

Form P7621 Edition 3 June 2009 04579421

Air Motor

SM4AM

# **Operation and Maintenance Information**



Save These Instructions





## **General Product Safety Information**

- Important Safety Information enclosed.
- Read and understand this manual before operating this tool.
- It is your responsibility to make this safety information available to others that will operate this tool.



## Failure to Observe the Following Warnings could result in injury.

#### **Placing the Motor in Service**

- Always install, operate, inspect and maintain this product in accordance with all applicable standards and regulations (local, state, country, federal, etc.).
- Always use clean, dry air at 90 psig (6.2 bar/620 kPa) maximum air pressure at the inlet. Higher pressure may result in hazardous situations
  including excessive speed, rupture, or incorrect output torque or force.
- · Ensure an accessible emergency shut off valve has been installed in the air supply line, and make others aware of its location.
- · Do not use damaged, frayed or deteriorated air hoses and fittings.
- Always turn off the air supply and disconnect the air supply hose before installing, removing or performing any maintenance on this motor.
- Do not lubricate with flammable or volatile liquids such as kerosene, diesel or jet fuel. Use only recommended lubricants.
- · Keep work area clean, uncluttered, ventilated and illuminated.
- Do not remove any labels. Replace any damaged label.

#### Using the Motor

- Always use Personal Protective Equipment appropriate to the motor used. This may include dust mask or other breathing apparatus, safety
  glasses, ear plugs, gloves, apron, safety shoes, hard hat and other equipment.
- · Keep others a safe distance from your work area, or ensure they use appropriate Personal Protective Equipment.
- · This motor is not insulated against electric shock.
- · Keep hands, loose clothing, long hair and jewelry away from motor.
- · Motor and/or accessories may briefly continue their motion after throttle is released.
- Do not operate when tired, or under the influence of medication, drugs, or alcohol.
- Never use a damaged or malfunctioning motor or accessory.
- · Do not modify the motor, safety devices, or accessories.
- · Do not use this motor for purposes other than those recommended.
- Use accessories recommended for Ingersoll Rand Fluid Products.

## Safety Symbol Identification



Wear Respiratory

Protection



Wear Eye Protection



Wear Hearing Protection



Read Manuals Before Operating Products

(Dwg. MHP2598)

## Safety Information - Explanation of Safety Signal



## Model Identification



## **Equipment Options**

Carrier	Furnished with Cataloged M			
Series	Mounting	Muffler		
CAAAAA	3 Hole Face Mount	Supplied with Motor	SM4AM-AH634 Mounting Foot	
SIM4AIM	NEMA 56C Mounting Flange with SM4AMAN	Supplied with Motor		

## Servicing the Motor



## Operation

## NOTICE

If the motor operates sluggishly, flush it with a clean, non-toxic, nonflammable commercial solvent in a well ventilated area.

#### To flush the motor:

- 1. Disconnect the air line and muffler.
- 2. Pour 6 to 8 cc of solvent into each inlet.
- 3. Rotate the motor shaft by hand in both directions several times to ensure all internal parts of motor are thoroughly cleaned.
- 4. Apply air pressure to the inlet and slowly increase the air flow until there is no trace of the solvent in the exhaust.
- 5. After flushing, shut off the air supply and disconnect air supply line.
- Pour 6 to 8 cc of a high detergent SAE10 motor oil into the air inlet.
- Reconnect the air supply line, slowly increase the air pressure to ensure all internal parts of motor will be covered with a film of oil.
- 8. If the motor is still low in power, return motor to your nearest service repair center.

#### Lubrication

SM4AM Series suggests using an air line lubricator with these motors. We recommend a 1/2 inch Filter-Regulator-Lubricator (FRL) for optimum motor performance and life.

SM4AM Series vanes are made of a special material that does not require lubrication. While we suggest lube for optimum service life, our vanes have been shown to last substantially longer than standard laminate versions. This makes **Ingersoll Rand** motors a good choice for Food Grade or Clean Room environments where oil is not permitted.

## Installation

The use of an air line lubricator in the air supply line is recommended. Attach the unit as close to the motor as practical. Where the lubricator cannot be permanently mounted, we recommend using a 1/2 inch FRL.



