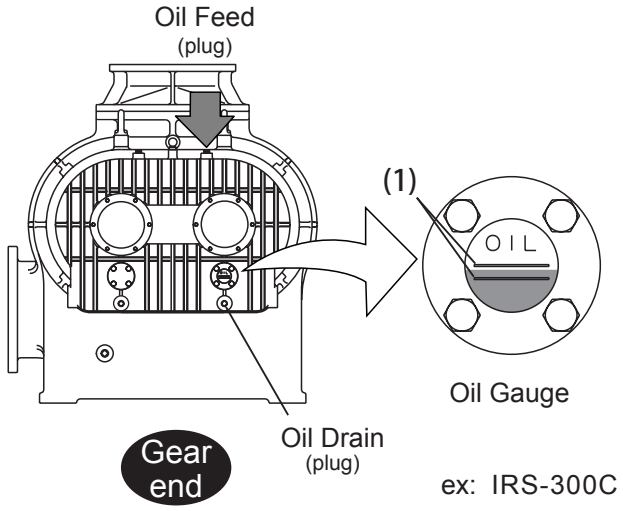
Add oil

1 Turn off the electric power supply.

2 Remove the oil feed plug.

3 Add oil until its level is between the two red lines (1).

4 Put the oil feed plug back in its original place.



ex: IRS-300C

Change oil

1 Turn off the electric power supply.

2 Remove the oil feed plug.

3 Remove the oil drain plug and drain all the oil.

4 Put the oil drain plug back in its original place.

5 Add the oil until its level is between the two red lines (1).

As for the oil capacity, see the table below.

< Oil Change Intervals & Capacity >

Model	Drive end	Gear end	First Change	From Second Change on
IRS(T)-300C IRS(T)-300D IRS(T)-350C	4.9 L	11.3 L	After 500 operating hours (about 20 days)	Every 2000 operating hours (about 3 months)
IRS(T)-350E IRS(T)-400B	7.0 L	17.0 L		
IRS(T)-400C IRT-400D IRT-450B IRT-450A IRT-500B IRT-600A	7.8 L	14.0 L		

※ Oil capacities in the table above are just a reference. It may increase or decrease depending on each blower.

6 Put the oil feed plug back in its original place.

4.6 Clean or Replace Filter on Suction Side

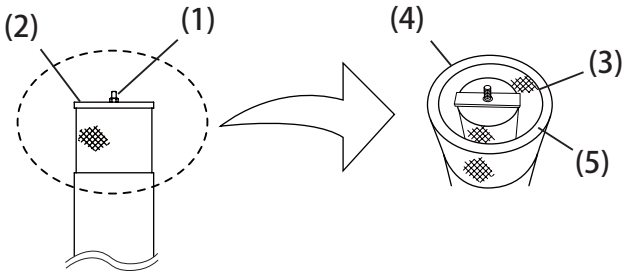
⚠ CAUTION

While removing accessories or piping from the blower unit, make sure that foreign objects do not enter the piping and the blower inside.
Foreign objects may result in blower seize or damage in the casing.

When a suction strainer or a filter is clogged, clean it.
The suction pressure may fall into a vacuum state, leading to blower seize.

1 Turn off the electric power supply.

2 Loosen the nut or eyenut (1), and remove the lid (2).



3 Remove the filter (5) between perforated metals (3) and (4).

4 Clean or replace the filter (5).

- **When cleaning the filter,**
  clean the filter with water or mild detergent, and then dry it completely.
- **When replacing the filter,**
  replace the filter with a new one.

5 Put the filter (5) and perforated metals (3)(4) back in their original place, place the lid (2), and secure it with the nut or eyenut (1).

Chapter 5 Troubleshooting

If a trouble occurs,
turn off the electric power supply immediately, and see Troubleshooting Checklists categorized by symptoms in the next several pages, and perform its corresponding remedies.

If the trouble cause can not be identified, or the trouble can not be corrected even after remedies in this chapter are used, contact your ITO branch or office on the back page.

