
	OFFSHORE DESIGN SECTION	FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE	<table><tr><td>SPEC. No.</td><td>FS 4002</td></tr><tr><td>Rev. No.</td><td>9</td></tr><tr><td>Discipline</td><td>Elect</td></tr><tr><td colspan="2">Page: 1 of 13</td></tr></table>	SPEC. No.	FS 4002	Rev. No.	9	Discipline	Elect	Page: 1 of 13	
SPEC. No.	FS 4002										
Rev. No.	9										
Discipline	Elect										
Page: 1 of 13											


**FUNCTIONAL SPECIFICATION
OF
CATHODIC PROTECTION SYSTEM
FOR SUBMARINE PIPELENE**

PREPARED / REVISED BY	REVIEWED BY	APPROVED BY	TOTAL NO. OF PAGES	DATE	REV.
P.Kumar	K.Rajamouly	A.Sezhian	13	29-07-2016	9

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004A	ODS/SOP/008 to 015	01	01	15/10/2003

	OFFSHORE DESIGN SECTION	FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE	<table><tr><td>SPEC. No.</td><td>FS 4002</td></tr><tr><td>Rev. No.</td><td>9</td></tr><tr><td>Discipline</td><td>Elect</td></tr><tr><td colspan="2">Page: 2 of 13</td></tr></table>	SPEC. No.	FS 4002	Rev. No.	9	Discipline	Elect	Page: 2 of 13	
SPEC. No.	FS 4002										
Rev. No.	9										
Discipline	Elect										
Page: 2 of 13											
<div>CONTENTS</div> <div><div>1.0</div><div>SCOPE</div></div> <div><div>2.0</div><div>TECHNICAL REQUIRMENTS</div></div> <div><div>3.0</div><div>ANODE MATERIAL</div></div> <div><div>4.0</div><div>TESTING & INSPECTION</div></div> <div><div>5.0</div><div>ANODE DIMENSIONS AND PHYSICAL CHARACTERISTICS</div></div> <div><div>6.0</div><div>ANODE INSTALLATION</div></div> <div><div>7.0</div><div>SERVICE AFTER INSTALLATION</div></div> <div><div>8.0</div><div>ELECTRICAL CONTINUITY AND RESISTANCE TESTS FOR PIPELINES.</div></div> <div><div>9.0</div><div>WARRENTY</div></div> <div><div>10.0</div><div>VENDOR PREQUALIFICATION</div></div> <div><div>11.0</div><div>VENDOR DATA REQUIRMENTS</div></div> <div><div>12.0</div><div>PACKING AND TRANSPORTATIONS</div></div>											

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003

	OFFSHORE DESIGN SECTION	FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE	<table><tr><td>SPEC. No.</td><td>FS 4002</td></tr><tr><td>Rev. No.</td><td>9</td></tr><tr><td>Discipline</td><td>Elect</td></tr><tr><td colspan="2">Page: 3 of 13</td></tr></table>	SPEC. No.	FS 4002	Rev. No.	9	Discipline	Elect	Page: 3 of 13	
SPEC. No.	FS 4002										
Rev. No.	9										
Discipline	Elect										
Page: 3 of 13											

1. SCOPE

This specification defines the functional requirements for the material selection, design, manufacture, supply and installation of a sacrificial type unmonitored cathodic protection system for submarine pipelines, and risers in case of rigid lines and I/J tubes in case of flexible lines.

1.1 SCOPE OF SUPPLY

The scope of supply through this specification includes:

- Sacrificial anodes, cables and accessories etc. for cathodic protection of rigid pipelines and risers
- Or
- Sacrificial anodes, cables and accessories etc. for cathodic protection of flexible pipelines and I/J Tubes

CODES & STANDARDS

Design and installation of the cathodic protection system shall be in accordance with good marine practice in corrosion protection and compliance with the latest revisions of following Codes & Standards:

NACE RP 0387-99 : National Association of Corrosion Engineers
NACE RP 0492-92
ASTM A 36 : American Society of Testing of Materials.
DNV RP-F-103 : Det Norske Veritas.
DNV RPB 401
ISO 15589-2 : International standards organization

Any other international standard or code may be used in lieu of the above with prior approval of the Company.