(Dwg. TPD905-2)



## Specifications

Carrier	Max.	Power	Speed at Max. Power	Free Speed•	Starting	Torque	Stall T	orque	Air Consumption	at Max. Power	Wei	ght
Series	hp	kw	rpm	rpm	lbft.	Nm	lbft.	Nm	scfm	m³/m	lb.	kg
Reversible												
SM4AM	1.5	1.1	3000	7900	2.6	3.5	4.1	5.6	67	1.9	8.25	3.7
SM4AM	1.5	1.1	3000	7900	2.6	3.5	4.1	5.6	67	1.9	8.25	_

 ALL models must be operated with sufficient load to prevent speed from exceeding maximum allowable speed shown on performance curve. Performance figures are at 90 psig (620 kPa) air pressure, with muffler installed.

## **Foot Mount Drawing**



(Dwg. MHP2546)

## **Dimension Drawings**

## Model SM4AMB



(Dwg. MHP2529)

#### Model SM4AMANRSS



## Model SM4AMAN



(Dwg. MHP2530)

## Model SM4AM Foot Mount





(Dwg. MHP2551)



一般产品安全信息

- 包含重要的安全信息。
- 在操作本工具前,请认真阅读并理解本手册的内容。
- 您有责任为其他准备操作本工具的人员提供此安全信息。

## \rm 🛉 告

### 若不遵循以下警告,则有可能造成人身伤害。

#### 准备使用马达

- 安装、操作、检查和维护本产品时,务必遵守(当地、州/省、国家/地区、联邦等)所有适用的标准和法规。
- 在进气口处务必使用最大气压为 620kPa/6.2bar (90 psig)的洁净干燥空气。若气压更高,则可能发生速度过快、破裂、错误的输出力 或扭矩等危险情况。
- 确保供气管已安装有易操作紧急关闭阀并将其位置通知给其他人。
- 切勿使用已损坏、磨损或老化的空气软管及其连接件。
- 在安装、拆卸或维护本马达前,请务必关闭气源并断开供气软管。
- 请勿使用煤油、柴油或喷气机燃油等易燃、易爆液体进行润滑。 仅使用推荐的润滑油。
- 请保持工作环境干净、整洁、通风和明亮。
- 切勿撕下任何标签。 请更换任何受损标签。

#### 使用马达

- 务必使用适于本马达的"个人保护设备"。它包括防尘面罩或是其它呼吸设备、安全眼镜、耳塞、手套、防护裙、安全鞋、头盔及 其它设备。
- 他人须与您的工作区保持安全距离,或使用适当的个人防护装备。
- 该马达没有防电击绝缘装置。
- 请将双手、宽松衣物、长发及首饰远离马达。
- 释放节气阀后,马达及/或配件可能暂时还会继续运行。
- 严禁在疲劳时、服用药物、毒品或酒精后操作本马达。
- 切勿使用已损坏或出现故障的马达及配件。
- 不要自行改装本马达、安全装置及配件。
- 不要将本马达用于其它非推荐用途。
- 使用推荐的Ingersoll Rand流体产品配件。

## 安全符号标识



配戴呼吸保护装置



配戴防护眼镜



配戴听力保护装置



操作产品前,请阅读 手册

(制图 MHP2598)

安全信息一安全标识说明



## 型号标识



## 设备选装件

হ সা	目录所列型号配备			
赤곗	安装	消声器	近太郎什	
CAAAAAA	3 孔平面安装	口法担併	SM4AM-AH634安装脚座	
SIVI4AIVI	适用于SM4AMAN的NEMA 56C安装法兰			

## 保养马达



#### 润滑

SM4AM系列马达建议使用空气管路润滑器。我们推荐使用1/2英 寸过滤器-调节器-润滑器 (FRL),以实现马达的最佳性能并延长使 用寿命。

SM4AM系列叶片由特殊材料制作,无需进行润滑。虽然我们建议 使用润滑剂以达到最佳使用寿命,但事实证明我们的叶片寿命远 远大于标准层压型叶片。这使得Ingersoll Rand马达成为了禁止 使用机油的食品级或无尘室环境的理想选择。

## 安装

建议在供气管中使用空气管路润滑器。 将该装置尽可能靠近马达 连接。 我们推荐在无法固定安装润滑器的地方使用1/2英寸FRL。



(制图 TPD905-2)