Troubleshooting Checklist

No. 1 Blower won`t start

Trouble source	Check Items	Cause and/or Remedy
Electrical System	Check that all wires are connected.	Connect unconnected wires.
	Check that the electric power supply is supplied.	Supply the electric power supply.
	Check that the breaker is not tripped.	Turn on the breaker.
	Check that no fuse on the distribution board is blown.	Replace the blown fuse with a new one.
	Check that the wires are connected correctly.	Connect wires correctly.
	Check that the start-up method is correct.	Check the start-up method.
	Check that the start-up period is set correctly.	For star-delta start-up, torque may be too small. Adjust the start-up period.
	Check that the wire is thick enough for the design current.	Any wire may be damaged. Replace any defective wires with new ones that are thick enough for the design current.
	Check that no wire is broken or defective.	Replace the broken or defective wire with a new one.
Piping System	Check that the pressure is less than the rated value.	See No. 6 “Pressure is too high.”
	Check that the pipe connections are not covered with protective covers or so on.	Remove all protective covers.
	Check that the filter on the suction side is not clogged.	Clean or replace the filter.
	Check that the strainer on the suction side is not clogged.	Clean the strainer.
Blower	Check that there is no cut on the V-belts.	Replace the V-belts with new ones.
	Check that the blower shaft can be rotated manually.	See No. 3 “Blower shaft cannot be rotated manually.”
	Check that you don`t hear any abnormal sounds rotating the blower shaft manually.	Any bearing or gear may be worn or the blower may be damaged. Contact your ITO branch or office.
	Check that there is no contact or damage in the casing.	Contact your ITO branch or office.
Motor	Check that there are no abnormal conditions for the motor.（See the motor manual.）	Contact the motor manufacturer or your ITO branch or office.

No. 2 Blower stops during operation

Trouble source	Check Item	Cause and/or Remedy
Piping System	Check that the pressure is less than the rated value.	See No. 6 “Pressure is too high.”
	Check that the filter on the suction side is not clogged.	Clean or replace the filter.
	Check that the strainer on the suction side is not clogged.	Clean the strainer.
Blower	Check that there are no defective appearances by visual check.	The blower may be damaged. Contact your ITO branch or office.
	Check that the blower shaft can be rotated manually.	See No.3 “Blower shaft cannot be rotated manually.”
	Check that you don`t hear any abnormal sounds rotating the blower shaft manually.	Any bearing or gear may be worn or the blower may be damaged. Contact your ITO branch or office.
	Check that there is no contact or damage in the casing.	Contact your ITO branch or office.
Motor	Check that there are no abnormal conditions for the motor.（See the motor manual.)	Contact the motor manufacturer or your ITO branch or office.

No. 3 Blower shaft cannot be rotated manually

Trouble source	Check Items	Cause and/or Remedy
Blower	Check that there are no defective appearances by visual check.	The blower may be damaged. Contact your ITO branch or office.
	Check that there are no foreign objects inside the casing.	Remove the foreign objects.
	Check that there is no corrosion inside the casing.	Contact your ITO branch or office.
	Check that there is no contact or damage in the casing.	Contact your ITO branch or office.

No. 4 Air capacity is decreasing

Trouble source	Check Items	Cause and/or Remedy
Piping System	Check that the pressure is less than the rated value.	If the blower is overloaded, the air capacity decreases. See No.6 “Pressure is too High.”
	Check that there are no loose bolts on the flanges.	Tighten the loose bolts.
	Check that the filter on the suction side is not clogged.	If the blower is overloaded, the air capacity decreases. Clean or replace the filter.
	Check that the strainer on the suction side is not clogged.	If the blower is overloaded, the air capacity decreases. Clean the strainer.
	Check that the safety valve is not activated.	Contact your ITO branch or office.
Blower	Check that the speed of rotation is not decreasing.	Any V-belt may be slipped. Adjust V-belt tensions.
	Check that the blower shaft can be rotated manually.	See No.3 “Blower shaft cannot be rotated manually.”