2.0 TECHNICAL REQUIREMENTS

2.1 General

Cathodic protection system shall be made up of anodes with a configuration and anodic material composition suitable for use in seawater. All raw materials finished products and components of the CP system specified herein shall be new and unused, of current manufacture, of highest grade and free from all defects and imperfections that could adversely affect the performance of the system.

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003



**OFFSHORE
DESIGN
SECTION**

**FUNCTIONAL
SPECIFICATION FOR
CATHODIC PROTECTION
SYSTEM FOR SUBMARINE
PIPELINE**

SPEC. No.	FS 4002
Rev. No.	9
Discipline	Elect
Page: 4 of 13	

2.2 Design Criteria:

The cathodic protection system for the submarine pipelines and risers shall be designed in accordance with the requirements of this specification and DNV RP-F-103. However, parameters/values mentioned in this specification shall be used in calculations irrespective of any parameters/ values mentioned in any codes, standards or recommended practices.

The sacrificial anode shall be Galvalum-III or equivalent mercury free Al-Zn-In alloy.

The following cathodic current densities and driving potentials shall be considered by bidders for design and evaluation of CP system.


- **CD in sea water: 100 ma/m²**
- **CD (buried pipeline) : 50 ma/m²**
- **Driving potentials (initial and near end life):250mv.**
- **Driving potentials (mid life):150mv.**

For pipelines carrying hot fluids, the current density values shall be increased by 1mA/m² per degree Celsius of operating fluid temperature. The temperature difference to be considered for the purpose shall be the difference of operating fluid temperature and 25° C.

For calculation of Anode mass, electrochemical efficiency shall be taken as given in Table 1. For operating fluid temperatures between the limits stated, the electrochemical efficiencies shall be linearly interpolated.

Table 1		
Operating Fluid Temperature	Non buried P/L Ah/Kg	Buried P/L Ah/Kg
< = 30 C	2000	2000
60 C	2000	850
80 C	900	400

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003

<div><div>ओएनजीसी</div><div></div><div>ongc</div></div>	<div>OFFSHORE DESIGN SECTION</div>	<div>FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE</div>	<table><tr><td>SPEC. No.</td><td>FS 4002</td></tr><tr><td>Rev. No.</td><td>9</td></tr><tr><td>Discipline</td><td>Elect</td></tr><tr><td colspan="2">Page: 5 of 13</td></tr></table>	SPEC. No.	FS 4002	Rev. No.	9	Discipline	Elect	Page: 5 of 13	
SPEC. No.	FS 4002										
Rev. No.	9										
Discipline	Elect										
Page: 5 of 13											

2.2.1 Design Life : As per data sheet


2.2.2 *Average coating breakdown factor for pipeline and field joint together shall be considered as 5% for coal tar enamelled (CTE) coated pipes and 2 % for 3LPE/ PP coated pipes.*

2.2.3 Technical Requirements :

RIGID PIPELINES:

- Tapered anodes shall not be acceptable for concrete coated rigid pipelines
- *In case of rigid pipelines, anode spacing shall be half of that calculated using design parameters, for the following case and additional anodes shall be provided accordingly*
 - *At the platform ends, for the first 200 metres length of the pipeline measured from the bottom of the monel sheathing in the riser pipe.*
- For pipeline crossings, a barrier of minimum 350 mm shall be maintained by mattresses, grout bag etc.
- The anodes for risers can be accommodated in the adjacent pipeline section when both the riser and Pipeline are supplied and installed under the same contract.
- For pipelines carrying hot fluids, the entire length of the pipeline may be divided into number of sections. The temperature to be taken for each section of the pipeline shall be the temperature at the upstream of the particular section of the pipeline calculated from the temperature gradient analysis. For temperature at originating point of the pipeline segment, the operating fluid temperature shall be taken for calculation purposes.
- In case of water injection pipelines, the anode temperature to be considered for the purpose of anode design shall be 30°C both for pipeline and riser segments. However, for the pipelines carrying hot fluids the temperatures considered shall be the same as fluid temperature.
- In case of rigid pipelines where operating fluid temperature is more than 80°C, the anodes shall be thermally insulated from the pipeline using suitable material.
- In case of rigid pipelines, the submerged area of monel sheathing shall also be considered for the purpose of CP system design.