操作



#### 如马达运行迟滞,请在通风良好处用洁净、无毒且不易燃的商业 溶剂进行冲洗。

#### 如需冲洗马达:

- 1. 断开空气管路及消声器。
- 2. 向每个进气口倒入6到8 cc溶剂。
- 用手向左右两个方向旋转马达轴数次,确保马达内部的所有零 件均得到彻底清洁。
- 向进气口施加空气压力并逐渐增加空气流量,直至排气管中没 有任何溶剂。
- 5. 冲洗完后,关闭气源并断开供气管。
- 6. 向进气口倒入6到8 cc强效清洁SAE10马达润滑油。
- 7. 重新连接供气管并逐渐增加空气压力,确保马达内部的所有零件均覆盖了一层润滑油。
- 8. 如马达功率仍然不高,请将马达送至您附近的服务维修中心。



## 规格

	最大功率 最大功率时转速 空载转速• 起动扭矩 -		卡死扭矩		最大功率时耗气量		重量					
糸列	HP	kW	RPM	RPM	磅-英尺	牛米	磅-英   尺	牛米	标准立方英 尺/分钟	立方米/分钟	磅	千克
SM4AM	1.5	1.1	3000	7900	2.6	3.5	4.1	5.6	67	1.9	8.25	3.7
<ul> <li>所有型</li> <li>得, 到</li> </ul>	一所有型号在操作时,必须有足够负载,以防止转速超过性能曲线上显示的最大允许转速。 性能数字在90 psig (620 kPa)空气压力下测得,并装有消声器。											

## 脚座安装图



(制图 MHP2546)

尺寸图

## 型号SM4AMB



(制图 MHP2529)

## 型号SM4AMANRSS



(制图 16613218)

## 型号SM4AMAN



(制图 MHP2530)





(制图 MHP2551)

## SM4AM Series Air Motor - Assembly Drawing



(Dwg. TPM1002)

## SM4AM Series Air Motor - Parts List

ltem	Description	Part Number		
1	Cylinder	**		
2	Front End Plate	**		
3	Rear End Plate	**		
4	Rotor	**		
4A	Drive Key	**		
5	Vane (4)	**		
5A	Vane Spring (2)	**		
5B	Vane Pin (4)	**		
8	Rear Rotor Bearing	**		
8A	Front Rotor Bearing	**		
9	Rotor Shaft Seal	**		
10	End Plate Gasket (2) **			
11	Rear End Cap **			
12	End Cap Gasket **			
13	Muffler Assembly	**		
*	Muffler Screen (2)	**		
*	Muffler Felt	**		
15	Front End Plate Cap Screw (6)	**		
*	Rear End Plate Cap Screw (6)	**		
*	Mounting Foot SM4AM-AH634			
*	NEMA Mounting Flange **			
*	Not shown			

Not shown

\*\* Parts not sold separately (only sold in complete Motor or Tune-Up Kit)

## Service Kits

## (includes illustrated parts 5, 5A, 5B, 8, 8A, 9, 10 and 12)

Series	Tune-up Kits	Vane Pack	
SM4AMB	SM4AMB-TK1		
SM4AMAN	SM4AMAN-TK1	SM4AMB-005	
SM4AMANRSS	SM4AMAN-TK1	7	

## **Maintenance Section**

#### NOTICE

#### If the motor operates sluggishly, flush it with a clean, non-toxic, nonflammable commercial solvent in a well ventilated area.

- To flush the motor:
- 1. Disconnect the air line and muffler.
- 2. Pour 6 to 8 cc of solvent into each inlet.
- 3. Rotate the rotor shaft by hand in both directions several times to ensure all internal parts of motor are thoroughly cleaned.
- 4. Apply air pressure to the inlet and slowly increase the air flow until there is no trace of the solvent in the exhaust.
- After flushing, shut off the air supply and disconnect air supply line.
   Pour 6 to 8 cc of a high quality non-detergent SAE 10 motor oil
- into the air inlet.Reconnect the air supply line, slowly increase the air pressure to ensure all internal parts of motor will be covered with a film of oil.
- If the motor is still low in power, check for damaged vanes or foreign material in the vane slots in the Rotor.

