

TUNNEL PASTEURIZER

Instructions for use and maintenance

Marking



TMCI Padovan spa

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Type **78 MQ.**

Serial N° **91200198-0/001**

Year of supply **2020**

CAT. 018638-rev.08-2020



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TECHNICAL DATA

■ PLANT IDENTIFICATION DATA

Plant type :	TUNNEL PASTEURIZER
Serial Number:	91200198-0/001
Year of supply:	2020

Cans treated:	n°/h	27,000
Cans diameter :	mm	66
Cans capacity :	l	0.473
Product treated:		soft drink

■ TREATMENT TEMPERATURE:

Cans inlet temperature:	°C	4
Heating from 4°C to 20°C with water at:	°C	28.5
Heating from 20°C to 37°C with water at:	°C	46
Heating from 37°C to 56.5°C with water at:	°C	64.5
Heating from 56.5°C to 82°C with water at:	°C	86
Holding at 82°C with water at:	°C	82
Cooling from 82°C to 68°C with water at:	°C	63,5
Cooling from 68°C to 51°C with water at:	°C	45
Cooling from 51°C to 35°C with water at:	°C	27.5
Cans outlet temperature:	°C	35

■ TREATMENT TIME

Heating:	mins	---
Holding at pasteurizing temperature:	mins	9.2'
Cooling:	mins	---
	-----	-----
Total cycle time:	mins	38'

■ CONSUMPTION

Steam consumption at startup:	kg/h	1,500
Steam consumption in operation:	kg/h	1,000
Steam pressure:	bar	3
Consumption of water during operation:	m ³ /h	2
Consumption of water at stop:	m ³ /h	30
Inlet water temperature:	°C	15
Inlet water max. pressure:	bar	2
Air consumption:	NI/h	2,000
Air pressure:	bar	6
Installed total power: U 460 Vac, f: 3ph 60 Hz	A	106

■ CONSTRUCTION FEATURES

Tunnel elements

- number:	n°	7
- total length:	mm	17,200
- total width:	mm	6,330 + 800
- max. height:	mm	2,030 (2,800)
- total surface:	m ²	78
- decks:	n°	1

Net total weight:	kg	---
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No. of water circulation pumps:	n°	8
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No. of conveyor belts

- at inlet:	n°	1 (3 ways)
- at outlet:	n°	1 (4 ways)

PUMPS

No. 5 WATER CIRCULATION PUMPS

Pos. M1-M2-M3-M7-M8

Code 46220372

Type : electropump mod. NSCS100-160/55 :
Power : 5.5 kW
Material : cast iron
Motor : 4 poles / IP55 Class F
Mechanical seal : our code 48604103

No. 2 WATER CIRCULATION PUMPS

Pos. M4-M5

Code 46220374

Type : electropump mod. NSCS125-200/110
Power : 11 kW
Material : cast iron
Motor : 4 poles / IP55 Class F
Mechanical seal : our code 48604103

No. 1 WATER CIRCULATION PUMP

Pos. M6

Code 46220373

Type : electropump mod. NSCS100-160/75
Power : 7.5 kW
Material : cast iron
Motor : 4 poles / IP55 Class F
Mechanical seal : our code 48604103

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1) GENERAL SAFETY RULES

1.1) GENERAL INFORMATION

Tunnels are equipped with some safety devices that meet specific directives and rules. However, the operator is responsible for making sure that the general standards and rules and special safety indications are strictly respected when handling and maintaining the system.

1.2) EQUIPMENT OF PERSONNEL

The operators and maintenance personnel must wear a plastic visor on the head, insulated gloves because of high temperature steam piping, gloves and boots during cleaning operations of the plant and of the basin for water collecting.

1.3) GENERAL MANDATORY INSTRUCTIONS

- If it is necessary to carry out any operations on the bottle outlet belt, protect face and hands as described above.
- **IMPORTANT!!** - Close the main switch before opening the electric switchboard or carrying out any operations on motors or electrical connections.
- Make sure that the system has been earthed appropriately.
- Close the main switch before performing any operations on any parts in movement (conveyor belts, advancement surfaces, pumps).
- Do not put hands or objects held with hands in areas where there are moving parts.

