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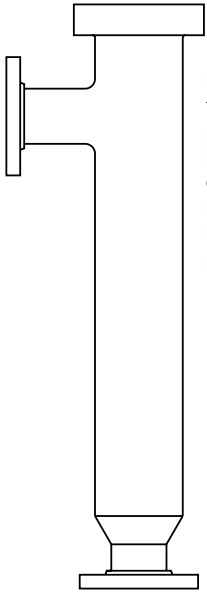
TES Issue 2

SJT
Steam Jet Thermocompressor
Installation and Maintenance Instructions



Please note that the preferred installation orientation is in the horizontal plane

1. Safety information

Safe operation of these products can only be guaranteed if they are properly installed, commissioned, used and maintained by qualified personnel (see Section 1.11) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

1.1 Intended use

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended use / application. The product complies with the requirements of the European Pressure Equipment Directive 97 / 23 / EC and carries the CE mark when so required. The product falls within the Pressure Equipment directive categories as shown below:

Application	Group 1 Gases	Group 2 Gases	Group 1 Liquids	Group 2 Liquids
Steam		Will not exceed Cat. 3		
Water				Will not exceed Cat. 2

i) This product has been specifically designed for use on steam which is in Group 2 of the above mentioned Pressure Equipment Directive.

ii) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.

iii) Determine the correct installation situation and direction of fluid flow.

iv) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.

v) Remove protective covers from all connections and protective film from all name-plates, where appropriate, before installation on steam and water lines.

1.2 Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

1.3 Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

1.4 Hazardous liquids or gases in the pipeline

Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider: flammable materials, substances hazardous to health, extremes of temperature.

1.5 Hazardous environment around the product

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

1.6 The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?
Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are opened and closed progressively to avoid system shocks.

1.7 Pressure systems

Ensure that any pressure is isolated and safely vented to atmospheric pressure. Consider double isolation (double block and bleed) and the locking or labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.8 Temperature

Allow time for temperature to normalise after isolation to avoid the danger of burns.

1.9 Tools and consumables

Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco replacement parts.

1.10 Protective clothing

Consider whether you and/or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high /low temperature, radiation, noise, falling objects, and dangers to eyes and face.

1.11 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.
Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.
Post 'warning notices' if necessary.

1.12 Handling

Manual handling of large and / or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

1.13 Residual hazards

In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature may reach temperatures in excess of 570 °C (1058 °F).
Many products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to 'Maintenance instructions').

1.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

1.15 Disposal

Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

1.16 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

2. General product information

2.1 General description

The SJT Steam Jet Thermocompressor is designed having a fabricated metallic construction. The Thermocompressor may (or may not) incorporate an 'Actuator assembly', a 'Positioner' and an 'Air regulating set'. If the Thermocompressor is supplied complete with these accessories, the reader will find the Instruction Manuals for these items to the rear of this document.

An SJT Steam Jet Thermocompressor can be described as a particular type of Ejector. An Ejector is a device in which steam under pressure is used to entrain a gas or vapour that is at a lower pressure. Within the Body of the Ejector, the two gases become intimately mixed and are subsequently discharged at a pressure that lies somewhere between the original steam pressure and the pressure of the entrained gas or vapour.

When the gas being entrained is purely water vapour, the Ejector is referred to as a Steam Jet Thermocompressor.

Standards

These products fully comply with the requirements of the European Pressure Equipment Directive 97/23/EC. The product is manufactured to ASME B31.3 mechanical design code.

Certification

This product is available with certification to EN 10204 3.1.

Note: All certification / inspection requirements must be stated at the time of order placement.

2.2 Materials

The materials of construction for an SJT depend upon the following:

a) The size of the SJT (reflects how the SJT is designed and made).

b) The Mechanical Design Temperature (MDT).

