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Title

# RETROFITTING OF THE "DIXI" MACHINE TOOL - ID. AVIO "A 3331"

#### Plant / Centre of Excellent

POMIGLIANO D'ARCO (NA) - COMBUSTOR

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#### **TECHNICAL FOCAL POINT**

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#### **INTRODUCTION:**

**Confidentiality and Property Rights of the PROJECT** - All data and information that will be knowledge of the supplier in the development of this project, these will be treated confidentially and will not be disclosed or used for any third part.

**Importance of the PROJECT** - Avio Aero consider this a very important project ensuring full availability of its technical staff to provide all the information and advice the supplier need so that it may be placed in the best condition to submit a proposal aimed at the achievement of expected results.

**Responsibility of the SUPPLIER** - Avio Aero intends to entrust the project to a single supplier, who will also be solely responsible for setting up and functionality of the cells as a whole, for machinery, for groups and infrastructure dedicated to functionality of the cells themselves.

The present Technical Supply Specification (PRELIMINARY Rev. 0) as regulates the relationship between Supplier-Partner and AVIO AERO (GE Avio S.r.l.) in connection with what is indicated in the subject and with what is necessary to its commissioning, to be performed in the plant recipient.

#### **SCOPE**

The present Technical Supply Specification, as an integral part of the "Purchase Order" that follows and, therefore, has the same legal effect of the provisions of the "Purchase Order".

#### GENERAL RESPONSIBILITIES OF THE SUPPLIER

The supply must comply with the technical and functional specifications contained or attached to "Purchase Order" and deliver the required performance.

The present Technical Supply Specification, as not relieve the Supplier from full responsibility to properly design and construction, to the smooth functioning and operational safety / functional supply.

The contents of this document should be considered confidential and not to be disclosed to third parties.



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# 1. GENERAL INFORMATION

This document describes the technical requirements for the execution of retrofitting (later also called "revision") of the CN "DIXI" Machine Tool whose data are shown in the table below:

## Personal data "DIXI" Machine Tool

ID. AVIO	MODEL	YEAR OF CONSTRUCTION	MANUFACT. NUMBER
A 3331	350 TPA-5X	1988	s/n 350-32

This Machine Tool, manufacturer by "DIXI" company is:

- ♦ Owned AVIO AERO;
- charge of the Construction department (building # 2) of the "Product Combustor Center" of Pomigliano d 'Arco plant;
- $\checkmark$  currently used to perform the operations on particular products at the aforesaid "Product" Combustor Center".

#### 1.1. Layout

The positioning and the mounting of the DIXI Machine Tool as a whole and particularly in the equipment and in the arrangement of the elements and drive groups, command and control, not to undergo substantial changes with respect to what is the current layout. Any changes to the layout of the system will still need to be based on maximum functionality and accessibility according to the criteria of good maintainability.

These changes must be submitted and accepted by AVIO AERO - Technologies and Improvement of Production Processes - Combustor (later called T.I.P.P. - Combustor) by the presentation of the plan drawing showing the new spaces.

#### 1.2. Safety requirements

The revision activities of the DIXI Machine Tool, must be made in accordance with specific provisions of the current regulations regarding safety, health, environmental and ecology, briefly:

- ✤ The Directive 2006/42/EC transposed by Italian Legislative Decree no. 17 of 27 January 2010,
- ✤ To Italian Decree 81/08 Consolidated Safety;
- The technical standards approved by the recognized organizations to conduct business regulations (UNI / EN / ISO), in the part of applicable laws.

Pursuant to Annex XV par. 3.2.1. of Italian Legislative Decree 81/08 of 9 April 2008, for the execution of the revision of the DIXI Machine Tool, Supplier shall prepare the "Specific Safety Plan" (SSP) that contains:

- the name of the supervisor for the duration of intervention;
- a description of the work to be carried out;
- any companies involved in sub-contracting and the description of the work / tasks / duties entrusted to them;

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- the list of the equipments and tools used;
- the risk analysis and
- the security measures adopted by the list of "Personal Protective Equipment" (PPE) available to workers from the Employer.