-
- Do not sprinkle the electric switchboard, motors or electrical connections with water or other liquids.
 - Follow the general safety rules when washing the tunnel periodically with acid or basic detergent solutions. Remember to use protective gloves and glasses.
 - When handling caustic soda, remember that it develops a great amount of heat when soda is dissolved in water.
 - If operations have to be carried out on parts subject to steam pressure or hot water (piping, regulation valves, tube nest heat exchangers), make sure that the steam or water cutoff valves are closed, that the parts involved have been drained and that they have reached acceptable temperatures.
 - If you are operating on components subject to heating, make sure that they have reached a temperature tolerated by the operator. If necessary protect hands with special gloves.
 - When handling containers (especially glass bottles) containing pressurized liquids, remember not to open the tunnel's inspection doors during use. The danger of explosions in this containers increases as the temperature increases because the latter makes the inner pressure increase.
 - During the process some containers make break inside the tunnel; the broken glass must be removed periodically from the vats or from the advancement surfaces. The operator must perform these operations carefully and protect hands with appropriate gloves.

2) INSTALLATION INSTRUCTIONS

2.1) UNLOADING FROM TRANSPORT MEANS

Tunnel pasteurizers are generally delivered divided as follows:

- modular elements including metal structure, a part of the distribution piping, pumps, filters, water vats, etc..
- accessories such as conveyor belts, electric switchboard, head fairing, etc.

The modular elements must be unloaded and positioned on site using self-propelled or overhead cranes.

Each tunnel has a special fastening frame onto which cables must be fixed to the special fittings.

The frame is only one and must be used to lift one unit at a time. Make sure that the crane and the manouevring equipment can bear the weight of each element.

If the elements are packed, pass the cables under the packaging at the indicated points.

Lift the elements according to the above-mentioned instructions to take them out of the packaging.

For eventual container transportation of the elements: in order to take the elements out of the container, fasten the cables to the indicated points and pull the element carefully outwards. When the unit protrudes sufficiently, fasten the cables and proceed as above.

WARNING!!

Never lift the elements using inappropriate hoisting means, such as fork lift trucks; once the unit has been placed on the ground, never push it around.

When cables are used for hoisting, once they have been pulled tightly make sure that they do not scrape against delicate components.

Lift each element about 50 mm and make sure that it is perfectly balanced. Balancing can be achieved by adjusting the cable on the frame.

Do not cause abrupt movements of the equipment.

During these operations be careful that the equipment does not knock abruptly on the floor.

Use the same attention when unloading and moving the accessories so that no parts are deformed or damaged.

2.2) CONTROL OF DELIVERY AND ASSESSMENT OF ANY DAMAGE

Control all the goods upon arrival and make sure that all the components listed in the delivery note or packing list are in perfect conditions.

If some parts are missing, if the crates or packaging have been tampered with or goods are damaged, it is necessary to write out a report, have it signed by the forwarding agent and notify the insurance company immediately.

N.B. If You immediately inform the constructor and send a list of all damaged parts, they will be replaced as soon as possible, thus avoiding any useless interruption of the assembling operations.

Notify the insurance company even in case of damage occurred during unloading, displacement and positioning.

If the insurance is at constructor's own expenses, advise the company immediately by telex or fax and wait for instructions.

Any rights to damage indemnification are forfeited if the constructor is not notified immediately.

Do not remove protections or locking devices until installation, unless there are clear signs of damage.

Put covers back into position if the goods are going to be stored for some time.

Crates which have been opened for inspection must be handled with care to prevent damaging contents; pack the parts again and store in a safe place until it is time for assembly.

Please refer to STORAGE for information concerning how to handle these units.

2.3) TEMPORARY STORAGE

If the tunnel is not placed immediately in the final installation position, store it in dry and well-aired premises at a minimum temperature of +10°C.

Cover all surfaces subject to oxidation and corrosion with a suitable protection.

Control frequently any signs of oxidation, especially on machined or uncoated surfaces (shafts, bearings, etc.).

Remove the oxidation or any signs of corrosion immediately and apply an appropriate anticorrosion protection over the damaged surfaces.

Rubber parts must be protected against very low temperature and should never be stored outdoor even for very short periods. Keep rubber parts well-aired if the environment is warm.

In case of prolonged storage or inactivity after a first startup or a considerable delay in starting up the system after delivery, it may occur that some gaskets or seal rings harden causing leakages or seizures.