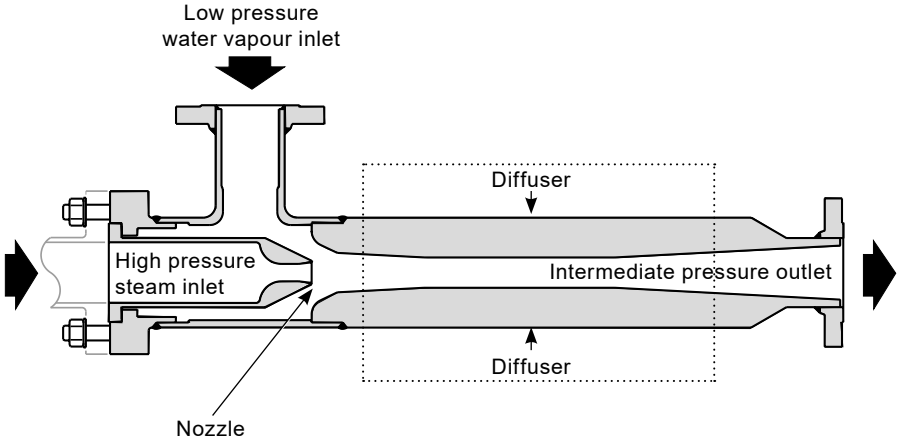
c) The Minimum Metal Design Temperature (MDMT, not often specified).

The most common material of construction for Spirax-Sarco Limited's SJT is carbon steel. Chrome Molybdenum materials are used for high temperature applications and occasionally stainless steel grade 316L is employed. A carbon steel SJT tends to employ stainless steel 316L motive steam nozzles.

Component	Carbon steel	Stainless steel Gr. 316L	Chrome Molybdenum
MDT Mechanical Design Temperature	up to and including 425 °C (797 °F)	up to and including 500 °C (932F)	above 425 °C (797 °F) up to and including 570 °C (1058 °F)
Pipe	ASTM A106 Gr. B	ASTM A312 TP 316L	ASTM A335 P11
Fittings	ASTM A234 WPB	ASTM A403 WP 316L	ASTM A234 WP11
Forgings	ASTM A105N or ASTM A350 LF2N	ASTM A182 F316L	ASTM A182 F11
Bar	ASTM A350 LF2N	ASTM A479 316L	ASTM A739 B11
Plate	ASTM A516 Gr. 70	ASTM A240 316L	ASTM A387 Gr. 11
Flanges	ASTM A105N	ASTM A182 F316L	ASTM A182 F11
Bolts	ASTM A193 Gr. 7	ASTM A193 Gr. B8	ASTM A193 Gr. B16
Nuts	ASTM A194 Gr. 2H	ASTM A194 Gr. 8	ASTM A194 Gr. 4
Washers	ASTM F436 Gr. 8 or BS 4320 Gr. 8 or BS 3410 Gr. 8	ASTM F436 Gr. A2 or ASTM F436 Gr. A4 or BS 4320 Gr. A4 or BS 3410 Gr. A2 or BS 3410 Gr. A4	ASTM F436 Gr. A2 or ASTM F436 Gr. A4 or BS 4320 Gr. A4 or BS 3410 Gr. A2 or BS 3410 Gr. A4

2.3 Mechanical Design Temperature and Flange rating

< 374 °C (705 °F)	ASME 150, ASME 300 and ASME 600
	EN 1092 PN16, PN25 and PN40 Slip-on (Weld neck optional)
374 - 525 °C (705 °F - 977 °F)	ASME 150, ASME 300 and ASME 600
	EN 1092 PN16, PN25 and PN40 Weld neck (Slip on N/A)
375 - 570 °C (707 °F - 1058 °F)	ASME 150, ASME 300, ASME 600, ASME 900 and ASME 1500
	EN 1092 PN16, PN25, PN40, PN63 and PN100 Weld neck (Slip on N/A)



Please note that for clarity welds are not shown.

Fig. 1
SJT Steam Jet Thermocompressor - illustrating the preferred installation orientation

2.4 Inspection and Performance Confirmation

2.4.1 Receiving Inspection

Although Spirax-Sarco Limited carries out a full inspection of all units before dispatch, damage may occur during transit. On receipt of the unit, a visual inspection will show any external damage and hence indicate any possible internal damage that may have occurred. If damage has occurred, please do not hesitate to contact us.