No. 5 Current is too high

Trouble source	Check Items	Cause and/or Remedy
Piping System	Check that the pressure is less than the rated value.	See No. 6 “Pressure is too high.”
	Check that the filter on the suction side is not clogged.	Clean or replace the filter.
	Check that the strainer on the suction side is not clogged.	Clean the strainer.
Blower	Check that the blower shaft can be rotated manually.	See No.3 “Blower shaft cannot be rotated manually.”
	Check that you don`t hear any abnormal sounds rotating the blower shaft manually.	Any bearing or gear may be worn or the blower may be damaged. Contact your ITO branch or office.
	Check that there is no contact or damage in the casing.	Contact your ITO branch or office.
Motor	Check that there are no abnormal conditions for the motor.（See the motor manual.）	Contact the motor manufacturer or your ITO branch or office.
Instrument	Check that there are no abnormal conditions for the ammeter.（See the ammeter manual.）	Contact the ammeter manufacturer or your ITO branch or office.

No. 6 Pressure is too high

Trouble source	Check Items	Cause and/or Remedy
Piping System	Check that the gate valve is opened fully.	Open the gate valve fully.
	Check that the piping is not clogged.	Clean the inside of the piping.
Instrument	Check that there are no abnormal conditions for the pressure gauge.（See the pressure gauge manual.）	Contact the pressure gauge manufacturer or your ITO branch or office.

No. 7 Abnormal sounds are heard

Trouble source	Check Items	Cause and/or Remedy
Blower	Check that there are no loose V-belts.	Adjust V-belt tensions.
	Check that lubricant is enough.	Too little lubricant may cause abnormal sounds. Add lubricant.
	Check that the oil is not dirty.	Change oil.
	Check that the blower shaft can be rotated manually.	See No.3 “Blower shaft cannot be rotated manually.”
	Check that you don`t hear any abnormal sounds rotating the blower shaft manually.	Bearing or gear wear, poor mechanical seal contact or wear, or blower damage may result. Contact your ITO branch or office.
	Check that there is no contact or damage in the casing.	Contact your ITO branch or office.
	Check that the coupling rubber is not worn.	Replace the coupling rubber.
Piping System	Check that the pressure is less than the rated value.	Blower overload may cause abnormal sounds See No.6 “Pressure is too high.”
	Check that there are no loose bolts on the flanges.	Tighten the loose bolts.
	Check that there is no transmitted noise.	Cover the noise source with lagging.
	Check that there are no resonances in the piping.	Correct piping supports.

No. 8 Strange odor is emitted

Trouble source	Check Items	Cause and/or Remedy
Piping System	Check that there are no loose bolts on the flanges.	Gas may be leaking from the piping. Tighten the loose bolts.
Blower	Check that there are no loose V-belts.	Adjust V-belt tensions.
	Check that there are no defective appearances by visual check.	The blower may be damaged. Contact your ITO branch or office.
	Check that the blower shaft can be rotated manually.	See No.3 “Blower shaft cannot be rotated manually.”
	Check that you don`t hear any abnormal sounds rotating the blower shaft manually ?	Any bearing or gear may be worn or the blower may be damaged. Contact your ITO branch or office.
	Check that there is no contact or damage in the casing.	Contact your ITO branch or office.
Motor	Check that there are any abnormal conditions for the motor.（See the motor manual.)	Contact the motor manufacturer or your ITO branch or office.

No. 9 Vibration is too high

Trouble source	Check Items	Cause and/or Remedy
Installation	Check that there are no loose anchor bolts.	Tighten loose anchor bolts.
	Check that the foundation is steady.	If any requirement in section 2.3 is not met, construct the foundation again.
	Check that the pulleys or the couplings are aligned.	Align the pulleys or the couplings.
Piping System	Check that the pressure is less than the rated value.	See No.6 “Pressure is too High.”
	Check that there are no loose bolts on the flanges.	Tighten the loose bolts.
	Check that there are not too much load onto piping joints.	Correct joints by using expansion joints and so on.
	Check that there are no resonances in the piping.	Correct piping supports.
Blower	Check that there are no defective appearances by visual check.	Blower may be damaged. Contact your ITO branch or office.
	Check that the blower shaft can be rotated manually.	See No.3 “Blower shaft cannot be rotated manually.”
	Check that you don`t hear any abnormal sounds rotating the blower shaft manually.	Any bearing or gear may be worn or the blower may be damaged. Contact your ITO branch or office.
	Check that there is no contact or damage in the casing.	Contact your ITO branch or office.
	Check that water is not left inside the blower.	Drain water.
	Check that blower mounting bolts are not loose.	Tighten loose mounting bolts.