#### Vane Replacement

Periodically, you should check the Vanes for wear, and replace them if the width of the Vane is equal to or less than the replacement width shown below:

- Width of new Vane: 3/4 inch (19.05 mm)
- Replacement width: 9/16 inch (14.29 mm)

Always replace Vanes in sets; never replace an individual Vane. Replace Vanes as follows:

- 1. Disconnect the air line at the motor.
- 2. Unscrew and remove the Rear End Cap.
- 3. Unscrew and remove the Rear End Plate Cap Screws.
- 4. Using a puller, pull the Rear End Plate along with the Rear Rotor Bearing from the motor.
- Wipe each of the new Vanes to be installed with a thin film of light oil.
- Rotate the Rotor by hand to place two of the Vanes in a horizontal position.
- Obtain a stiff piece of wire or length of key stock that will slide into the vane slots, and grind one end of it to a gentle, sloping bevel. You will use this for depressing the Vane Pins while changing Vanes.
- Insert the depressing tool in the vane slot along the bottom edge of the Vane so that it passes between the Vane and the Vane Pin.
- Depress the Vane Pin toward the center of the Rotor and while holding it in this position, withdraw the worn Vane and install the new Vane with its notched side toward the center of the Rotor.
- 10. Repeat the procedure with each Vane.

## NOTICE

The use of other than genuine Select Series replacement parts may result in decreased tool performance and increased maintenance, and may invalidate all warranties.

## MARNING

Always wear eye protection when operating or performing maintenance on this motor.

Always turn off air supply and disconnect supply hose before installing, removing or adjusting any accessory on this motor, or before performing any maintenance on this motor.

## Disassembly

## **General Instructions**

- Always disconnect the air line at the motor before attempting any disassembly.
- 2. Do not disassemble the motor any further than necessary to replace or repair damaged parts.
- The Vanes are spring loaded. Do not withdraw the Rotor from the Cylinder unless it is absolutely necessary. Vanes can easily be replaced without withdrawing the Rotor. (see "Vane Replacement" section)
- 4. When grasping a part in a vise, always use leather-covered or copper-covered vise jaws to protect the surface of the part and help prevent distortion. This is particularly true of threaded members and housings.
- Do not remove any part which is a press fit in or on a subassembly unless the removal of that part is necessary for repairs or replacement.
- Important: After these motors were assembled at the factory, Cylinder Dowel alignment pins were pressed into the End Plates and Cylinder. During disassembly, these pins will usually remain with the Cylinder. Do not remove them.

#### **Disassembly of the Rear End Plate**

- 1. Unscrew and remove the Rear End Cap (11).
- 2. Unscrew and remove the Rear End Plate Screws (16).
- 3. Using a puller, pull the Rear End Plate (3) along with the Rear Rotor Bearing (8) from the motor.
- The Rear Rotor Bearing is a slip fit in the Rear End Plate. Slide or push it from the bearing recess.

#### **Disassembly of the Front End Plate**

- 1. Unscrew the Front End Plate Cap Screws (15).
- 2. Using a puller, pull the Front End Plate (2) along with the Front Rotor Bearing (8A) from the rotor shaft.
- The Rotor Shaft Seal (9) is pressed into the Front End Plate. Do not remove this Seal unless you have a new Seal on hand. This Seal is always destroyed in the removal process. If you have to remove the Rotor Shaft Seal, pry it out with a large screwdriver.
- 4. The Front Rotor Bearing is a slip fit in the Front End Plate. Slide or push it from the bearing recess.

## **Removal of the Rotor**

- 1. If the Rotor (4) must be withdrawn from the Cylinder, remove the Rear End Plate as previously described.
- 2. Unscrew the Front End Plate Cap Screws.
- Carefully withdraw the assembled Front End Plate and Rotor from the Cylinder.



## As you withdraw the Rotor, grasp the rotor body so that the Vanes (5), Vane Springs (5A) and Vane Pins (5B) do not fly.

- 4. After withdrawing the Rotor, remove the Vanes.
- Support the Front End Plate as close to the rotor body as possible, and press the Rotor from the Front Rotor Bearing.

#### Assembly

#### **General Instructions**

- 1. Always wipe all parts with a thin film of oil before installing them in the motor.
- Always press on the inner ring of a ball-type bearing when installing the bearing on a shaft.
- 3. Always press on the **outer ring** of a ball-type bearing when pressing the bearing into a bearing recess.
- Whenever grasping a part in a vise, always use leather-covered or copper-covered vise jaws to protect the surface of the part and help prevent distortion. This is particularly true of threaded members and housings.

