Integrated Vacuum Conveying & Sieving Machine

User Manual

Model: SPM-Z400A



Please read the “Safety Precautions” and operating instructions before use.
To improve product quality, the appearance and specifications of this product may change without notice.
The Company reserves the right of final interpretation of this manual.

Important Safety Instructions

1. Safe Operation Instructions

1.1 Before starting the equipment, please read the following:

● Make sure the equipment is safely and reliably grounded.

● Before starting the equipment, read all operating and maintenance instructions. Do not operate the supplied product until you have fully read and understood these instructions.

● Always strictly follow the requirements of the safety instructions.

● All personnel involved in work with this equipment must read and understand these instructions.

● Operators must be trained before operation and must master the working principle, performance and operating essentials of the equipment.

● Protective devices of the equipment must not be dismantled, removed or disabled at will.

1.2 When operating the equipment, please read the following:

● Stay focused on duty, strictly follow the workshop management rules, and do not do anything unrelated to work.

● Before starting work, check your own and each other's personal protective equipment to ensure it is in good condition.

● Before starting the machine, carry out a thorough inspection of the equipment (integrity of the wiring and of the protective devices).

● Stay alert and be careful at all times while working. Never operate this equipment when fatigued or after consuming alcohol, drugs or special medication. A moment of carelessness during operation may lead to a dangerous situation.

● If the equipment fails, never try to achieve its functions by directly operating the existing terminal switches (valves).

2. Hazards

2.1 Explosion Hazard

● An explosion can very easily occur if the oxygen content or temperature inside the equipment exceeds the limit.

● Before wetting a filter cartridge for replacement, check the composition of the dust, paying particular attention to reactive substances. Dust that heats up and reacts on contact with water must never be treated with water, and explosion-proof clothing must be worn. Incorrect handling can also cause fire or explosion.

2.2 Poor Thermal Stability

● Some dusts ignite spontaneously at high temperature, especially reactive dusts (magnesium alloys, titanium alloys, etc.), which have low density, high specific strength, good damping, good electrical and thermal conductivity and good processability, but poor corrosion resistance, oxidise and burn easily, and have poor heat resistance.

2.3 Electrical Hazard

Electrical components in the dust-removal equipment may cause electrical hazards due to ageing, improper use, etc.

3. Preventive Measures

3.1 Preventing Explosion Hazards

● Before start-up, confirm that the oxygen content inside the equipment meets the requirement; only then may the equipment be run. During operation, monitor the oxygen content and temperature at all times. If either exceeds the limit, stop the equipment, and continue only after the oxygen content is within the limit and the temperature has returned to normal.

● Open the exhaust filter housing (crack it open slightly), make sure there is no sudden hazard, and check the filter cartridge for sparks or flames. If any are present, take no action other than leaving it undisturbed; replace the cartridge after they have died out naturally. Wear protective clothing.

Note: Waste powder must be given special treatment as appropriate.

3.2 Preventing Hazards from Poor Thermal Stability of Dust

● Simply monitor the readings of the equipment's oxygen sensor and temperature sensor at all times and keep them within the safe range.

3.3 Preventing Electrical Hazards

● Regular maintenance: inspect and service the equipment regularly for abnormalities such as unusual noise, looseness or electrical leakage, and promptly replace worn or damaged electrical components.

4. Emergency Measures

4.1 Cut Off the Power Immediately

● When a fire is discovered, immediately stop the dust-removal equipment and cut off the power to prevent the situation from escalating.

4.2 Fight the Fire with an Extinguisher

● Extinguish the fire according to the properties of the powder, avoiding anything that would feed the fire or cause a secondary explosion.

4.3 Raise the Alarm and Call for Help Promptly

● If the fire is large, immediately call the fire emergency number (119) and notify the fire brigade.

Preface:

Metal 3D printing manufactures parts by sintering metal powder; the finer the powder, the better the performance of the printed parts. However, the smaller the particles, the greater their adsorption, agglomeration and specific surface area, and the more prone they are to oxidation and explosion. In addition, different metal or alloy powders have different physical properties, making it difficult to reduce the oxygen content, remove large particles and separate fine particles with a simple sieving machine alone.

The SPM-Z400A is a compact powder-handling system that integrates powder collection and sieving. Metal powder must be sieved before it can be supplied to 3D printing equipment.