2.4.2 User's Rating Inspection

Before installation of the SJT Steam Jet Thermocompressor, the user must ensure that the mechanical rating of the unit is suitable for the intended service.
Details of the mechanical rating can be found on the name-plate and associated documentation.

3. Installation

Note: Before actioning any installation observe the 'Safety information' in Section 1.

It is important that installation should only be carried out by qualified, experienced personnel, who are familiar with the fitting of Steam Jet Thermocompressors and have read and understood all the instructions in these Installation and Maintenance Instructions.

3.1 Suction piping and orientation - Installation considerations:

3.1.1 Spirax Sarco SJT Steam Jet Thermocompressors can be installed and operated in any position but, the preferred orientation is to have the ejector discharge connection pointing virtically downwards.
In cases where the motive steam supply is likely to be wet, an installation which has the thermocompressor discharge connection pointing upwards must be avoided.
Further, when deciding on the orientation of a thermocompressor, remember that when the unit is shutdown, condensate is likely to build-up around the low points within the ejector body, which could influence the corrosion rate and cause operational problems during start -up. If the ejector discharges vertically downwards, full drainage of the unit will be achieved after shutdown and these possible sources of problems eliminated.

3.1.2 The connecting suction pipework should be sized and installed so as to provide as little resistance to flow as possible. The effect of pipeline frictional losses must be considered when specifying the performance of an SJT Steam Jet Thermocompressor.
It is recommended that the connecting pipework should have at least the same bore as the mating unit flange. However, if this is not possible, slow tapers should be installed, preferably 6 to 10 pipe diameters away from the unit.
We strongly recommend that the Installation Engineer performs velocity calculations to size the suction pipework and does not simply make the piping the same size as the suction connection on the thermocompressor, without performing a check.

3.1.3 The thermocompressor should be located as close as possible to the source of the low pressure water vapour that forms the suction gas - thus keeping the piping as short and as straight as possible.

3.1.4 The suction line should lead downwards to the connection on the thermocompressor. This will avoid condensate from the motive steam line entering the plant during start-up. The best layout would be to have the ejector suction branch below the point where the vacuum is required. The connecting suction pipework would then come down and turn through a 90º bend, immediately before the ejector suction branch. We appreciate that this is an ideal situation and may not be achieved in practice but, any potential problems due to liquid build-up are eliminated because of the natural drainage of this type of layout.

3.1.5 If flow reversal into the suction branch must be prevented, a check valve should be installed in the suction piping, adjacent to the thermocompressor. The resistance to flow offered by such a valve should have been taken into account when the thermocompressor was specified.

3.1.6 The suction piping must be free of any loops in the vertical plane. These are potential sources of liquid and solids collection points and they can cause serious operational problems - particularly if the suction gas contains droplets, dust or vapour near its saturation point.

3.1.7 An isolation valve should be fitted in the suction line, bearing in mind that this valve will present an additional resistance to flow. We strongly recommend the use of full bore valves (e.g. Ball valves, Gate valves).

3.2 Motive steam piping - Installation considerations:

3.2.1 The steam supply line to the thermocompressor is to be insulated to minimise heat loss and for personnel protection.

3.2.2 A steam isolation valve should be provided in the steam line, feeding the SJT steam jet thermocompressor. This should be installed in a vertical run of piping, in accordance with recommended good practice for steam lines.

3.2.3 The thermocompressor should be located as close as possible to the vessel where the vacuum is required, thus keeping the piping as short and as straight as possible. The number of flanged joints should also be kept to a minimum as they are a potential source of leaks and add to the resistance of the piping.

3.2.4 Spirax-Sarco Limited strongly recommend the incorporation of a steam strainer. This should be positioned upstream of any valve feeding the thermocompressor.

3.2.5 The steam piping to the thermocompressor should come off the top of the main line, since that is the region of driest steam within the line.

3.3 Discharge piping - Installation considerations:

3.3.1 Long runs of pipework in which the flow is vertically upwards must be avoided.

3.3.2 Discharge piping should be kept as short and as straight as possible with the minimum number of bends and fittings.