## Assembly of the Rear End Plate

- 1. Support the Motor on the Front End Plate (2).
- Place End Plate Gasket (10) on the rear face of the Cylinder (1), making certain that it is properly oriented relative to the Cylinder Dowels and tapped holes in the Cylinder.

## NOTICE

#### If you are installing a new Gasket, you will have to punch or cut two holes in it to accommodate the Cylinder Dowels. Do this by placing the Gasket on the Rear End Plate to determine the location of the dowel holes. Use a proper size gasket punch to cut the required dowel holes.

- Align the dowel holes in the Rear End Plate (3) with Cylinder Dowels in the Cylinder and, using a plastic hammer, tap the Rear End Plate into place against the Gasket.
- 4. Using a sleeve that contacts only the inner ring of the Bearing, press the Rear Rotor Bearing (8) onto the rotor shaft until it seats in the bearing recess in the Rear End Plate.

## CAUTION

## Do not bind the End Plate against the Rotor.

- 5. Rotate Rotor (4) by hand. It should rotate freely with no binding or rubbing against the Cylinder. If the Rotor rubs or binds, tap the top edge of the Rear End Plate with a plastic hammer in the area midway between the inlet and outlet ports. Tap the End Plate gently. The Rotor needs only 0.0015 inch (0.038 mm) clearance from the top of the Cylinder. If the Rotor continues to rub, it may be contacting the Front End Plate due to pressing on the Rear Rotor Bearing. Lightly tap the keyed end of the rotor shaft with a plastic hammer. The Rotor needs about 0.002 inch (0.051 mm) clearance between the rotor body and each End Plate.
- When the Rotor turns freely, install the End Plate Cap Screws (16). Tighten them to 8 to 10 ft-lb (10.8 to 13.5 Nm).
- 7. Slip End Cap Gasket (12) over the threaded hub of Rear End Cap (11) and thread the Rear End Cap into Rear End Plate.

#### **Assembly of the Front End Plate**

- 1. Support the Motor on the Rear End Plate.
- Place an End Plate Gasket on the front face of the Cylinder, making certain that is properly oriented relative to the Cylinder Dowels and tapped holes in the Cylinder.

## NOTICE

If you are installing a new Gasket, you will have to punch or cut two holes in it to accommodate the Cylinder Dowels. Do this by placing the Gasket on the Front End Plate to determine the location of the dowel holes. Use a proper size gasket punch to cut the required dowel holes.

- Align the dowel holes in the Front End Plate with the Cylinder Dowels in the Cylinder and, using a plastic hammer, tap the Front End Plate into place against the Gasket.
- Using a sleeve that contacts only the inner ring of the Bearing, press the Front Rotor Bearing (8A) onto rotor shaft until it seats in the bearing recess in the Front End Plate.
- 5. Rotate the Rotor by hand. It should rotate freely with no binding or rubbing against the Cylinder. If the Rotor rubs or binds, tap the top edge of the Front End Plate with a plastic hammer in the area midway between the inlet and outlet ports. Tap the End Plate gently. The Rotor needs only 0.0015 inch (0.038 mm) clearance from the top of the Cylinder. If the Rotor continues to rub, it may be contacting the Rear End Plate due to pressing on the Front Rotor Bearing. Remove the Rear End Cap and lightly tap the end of the rotor hub with a plastic hammer. The Rotor needs about 0.002 inch (0.051 mm) clearance between the rotor body and each End Plate.

- 6. When the Rotor turns freely, install the Front End Plate Cap Screws (15). Tighten them to 8 to 10 ft-lb (10.8 to 13.5 Nm).
- Moisten the lip of a new Rotor Shaft Seal (9) with O-Ring lubricant, and press the Seal, lip side first, into the Front End Plate until the trailing face of the Seal is flush with the face of the End Plate.