AVIO AERO will first inform the Supplier inherently the specific risks of the intervention area.

Before any revision activity, the Head of Provider's site and AVIO AERO will provide to fill the special "**Verbal opening work**".

At the end of the revision activity, the Head of Provider's site and AVIO AERO will provide to fill the special "**Verbal closing work**".

### 1.3. Components

All components of the new supply, relating to the retrofitting of the DIXI Machine Tool (plate Avio "A 3331"), must comply with the European regulations and must be "CE" marked.

# 2. DETAIL OF THE ACTIVITIES' REVISION

It's required robustness and reliability of the DIXI Machine Tool after the revision, for its use in a workshop environment with temperatures of  $15 \div 45^{\circ}$  C and the continuous pace of work (24 hours a day, 6 days a week).

The revision of the DIXI Machine Tool, plate AVIO "A 3331", provides the replacement / supply of the following items:

### Electric / electronic retrofit

- Complete disassembly of the Machine electrical parts;
- Disassembly of the electrical cabinet;
- Design and construction of a new electrical cabinet;
- Complete rebuilding of the electrical system on the machine.

### Electronic supply:

- Replacement of the current CN with a 5-axis CNC numerical control SIEMENS SINUMERIK 840D SL, complete of axis motors and spindle motor (the CN must be able to work with CYCLE800 and must have an interface for managing of standard part probing cycles);
- Replacement of the current axes encoders with new Heidenhain encoders for all axes (optical linear encoders for the X, Y and Z axes and angle encoders for A and B axes);
- Replacement of the current workpiece measurement systems whit a Renishaw optical transmission system and Renishaw OMP600 probe;

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- Design and logic realization of PLC machine CNC commissioning and axis calibration;
- Spindle measuring system;
- Tool change motor;
- Pallet change motor;
- Development of the machine and spindle software;
- Development of the tool change software;
- Development of the changing pallet software;
- Software development for cabinet and operator safety.

## Electrical cabinet and wiring supplies

- Supply of a new fully wired cabinet;
- Complete wiring of the machine;
- Complete wiring of the tool changer;
- Complete wiring of the pallet change;
- Complete wiring of the safety cabinet;
- Commissioning of the Machine and its accessories;
- Supply of electrical and safety diagrams.

### Mechanical retrofit, auxiliary circuits and services

- Disassembly and preparation of the machine for transport (eventually);
- Transport of the machine to supplier's factory;
- Complete cleaning of the Machine;
- Machining of the guides (if necessary);
- Assembly of the Z axis scale;
- Assembly and adjustment of the Z axis;
- Assembly of the X axis scale;
- Assembly and adjustment of the X axis;
- Assembly of the Y axis scale;
- Assembly and adjustment of the Y axis;
- B axis encoder assembly;
- Assembly and adjustment of the B axis;
- Assembly spindle motor (adjustment and positioning);
- Replacement of the steel protections of the Z axis;
- Revision of hydraulic power unit and lubrification system;
- Machine Start up.



# Painting

- Painting of the fixed part of the Machine with RAL 7035;
- Painting of the moving part of the Machine RAL 3002.

## Plumbing works

- Replacement of all solenoid valves;
- Replacement of hoses;
- Axis locking system revision;
- Overhaul of lubrication systems;
- Replacement of the Kabelschlepp (cable holder) axes X and Z;
- Hydraulic unit modification;
- Disassembly of the old system of the machine cold part (spindle oil cooling);
- Replacing the heat exchanger (oil water) of the spindle;
- Supply and assembly of a new cold unit;
- Supply and installation of temperature probes;
- Commissioning of the new system;
- Control and calibration of spindle temperature.

## Tool change

- Disassembly of the old tool changer;
- Revision of the old tool change;
- Functional tests and start-up of the tool change.

## **OPTIONALS**

In its Offer, the supplier must quote (as an options) the following items:

- A) the possibility of switching from the current refrigerant system (neat oil) to a system with cooling lubricant (emulsion of water + oil) and providing the supply of a pump, for the delivery of the cooling lubricant liquid both external and through the spindle, to a pressure of at least <u>60 bar</u>;
- B) the possibility of upgrading the spindle to have a speed of at least 12.000 RPM (if the machine doesn't already reach this number of revolutions per minute);
- C) the supply of a new handwheel with the possibility of moving the axes in JOG (NOTE: in JOG the spindle must be idling in order to be manually maneuvered by the Operator during the setup phase).



