DESFA
Hellenic Gas Transmission System Operator

HELLENIC GAS TRANSMISSION SYSTEM OPERATOR

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TECHNICAL JOB SPECIFICATION
900/9
REVISION 0
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HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

POSITIVE MATERIAL IDENTIFICATION

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QUALITY ASSURANCE PAGE

CHANGES LOG

REVISIONS LOG

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CONTENTS

REFERENCE DOCUMENTS

- Job Spec. No. 900/3 [Material Color Coding]
- Job Spec. No. 970/2 [Shop Inspection of Equipment & Materials]
- Job Spec. No. 970/3 [Inspection and Test Instructions]

- Pressure Equipment Directive (P.E.D) No. 97/23/EC

1.0 SCOPE

This specification specifies all the requirements for positive material identification / 2 \ **(P.M.I.) of alloy bulk materials** to be employed by the Contractor, which include the supply, fabrication or erection of alloy materials.

P.M.I, specifies identification, examination, marking, traceability and certification in according with **Pressure Equipment Directive (P.E.D) No. 97/23/EC** throughout all the phases of material supply, fabrication, warehousing and erection to assure correct materials are installed.

Carbon steel materials are not subject to this specification. It is understood that this P.M.I, procedure does not substitute any other inspection and testing requirements and that all the above materials will continue to receive all the normal delivery checks for compliance with the Purchase Order and all the normal field inspection controls during prefabrication and erection to ensure that the quality of materials and workmanship meets project requirements.

2.0 RESPONSIBILITIES

The application of P.M.I, procedure according to the present specification is at complete care and charge of Mill, Stockist, Shop Prefabricator or Fabricator, Field Erector and shall include:

Supply of the required apparatus (portable analyzer) or chemical analysis performed by a recognized laboratory.

Supply of qualified analyzer operator.

Application of controls and issue of P.M.I, reports.

The execution of controls at field site shall not be at shop Prefabricator or Fabricator charge except for assembling/erection works performed in field by the same shop Prefabricator/Fabricator.

3.0 LIMITS OF P.M.I. INSPECTION

3.1 ITEMS TO BE P.M.I. INSPECTED

All alloy bulk materials for piping systems including all components (i.e. pipes, fittings, pressure containing parts of valves, plugs, couplings, flanges, pressure containing parts of control valves, flow nozzles, flowmeter runs, thermowells, PSV's orifice plates, orifice flanges, etc.).

Tubular products used in equipment fabrication and internals (i.e. heat exchangers, heaters, boilers, furnace tubes, return bends, fittings, packaged units, tube hangers, tube supports, baffles and tubesheets).

Equipment and materials shall be in accordance with **Job Spec. No. : 970/2** requirements.

3.2 MATERIALS TO BE P.M.I. INSPECTED

Alloy materials.

3.3 COLOR MARKING

Materials must be color marked by Supplier according to the **Job Spec. No. 900/3.**

Materials without color marking will not be delivered to the job site and/or used for prefabrication/construction.

LOCATION OF INSPECTION

The P.M.I, examination will be implemented in the following potential problem areas:

- Source Contractor.
- Fabrication Shop.
- Gen. Site Warehouse.
- Field.

4.0 EXTENT OF P.M.I. EXAMINATION

4.1 CHECKS TO BE PERFORMED AT SOURCE SUPPLIER (MILL- STOCKIST)

The positive material identification will be performed on a representative sample taken out from each lot supplied.
As a lot it is intended that all the materials supplied are produced from the same heat.
A representative sample consists of one or more units (pieces) randomly selected from the lot to be inspected, which are to be examined to determine lot acceptability.
The sampling criteria will be in accordance with **TABLE 1.**

TABLE 1

Size of the Lot	Size of the Representative Sample
5 units or less	100%
6 to 200 units	5 units or 5% of total, whichever is greater
Greater than 200 units	10 units or 3 % of total, whichever is greater.

If any piece from the representative sample is found to be unacceptable, the balance of the lot will be 100 % checked.

When a lot is found to contain unacceptable pieces, the next two lots (from the same supplier) shall be checked 100 %. If both lots are acceptable the sampling procedure per **point 4.0** above may be resumed.

Materials supplied by stockist will be always 100 % checked.
Repetitive problems will be discussed with Contractor management to strongly reinforce the need for improved Quality Control.