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003

	OFFSHORE DESIGN SECTION	FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE	<table><tr><td>SPEC. No.</td><td>FS 4002</td></tr><tr><td>Rev. No.</td><td>9</td></tr><tr><td>Discipline</td><td>Elect</td></tr><tr><td colspan="2">Page: 6 of 13</td></tr></table>	SPEC. No.	FS 4002	Rev. No.	9	Discipline	Elect	Page: 6 of 13	
SPEC. No.	FS 4002										
Rev. No.	9										
Discipline	Elect										
Page: 6 of 13											

The submerged area of monel sheathing is defined as
Lower limit : bottom of the monel sheathing
Upper limit : Average of astronomical tide and storm surge
defined in pipeline design criteria.

Further, the submerged area of the monel sheathing shall be treated as bare steel surface with 100% coating breakdown while calculating the current requirements.

FLEXIBLE PIPELINES:

The Cathodic Protection requirement are to be read in conjunction with description of work and specification FS 2020E for flexible pipeline given else where in the bid document.

The vendor shall consider anodes for surface area as 1% of the total length of the flexible pipeline for a period of five years and end fittings for the service life of the pipe for flexible pipeline CP system design. The anodes thus calculated shall be put at/near to the end fittings.

The end fittings, which shall always remain in contact with the corrosive environment, shall be provided with sacrificial anodes for cathodic protection. These anodes shall be electrically connected to the pipe end fitting which shall have electrical continuity with the tensile armours.

3.0 Anode Material


Anodes shall be GALVALUM-III or Equivalent (Al-Zn-In) alloy suitable for protection of steel in submerged marine environment. They shall not have any mercury content. The potential of the sacrificial alloy material shall be (-) 1.08V or more negative referred to a silver/silver chloride reference electrode. *For material selection purpose*, the Electro-chemical efficiency of anode material shall be minimum 2500 AH/Kg after four (4) days of operation as per DNV RP B 401.

4.0 Testing and Inspection

4.1 Anode Composition analysis

Anode composition analysis shall be undertaken by methods agreed upon in advance. Two samples from each melt shall be taken for chemical analysis. The samples shall be taken in the beginning and at the end of casting from the pouring

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003

	OFFSHORE DESIGN SECTION	FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE	SPEC. No.	FS 4002
			Rev. No.	9
			Discipline	Elect
			Page: 7 of 13	

string. Checking of closed circuit potential and practical mass consumption shall be done for each 15 ton produced anodes. The test samples may be separately casted or cut directly from an anode. Ampere-hour capacity test shall be carried out by weight loss method only.

4.1.2 After casting, the inspection of the anodes shall be done to ensure that:

4.1.3 AH capacity of anodes shall not be less than the figures considered for design i.e. no negative tolerance shall be permitted.

4.1.4 Closed circuit potential shall be within (+) 10 mV and (-) 50mV of the guaranteed value. For example, for design value of (-) 1.08 volts, anodes having closed circuit potential less negative than (-) 1.07 Volts shall be rejected.

4.1.5 The anodes shall have minimum net weight (Gross weight minus core weight) within a tolerance of + 2.0% to – 1.0%. However, overall negative tolerance shall be 0% to ensure that is no short fall in total alloy weight.

4.1.6 Dimensions shall be within tolerance limits indicated in the approved drawings. No negative tolerance shall be allowed in standoff dimensions.


4.1.7 At least one anode per delivery or at least 0.5 percent of the anodes shall be subjected to destructive testing to check that the casting is to an acceptable standard, each anode shall be cut at 3 of the most relevant locations. The cut surface shall generally be free from visible pores and slag/dross inclusions. The lack of bond or void between anode core and anode material shall not exceed 5%.
As an alternate to a destructive testing, a non-destructive testing by radiography may be used to check for lack of bond or slag/dross inclusions if so permitted by the Company or its authorized representative.

4.1.8 Anode to steel insert shall be checked for electrical continuity. The resistance between the connector and the body of the anode shall not exceed 0.005 ohm.