No.10 Oil or Water is leaking

Trouble source	Check Items	Cause and/or Remedy
Blower	—	Locate leaking points and contact your ITO branch or office.

No.11 Discharge temperature is too high

Trouble source	Check Items	Cause and/or Remedy
Piping System	Check that the suction temperature is less than the rated value.	Lower the temperature to the rated value or less.
	Check that the pressure is less than the rated value.	See No.6 “Pressure is too High.”
	Check that the filter on the suction side is not clogged.	Clean or replace the filter
	Check that the strainer on the suction side is not clogged.	Clean the strainer.
Instrument	Check that there are no abnormal conditions for the thermometer.（See the thermometer manual.)	Contact the thermometer manufacturer or your ITO branch or office.

No.12 Bearing temperature is too high

Trouble source	Check Items	Cause and/or Remedy
Piping System	Check that the suction temperature is less than the rated value.	Lower the temperature to the rated value or less.
	Check that the pressure is less than the rated value.	See No.6 “Pressure is too High.”
	Check that the filter on the suction side is not clogged.	Clean or replace the filter.
	Check that the strainer on the suction side is not clogged.	Clean the strainer.
Blower	Check that lubricant quantity is proper.	Adjust the lubricant quantity.
	Check that lubricant type is correct.	Use ITO recommended lubricant.
	Check that cooling water is enough.	See No.13 “Outlet temperature of cooling water is too high” and No.14 “Cooling water is not flowing.”
	Check that there are no defective appearances by visual check.	The blower may be damaged. Contact your ITO branch or office.
	Check that the blower shaft can be rotated manually.	See No.3 “Blower shaft cannot be rotated manually.”
	Check that you don`t hear any abnormal sounds rotating the blower shaft manually.	Any bearing or gear may be worn or the blower may be damaged. Contact your ITO branch or office.
	Check that there is no contact or damage in the casing.	Contact your ITO branch or office.
Instrument	Check that there are no abnormal conditions for the thermometer.（See the thermometer manual.)	Contact the thermometer manufacturer or your ITO branch or office.

No.13 Outlet temperature of cooling water is too high

Trouble source	Check Items	Cause and/or Remedy
Blower	Check that the cooling water quantity is enough.	Adjust the cooling water quantity to the rated value.
	Check that the Inlet temperature of the cooling water is less than the rated value.	Lower the temperature to the rated value or less.
	Check that the suction temperature is less than the rated value.	Lower the temperature to the rated value or less.
	Check that the pressure is less than the rated value.	See No.6 “Pressure is too High.”
	Check that lubricant quantity is proper.	Adjust the lubricant quantity.
	Check that lubricant type is correct.	Use ITO recommended lubricant.
Instrument	Check that there are no abnormal conditions for the thermometer.（See the thermometer manual)	Contact the thermometer manufacturer or your ITO branch or office.

No.14 Cooling water is not flowing

Trouble source	Check Items	Cause and/or Remedy
Cooling Water Piping	Check that the gate valve is opened.	Open the gate valve.
	Check that piping is not clogged.	Clean the inside of the piping.
	Check that hoses are not curved.	Straighten them.
	Check that the water quantity and pressure are proper.	Adjust water quantity and pressure properly.
Instrument	Check that there are no abnormal conditions for the flow sight.（See the flow sight manual.)	Contact the flow sight manufacturer or your ITO branch or office.

Service Warranty

Basic Warranty Conditions

1 ITO Engineering Co.,Ltd. , not otherwise specified, warrants any part of ITO Blower against defects in design, materials, and workmanship for one year from the date of the blower arrival. Within the warranty period, we adjust, repair, or replace any defects under normal use free of charge.

This warranty applies only when the blower is properly used in accordance with instructions in manuals, the nameplate, and others. This warranty does not apply under the following conditions.

(1) Defects or malfunctions resulting from failure to properly store, operate, or maintain the unit in accordance with this manual.
(2) Defects resulting from failure to use parts recommended by ITO.
(3) Defects caused by adjustment, repair, or modification by someone other than ITO authorized personnel.
(4) Defects rusulting from failure to use water in conformity to water quality specified in this manual.
(5) Defects caused by accidental fire, flood, earthquake, lightening, and the like.
(6) A breakdown or damage caused by foreign objects, abnormal pressure.