4.2 CHECKS TO BE PERFORMED AT FABRICATOR'S SHOP

The positive material identification at this stage will consist in a visual check to ensure that Mill certificates, marking and stamping on materials previously P.M.I, checked, correspond.
Lots of materials not previously P.M.I, checked will be tested according to **point 4.1** of the present specification.
Each piece of material from a lot previously P.M.I, checked and found without color marks will be identified and marked and rejected to the supplier if not in accordance with the material specification.
Materials previously P.M.I, identified and color marked but not stamped will be spot-checked to assure that material control procedures are functioning properly.
If color mark/stamp of any component could be destroyed during work process or will be no longer clearly visible, identifying symbols shall be transferred/reapplied at Contractor's care and responsibility.
All alloy materials already validated shall be stored in segregated areas to prevent material mix-ups during fabrication and/or assembling.
Repetitive problems will be discussed with Contractor management to strongly reinforce the need for improved Quality Control.

4.3 CHECKS TO BE PERFORMED AT SITE (FIELD WAREHOUSE)

On their arrival at field warehouse, the bulk or shop fabricated materials will be submitted to a visual examination to ensure that color stamping, marking and Purchase Order specification correspond.
Materials part of P.M.I, identified lots, found without color marks, will be 100 % tested and accepted only if strictly in accordance with the relevant material specification. Otherwise they will be rejected to the supplier for substitution.
Spot-checking of color marked materials will be performed. The pieces to be inspected will be selected by Owner surveyor.
After all alloy materials have been validated, they shall be stored in segregated areas, to prevent material mix-ups during erection.
If color marks/stamps of any component are no longer clearly visible, identifying symbols shall be affixed again, on it.
Repetitive problems will be discussed with Contractor Management to strongly reinforce the need for improved Quality Control.

4 4 CHECKS TO BE PERFORMED AT SITE (FIELD PREFABRICATION AREA)

The criteria to be followed shall be in accordance with **point 4.2** of the present specification.

4.5 **CHECKS TO BE PERFORMED AT SITE (DURING CONSTRUCTION PROGRAM)**

After erection and before starting with painting/insulating operations, all items will be visually checked to identify marks and stamps and check correct installation.
Pieces found without color marks will be 100 % tested and accepted only if strictly in accordance with the relevant material specification; otherwise they will be rejected and cut out immediately.
All alloy materials already validated shall be stored in segregated areas, to prevent material mix-ups during construction.
Repetitive problems will be discussed with Mechanical Erection Management to strongly reinforce the need for improved Quality Control.
If color mark/stamp of any component could be destroyed during work process or were no longer clearly visible, identifying symbols shall be transferred/affixed again at Mechanical Erector's care and responsibility.

5.0 EXAMINATION METHODS

The instruments or methods used for examination shall be capable of positively identify the materials by proving a quantitative measurement of the critical alloying elements.

5.1 **ACCEPTABLE METHODS ARE LISTED BELOW IN ORDER OF PRIORITY**

Portable analyzers such as :
= "Texas nuclear 9266"
= "ARC-Met 900"
= "TEXAS Nuclear 9277"
= "METALLURGIST-XR"
= "X-Met 880" or "X-Met 840"
= "SPECTRO PORT TP-07 and TFO-02"

Approved Analytical Laboratory using :
= "X-ray emission spectrometry"
= "Optical spectroscopy"
= "Wet chemical analysis"

Portable analyzer operators shall be trained and fully conversant with the equipment used.
When a portable analyzer is used and identification element coverage is not sufficient to identify the material, then that material shall be checked by an approved analytical laboratory.
All laboratory chemical analysis shall be carried out according to the pertinent ASTM Standards.

Portable x-ray emission analyzers must be used at temperatures greater than 0°C to avoid erroneous observations.

IDENTIFICATION

After the acceptance has been established, all items in a lot must be color marked according to Owner Specification for material color coding **Job Spec.** No. **900/3.**

Each unit (piece) part of the tested sample will be identified both by an alphabetic symbol rubber-stamped and a color mark, in accordance with **TABLE 2** and **Job Spec. No. 900/3.**

Identification stamps shall be located near color marks.

Materials used for rubber stamping shall be suitable to mark metals as free as practicable from sulphur, halogens and metals such as zinc, lead or copper and shall be of such a quality that it shall have a life of at least one year in exposed outdoor weather conditions.