The greases or lubricants used to install the bearings, shafts, etc. may also harden.

Therefore in these cases (inactivity lasting over 6 months), it is necessary to control the entire machine, replace all the gaskets or parts that may deteriorate during storage or inactivity.

These operations require qualified and authorized personnel to prevent that badly performed operations or incorrect reassembly may damage the appliance when operation begins again.

IMPORTANT !! Make sure that:

- there is no water in the vats, in the tanks and in the pumps; leave the drains or taps open;
- there are no iron objects in contact with stainless steel components;
- there is no dripping from iron structures;
- there is no possibility of damaging components caused by equipment in transit, goods or people close to the plant.

2.4 INSTALLATION OF TRANSMISSION SHAFT AND COUNTERSHAFT (Only for units equipped with more elements)

Once the units have been positioned, install the transmission shaft (to which the motor-driving unit has been installed) and the countershaft.

They are both fitted on appropriate supports that must be fixed to the end of the tunnel.

During this phase make sure to install correctly the central bearing of the driving shaft, provided only for plants with particular dimensions.

2.5 BELT INSTALLATION **(Only for units equipped with more elements)**

Arrange the roll/s in front of the tunnel (bottle inlet side) with the ends of the tube, that passes through the middle of the roll, on special supports.

Make some ropes pass under the transversal bars supporting the belt and above the rollers supporting the belt return.

Tie the ropes to an iron rod and then tie the latter with several wires to the belt's first bar.

Pull the ropes slowly from the end of the bottle outlet and push the belt inside the tunnel.

When the belt reaches the transmission shaft, roll up its end around the gears and reverse the ropes right up to the bottle inlet head.

It is now possible to make the transmission shaft turn with the belt end connected by means of the gearmotor. At this stage it is necessary to keep the end of the belt stretched with the ropes, stop the gearmotor when the end of the belt comes out of the tunnel. Detach the ropes and whatever else from the belt and join the two pieces keeping the belt well tensioned. Insert the connecting bar and fix the end nut.

After this operation it is advisable to start the belt at full speed and make it turn for 4-8 hours to control operation and stability.

Control that the return of the belt is supported appropriately and does not scrape over any surfaces of the lower vats, but is supported by the lower rollers.

2.6) INSTALLATION OF BELTS AND HEAD FAIRING

The inlet and outlet belts can be delivered already assembled to their fairing or be supplied separately.

If they are separate, it is necessary to fix them to each fairing with the front screws; then fix the fairings and belts to each end of the tunnel with the perimeter screws, insert the upper tie rods supporting and regulating the belt height and then insert the lateral screws to fix the belts to the heads.

The carter assemblage should be done applying a thin silicone layer (or the appropriate gaskets supplied) between the surfaces carter to seal before fixing them to the tunnel head. This action is with the purpose to avoid water losses outside, during the operation cycle.

2.7) PIPING AND ACCESSORIES

Once the tunnel has been installed, fit the pump connection piping to each area, the steam inlet pipes in the heat exchangers with the regulation valves, the condensation and manifold drain pipes.

We recommend to carry out these operations according to the plant's technological diagram.

3) CONNECTIONS

3.1) ELECTRICAL CONNECTIONS AND CONTROLS (Dwg. No. 712-295)

- The tunnel is supplied with electrical connections between the switchboard and the motors and control instruments. It is sufficient to connect the cable terminals on the switchboard according to the diagrams included and connect the electric switchboard to the mains.
- Control that the connection terminals on the motors are tightened firmly (the vibrations during transport may unloose the terminals or even disconnect the cables).
- Control that the power supply and the electrical features of the machine are equivalent.
- Connect the electric switchboard with a four-pole cable (three phases + earth) and plug to a socket with switch and fuses.
- Control that the diameter of the feed line is sufficient for the working and starting load.
- Control that the direction of rotation of the motors is equivalent to the data plate figures installed on the motors.
Control the pumps only for a few seconds to avoid damaging the rotary seals.

3.2) EARTHING

- Connect the earth plate on the tunnel to the earth line with an appropriate size cable.