## Assembly of the Motor

- 1. Position the Rotor vertically on the table of an arbor press so that the short hub is upward.
- Place the Rear End Plate, flat side first, on the short hub of the Rotor.
- 3. Place a 0.002 inch (0.051 mm) thick shim on each side of the Rotor between the rotor body and the Rear End Plate.
- 4. Using a sleeve that contacts only the inner ring of the Bearing, press the Rear Rotor Bearing (8) onto the hub of the Rotor until it seats in the bearing recess in the Rear End Plate.
- 5. Withdraw the shims.
- 6. Stand the assembled Rotor and End Plate upright on the hub of the Rear End Plate.
- 7. Place a Vane Spring (5A) in the center of each cross-hole in the rotor body. Place a Vane Pin (5B) at each end of each Vane Spring.
- 8. Moisten each Vane (5) with film of light oil.
- 9. Place a Vane, notched side first, in each vane slot.
- 10. Place a rubber band around the rotor body to hold the Vanes, Vane Springs and Vane Pins in place.
- 11.Place an End Plate Gasket on the rear face of the Cylinder, making certain that it is properly oriented relative to the Cylinder Dowels and tapped holes in the Cylinder.

## NOTICE

If you are installing a new Gasket, you will have to punch or cut two holes in it to accommodate the Cylinder Dowels. Do this by placing the Gasket on the Rear End Plate to determine the location of the dowel holes. Use a proper size gasket punch to cut the required dowel holes.

- 12 Slide the assembled Rotor and Rear End Plate into the Cylinder until the End Plate contacts the Cylinder Dowels.
- 13. Using a wire hook inserted between the End Plate Cylinder, pull the rubber band free of the Rotor, thus leaving the Vanes, Vane Springs and Vane Pins trapped in the Cylinder.
- 14. Align the dowel holes in the Rear End Plate with the Cylinder Dowels in the Cylinder and, using a plastic hammer, tap the Rear End Plate into place against the Gasket.
- 15. Install the Front End Plate as described in Steps 1, 2, 3 and 4 in the section titled Assembly of the Front End Plate.
- 16. Rotate the Rotor by hand. It should rotate freely with no binding or rubbing against the Cylinder. If the Rotor rubs or binds, tap the top edge of the Rear End Plate with a plastic hammer in the area midway between the inlet and outlet ports. Tap the End Plates gently. The Rotor needs only 0.0015 inch (0.038 mm) clearance from the top of the Cylinder. If the Rotor continues to rub, it may be contacting the Rear End Plate due to pressing on the Front Rotor Bearing. Lightly tap the end of the rotor hub with a plastic hammer. The Rotor needs about 0.002 inch (0.051 mm) clearance between the rotor body and each End Plate.
- 17. When the Rotor turns freely, install the End Plate Cap Screws (15, 16) and tighten them to 8 to 10 ft-lb (10.8 to 13.5 Nm).
- Install the Rotor Shaft Seal (9) and Front End Cap as described in Step 7 in the section titled Assembly of the Front End Plate.
- 19. Install the Rear End Cap (11) as described in Step 7 in the section titled Assembly of the Rear End Plate.
- 20. Again, check the Rotor to see that it rotates freely. Make certain it is rotating freely before connecting the air supply line.

## Troubleshooting Guide

Trouble	Probable Cause	Solution	
Low power or low free speed	Low air pressure at the inlet	Check air pressure at the inlet. For top performance and durability of parts, the air pressure must be 90 psig (6.2 bar/620 kPa) at the inlet.	
	Worn or broken Vanes	Install a new set of Vanes.	
	Improper lubrication or dirt building up in the Motor	Lubricate as instructed under LUBRICATION. If this does not help, flush the Motor as instructed under OPERATION.	
Rough operation	Worn or broken Rotor Bearings	Examine each Bearing. Install new bearing where necessary.	
Scoring of End Plates and/or Cylinder	Rotor does not have proper clearance	Refer to Assembly of Motor section. (Step 16)	

## **Parts and Maintenance**



The use of other than genuine Ingersoll Rand replacement parts may result in safety hazards, decreased motor performance, and increased maintenance, and may invalidate all warranties.

Ingersoll Rand is not responsible for customer modification of motors for applications on which Ingersoll Rand was not consulted. Repairs should be made only by authorized trained personnel. Consult your nearest Ingersoll Rand Authorized Service center.

When the life of the tool has expired, it is recommended that the tool be disassembled, degreased and parts be separated by material so that they can be recycled.

Refer all communications to the nearest Ingersoll Rand Office or Distributor.

Notes:

## Notes:

## www.ingersollrandproducts.com



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