TABLE 2

MATERIAL	COLOR CODE (SEE APPENDIX)	ALPHABETIC SYMBOL FOR STAMPING	IDENTIFICATION ELEMENTS AND PERCENTAGE (%) See Note
C-1/2 Mo	White/Brown	A	Mo (0.44-0.65)
1 1/4Cr	Yellow	B	Cr (1.00-1.50) Mo (0.44-0.65)
2 1/4 Cr	Yellow/Green	D	Cr (1.90-2.60) Mo (0.87-1.13)
5 Cr	Yellow/Grey	E	Cr (4.00-6.00)
9 Cr	Yellow/Brown	F	Cr (8.00-10.00)
12 Cr	Yellow/Black	G	Cr (11.5-13.5)
304	Orange	H	C (<0.08) Cr(18.0-20.0) Ni (8.0-11.0)
304 L	Red/Green	J	C (<0.035) Cr (18.0-20.0) Ni (8.0-13.0)
304 H	Orange/Lilac	HH	C (0.04-0.10) Cr (18.0-20.0) Ni (8.0-11.0)
310	Orange/Green	K	Cr (19.0-22.0) Ni (24.0-26.0)
316	Orange/Brown	M	C (<0.08) Cr (16.0-18.0) Ni (11.0-14.0) Mo (2.0-3.0)
316 L	Red/Brown	N	C (<0.035) Cr (16.0-18.0) Ni (10.0-15.0) Mo (2.0-3.0)
316 H	Orange/Beige	MH	C (0.04-0.10) Cr (16.0-18.0) Ni (11.0-14.0) Mo (2.0-3.0)
321	Orange/Black	P	Cr (17.0-20.0) Ni (9.0-13.0) Ti (5x%C-0.7)
347	Orange/Grey	Q	Cr (17.0-20) Ni (9.0-13.0) Cb+Ta (10x%C-1.0)
Carpenter 20 Cb-3	Blue	R	Cr (19.0-21.0) Ni (30.0-38.0) Cu (3.0-4.0) Cb+Ta (8x%C-10)
321 (C>0.0 4)	Orange/Blue	PP	C (0.04-0.08) Ni (9.0-12.0) Cr (17.0-19.0) Ti (5x%C-0.7)
Incoloy 800	Blue/Green	T	Cr (18.0-23.0) Ni (30.0-35.0) Cu (<0.75)
Incoloy 825	Blue/Brown	u	Cr (19.5-23.5) Ni (38.0-46.0) Mo (2.5-3.5) Cu (1.5-3.0)
Hastelloy B-2	Blue/Black	v	Mo (26.0-30.0) Ni (65.0-70.0) Fe (<2.0)
Titanium	Blue/Grey	X	Ti (>98.0)
Aluminium Brass	Blue/Beige	Y	Cu (76.0-79.0) Al (1.8-2.5) Zn (18.0-20.0)
HK-40	Lilac	HK	Cr (23.0-27.0) Ni (19.0-22.0)
Monel	Lilac/Green	AA	Cu (28.0-34.0) Ni(>63.0)
Cu-Ni 70/30	Lilac/Brown	BB	Cu (>65.0) Ni (29.0-33.0)

Note : Percentages must be within the limits proper of relevant standard, taking into account the tolerance proper of adopted portable analyzer. In the case of dissimilar welds, the percentages must be within the limits proper of the Standard relevant to the filler metal used.

7.0 CERTIFICATION

Results of all examinations shall be recorded on report forms in accordance with **TABLE 3.**

All P.M.I, reports shall become part of the permanent inspection records.

Each report shall refer to one lot or line only and shall be completed by the portable analyzer operator or by the Contractor/Mechanical Erector if a laboratory test is involved. In this case, the laboratory certificates will be considered as integral part of the P.M.I, reports.

- POSITIVE MATERIAL IDENTIFICATION CLIENT :			Sheet # of #
PLANT : LOCATION :	CONTRACT No. ::		
MATERIAL CLASS :	MILL CERTIFICATE No. :	HEAT NUMBER :	
LOT SIZE : TEST LABORATORY :	SAMPLE SIZE : CODING PAINT DESCRIPTION :	PORTABLE ANALYZER TYPE :	

ANALYSIS RESULTS														
ITEM No.	ITEM DESCRIPTION	IDENTIFICATION ELEMENTS										ALPH. CODE	COLOR CODE	REMARKS
		REQUIRED					MEASURED							
		Cr%	Ni%	Mo%			Cr%	Ni%	Mo%					
Date : Analyst / Operator :		Contractor : Owner's Inspector :												

8.0 REJECTION

Substitution of incorrect materials discovered in shop or warehouse shall remain always at Contractor's care and cost. Materials and labour for replacing uncorrectly erected materials and wrong field welds will be at Mechanical Erector's care and cost.

Whenever material is identified as incorrect by a portable analyzer control, option to perform more accurate tests is allowed (always according to **point 5.1** of the present specification), to verify the material composition or to replace the material involved.

9.0 MISCELLANEOUS

Certificates of compliance are NOT acceptable as substitute for P.M.I examination.

Whenever in the Purchaser Material Requisition is included a specification "or equivalent", all materials presented as equivalent will have to be approved in writing by the Purchaser.

Contractor shall inform Owner 15 days in advance of their P.M.I examination execution, in accordance with **Job Spec. No. 970/3.**

Owner, or his authorized Representative, has the right to witness and audit the P.M.I examination.