# 3. METHOD OF PERFORMANCE OF THE REVISION

The revision of the DIXI Machine Tool plate AVIO "A 3331", must be made in AVIO AERO, Pomigliano d' Arco plant.

It prescribed so that:

- The DIXI Machine Tool must be serviced within <u>5 (five)</u> months from the date of receipt the Purchase Order (a further month will be allowed for functional testing and qualification tests of the same);
- The Supplier shall communicate to AVIO AERO department of Technologies and Improvement of Production Processes - the willingness to intervene at least 15 (fifteen) working days before the beginning work;
- AVIO AERO department of Technologies and Improvement of Production Processes convene the Supplier with a notice of at least 3 (three) calendar days, by e-mail, stating the period of availability of the DIXI Machine Tool (from to);
- From the date of release of the DIXI Machine Tool in production, the Supplier shall provide technical assistance for at least 5 (five) working days after acceptance in case of breakdown or problems of the operation and in resumption of production activities;
- In the event that the Supplier should find that the 'system is not available, for exceptional production requirements, AVIO AERO will not recognize any charge / refund or economic costs incurred by the Supplier.

# 4. DISCONNECTING AND RECONNECTING TO CORPORATE USERS

Any works by disconnecting and reconnecting of the DIXI Machine Tool to corporate users (for example Electricity, compressed air, cooling water, fume extraction etc..), <u>will be borne</u> by AVIO AERO.

# 5. TRANSPORT

## It will be the sole responsibility and care of the Supplier:

- The transport of the new components required for the revision of the DIXI Machine Tool, from the workshop / warehouse of the Supplier to the AVIO AERO – Pomigliano d' Arco plant;
- The transport of these new components from the receiving zone of AVIO AERO -Pomigliano d 'Arco plant - to the place where is located the DIXI Machine Tool (Construction department - building # 2).



# 6. SAFETIES

# 6.1. Compliance with the regulations in force

The Supplier will have to adjust the system in the manner expressly required by the applicable regulations regarding safety in the workplace, with particular reference to the laws and ordinances already mentioned in section 1.2. of this Technical Supply Specification.

The Supplier shall give a guarantee of safety from the dangers generated by moving parts involved in the process.

The operator must therefore be protected from the entrapment of body parts between the moving parts of the system.

## 6.1.1. General Safeties

- The DIXI Machine Tool must be equipped with an emergency device (compliant with standard UNI EN 413) in the immediate vicinity of the operator, able to exclude the power of the same. The stop member will have a red mushroom button latched (Art. 69 of Presidential Decree 547/55, standards CEI 44 and UNI 8703/66).
- During the processing phases the level of noise emissions admitted, must be maximum of **75 dB (A)** [the sound pressure must be controlled at all points perimeter surrounding the system at a distance of 1 meter (details on the methodology of measurement are indicated in the standards UNI 7712 and **ISO 3746**)].
- The electrical cabinets must be equipped with lighting independent of the main power supply of the system. The lighting of the lamps must be automatic when the cabinets doors are opened.
- All wires for wiring of the electrical cabinets <u>must be marked</u>; these codes must be clearly indicated in the electrical sheets of the Machine.
- The system must be equipped with components that would enable the application of special security locks (padlocks) for the isolation / blocking of the Energy Sources (Lock Out Tag Out LOTO program). These safety devices must enable the isolation of the main electrical switch and main pneumatic and hydraulic valves (if any), identified with clearly visible and legible labels.
- As far as the "System status" signal lights are concerned, a flashing indicator with three colors superimposed green / yellow / red will be installed that will indicate the logic status of the system, placed on a column in such a position as to be visible from any position around it. If visibility is in some cases impeded, the presence of light signal repeaters must be provided. The operating logic of the light and any repeaters is shown in the following Table I:

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#### Table I:

<mark>⊣GREEN</mark> ⇒ a b	Equipment in AUTOMATIC CYCLE	<ul> <li>in automatic</li> <li>processing from part program with defined parameter</li> <li>axes federate = 100%</li> </ul>
BLINKING GREEN ⇒	Equipment in AUTOMATIC CYCLE	<ul> <li>axes federate ≠ 100%</li> </ul>
YELLOW ⇒	Machine <u>NOT in AUTOMATIC</u> <u>CYCLE</u>	<ul> <li>block to block</li> <li>in manual</li> <li>part control</li> <li>loading/unloading phases</li> <li>miscellaneous operations</li> <li>et cetera</li> </ul>
BLINKING YELLOW ⇒	VARIATION in processing conditions	<ul> <li>adaptive control operating</li> <li>part programme parameter value or override</li> <li>pre-alarms active</li> </ul>
RED⇒	Machine <u>in FAILURE</u> <u>MODE</u>	<ul> <li>emergency pushbutton pressed</li> <li>machine/equipment in shutdown</li> <li>stoppage device pressure drops</li> <li>drive overload</li> <li>miscellaneous anomalies</li> <li>alarms present</li> <li>maintenance in progress</li> </ul>

# 7. TESTS AND INSPECTIONS AT AVIO AERO

After retrofitting, the DIXI Machine Tool must be presented at the AVIO AERO – Pomigliano d' Arco plant - for the following tests and inspections:

- a) LASER CONTROL OF THE AXES WITH INTRODUCTION OF THE MEASURED CORRECTIONS;
- b) GEOMETRIC CONTROL OF THE MACHINE;
- c) PROCESSING OF SOME PRODUCTION PIECES CHOSEN FROM THE MOST CRITICAL ONES FOR MACHINE ACCEPTANCE;
- d) VERIFICATION OF THE EFFICIENCY TO THE SAFETY DEVICES

The pieces (of production and / or waste), the equipment and tools to be used for the testing and qualification of the system in AVIO AERO - Pomigliano d 'Arco plant - will be provided by AVIO AERO.

The Supplier will carry out the tests with its technicians and its equipment, of which is required a specific certification and qualification, in the presence of the AVIO AERO staff.

The Supplier shall be liable also for testing of components or parts provided by third parties (for example pumps, special equipment, electrical / electronic parts, etc.).



# 8. MANUALS

After the retrofit, the DIXI Machine Tool must be supplied with the following manuals:

- User 's Manual;
- Maintenance Manual;
- > Drawings and diagrams of maintenance (wiring electrical / electronic, mechanical, fluidic);
- Certificates of compliance with applicable rules;
- > Table of "Residual Risks Analysis";
- PLC project complete on DVD or CD Rom + PLC listed, the list of alarms and their comments on paper;
- Backup CN and PLC data on DVD or CD Rom;
- "Ghost image" of the 'Hard-Disk of the PC (on DVD or CD Rom) with attached the recovery Process;
- Spare parts list with indication of critical spare parts, lead time and failure rate for each proposed / identified critical parts;
- List of preventive maintenance activities (self-maintenance) according to the standard with evidence of the risk assessment of each activity (machinery powered or disconnected, technical / organizational safety measures to be implemented, PPE to wear, etc.),
- Certificate of Labelling "CE".

*The Supplier shall deliver to AVIO AERO - department of Technologies and Improvement of Production Processes – this documents:* 

- written in Italian language;
- with the units of measurement according to the International System;
- in three copies.

Any documents in support of equipment that is not written in the <u>Italian language</u> must be translated by the Supplier.

Moreover, it should be also provided the supply of:

- ♦ Any password designed to protect software;
- The license of all the software installed on the machine (operating system, office tools, etc.) also included the license of the software interface for the management of system;
- All that is necessary to ensure the full back-up and restoration of all data management and control systems used at the time of acceptance of plant;
- All that is considered necessary to allow you to run the back-up and recovery programs of work (part-program), which AVIO AERO will introduce into the Machine;
- Documentation in electronic form (in Italian language) compatible with Windows operating systems and made with the most popular programs (AutoCAD, Microsoft Office, Acrobat Reader, etc ...). This documentation must be prepared on CD-ROM.