3.3) STEAM CONNECTION (Dwg. No. 32003-0154)

Connect the flanged fitting to the steam feed piping. The piping must have a suitable diameter to ensure that pressure and output are suitable for the plant's requirements. If the pressure is greater, it must be reduced by fitting a pressure reduction unit. The feed steam must not contain any condensate; the feed piping must be insulated and equipped with a steam trap, if necessary.

3.4) CONDENSATE CONNECTION (Dwg. No.32003-0154)

When heating is achieved by steam condensation in tube nest heat exchangers, the manifold fitting must be connected to the piping for the return to the boiler.

The return to the boiler can be made directly, if the distance and different boiler level allow it, or using a pump.

3.5) EXHAUST STEAM CONNECTION

Fittings dia. 200/300 mm can be available on the tunnel covers near each end.

If these fittings exist, they can be connected to the outside of the building using stainless steel or stiff plastic tubes.

3.6) WATER CONNECTION (Dwg. No.32003-0154)

Connect the fitting to the water supply piping coming from the water mains.

This pipe must have a suitable diameter to ensure a proper water output and pressure as shown in the technical chart.

3.7) WATER DRAINING

The vats are equipped with an overflow drain that eliminates any excess of water during use. At the end of the process, drain the vats and wash them with jets of water. The drain water must be collected in a drain channel made in the floor.

3.8) PNEUMATIC CONNECTION (Dwg. No. No.32003-0154)

- Connect the air distribution line to the filter; the air is distributed to the various steam valves through a manifold.
- Reduce the pressure not lower than 1.5 bar with the pressure regulators.
- The converter transforms the electric signal coming from the PLC into a pneumatic signal which is sent to the valves, regulating the opening according to the water temperature.

3.9) PLATE-TYPE EXCHANGER CONNECTION **(optional fitting supplied)**

In some case, to reduce water consumption in the cooling section, a plate type exchanger is applied: such device allows to lower water temperature in the final section by means of glycol solution.

The connection piping diameter must be suitable for the foreseen fittings.

4) REGULATIONS AND PRELIMINARY CONTROLS

4.1) THERMOREGULATION DEVICE

The temperature of water in the pasteurizer sections can be adjusted in one of the following three ways:

- I) *Using special tube in tube heat exchangers placed on the water circuit, that keep the set operating temperature in the plant's different sections by means of a pneumatic valve controlled by a special thermoregulator.*
- II) *By means of steam injectors inside some vats or on the delivery side of some pumps. In this case the water temperature is controlled by thermostats that control the steam cutoff solenoid valves..*
- III) *By means of a plate-type exchanger, with coolant, for the cooling phase.*

4.2) INLET AND OUTLET CONVEYOR BELTS

After positioning the conveyor belts on the two tunnel heads, check that they are positioned exactly with reference to the mobile surface moving the tunnel forward. This can be done by means of the adjusting screws with which the conveyor belts are equipped.

4.3) BELT LUBRICATION

The tunnel advancement and emptying belts must be regularly lubricated, so that the containers can be transported without falling down.

The lubrication should be done by spraying specific lubricating liquids, which can be found on the market or - if not available - a soap solution on each belt.

The lubricating liquid should be sprayed on the flat section of each belt where there is not movement of containers, on the opposite side of the drive end, so that the soap solution does not end up in the vats of the tunnel.

Either a central system for the bottling line lubrication can be used or an independent central unit with a tank and a dosing pump.

4.4 REGULATION OF BELT SPEED

The inlet and outlet belts are two or more; they all have a speed that allows a capacity of approximately 10% more than the tunnel's own capacity and they can be driven by a gearmotor with fixed reduction ratio or by a ratiomotor.

A limit or proximity switch is installed at the end of the outlet belt.

When the movement of containers after the tunnel is interrupted, the containers fill the outlet belt completely.

The pressure of the containers makes the limit switch operate and it stops the advancement of tunnel surface.

4.5 REGULATION OF SAFETY LIMIT SWITCH

A safety limit switch is installed on the belt movement unit near the torsion bar of the transmission shaft. It is extremely important for the integrity of the tunnel belt.

This safety device blocks the belt in case of belt overloading or clogging, caused by broken containers inside the tunnel.

The belt can be started again only from the electric switchboard and once the cause of the overload has been eliminated.