The sieving unit of the SPM-Z400A combines ultrasonic sieving with vibratory sieving. An acoustic transmission system delivers ultrasonic energy to the mesh wires, breaking the surface tension on the wires, preventing fine powder from adhering, reducing the probability of mesh blinding and helping fine powder pass through the mesh, thereby achieving the sieving of fine or easily adhering powders. The equipment is equipped with an inert-gas protection system that strictly controls the oxygen content of the system, preventing the metal powder from contacting oxygen and ensuring powder purity, which in turn improves the quality of metal 3D-printed parts.

Thank you for using this product. It is suitable for Zone 21 and Zone 22. This manual provides information on VANSEN 3D printing auxiliary equipment. Please read it carefully before use to ensure correct operation, and keep it in a conspicuous place for reference at any time. Do not operate this equipment until you have finished reading this manual.

For more information on VANSEN series vacuum equipment, please visit the Vansen website (www.tj-vansen.com).

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Precautions for Use:



Before use, please read these safety instructions carefully. Always observe the following safety precautions during acceptance inspection, installation, operation and maintenance.

Working Environment

- The floor must be a concrete foundation with a level surface;
- Place the equipment in a well-ventilated workshop with dry air where possible; keep it away from heat sources or heating equipment.

Safety Precautions

- Power supply: 380 V three-phase AC, 50 Hz, total power 2.2 kW;
- The external power supply must be well grounded, with resistance not exceeding 100 Ω;
- No material may accumulate on the mesh before start-up or shutdown;
- The machine body and sieve mesh must be level, and the caster brakes locked;
- Check whether the clamping devices are tight or have come loose;
- First start the gas purging system; only when the oxygen content is below 5% may an appropriate amount of material be loaded for sieving;
- Pay attention to the tension of the sieve mesh while the equipment is running;
- Operation of the equipment must be supervised by designated personnel.

Equipment Structure:

The integrated vacuum conveying and sieving machine mainly consists of the cabinet, conveying system, sieving system, powder containers, etc. The main components and structure are shown in Figure 1 below.