4.1.9 The electrical continuity and resistance tests shall be performed for flexible lines as per API 17J.

4.1.10 The anodes shall be free from mechanical defects like cracks, shrinkages, excessive flash, surface projections, laminations, cold laps, surface slag, etc. as consistent with good casting practice. Criteria for accepting these shall be as per NACE RP 0492-92.

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003

	OFFSHORE DESIGN SECTION	FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE	<table><tr><td>SPEC. No.</td><td>FS 4002</td></tr><tr><td>Rev. No.</td><td>9</td></tr><tr><td>Discipline</td><td>Elect</td></tr><tr><td colspan="2">Page: 8 of 13</td></tr></table>	SPEC. No.	FS 4002	Rev. No.	9	Discipline	Elect	Page: 8 of 13	
SPEC. No.	FS 4002										
Rev. No.	9										
Discipline	Elect										
Page: 8 of 13											

All the above Inspection / tests shall be witnessed by Company or its authorized representative.

All anodes shall be delivered with material certificate from the Vendor stating batch identification number and chemical analysis.

4.1.11 All work, materials, and equipments shall be subjected to inspection by Company at all reasonable times. However inspection by the Company shall not relieve the Vendor of his responsibility under terms of contract.

5.0 Anode Dimensions & Physical Characteristics

Anodes shall be half-shell bracelet type with steel inserts, which support the anode material and provide electrical continuity to the pipe by bonding leads. The steel core / insert of the anode and stub pipes or brackets provided for mounting the anode on the structure shall conform to ASTM-A36 or equivalent (for structural shapes) and API-5L Gr. B Seamless (for pipes) or equivalent.

For the I/J Tubes of flexible lines, anodes shall be flush type designed so as to fit the outside of the J tube.

6.0 Anode Installation

Anode attachment / detailed installation procedures shall be submitted to Company for approval prior to taking up the job. All welding shall be in accordance with qualified procedures indicated in the relevant specification in the Bid document. All bracelets shall be visually inspected to assure all faces to be exposed have been properly cleaned and free of paint or other contamination.


All weld connections are to be inspected prior to coal tar flood coating. This inspection shall ensure a firmly attached bond and electrical continuity.

For flexible pipelines, anodes shall be installed at/near to the end fittings.

6.1 Anode Installation for Rigid Pipelines In case of Reel Lay Method

Anodes shall be installed on the pipelines during laying operations. Anode pads shall be pre-welded onto pipe joints mid-way from the joint end prior to pipe coating operations and places 180⁰ diametrically opposite. The anode pad pipe joints shall be welded up into pipe stalks in accordance with ONGC approved stalk assembly drawings. The pad locations on the pipelines shall be identified by taping wide red

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003

	OFFSHORE DESIGN SECTION	FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE	<table><tr><td>SPEC. No.</td><td>FS 4002</td></tr><tr><td>Rev. No.</td><td>9</td></tr><tr><td>Discipline</td><td>Elect</td></tr><tr><td colspan="2">Page: 9 of 13</td></tr></table>	SPEC. No.	FS 4002	Rev. No.	9	Discipline	Elect	Page: 9 of 13	
SPEC. No.	FS 4002										
Rev. No.	9										
Discipline	Elect										
Page: 9 of 13											

bands around the pipe at appropriate places. The half shell bracelet anodes shall be bolted onto the pipe at the anode pad locations. The electrical connection from anode to pipe shall be made by welding anode straps of suitable size to the anode pads. Anode attachment / installation procedure shall be submitted to Company for approval prior to taking up the job.

7.0 Service after installation


7.1 The contractor shall carry out post installation CP potential survey for all pipelines and risers after 30 days (min) of the laying to ensure that the system has polarized and attained the required level of protection potential. On locations where the response is inadequate and measurements indicate that cathodic protection has not been attained, Contractor shall take necessary corrective measures including installation of additional anodes, if necessary. During detailed engineering, the contractor shall develop and submit procedure for carrying out CP potential survey, for Company’s approval. However, the survey procedure shall comply with the requirements of DNV standard RP B-403 The basis of redesign / redistribution and all relevant back-up documents, as required by the Company, shall be made available by the contractor for review and approval.