4.6 LIMIT SWITCH CONTROL BEFORE STARTING

Before starting the plant for the first time or after long periods of inactivity, we recommend to carry out the following operations:

- Unloose the lock screws on the torsion bar of the transmission belt's ratiomotor.
- Start slowly. The limit switch will operate and stop movement because the screws have been unloosed.
- Tighten the screws a little and repeat the operation until movement is continuous.
- Place the containers. If the belt should stop, tighten the screws again until the belt with all the containers move safely and constantly.

5) CHOICE OF OPERATION CYCLE

5.1) GENERAL PRINCIPLES

The kind of treatment cycle is established when designing the tunnel according to:

- *length and number of stages for heating phase,*
- *holding time and temperature for pasteurization phase,*
- *time and number of stages for cooling phase.*

The number and time of heating and cooling phases are established according to:

- *type, volume and resistance to heat shocks of containers,*
- *energy recovery.*

The pasteurization time and temperature are established according to:

- *pressure/temperature resistance of containers,*
- *number of pasteurization units required.*

A PU pasteurization unit is the pasteurization result achieved by holding a product at 60°C for one minute.

The enclosed table (1) provides a list of the different PU according to the treatment temperature.

The total pasteurization effect of a cycle is calculated by multiplying the PU of the pasteurization temperature by the holding time and adding the pasteurization effect achieved in the heating and cooling phases.

5.2) VARIATIONS OF PASTEURIZATION CYCLE

The length of each area in which the tunnel is divided for heating, holding and cooling is fixed, and so are the ratios between the travelling time of the containers in each area.

The following values can be changed:

- | | |
|----------------------------|--|
| Total treatment time | - <i>By acting manually on the speed variator of the belt advancement unit.</i> |
| Pasteurization temperature | - <i>Adjust the set point of the thermoregulators of the heating and pasteurization baths.</i> |

TABLE 1**RELATIONSHIP BETWEEN TEMPERATURE AND LETHALITY POTENTIAL AND PASTEURIZATION UNIT BY MINUTES OF TREATMENT**

TEMPERATURE (°C)	LETHALITY PO- TENTIAL AND PU	TEMPERATURE (°C)	LETHALITY PO- TENTIAL AND PU
46	0.01	63.5	3.2
46.5	0.012	64	3.7
47	0.014	64.5	4.5
47.5	0.016	65	5.2
48	0.019	65.5	6.2
48.5	0.023	66	7.2
49	0.027	66.5	8.6
49.5	0.032	67	10
50	0.037	67.5	12
50.5	0.045	68	14
51	0.052	68.5	16.5
51.5	0.062	69	19
52	0.072	69.5	23
52.5	0.086	70	27
53	0.1	70.5	32
53.5	0.12	71	37
54	0.14	71.5	45
54.5	0.16	72	52
55	0.19	72.5	62
55.5	0.23	73	72
56	0.27	73.5	86
56.5	0.32	74	100
57	0.37	74.5	119
57.5	0.45	75	139
58	0.52	75.5	166
58.5	0.62	76	196
59	0.72	76.5	231
59.5	0.86	77	268
60	1	77.5	320
60.5	1.2	78	373
61	1.4	78.5	445
61.5	1.65	79	519
62	1.9	79.5	620
62.5	2.3	80	720
63	2.7	80.5	860

5.3) HEATING CYCLE VARIATIONS

What has been said at paragraph 5.2 applies also to the heating cycle.

6) PLANT OPERATION

6.1) STARTING THE PLANT

- Turn on the electric switchboard by turning the main switch.
- Open the water supply piping. The water level in the vats is adjusted by special probes. When the vats are full start the water circulation pumps. The water must be treated with anti-algae and anti-scale products compatible with the construction materials of the Tunnel.
- Open the compressed air valve feeding the pneumatic device. Make sure that the max. pressure is 6 bar.
- Drain any condensate by opening the cap on the lower part of the filter-reducer unit.
- Set the desired water temperature in the different treatment areas by adjusting the thermoregulators (or thermostats) set-points.
- Open the steam feed valves slowly. The temperature of the water in the vats will increase until the set-point has been reached.
- Once the set-points of water temperature are reached, start the advancement of the mobile surface.
- Start the tunnel inlet belts.
The containers will fill the tunnel progressively and pass through the different zones at different temperatures.

NOTE:

In each area water will circulate in a closed circuit between vat-pump and spray nozzles. The level probes will maintain a constant water level in the vats.