3.3.3 We strongly recommend that the Installation Engineer performs his own velocity calculations to size the pipework, rather than simply relying on the discharge connection size as being a reliable basis.

3.3.4 When the proposed installation is to have the thermocompressor discharging directly to the atmosphere, we recommend that a silencer is fitted to bring the noise down to an acceptable level.

3.3.5 The discharge piping must be free of any loops in the vertical plane. These are potential sources of liquid and solids collection points and they can cause operational problems - particularly if the suction gas contains droplets, dust or a vapour near its saturation point.

3.4 General recommendations - Installation considerations:

3.4.1 All connecting pipework must be sized and installed with good working practice. We strongly recommend that the Installation Engineer performs his own velocity calculations to size all pipework and does not simply make the piping the same size as the corresponding connections at the termination points of the thermocompressor, without first performing this check.

3.4.2 All termination points of the Thermocompressor are not designed to be load bearing, therefore the customer is responsible for ensuring that all connecting pipes are free of stresses. We recommend that heavy pipes are supported from adjacent steelwork, to prevent loads being transmitted to the thermocompressor.

3.4.3 Gaskets, valves, cocks and any in-line instruments should not reduce the cross sectional area of the pipes. This is of particular importance in the suction and discharge piping.

3.4.4 Ensure that low points of all interconnecting pipework have suitable connections for drains.

3.4.5 We strongly recommend that all lines connected to the thermocompressor incorporate connections for pressure tappings. Thus, should an operational problem arise, gauges can be quickly fitted, which will then help to identify a particular problem.

3.5 Unit installation

Before reading this section, the reader is strongly advised to read and take note of the considerations laid down in the previous sections within Section 3.

3.5.1 Notes prior to installation:

- Always use a compatible gasket material on all flanged connections to reduce friction, improve sealing and facilitate disassembly of the unit from the line.

- A lot of potential trouble at the commissioning stage could be prevented if care is taken at this stage to ensure that all weld spatter, scale and other foreign bodies are removed from all connecting pipework, which would otherwise block the small cavities within the thermocompressor.

3.5.2 Installation of the unit into the surrounding pipework is easy.

All connections are flanged and only 3 connections are necessary:

- The Motive Connection is to be connected to the Motive Steam Line.

- The Suction Connection is to be connected to the Suction Line.

- The Discharge Connection is to be connected to the downstream pipeline.

3.5.3 Summary information regarding accessories

The SJT Steam Jet Thermocompressor is generally supplied without any accessories, however if supplied with a set of accessories, such as an Actuator, a Positioner and an Air Regulating Set, assembly of the a aforementioned upon the Steam Jet Thermocompressor will already have been effectuated by Spirax-Sarco Limited prior to dispatch of the equipment.

In the event accessories are supplied, an additional manual will accompany the unit, providing information as to how they should be connected to their supply medium, once the SJT Steam Jet Thermocompressor has been installed into its position in the pipework.

4. Operation

4.1 General information regarding operation

Steam under pressure is introduced to the Motive Nozzle, which is usually a converging / diverging type. As the steam passes through the Nozzle, its velocity is greatly increased and its pressure is reduced (pressure energy converted to velocity (Kinetic) energy). This results in a high velocity jet of steam emerging from the Nozzle outlet.

By a principle of momentum transfer, energy is transferred from the high velocity jet to the vapours present in the suction chamber or body of the Thermocompressor. This results in the suction gases being entrained with the motive steam, in a direction towards the Diffuser. In the converging section of the Diffuser, the motive steam and the suction vapours combine and mix intimately.

The resulting uniform mixture of vapours is then decelerated in the diverging section of the Diffuser, this is marked by a corresponding pressure rise as the velocity energy (Kinetic) is transferred back to pressure energy, thus enabling the Thermocompressor to overcome the specified backpressure.