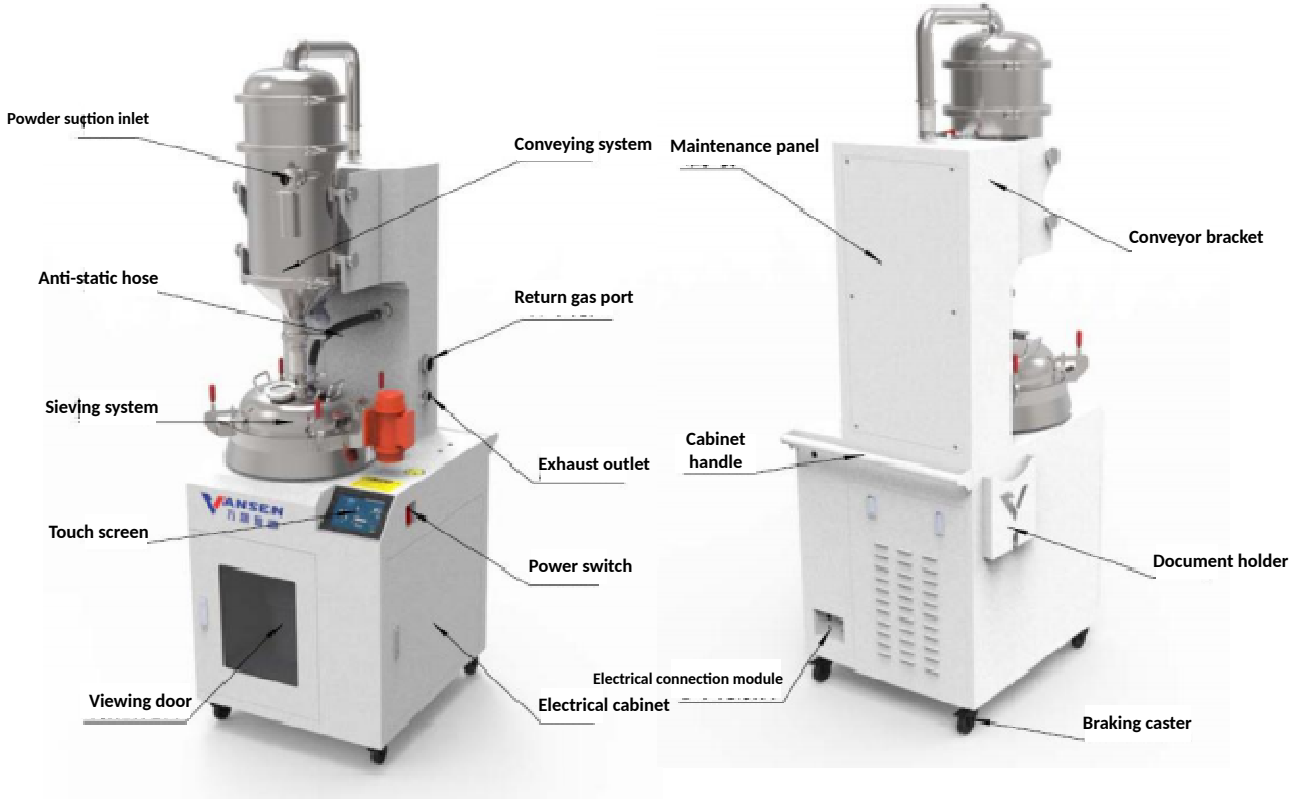


Figure 1 SPM-Z400A main components and structure

The conveying system, sieving system and powder containers are all made of 304 stainless steel with polished interiors, and the valves are sanitary-grade 304 stainless steel valves, ensuring that the metal powder is not contaminated in any way during sieving.

The conveying system is equipped with a pneumatic vibrator that helps discharge the metal powder into the sieving system. An ultrasonic generator is built into the cabinet and connected to the external ultrasonic transducer via a dedicated cable. The transducer is detachable from the sieve frame for easy removal when cleaning or replacing the mesh. The sieve frame is fully wrapped with a rubber ring, which seals the sieve lid to the vibrating body and provides a safe atmosphere for sieving reactive metal powders under inert-gas protection.

The system is equipped with an oxygen transmitter, fixed via a threaded connection, which communicates with the LCD panel and the oxygen concentration alarm via a dedicated communication line. The oxygen concentration is displayed in real time. Sieving must not be carried out when the oxygen content in the sieving atmosphere is above 5%; the operator must pause sieving, refill with inert gas until the oxygen content drops below 5%, and then resume sieving.

Product Features:

The SPM-Z400A automatic sieving machine has the following features:

- Modular, compact, fixed with quick-release clamps, easy to maintain
- Real-time pressure monitoring; filter cartridge back-flush dust removal
- Universal feed and discharge containers for easy loading, unloading and simple operation
- Dual action of motor vibration and ultrasonic vibration; low noise, high efficiency
- Anti-static filter cartridge, quick-fixed with star knobs
- All parts except the cabinet made of 304 stainless steel; anti-static hoses used
- Ergonomic structural design

Technical Specifications:

Model	SPM-Z400A
Applicable powders	Stainless steel, mould steel, aluminium alloy and other 3D-printing metal powders
Power supply	380V 50Hz
Rated power (kW)	2.2
Oxygen content (%)	≤2 -~ 5
Compressed air (MPa)	0.4-0.6
Working gas (MPa)	0.4-0.6
Ultrasonic power (W)	0-200
Sieve diameter (mm)	Φ400
Mesh specification (mesh)	<500 (selected as required)
Sieving rate (kg/min)	≥3 kg (stainless steel)
Conveying rate (kg/min)	≥5 kg (stainless steel)
Max. conveyor powder capacity (L)	18
Powder container (L)	10
Exhaust emission class	H
Noise (dB)	68

Note: Sieving and powder suction are two independent operations. In actual operation, suction and sieving alternate several times until all the powder in the powder cart has been drawn off, completing the whole process. Throughput per unit time must be calculated from the actual proportion of sieving and suction time.

Equipment Functions:

Equipment	Sieving machine	Function
Equipment composition	Vacuum conveying unit	Collects the powder to be sieved in the vacuum conveyor (max. 18 L) in preparation for sieving.
	Vibratory sieving unit	Mainly used for screening and filtering metal powder. The motor provides an exciting force that makes the metal powder in the sieving machine vibrate at high frequency, while the mesh separates out oversized and undersized particles, ensuring that the metal powder is within the required size range.
	Ultrasonic unit	Clears metal powder from the mesh, preventing mesh blinding during sieving and improving sieving efficiency.
	Purging system	Keeps the sieving machine under an argon (Ar) protective atmosphere during operation to prevent metal powder explosions.
	Control system	Integrates control of purging, sieving, ultrasonics and sieving pressure with oxygen content monitoring, enabling automatic control of the sieving process.