2 This warranty is limited to adjustment, repair, and replacement of defected parts.
Damage secondary to the first is not applicable. Price of the warranty is whitin that of the defected part.

3 Consumables such as rubber and plastic are not applicable.

We recommend that a spare blower is prepared in case of emergency.

Disposal

Dispose of a blower as a general industrial waste, complying with local regulations.

Blower Specifications

Model	Flange Diameter	Rotation Speed (min^{-1})	Suction Air Capacity (m^3/min)	Pressure (kPa)	Output (kW)	Weight (kg)
Standard Blower						
IRS(T)-300C	300A	500 ~ 1200	45.4 ~ 148	10 ~ 70	15.9 ~ 198	2140 (2360)
IRS(T)-300D	300A	500 ~ 1200	57.1 ~ 182	10 ~ 70	19.4 ~ 243	2360 (2570)
IRS(T)-350C	350A	500 ~ 1100	71.7 ~ 205	10 ~ 70	23.5 ~ 272	2760 (2860)
IRS(T)-350E	350A	500 ~ 1100	80.1 ~ 225	10 ~ 70	23.6 ~ 294	3460 (3620)
IRS(T)-400B	400A	500 ~ 1000	110 ~ 274	10 ~ 70	30.8 ~ 357	3960 (4150)
IRS(T)-400C	400A	500 ~ 850	141 ~ 276	10 ~ 70	41.7 ~ 368	5010 (5310)
IRT-400D	400A	500 ~ 850	176 ~ 345	10 ~ 70	51.4 ~ 458	(5570)
IRT-450B	450A	500 ~ 850	215 ~ 418	10 ~ 70	60.9 ~ 551	(6670)
IRT-450A	450A	500 ~ 850	251 ~ 487	10 ~ 70	70.1 ~ 640	(7020)
IRT-500B	500A	500 ~ 850	276 ~ 525	10 ~ 60	74.6 ~ 594	(7590)
IRT-600A	600A	500 ~ 850	276 ~ 525	10 ~ 60	74.6 ~ 594	(7610)
Side-Cover Water Cooled Type Blower						
IRS(T)-300CJ	300A	500 ~ 1200	41.6 ~ 135	80 ~ 100	93.6 ~ 278	2190 (2410)
IRS(T)-300DJ	300A	500 ~ 1200	52.7 ~ 167	80 ~ 100	114 ~ 341	2410 (2610)
IRS(T)-350CJ	350A	500 ~ 1100	66.7 ~ 188	80 ~ 100	140 ~ 383	2810 (2900)
IRS(T)-350EJ	350A	500 ~ 1100	74.9 ~ 207	80 ~ 100	152 ~ 416	3510 (3660)
IRS(T)-400BJ	400A	500 ~ 1000	103 ~ 251	80 ~ 100	203 ~ 505	4010 (4200)
IRS(T)-400CJ	400A	500 ~ 850	135 ~ 257	80 ~ 100	246 ~ 517	5080 (5370)
IRT-400DJ	400A	500 ~ 850	170 ~ 322	80 ~ 100	306 ~ 644	(5630)
IRT-450BJ	450A	500 ~ 850	207 ~ 390	80 ~ 100	368 ~ 775	(6730)
IRT-450AJ	450A	500 ~ 850	242 ~ 456	80 ~ 100	427 ~ 901	(7080)
Dry Type Vacuum Pump						
IRS(T)-300C	300A	500 ~ 1200	41.7 ~ 147	-10 ~ -50	15.9 ~ 144	2140 (2360)
IRS(T)-300D	300A	500 ~ 1100	52.8 ~ 182	-10 ~ -50	19.4 ~ 177	2360 (2570)
IRS(T)-350C	350A	500 ~ 1100	66.9 ~ 204	-10 ~ -50	23.5 ~ 199	2760 (2860)
IRS(T)-350E	350A	500 ~ 1100	75.1 ~ 224	-10 ~ -50	23.6 ~ 213	3460 (3620)
IRS(T)-400B	400A	500 ~ 1000	103 ~ 274	-10 ~ -50	30.8 ~ 259	3960 (4150)
IRS(T)-400C	400A	500 ~ 850	135 ~ 276	-10 ~ -50	41.7 ~ 269	5010 (5310)