7.2 The potential measurement for each pipeline shall be carried out by towed fish method (Trailing Wire Survey) along the entire length of the pipeline in accordance with applicable international standards. Pipe to electrolyte potential at an interval of 1.0 to 1.5 m along the entire length of the pipelines shall be measured and recorded using a microprocessor based system. Positioning equipment shall ensure that the reference cell mounted on the carrier is positioned at a distance less than ± 20 m from the “As laid Position” of the pipelines.

Cell to Cell method for potential survey may be used after obtaining necessary approval of the Company either in the event of wire break during course of survey by the towed fish method for such long lines where resurvey on reaching over to the other end to run back the survey would be difficult.

Detailed survey procedures including details of positioning / navigation equipment, instruments used for measurement and recording as well as the procedure for calibration of instruments shall be submitted by the Contractor for approval by the Company.

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003

	OFFSHORE DESIGN SECTION	FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE	SPEC. No.	FS 4002
			Rev. No.	9
			Discipline	Elect
			Page: 10 of 13	

Risers at platform connected pipelines shall also be surveyed for potential using dunking cell and drop cell method. The survey of the risers shall be done to check the potential level at regular depths along the riser. The clamps which will be installed for risers will be cathodically protected by the existing anodes of the jacket; CP readings are to be recorded on the riser clamps after installation. Jacket anodes in case of fouling will be relocated and the CP readings are to be taken on the jacket braces at relocation points and submitted to ONGC for information.

The final survey report data shall be presented on the alignment sheets for the pipeline with all corrected measurements shown as continuous line plots of pipe / sea potential correlating with the positional / navigational data and time. Extended scale plots shall be provided for areas of particular interest such as grout sleeve areas, crossing of other pipelines, areas with stress concentration, areas expected to have stray current interference etc.

In areas where measurements indicate that Cathodic Protection has not been attained whether due to coating damage or damage of cable or inactive anodes, necessary corrective action shall be in the Contractor's scope including but not limited to mounting of additional sacrificial anodes. Detailed procedure for the corrective action shall be furnished by the Contractor for the approval of the Company.


7.3 The Contractor shall carry out potential survey for all the flexible pipelines and I / J tubes. Prior to taking up the survey, relevant procedure along with all the related documents will be submitted to company for approval. In a situation where potential measurements indicate that cathodic protection has not been attained, taking necessary corrective action shall be in the contractor's scope of work including but not limited to mounting of additional anodes.

Detailed procedure for the corrective action shall be furnished by the contractor for company's approval.

8 Electrical Continuity And Resistance Tests For Pipelines.

The electrical continuity and resistance tests shall be performed after completion of hydrostatic test. The electrical continuity test shall be performed between segment ends. Electrical resistance tests shall be performed between the segment end fittings and the carcass. The measured values for both the tests shall be recorded. The acceptance criteria shall be as follows:

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003

	OFFSHORE DESIGN SECTION	FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE	<table><tr><td>SPEC. No.</td><td>FS 4002</td></tr><tr><td>Rev. No.</td><td>9</td></tr><tr><td>Discipline</td><td>Elect</td></tr><tr><td colspan="2">Page: 11 of 13</td></tr></table>	SPEC. No.	FS 4002	Rev. No.	9	Discipline	Elect	Page: 11 of 13	
SPEC. No.	FS 4002										
Rev. No.	9										
Discipline	Elect										
Page: 11 of 13											

Electrical resistance between internal carcass and the end fittings: 1 Mega ohm (min)
Electrical resistance between segment end fittings: 10 ohm/km (max.)