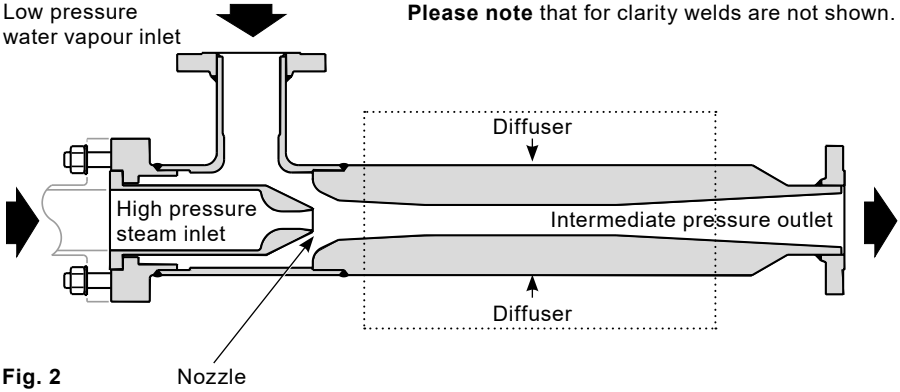


Fig. 2

To summarise, high pressure motive steam entrains lower pressure water vapour and, the mixture is discharged at a pressure with a value lying between the suction and motive pressure.

In some operating circumstances, the required operating duty of the Thermocompressor can be constantly changing. Thus the amount of motive steam actually required to make the Thermocompressor perform is constantly changing too.

You will appreciate that the design must cater for the worst envisaged operating conditions, which of course will correspond with the highest motive steam requirement. As a consequence of this, when the Thermocompressor is only required to perform low duty (and therefore only requiring a low amount of motive steam), if some form of steam flow regulating device is not present, the Thermocompressor will actually be using much more motive steam than is actually required to perform the duty. This can be a costly waste of motive steam.

It is in these circumstances that a steam flow regulating device is usually employed. This comprises an Actuator, a Positioner and an Air Regulating Set, mounted directly onto the Thermocompressor. The Actuator regulates the position of a spindle within the Steam Nozzle.

The operation of the Flow Regulating Device can be described as follows:-
A control signal is sensed by the Actuator, which then moves the spindle either into or out of the Motive Steam Nozzle. In the region of the Motive Nozzle, the spindle is tapered so that it has a varying cross-section. Thus, as the spindle moves in and out of the Motive Nozzle, the cross-sectional area within the Nozzle that is available for the flow of steam is constantly changing and, since the flow of steam is proportional to the cross-sectional area of the Nozzle, this gives rise to a change in steam flow.
Since it is the cross-sectional area of the Nozzle that changes and not the motive steam pressure, the design ensures that the velocity of the steam jet, as it emerges from the Nozzle, is unchanged, which is a desirable feature for stable operation of the Thermocompressor.
If the Thermocompressor is supplied with the accessories mentioned above, more detailed information regarding their operation will be provided within a supplementary documentation.

4.2 Pre-operational checks

4.2.1 Check that all installation procedures have been carried out in accordance with the recommendations of these Installation and Maintenance Instructions and other Suppliers' Manuals which may appear at the rear of this document.

4.2.2 Ensure that all connecting lines have been made free of foreign materials (e.g. weld spatter) which could potentially clog the small bores within the body of the Thermocompressor.

4.2.3 Ensure that any Valves in the discharge line are fully-open.

4.2.4 Ensure that the Motive Steam Supply Valve is fully-closed.

4.2.5 Ensure that any Suction Steam Line Valves are fully-closed.

4.2.6 Take all precautions necessary to handle the possibility of leakage, both in terms of protection of personnel and other equipment.

4.3 Start-up

4.3.1 If the Thermocompressor is supplied complete with accessories as previously stated activate their control loop. Ensure that instrument air is feeding the Air Regulating Set (if present).

4.3.2 Open the motive steam Supply Valve to the Thermocompressor. The motive steam should now be flowing through the Unit, which will be indicated on the Pressure Gauges, positioned immediately before and after the unit (if fitted).