# 9. TRAINING COURSES

All training courses must be made in AVIO AERO - Pomigliano d' Arco plant -.

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In accordance with AVIO AERO and, in any case, before the start of production on the DIXI Machine Tool, the Supplier shall agree on the start date of the training.

All courses will be held in <u>Italian language</u> with the use of documents written in Italian language; any need for interpreting and / or translation shall be borne by the Supplier.

The Supplier shall ensure assistance in the training of AVIO AERO's people assigned to the use and maintenance of the DIXI Machine Tool, through training courses shown in the following Table II:

#### Table II

Type of Course	No. of Participants	Duration [h]
Operators	6	32
Programmers	3	24
Mechanical / Fluidic Maintenance	2	16
Electrical / Electronic Maintenance	2	16

# 10. SUPPLY ACCEPTANCE

The supply acceptance will take place at the AVIO AERO - Pomigliano d' Arco plant -. Constitute elements of the supply acceptance:

- CE marking and certification of its parts replaced;
- the positive outcome of the inspections and tests post-revision specified in the section 7.;
- the goodness and completeness of technical documentation;
- the quality and the completeness of the training courses for the AVIO AERO's staff.

# 11. AVAILABILITY AND TECHNICAL RELIABILITY

The supply, as a whole, after acceptance at the AVIO AERO plant and for the whole the duration of the warranty period, is subject to verification of AVAILABILITY and TECHNICAL RELIABILITY through the two parameters <u>VT (Technical Availability)</u> and <u>MTBF (Mean Time Between Failure)</u> in the following manner and in accordance with the objectives to be achieved (target):

- Start of assessment: as of the 91st day following acceptance of the supply
- End of evaluation periods: end of warranty period
- Period of assessment: 4 months
- Number of observation periods: how necessary during warranty period.

### A. <u>Technical AVAILABILITY (VT)</u> target ≥ 95%

The Technical AVAILABILITY in % is the ratio between how the machine is available for the production and how much was planned to be usable.

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To contribute in the calculation, the time planned usability of the machine, the time of not-use justified and of course the time of unavailability following a fault; all referring to the period of observation.

Calculation mode

**VT%** = 
$$\left[1 - \frac{TT}{TB - TW}\right]$$
x 100

where:

**77:** is the time of UNAVAILABILITY of the machine [in hrs] in the period of observation,

following a fault, results from the sum of:

- Waiting time for repair exceeding the allowed time (see point **12.4.**)

- Downtime for repair
- Waiting time for replacement materials
- Time for tests and verification preliminary and consequent intervention
- **TB:** is the planned time to use the machine in the period of observation 48 (labor weeks) x 15 (shifts) x 7,5 (hrs/shift) x 0,90 (stand-alone production management index) = <u>4.860 hrs</u>

TW: is the time justified of not-use [in hrs] given from the sum of:

- Waiting time for repair admitted and indicated in point 12.4.

- Time for the inspection and the preventive maintenance activities required in the machine/equipment manual.

B. <u>Technical RELIABILITY</u> through the MTBF - Mean Time Between Failures value <u>target  $\geq$  360h</u>

The Technical RELIABILITY of the machine is evaluated by calculating the MTBF that is the average time of technical availability, between two successive failures.

Contribute in calculating the time of technical reliability of course the total number of faults and the duration of them, all referring to the period of observation.

Calculation mode 
$$MTBF = \frac{Technical Availability Time}{number of failures} = \frac{\sum (TD - TU)}{n}$$

where:

- *TD:* Down Time is the time when begins the machine unavailability time due to failure, referenced the initial period, or the end of observation period.
- *TU:* Up Time is the time when starts the machine availability time after the failure repair or the start of observation period.
- *n*: number of failures in assessment period.

Explanatory scheme:





C. <u>Technical Availability (VT) and Reliability (MTBF)</u> values must be maintained for all warranty period.

In the event of a unsuccessful outcome of one or of both parameters (VT and MTBF), the Supplier will propose and reach an agreement with the AVIO on an intervention plan, at its own expense, to eliminate the anomalies noted. On completion of the intervention, a new period of assessment will begin with the same previous procedure.

