



Accelerator Science and Technology Centre

CCLRC Daresbury Laboratory

Vacuum Science Group

Vacuum Systems

Material for Vacuum Flanges.

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CONTENTS

1.	General.....	1
1.1	Definitions	1
1.2	Scope.....	1
2.	Prescribed Grade And Quality Of The Steel.....	1
3.	Mechanical Properties of the Steel.....	1
4.	Special Requirements of CLRC	2
4.1	Method of manufacture.....	2
4.2	Ferrite content	2
4.3	Structural characteristics.....	2
4.4	Relative magnetic permeability	2
4.5	Cobalt content	2
5.	Dimensions.....	2
6.	Inspection	2
6.1	Batches.....	2
6.2	Billets	2
6.3	Blanks	2
7.	Identification and Marking.....	2
7.1	Blanks	2
7.2	Tracing.....	3
7.3	Documentation.....	3
8.	Post Delivery Testing.....	3
	Appendix 1	4

1. General

1.1 Definitions

Reference should be made to ASTEC-VAC-QCD-spc-001 *Definitions relevant to Quality Control Documentation* for the definitions of various terms used in this document

1.2 Scope

This document defines the material required for the manufacture of stainless steel vacuum flanges. It is intended primarily for those of the knife edge type, but may equally well be applied to flat flanges using diamond section or similar metal gaskets.

It also applies to the stainless steel component of bi-metallic explosion bonded flanges such as aluminium-stainless steel transition flanges.

This is mainly a copy of the CCLRC specification DL/SRS/S/79/A revised June 1992, with minor alterations. It has been recast as a general specification rather than a tender specification. It may only be used in this form with the express permission of CCLRC Daresbury Laboratory.

2. Prescribed Grade And Quality Of The Steel

Chemical composition (%)		Tolerances above and below maximum
Constituents	%	
Cr	16-18.5	0.20
Ni	11-14	0.15
C	0.03 max.	0.005
Si	1 max.	0.05
Mn	2 max	0.04
Mo	2-3	0.10
N	0.14-0.18	0.01
P	0.045 max.	0.01
S	0.030 max.	0.005
Fe	remainder	

NB The limits prescribed therefore cover, in particular, steels of the following types:

316LN	AISI standard	USA
I4406-1 4429	standard DIN 17440	Germany
22 CND 17 12 nitrogen	standard NFA35582	France
22 CND 17 13 nitrogen		
2375	standard SIS 14	Sweden

3. Mechanical Properties of the Steel

Minimum yield stress 0.2%	daN/mm ²	30
Minimum ultimate tensile strength	daN/mm ²	60
Minimum elongation at break	%	35
Brinell hardness DH	daN/mm ²	160-190

4. Special Requirements of CLRC

4.1 Method of manufacture

- 4.1.1 The steel for the blanks shall be manufactured using the "Electroslag refining" process (ESR).
- 4.1.2 Discs will be cut from blooms or billets. After reheating they will be forged in all directions.

4.2 Ferrite content

Nil.

4.3 Structural characteristics

- 4.3.1 Austenitic structure.
- 4.3.2 Inclusion class 1 maximum for types A-B-C and 1.5 maximum for type D (following ASTM 45.63 JERNKONTORET method).
- 4.3.3 The presence of sigma phase or precipitated carbide is not permitted
- 4.3.4 Grain size shall be in the range 3 to 8 as defined in BS 4490 1989.

4.4 Relative magnetic permeability

- 4.4.1 This shall be lower than or equal to 1.04.

4.5 Cobalt content

- 4.5.1 In no case will cobalt content be >0.2%, measuring error included

5. Dimensions

The dimensions of blanks are indicated in the attached Appendix 1.

6. Inspection

6.1 Batches

For each batch delivered the following tests shall be carried out by the supplier on each cast

- 6.1.1 Samples should be taken from the top and the bottom of the ingot.
- 6.1.2 On each sample, mechanical and chemical analysis shall be carried out, including metallographic examination (inclusions, structure) and ferrite content

6.2 Billets

Each Billet to be marked and identified and then each billet to be checked:

- 6.2.1 for nitrogen content
- 6.2.2 ultrasonic test for defects

6.3 Blanks

On a sampling of the blanks

- 6.3.1 The following information must be supplied:
 - 6.3.1.1 metallographic examination (inclusions, structure, grain size)
 - 6.3.1.2 nitrogen content
 - 6.3.1.3 ferrite content
 - 6.3.1.4 magnetic permeability
 - 6.3.1.5 Brinell hardness

7. Identification and Marking

7.1 Blanks

The blanks shall be marked on the outer diameter by engraving or a similar method with the following indications:

- 7.1.1 identification of each blank within the billet
- 7.1.2 manufacturer's name
- 7.1.3 type of material
- 7.1.4 casting reference number

7.2 Tracing

- 7.2.1 This identification requires a strict follow-up from the foundry to the final product.

7.3 Documentation

At the time of each delivery, the manufacturer shall supply:

- 7.3.1 the casting reference number
- 7.3.2 the results of metallographic examination of blanks with the corresponding microphotographs, if taken
- 7.3.3 the certificate of analysis
- 7.3.4 the test certificates for the various items supplied.

8. Post Delivery Testing

CLRC reserves the right to repeat the various tests and analyses prescribed either
on each item delivered,
or on part of the batch

In the event of disagreement and if the supplier fails to meet the specification or to fulfil the conditions accepted in respect of the quality of the supplies, CLRC reserves the right to reject all or part of the order. The cost of transport involved in returning the rejected items is to be borne by the supplier.

Appendix 1

CCLRC Daresbury Laboratory Specification (DL/SRS/S/79)

Table of sizes and identification references for the supply of material for vacuum flanges.

Item	Type	Daresbury Lab. Identification	Final machined dimensions			As forged		
			O.D.	I.D.	Thick	O.D	I.D.	Thick
All dimensions in millimetres								
1	Disc	6" Fixed blank	152		20	162		26
2	Disc	6" Rot. blank	121		15	131		21
3	Disc	8" Fixed blank	203		23	213		29
4	Ring	8" Fixed ring	203	125	23	213	115	29
5	Disc	8" Rot. blank	172		16	182		22
6	Ring	8" Rot. ring	172	125	16	182	115	22
7	Disc	10" Fixed blank	254		25	264		31
8	Ring	10" Fixed ring	254	175	25	264	165	31
9	Disc	10" Rot. blank	222		17	232		23
10	Ring	10" Rot. ring	222	160	17	232	150	23
11	Disc	10" Fixed blank	254		34	264		40
12	Disc	10" Rot. blank	222		34	232		40
13	Disc	8" Fixed blank	203		34	213		40
14	Ring	13 1/4" Fixed ring	337	197	29	347	187	35
15	Disc	14 1/4" Fixed blank	362		30	378		35
16	Disc	15" Fixed Blank	381		30	395		35
18	Bar	Forged bright bar in random lengths 70±0.5 mm diameter						
22	Bar	Forged bright bar in random lengths 37±0.5 mm diameter						