Touch Screen Functions:



Figure 2 Main page

Main page:

Oxygen content:
Displays changes in the system oxygen content in real time.

System pressure:
Monitors the pressure of the sieving and exhaust units.

Suction pressure and differential pressure:
Monitors the pressure in the conveyor and the pipeline differential pressure during suction.

Filter differential pressure:
Displays the filter cartridge differential pressure and back-flushes automatically.

Pipeline purge:
Press the Pipeline Purge button to automatically replace the gas with working gas and reduce the oxygen content.

Sieve purge:
Press the Sieve Purge button to automatically replace the gas in the sieving unit with working gas and reduce the system oxygen content.

Suction:
Press the Suction button: the system starts the vacuum pump, opens the suction and return-gas valves, and automatically draws material until the hopper is full.

Sieving:
Press the Sieving button: the discharge valve opens and the pneumatic vibrator starts to assist discharge; the ultrasonic unit and vibrating sieve start automatically and the powder outlet valve opens, until the powder container is full or the feed container is empty.

Stop:
During purging, suction or sieving, press the Stop button to stop the system automatically; the equipment returns to its initial state.

Alarm reset:
After the alarm signal has cleared, press the Alarm Reset button to clear the alarm.



Figure 3 Frequency setting

Fan frequency setting:
Sets the fan operating frequency.

Manual operation:

Press the Manual Operation button to enter the manual debugging screen; a message at the bottom of the screen indicates that the system is in manual operation. After entering the manual debugging screen, press the System Manual button in the upper-right corner to release the system interlocks. Operate only when the safety of equipment and personnel is ensured.

Operating Procedure:

Preparation:

□ Place the equipment on a level concrete foundation. The machine body and sieve mesh must be level and the caster brakes locked.

□ Depending on customer requirements, the suction system can be operated in open-loop or closed-loop mode.

Open-loop operation: metal powder is drawn directly without gas protection. Only suitable where customer requirements are not high and for metal powders with a high melting point, such as stainless steel. To prepare the conveying system, connect the suction hose and fittings and connect the grounding wire.

Closed-loop operation: metal powder is drawn from a printer, glove box or other sealed equipment under gas protection. The sealed equipment must have two ports: its powder suction port connects to the conveying unit port of this equipment (sanitary φ38 clamp), and the other port connects to the return-gas port of this equipment (sanitary φ51 clamp). As ports and operating conditions of glove boxes and other sealed equipment vary, the customer must prepare the adapter pipes and fittings.

The manual butterfly valve under the conveyor must be closed (handle horizontal) before suction.



Figure 6 Conveyor inlet



Figure 7 Return-gas port and exhaust port

□ Check that the mesh size matches the powder to be sieved. If not, first disconnect the pipes on the top cover of the vibratory sieving unit, unplug the aviation connector of the vibrating sieve, open the clamps and remove the top cover. Then remove the mesh, detach the ultrasonic transducer with a wrench and fit it to the mesh to be used. Finally, install the mesh with the ultrasonic transducer in the vibratory sieving unit, replace the top cover, reconnect the pipes and aviation connector, and tighten the clamps.



Fig. 8 Top cover piping



Fig. 9 Clamping device



Fig. 10 Ultrasonic transducer

□ Check that the vibration motor, sieve mesh and clamping devices meet the safety precautions.

□ Personnel must take dust-protection measures such as wearing masks and gloves.

□ Install the powder receiving container in position, connect the grounding wire and open its manual butterfly valve, as shown in Figure 11. A full container is heavy; a dedicated small forklift must be used to remove it, and the forklift arms must match the container's lifting lugs.



Fig. 11 Container installation



Fig. 12 Electrical interface



Fig. 13 Pressure regulators

□ Connect the equipment to a 380 V 50 Hz three-phase AC supply and ground the anti-static clip. Supply compressed air and compressed nitrogen at no less than 0.6 MPa. As shown in Figure 13, set the compressed-air regulator to 0.4–0.6 MPa and the nitrogen (working gas) regulator to 0.4–0.6 MPa. All connected gas lines are φ10 mm OD.