In this latter case, the period of validity of the warranty will be extended by a period equivalent to the time lapsing between completion of the latest successful period of assessment prior to the intervention (or from the start of the period of assessment if the first checking period has been unsuccessful) and completion of the successful period of assessment following the intervention.

N.B. the target values have to be maintained for at least three consecutive months in fourmonth period.

# 12. WARRANTY

The Supplier shall ensure that the DIXI Machine Tool revision is conforms to what is stated in this Technical Supply Specification.

The Supplier is responsible under the law for the non-conformity, defects in design and construction of the parts subject to revision.

### **12.1.** Warranty coverage

Are covered by the warranty all parts subject to revision or new supply.

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### **12.2.** Warranty effect

From the day of the acceptance of DIXI Machine Tool revisioned, with notification by e-mail from AVIO AERO - department of Technologies and Improvement of Production Processes -

## **12.3.** Warranty duration

The Supplier will have to give a warranty on all <u>NEW parts</u> and on all <u>RECONDITIONED parts</u> for a period of <u>24 (twenty-four) months</u> from the date of acceptance of the DIXI Machine Tool, against any defect in design, material and machining.

The warranty shall be automatically extended by the duration of any stop period of Machine that may occur to causes not attributable to AVIO AERO, during the warranty period.

### 12.4. Warranty service

During the warranty period, the Supplier shall ensure assistance (services and / or materials), <u>within 48 (forty-eight) hours</u> from written notice (sent by e-mail) about the operating fault. All delays in the timing of intervention, as well as expressly provided, will result in the application of penalties commensurate with the time of lost production of AVIO AERO.

# 13. ATTACHMENTS

To complete the document, you enter the number of attachment mentioned in previous chapters:

ATTACHMENT 01 Form for verification training; ATTACHMENT 02 Form for Tests and Inspections at AVIO AERO; ATTACHMENT 03 Form for final acceptance.



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## ATTACHMENT 01 - FORM FOR VERIFICATION TRAINING;

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QUESTIONARIO DI APPRENDIMENTO

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# ATTACHMENT 02 - FORM FOR TESTS AND INSPECTIONS AT AVIO AERO

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SELLER				
ADDRESS	1			
GOODS	<u>.</u>			
MODEL		S/N	2	
CONTRACT No.		Dat	ed	
TECHNICAL SPECIFICATIO	N No.	Dat	ed	
SELLER'S OFFER No.		Dat	ed	
DATE OF PRELIMINARY A	CCEPT.CE		2 - 4 Car 	
DATE OF ARRIVE IN AVIO	PLANT			
PLANT, PRODUCT CEN AREA OF DESTINATION	ITRE AND			
According to the results of t	he tests and notes mer	ntioned in following page/s	, we certify t	hat:
THE SUPPLY AS BEEN C	OMPLETED			YES /NO
DOCUMENTATION AND I WERE DELIVERED	MANUALS LAID DOWI	NIN THE SUPPLY SPEC	FICATION	YES /NO
TRAINING OF PERSONN SPECIFICATION WERE D	EL AVIO AERO LAID E ONE WITH GOOD RE	OOWN IN THE SUPPLY SULTS		YES /NO
GOODS IS MADE AND W TO THE REGULATION AN	ORKING AS PROVIDE ID TO THE SUPPLY S	ED BY ORDER AND ACCO PECIFICATION	ORDING	YES /NO
TESTS AND INSPECTION ACCORDANCE	s laid down in the	E SUPPLY SPECIFICATIO	N ARE IN	YES /NO
				YES /NO
And is				
OPERATING APPR	OVALS	ON		
TAKING CHARGE C	FTHE GOODS	ON		
ACCEPTANCE OF 1	HE GOODS	ON		
NOTE:		i i i i i i i i i i i i i i i i i i i		ka: 60
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# **TECHNICAL SPECIFICATION**

PRELIMINARY / FINAL Version (barrare la voce non valida) N° Doc.: 2021/01/DEV Prelimin. Rev. 1 Data: 28/04/2021

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