9.0 Warranty:

Vendor shall have final and total responsibility for the design and performance of all equipments supplied and guarantees the equipment/anode for their design life. Vendor shall warrant the equipments furnished by him and their performance in accordance with this specification and `General Specification- Definition. (Spec No. 1050)

10 Vendor Pre - qualification:

Vendor Pre-qualification will be as per the requirements stated elsewhere in the bid document

11. Vendor Data Requirements

Vendor shall furnish the following information relative to the anodes

10.1 Dimensional drawings of sacrificial anodes and supporting parts or accessories along with separate as well as assembled drawings for their supporting parts and other accessories

10.2 Net, gross, and buoyant weight of anodes.

10.3 Minimum closed-circuit potential in volts.

10.4 Recommended means of anode support.

10.5 Anode alloying compositions (% age by weight and volume)


10.6 Testing method of anodes and details of the test procedure. The test shall establish the guaranteed minimum electro-chemical value of the anode material and its potential w.r.t. Ag/AgCl reference electrode under site conditions.

10.7 Calculation of anode quantity and weight based on current and weight basis for the design life

12.0 PACKING AND TRANSPORTATION:

The offered equipment along with their accessories shall be shipped to anode installation site, packed in wooden crates. They shall be wrapped with polythene

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003


	OFFSHORE DESIGN SECTION	FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE	<table><tr><td>SPEC. No.</td><td>FS 4002</td></tr><tr><td>Rev. No.</td><td>9</td></tr><tr><td>Discipline</td><td>Elect</td></tr><tr><td colspan="2">Page: 12 of 13</td></tr></table>	SPEC. No.	FS 4002	Rev. No.	9	Discipline	Elect	Page: 12 of 13	
SPEC. No.	FS 4002										
Rev. No.	9										
Discipline	Elect										
Page: 12 of 13											

sheets, before being placed in the crates to prevent damage to finish. Crates shall have skid bottom for handling.

DATA SHEET

- | | | |
|-----------------------------|---|---|
| 1. Anode Material | : | GALVALUM – III or equivalent
Mercury free Al-Zn-In alloy |
| 2. Design Life documents | : | As mentioned elsewhere in bid |
| 3. Sea Water Temperature | : | -- |
| 4. Resistivity | | |
| • Sea Water | : | 20 Ohm cm |
| • Sea Mud | : | 40 Ohm cm |
| 5. Anode Details | | |
| a) Anode type/configuration | : | * |

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003

<div><div>ओएनजीसी</div><div></div><div>ongc</div></div>	OFFSHORE DESIGN SECTION	FUNCTIONAL SPECIFICATION FOR CATHODIC PROTECTION SYSTEM FOR SUBMARINE PIPELINE	<table><tr><td>SPEC. No.</td><td>FS 4002</td></tr><tr><td>Rev. No.</td><td>9</td></tr><tr><td>Discipline</td><td>Elect</td></tr><tr><td colspan="2">Page: 13 of 13</td></tr></table>	SPEC. No.	FS 4002	Rev. No.	9	Discipline	Elect	Page: 13 of 13	
SPEC. No.	FS 4002										
Rev. No.	9										
Discipline	Elect										
Page: 13 of 13											
<div><div><div>b) Anode dimensions</div><div>:</div><div>*</div></div><div><div>c) Anode driving potential</div><div>:</div><div>*</div></div><div><div>d) Electro-chemical efficiency of anode material</div><div>:</div><div>*</div></div><div><div>e) Anode utilization factor</div><div>:</div><div>*</div></div><div><div>f) Anode output</div><div>:</div><div>*</div></div><div><div>g) Anode potential</div><div>:</div><div>*</div></div><div><div>h) Anode alloy composition (% of impurity elements)</div><div>:</div><div>*</div></div><div><div><div>• Type</div><div>:</div><div>*</div></div><div><div>• Material/Grade</div><div>:</div><div>*</div></div><div><div>• Dimensions</div><div>:</div><div>*</div></div><div><div>• Weight</div><div>:</div><div>*</div></div></div></div> <div><div>5.</div><div>Minimum Protective Potential</div><div>:</div><div>*</div></div> <div><div>6.</div><div>Details of Surface area to be Protected</div><div>:</div><div>*</div></div> <div><div>NOTE:</div><div>-Vendor shall furnish data marked (*) along with bid</div><div>-Splashed zone portion, in spite of protective coating, shall be treated as a bare for design of CP system.</div></div>											

Format No	Ref. Proc. No	Issue No	Rev No	Rev. Date
ODS/SOF/004B	ODS/SOP/008 to 015	01	01	15/10/2003