4.3.3 If fitted, open the Isolating Valve in the suction line.

4.3.4 The Thermocompressor should now be fully operational. Checks should be made to ensure that:

i) The inlet steam pressure is equal to or exceeds that stated in the Purchase Order Specification.

ii) All steam traps and other equipment installed are operating satisfactorily, to ensure dry steam.

iii) The overall System operation is satisfactory with no instability and no pressure surges.

iv) The Actuator Assembly (if present) is operating satisfactorily - read in conjunction with the supplementary documentation covering the Actuators installation and connections.

v) The pressure at the discharge of the unit is equal to or lower than that stated in the specification.

If the above conditions are met, the unit should be entraining the correct amount (or slightly more) of the suction vapour.

4.4 Shutdown

4.4.1 If an Isolation Valve is present in the suction line, then this should be closed fully. The equipment on the suction side of the Thermocompressor can then be brought back to ambient conditions by opening the Vent Valve, positioned upstream of the Isolation Valve.

4.4.2 Fully close the Steam Supply Valve to the Thermocompressor.

4.4.3 De-activate the Control Loop for the accessories (if applicable).

5. Maintenance

Note: Before actioning any maintenance programme observe the 'Safety information' in Section 1.

Maintenance should only be carried out by qualified, experienced personnel, who are familiar with Steam Jet Thermocompressors and have read and understood all the installation and maintenance instructions within this document.

Caution: Do not proceed with any maintenance unless the SJT has:

i) All connecting lines fully isolated.

ii) Been allowed to reach ambient temperature.

iii) Been drained of all liquids.

iv) Been relieved of all pressure.

5.1 Preventive maintenance

We recommend that the user creates maintenance schedules, safety manuals and inspection details for each specific installation of an SJT Steam Jet Thermocompressor.
On all installations of the SJT Steam Jet Thermocompressor, the following items and conditions should be regularly checked by the user, for the purposes of maintenance:

1. Thermocompressor Motive Steam Nozzle for corrosion, wear and blockages.

2. Thermocompressor Diffuser Section for corrosion, wear and blockages.

3. All connecting piping and fittings for corrosion, debris build-up and blockages.

4. Strainers for debris build-up.

5. Leakage on any piping and related process equipment.

6. Satisfactory operation of associated Steam Traps for ensuring that condensate is being removed.

7. Satisfactory operation of the Steam Regulating Assembly, if fitted.

8. Wear around the Steam Regulating Assembly.

This schedule for maintenance checks on the unit must be the responsibility of the customer. Realistic maintenance schedules can only be determined with full knowledge of the services and the actual application involved.

5.2 Maintenance of the SJT Steam Jet Thermocompressor

Since the SJT has no moving parts, maintenance is virtually negligible and is limited to checking Nozzles and Diffusers for blockages and erosion and replacing these items when proven necessary.

Ejector inspection

In order to inspect the internals of the Thermocompressor, the Nozzle must be removed from the Unit. Reference should be made to the Spirax-Sarco Limited GA (General Arrangement Drawing).

1. Remove the bolts which hold the nozzle in position. The Nozzle can now be withdrawn from its location in the body.
2. When the Nozzle has been removed from the body of the unit, it can be inspected for internal wear. The bore of the Nozzle should be parallel and round and should not appear warped.
3. Whilst the Nozzle is removed from the unit, it is possible to inspect the Diffuser. The bore should be parallel and should not appear warped.
4. Re-assembly of the SJT is achieved by using the reverse procedure. However, care must be taken to ensure that:
   - The replacement Nozzle Gasket is the same thickness as the original one.
   - There is concentricity between the Nozzle and the Diffuser. This will ensure that the Thermocompressor performance is maintained. Concentricity will be automatically achieved if the Nozzle and Diffuser are still in prime condition.

6. Commissioning

After installation and maintenance ensure that the system is fully functional. Carry out tests on any alarms or protective devices.

7. Spare parts

The only available spare parts for the SJT Steam Jet Thermocompressor is the **Nozzle and its Gasket**.

For a complete replacement unit please contact Spirax Sarco and quote the following data:
Unit Serial number: .....
Original contract reference: .....
Your item number (if applicable): .....

8. Troubleshooting

8.1 Introduction

When successfully commissioned SJT Steam Jet Thermocompressors operate trouble free. However, as with any equipment in erosive or corrosive service, breakdowns beyond control may occur.