- Start the tunnel emptying belts.
- During the containers advancement phase, control the variables set on the thermoregulators and, if necessary, correct them until constant operating conditions have been achieved.

6.2) STANDARD OPERATION

- From time to time check that the operating conditions correspond to the set ones; pay particular attention to the various heating and cooling sections.
- A non-stop recorder (optional) records some of the pasteurizing parameters.
- If a travelling thermoregulator is available, control the actual pasteurization cycle in the container every now and then.
- Control the filters on the suction side of water circulations pumps and clean them periodically, if necessary, taking the filters out.

6.3) STOPPING THE PLANT

- Wait until all the containers have come out of the tunnel.
- Close the steam, water and air supply valves.
- Stop the circulation pumps.
- Stop the tunnel advancement, the emptying belt and the mobile surface of the tunnel itself.
- Turn off the appliance by turning off the main switch on the electric switchboard.
- Unload the water vats; clean and wash them with water.
- The vats are equipped with an overflow pipe which drains the water in excess during the process.
When necessary, the vats are emptied and washed with water jets.
All this water should be collected into a drainage channel dug in the floor.
- Clean the pump suction filters.
- If any nozzles are clogged, remove the nozzle holder, take off the nozzle caps using a screwdriver and blow compressed air against the holes to clean them.

TABLE 2)**LUBRICATION**

TYPE OF LUBRICANT		FREQUENCY	
IP BP SHELL MOBIL	Mellana Oil 220 Energol GRXP 220 Omala Oil 220 Mobilgear 630	- Control level every 3 months. - Change every 2 years.	Gearmotors and ratiomotors.
- GREASE	IP ATHEsia GREAS 2	- Grease every 15 days.	Supports. Transmission chains. Sliding wheels mobile surface.
- LOW VISCOSITY FINE OIL		- Oil every week (1-2 drops).	Limit switches.

7) SWITCHBOARD DESCRIPTION

(Ref. Electric diagram Drwg No. 712-295)

- Before turning on the switchboard, it is advisable to control that all electrical connections are correct and according to the wiring diagram.
- Tighten the cable screws that may have become loose during transport.
- Control that overheating protections in the automatic switches are set at the data plate figures of the motor they protect.
- Turn main switch **1QS0** to turn on the switchboard.

VARIE

41XF1

USB-A INTERFACE

41XF2

RJ45 PROFINET CONNECTION

DESCRIPTION OF CONTROLS

1QS0

GENERAL disconnecting switch

This switch turns on the electric switchboard.

On position 0 the electric switchboard does not receive power supply.

On position 1 the electric switchboard receives power supply.

30SB0

EMERGENCY STOP

This mushroom push button is pressed to cut power supply to the entire control circuit, therefore all the pumps and motors are stopped and the warning lights are turned off. The temperature indicators still receive power and so do the recorder.

Turn the emergency push button (30SB0) until it is released to supply power again and then press the start push button (30SH0).

(30SB11, 30SB12)

(EMERGENCY - OPTIONALS)

Emergency buttons direct-applied on tunnel and/or preset on the switchboard.

121SB2

PAUSE CYCLE

Push button to put the cycle on pause.

To re-start the cycle refer to the operator control panel (44A00).

30SH0

OPERATION AUXILIARES (CONTROL START)

Start luminous push button to energize the auxiliary control circuits.

When it is pushed the light switches off.

44A00

OPERATOR PANEL

Operator panel touch keyboard to run the machine.

DESCRIPTION OF SIGNALING APPARATUS

HS1

YELLOW SIGNAL

Luminous alarm. It lights to indicate a generic alarm: refer to the operator control panel (44A00).

HS2

BLUE SIGNAL

Luminous alarm. It lights when operator needed.

HS3

GREEN SIGNAL

Luminous alarm. It lights when plant in automatic cycle.

HA1

SIREN

Acoustic alarm. It starts when the HS1 signal is enabled, and indicates a generic alarm.

30SH0

OPERATION AUSILIARES (CONTROL START)

Luminous alarm. It lights when the auxiliary control circuits are not energised.

8) INSTRUCTIONS MANUAL FOR OPERATOR PANEL (TSM0814)

Refer to the relevant instructions contained in the attached document :

“TSM0814” operator panel instructions”