□ The connecting lines are controlled by the printer's purging; simply run two φ10 PU lines from the printer.
□ Finally, check that the 2 manual butterfly valves are open; they must be in the positions shown in Figure 8 and Figure 11 respectively.

□ On non-standard models, the conveyor discharge valve in Figure 8 is an electric butterfly valve whose opening angle is set on the parameter page.
□ Switch on the air circuit breaker in the control cabinet and turn the rotary switch on; the touch screen shows the main page and the equipment is ready for operation.

Operation:

□ Conveyor powder suction

Open-loop operation: press the Suction Start button to draw metal powder directly without gas protection.

Closed-loop operation: start the gas purging system; purging stops automatically when the oxygen content reaches 2%. Then press the Suction Start button to draw metal powder under gas protection. Suction must not be carried out when the oxygen content is above 5%.

During suction, do not push the suction nozzle into the powder; ideally the nozzle cross-section should be immersed to half its depth below the powder surface. In normal operation the suction pressure is −160 to −100 mbar. If operated incorrectly (nozzle buried in the powder), the suction pressure reaches −200 mbar and the powder immediately blocks the pipe; pull out the nozzle promptly and wait about ten seconds. When the suction pressure has recovered to about −110 mbar, resume suction correctly. The conveyor must not be loaded with more than 23 litres at a time. **(The suction pressure alarm value differs with the set frequency.)**

After suction is complete, back-flush 3–4 times to shake off most of the metal powder adhering to the filter cartridge.



Figure 13 Powder suction demonstration



Fig. 14 Discharge controlled by manual butterfly valve (automatic valve on high-spec models)



Fig. 15 Ultrasonic controller panel

□ Sieving operation

Press Sieving on the touch screen; refer to the reference table.

Start the Sieve Purge; purging stops automatically when the oxygen content reaches 2%. Monitor the equipment's oxygen concentration in real time on the touch screen. Sieving must not be carried out when the oxygen content in the sieving atmosphere is above 5%; the operator must pause sieving, refill with inert gas until the oxygen content drops below 5%, and then resume sieving.

To set up sieving, turn on the green switch of the ultrasonic controller (the power switch lights green and ultrasonic power is output), then press the "Sieving" button on the touch screen to start the sieving function. The system automatically opens the pneumatic butterfly valve under the conveyor. Observe the powder discharge rate and adjust the ultrasonic vibration level (the black switch on the panel selects the mode: I = high level, O = low level, II = pulse mode) so that the discharge rate and sieving rate are best matched.

The “Sieving” button keeps the vibrator running to assist powder discharge.

When the container is full, the system displays “Powder container full”, automatically stops sieving and closes the discharge valve. Replace the container manually:

A. Remove the container with the dedicated forklift

B. Empty the powder from the container, reinstall it on the equipment and secure the clamp and grounding wire
C. Open the manual butterfly valve on the container

When the butterfly valve is fully open, no powder is seen falling from the conveyor through the sight glass of the sieving system, and only a small amount of waste powder remains on the mesh, sieving is complete.

When cleaning the mesh, wiping with a dry cloth is recommended; after removing the mesh, blow the mesh surface clean with air.
□ After sieving, first switch off the equipment, clean the waste powder from the mesh, then disconnect the power supply and tidy up the lines, fittings and accessories.

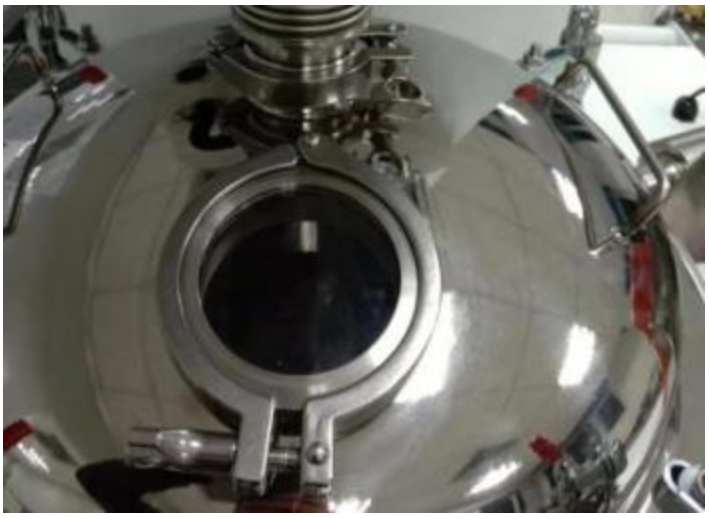


Figure 16 Sight glass

Maintenance and Care

Daily Maintenance

1. Wipe the cabinet surface with a cloth dampened with clean water. Do not use sharp objects, bleach, thinners or similar items that could damage the cabinet surface;

