

# ISO 24139-1:2022-11 (E)

## Petroleum and natural gas industries - Corrosion resistant alloy clad bends and fittings for pipeline transportation system - Part 1: Clad bends

Contents		Page
Foreword .....		v
1 Scope .....	1	
2 Normative references .....	1	
3 Terms, definitions, abbreviated terms and symbols .....	3	
3.1 Terms and definitions .....	3	
3.2 Abbreviated terms .....	5	
3.3 Symbols .....	5	
4 General .....	6	
4.1 Units of measurement .....	6	
4.2 Rounding .....	6	
5 Information supplied by the purchaser .....	6	
5.1 General requirements .....	6	
5.2 Recommendations .....	6	
5.3 Requirements and recommendations on the mother clad pipe .....	7	
5.4 Requirements and recommendations on the mother steel bend .....	8	
6 Designation .....	8	
7 Design .....	8	
8 Manufacturing .....	9	
8.1 Starting materials .....	9	
8.1.1 Mother clad pipe .....	9	
8.1.2 Mother steel bend .....	9	
8.1.3 Welding consumables .....	9	
8.1.4 Re-inspection of starting materials .....	10	
8.2 Manufacturing procedure qualification .....	10	
8.3 Clad bends manufacture .....	10	
8.4 Welding .....	10	
8.5 Heat treatment .....	10	
8.6 Forming and sizing after bending .....	11	
8.7 Jointers and girth welds .....	11	
8.8 End preparation .....	11	
8.9 Surface treatment .....	11	
9 Testing and inspection .....	12	
9.1 General requirements .....	12	
9.2 Extent of testing and inspection .....	12	
9.3 Chemical composition .....	14	
9.3.1 Requirements .....	14	
9.3.2 Test specimens .....	14	
9.3.3 Test method .....	15	
9.4 Physical testing .....	15	
9.4.1 Tensile testing .....	15	
9.4.2 Charpy V-notch impact testing .....	15	
9.4.3 Guided bend testing .....	16	

9.4.4	Through-thickness hardness testing .....	16
9.4.5	Surface hardness testing .....	19
9.4.6	Flattening tests .....	19
9.4.7	CRA cladding bond strength testing .....	19
9.4.8	Macrographic examination .....	20
9.4.9	Metallographic examination .....	21
9.5	Corrosion testing .....	21
9.5.1	Intergranular corrosion testing .....	21
9.5.2	HIC and SSC testing of backing steel material .....	22
9.5.3	Corrosion testing of clad layer material for service condition .....	22
9.6	Dimensions and tolerances .....	23
9.6.1	General .....	23
9.6.2	Wall thickness .....	23
9.6.3	Diameter .....	24
9.6.4	Bend angle, bend radius, end out-of-squareness, out-of-planeness and tangent length .....	24
9.7	Non-destructive testing .....	25
9.7.1	General .....	25
9.7.2	NDT personnel .....	25
9.7.3	Visual inspection .....	25
9.7.4	Inspection of surfaces of clad bend .....	26
9.7.5	Inspection of weld seam .....	26
9.7.6	Inspection of clad bend ends .....	26
9.7.7	Inspection of clad bend body .....	26
9.7.8	Level of residual magnetism .....	26
9.7.9	Imperfection and defect treatment .....	27
9.8	Hydrostatic testing .....	27
10	Marking .....	27
11	Packaging, handling and storage .....	28
12	Documents .....	28
	<b>Annex A (normative) Manufacturing procedure qualification .....</b>	<b>29</b>
	<b>Annex B (normative) Corrosion qualification of CRA clad layer for intended service condition .....</b>	<b>32</b>
	<b>Annex C (normative) Location and quantity of specimens for testing and inspection .....</b>	<b>35</b>
	<b>Annex D (informative) Chemical requirements for clad layer of some CRAs .....</b>	<b>39</b>
	<b>Bibliography .....</b>	<b>41</b>