IRT-400D	400A	500 ~ 850	170 ~ 344	-10 ~ -50	51.4 ~ 334	(5570)
IRT-450B	450A	500 ~ 850	208 ~ 417	-10 ~ -50	60.9 ~ 402	(6670)
IRT-450A	450A	500 ~ 850	243 ~ 486	-10 ~ -50	70.1 ~ 466	(7020)
IRT-500B	500A	500 ~ 850	264 ~ 525	-10 ~ -50	74.6 ~ 501	(7590)
IRT-600A	600A	500 ~ 850	264 ~ 525	-10 ~ -50	74.6 ~ 501	(7610)
Dry Type Vacuum Pump (Self Air Cooled Type)						
IRS(T)-300CT	300A	500 ~ 1200	36.7 ~ 140	-30 ~ -60	38.1 ~ 171	2140 (2360)
IRS(T)-300DT	300A	500 ~ 1200	46.9 ~ 173	-30 ~ -60	46.7 ~ 210	2360 (2570)
IRS(T)-350CT	350A	500 ~ 1100	60.0 ~ 194	-30 ~ -60	57.0 ~ 235	2760 (2860)
IRS(T)-350ET	350A	500 ~ 1100	68.0 ~ 214	-30 ~ -60	60.4 ~ 254	3460 (3620)
IRS(T)-400BT	400A	500 ~ 1000	94.8 ~ 261	-30 ~ -60	80.2 ~ 308	3960 (4150)
IRS(T)-400CT	400A	500 ~ 850	128 ~ 265	-30 ~ -60	100 ~ 319	5010 (5310)
IRT-400DT	400A	500 ~ 850	161 ~ 331	-30 ~ -60	124 ~ 396	(5570)
IRT-450BT	450A	500 ~ 850	197 ~ 402	-30 ~ -60	149 ~ 477	(6670)
IRT-450AT	450A	500 ~ 850	231 ~ 469	-30 ~ -60	172 ~ 553	(7020)
IRT-500BT	500A	500 ~ 850	252 ~ 507	-30 ~ -60	185 ~ 595	(7590)
IRT-600AT	600A	500 ~ 850	252 ~ 507	-30 ~ -60	185 ~ 595	(7610)
Wet Type Vacuum Pump						
IRS(T)-300C	300A	500 ~ 1200	50.7 ~ 151	-10 ~ -60	17.2 ~ 175	2140 (2360)
IRS(T)-300D	300A	500 ~ 1200	63.3 ~ 186	-10 ~ -60	20.9 ~ 215	2360 (2570)
IRS(T)-350C	350A	500 ~ 1100	78.9 ~ 209	-10 ~ -60	25.3 ~ 241	2760 (2860)
IRS(T)-350E	350A	500 ~ 1100	87.5 ~ 230	-10 ~ -60	25.1 ~ 258	3460 (3620)
IRS(T)-400B	400A	500 ~ 1000	119 ~ 280	-10 ~ -60	32.5 ~ 313	3960 (4150)
IRS(T)-400C	400A	500 ~ 850	148 ~ 281	-10 ~ -60	45.0 ~ 327	5010 (5310)
IRT-400D	400A	500 ~ 850	186 ~ 351	-10 ~ -60	55.4 ~ 406	(5570)
IRT-450B	450A	500 ~ 850	226 ~ 425	-10 ~ -60	65.6 ~ 488	(6670)
IRT-450A	450A	500 ~ 850	263 ~ 495	-10 ~ -60	75.2 ~ 565	(7020)
IRT-500B	500A	500 ~ 850	286 ~ 534	-10 ~ -60	79.9 ~ 608	(7590)
IRT-600A	600A	500 ~ 850	286 ~ 534	-10 ~ -60	79.9 ~ 608	(7610)

※ See the table above just as a reference.
※ For detail specifications, see your blower nameplate or specifications.
※ Item “Weight” shows the blower body weight.
Values in ( ) show IRT type blower body weights.

After-sales Service

ITO Engineering Co., Ltd. keeps track of all after-sales service history based on ITO original history sheets for each blower. To order periodic maintenance service, repair service, or parts, contact your ITO branch or office.

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