Knowledge of the correct procedures for locating and correcting faults can lead to considerable time saving.

Poor performance of an SJT Steam Jet Thermocompressor can be caused by either external or internal factors. Secondly, poor performance can also be classified as either being gradual or sudden.

In general, a gradual loss of performance will normally suggest internal corrosion or erosion, whereas a sudden loss in performance will normally suggest an external factor is to blame.

Before setting out to examine why an SJT Steam Jet Thermocompressor is not performing correctly, we strongly recommend that all instruments are first checked to ensure that it is not them that is giving false readings.

8.2 External causes of poor performance

At this stage, check that Steam Traps are operating correctly:

8.2.1 Motive pressure not in accordance with the specification.

If the available Motive Pressure is below that stated in the Design Specification, poor performance will result. The Motive Pressure must either be increased to that stated in the Design Specification or, the design of the unit must be modified.

The use of pressure above the design value usually improves performance slightly, up to a point beyond which no improvement is noted.

A varying steam pressure will cause a fluctuating performance. If for some reason this is undesirable, then a Steam Pressure Regulating Valve must be fitted within the steam supply line.

8.2.2 Steam Quality

The quality of steam feeding an SJT Steam Jet Thermocompressor is of primary importance and cannot be overstressed.

The effect of wet steam is two-fold:

Firstly, it creates poor performance because the energy available in the motive supply is less than if the supply were dry and saturated and,

Secondly, It will cause erosion of the internals of the Unit.

8.2.3 Steam Temperature

Check that the temperature of the steam does not exceed that specified in the Design Specification. If the steam is superheated at the design pressure and dry, saturated steam conditions were stated in the Design Specification, the Thermocompressor will be starved of motive steam, which will result in a loss of performance.

Generally, if dry saturated steam conditions were stated in the Design Specification, up to 5 °C (9 °F) of superheat will still be acceptable (in fact it will help to ensure that the steam supply is not wet!) with no loss in performance noted. However, if the steam is very superheated, it must either be:

i) Increased in pressure.

ii) Desuperheated.

iii) The SJT Steam Jet Thermocompressor must be re-designed.

8.2.4 High Discharge Pressure

If the backpressure to the System is greater than that stated in the Design Specification, poor System performance will result.

High backpressure to Thermocompressors are normally caused by:

a) A blockage or restriction somewhere in the discharge line.

b) Incorrectly sized discharge pipework.

c) Poor discharge pipework layout.

If high discharge pressure is suspected as the reason for poor performance, the remedial measures are to check for and remove any restrictions or blockages, check the line sizing of the discharge pipework and increase if necessary, check Steam Strainers for blockages and, finally, in the case of poor piping layout, re-route the pipework.

8.2.5 Restrictive Suction Piping

Restrictive suction piping is normally caused by:

a) A blockage or restriction somewhere in the suction line.

b) Incorrectly sized discharge pipework.

c) Poor discharge pipework layout.

The remedial measure is to check for and remove any restrictions or blockages, check the line sizing of the suction pipework and increase it if necessary, check for satisfactory operation of Non-return Valves and, finally, in the case of poor piping layout, re-route the pipework in accordance with our recommendations, given in Sections 3.1, 3.2 and 3.3.

8.3 Internal causes of poor performance

This involves an investigation into the individual SJT Steam Jet Thermocompressor. To perform a full investigation on an individual SJT, we recommend that the Nozzle is removed from its location, as described in Section 5.2 of these Installation and Maintenance Instructions. Things to be checked during disassembly are as follows:-

8.3.1 Eroded or corroded parts, particularly the Motive Steam Nozzle and the Diffuser. If the internal components are worn or corroded, spares should be fitted.

8.3.2 Gaskets and Gasket Seating Surfaces. Check that Gaskets are sitting correctly and do not permit by passing of the motive steam around the Nozzle. A new Gasket should always be fitted when reassembling an SJT Steam Jet Thermocompressor.

8.3.3 Concentricity between Nozzle and Diffuser.

8.3.4 Cracked components.