2. Do not stand on the cabinet or place heavy objects on it;

3. Protect the touch screen from impact;

4. Regularly check the power cable and anti-static hose for damage; wipe with a cloth dampened with clean water;
5. No material may accumulate on the mesh before start-up or shutdown;

6. If powder is spilled, collect it with a professional explosion-proof vacuum cleaner;

Periodic Maintenance

1. When the purging cycle becomes noticeably longer or a filter cartridge has been in use for more than six months, promptly replace the conveyor and exhaust filter cartridges, located as shown in Figures 17 and 18:



Figure 17 Exhaust filter housing



Figure 18 Conveyor filter housing

2. Regularly check the sieve mesh for damage;

3. Regularly check all parts of the machine body for damage or loose nuts caused by vibration;

4. Approximately every two months of operation, lubricate the vibration motor with No. 3 lithium-based grease (ZL-3);
5. After 1500 hours of cumulative operation of the vibration motor, check the bearings and replace them immediately if damaged.

Accessories and Consumables:

Filter cartridges are consumables and must be replaced at least every six months. Parts must not be interchanged between sieving machines used for different powders. A small forklift is required for operation; a hand-cranked trolley may also be used (purchased separately).

Category	Name	Spec./Model	Qty	Remarks
Equipment	Vacuum conveying & sieving machine	SPM-Z400A	1 set	
Consumables	Sieve mesh and seals		1 set	
	Filter cartridge		1 set	
	Corrugated hose		1 set	
	Clamps and seals	Φ51, φ219	1 set	
	Powder container	10L	1 set	

Fault Diagnosis:

Before requesting repair, please check the following items.

Symptom	Check points and remedies
Suction at the nozzle becomes weak	● Check whether the anti-static hose is damaged, or its connection to the nozzle or quick coupling is loose ● Check whether the anti-static hose is blocked ● Filter cartridge blocked: back-flush or replace the cartridge ● Check whether the equipment is running normally, the powder container is full, or the pressure is too high – to be opened and repaired by qualified personnel
Abnormal noise	● Quick clamp not locked: lock the quick clamp ● Cabinet or floor unstable: stabilise the cabinet and check the floor ● Machine in contact with other hard objects: keep at least 5 cm clearance between the cabinet and hard objects ● Vibration motor screws loose: retighten the screws

Symptom	Check points and remedies
Material cannot be discharged automatically	● Vibration motor rotating in the wrong direction: change the phase sequence of the power cable ● Sieve mesh damaged: replace with a new mesh ● Manual butterfly valves under the collection container and sieving module not open: open the valves ● Too many impurities retained on the mesh: clean the mesh surface
Equipment does not run	● Check that the power supply is normal; switch it on ● Cable broken or poor contact: replace the cable ● Check that the working gas and compressed air are connected and the internal pressure regulators are open ● Check that the air circuit breaker in the control box is on; switch on the breaker ● Check whether the fuse in the control box has blown; replace it with a fuse of the same rating
Problem persists after these checks	● Do not attempt to repair it yourself; please call our after-sales service hotline: 400-600-6290

Packaging and Transport:

□ Packaging: in accordance with the national standard of the People's Republic of China GB/T 13384-2008 "General specifications for packing of mechanical and electrical products", using new wooden crates suitable for long-distance (sea and land) transport, shock-proof and protected against rough handling;

□ We provide the packaging required to transport the goods to their final destination, with the necessary protective measures against moisture, sun, rust, corrosion, vibration and other damage, and bear all liability and costs for corrosion, damage and loss of the goods caused by improper packaging or protective measures.

Maintenance Record:

Date	Fault	Solution	Customer signature	Technician signature



Responsibility above all; achievement comes from dedication!

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