



गोपनीय एवं अधिकार सुरक्षित इस प्रपत्र पर दी गई जानकारी भारत हेवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है इसे प्रत्यक्ष या अप्रत्यक्ष रूप से कम्पनी के हितों को नुकसान पहुँचाने के लिए कदापि उपयोग नहीं किया जावे

## PURCHASE SPECIFICATION FOR CO<sub>2</sub> TYPE FIRE EXTINGUISHING EQUIPMENT

### 1. SCOPE:

This specification covers the design, manufacturing, testing, supply and quality requirements etc. for CO<sub>2</sub> type fire extinguishing equipment for protection of hydro generator against fire hazards. The system offered shall be as per IS-6382 / NFPA-12

### 2. TECHNICAL REQUIREMENTS

#### 2.1 MASTER / SLAVE CYLINDER PRINCIPLE

In this principle, at least two cylinders on each CO<sub>2</sub> bank (main & stand-by of initial and delayed discharge) should be provided with Electric control Head for electric/manual operation, the gas discharge from these master cylinders being used for release of CO<sub>2</sub> from remaining cylinders.

Where more than one generator to be protected, the system should also have suitable number of directional valves with electric control heads and non-return valves for routing the gas into the affected generator.

#### NOTE:

SYSTEM HAVING PILOT CO<sub>2</sub> CYLINDER AND WEIGHT OPERATED MECHANISM (USING WEIGHTS, PULLEY BLOCKS, CHORDS, SECTOR WHEELS ETC.) ARE NOT ACCEPTABLE.

2.2 For detecting fire, two independent systems of detectors shall be used i.e. smoke detectors for initial smoke detection and alarm where as the heat detectors shall be used for release of CO<sub>2</sub> gas.

2.3 CO<sub>2</sub> type fire extinguishing equipment should be initiated by a heat detector device. and being effected by total flooding of the generator air circuit with CO<sub>2</sub> gas at concentration sufficient to dilute the oxygen content to a point where combustion cannot continue.

The proposed values of concentration are 50% during initial discharge of about 2 minutes and there-after to maintain a 30% concentration for a period of 20 minutes or run down time of the generator whichever is more, or otherwise as specified at Annexure-1 (Data sheet).

2.4 In the event of fire occurring inside the generator, following sequence of operation should take place:

- Smoke detectors should operate and provide alarm

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(KVA)


(MCN)


हाइड्रोजेनरेटर इंजीनियरिंग विभाग  
भारत हेवी इलेक्ट्रिकल्स लिमिटेड


देयारकर्ता Sd/-  
M.C.NATH


अनुमोदनकर्ता Sd/-  
CKM SHASTRY


जारी करने की  
दिनांक 08.01.85


			<p align="center"><b>PRODUCT STANDARD</b></p> <p align="center"><b>HYDROGENERATOR</b></p>	<p align="center"><b>HG 10 021</b> <b>Rev. 05</b></p> <p align="center"><b>PAGE 02 OF 09</b></p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);"> गोपनीय एवं अधिकार सुरक्षित  इस प्रपत्र पर दी गई जानकारी भारत हेवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है इसे प्रत्यक्ष या अप्रत्यक्ष रूप से कम्पनी के हितों को नुकसान पहुंचाने के लिए कदापि उपयोग नहीं किया जावे </p>			<p>2.4 In the event of fire occurring inside the generator, following sequence of operation should take place:</p> <ol style="list-style-type: none"> <li>a) smoke detectors should operate and provide alarm</li> <li>b) discharge of CO<sub>2</sub> gas should be initiated by any one of the following <ol style="list-style-type: none"> <li>i) Automatic – by one or more of heat detectors and overall differential relay/stator earth fault relay</li> <li>ii) Manual – Electric push button on main CO<sub>2</sub> control panel <ul style="list-style-type: none"> <li>- Remote manual operation device on remote control panel</li> <li>- Electric push button at main control room</li> </ul> </li> </ol> </li> </ol> <p>2.5 <b>Instruction plate for manual operation</b>  Instruction plate for manual operation of the system giving the sequence of operation to be followed shall be fixed near the directional valve assembly or CO<sub>2</sub> bank assembly.</p> <p>2.6 A safety lock/cap on each manual operation device of Electric control Head should be provided.  A neon lamp on each electric control head should be available to indicate that the system has operated till it has been reset by push button on Main CO<sub>2</sub> control panel.</p> <p>2.7 The CO<sub>2</sub> system should consist of a bank of cylinders both for initial and extended discharge, complete with all other associated auxiliaries, piping etc, and an excess pressure relief device to release any excess pressure inside the generator barrel after CO<sub>2</sub> discharge.</p> <p>Squeeze grip discharge valve shall be mounted on each CO<sub>2</sub> bank manifolds (of main &amp; stand-by of initial and delayed discharge) for emergency local release of CO<sub>2</sub> which if entrapped in cylinder manifold due to leakage of CO<sub>2</sub> from cylinders.</p> <p>2.8 Bank of CO<sub>2</sub> cylinders (Main, Stand by and Unconnected) shall be provided with suitable wire mesh enclosure with door &amp; lock to ensure safety.</p> <p>2.9 Unconnected CO<sub>2</sub> bank identical to main would be supplied if specified in Annexure-1 (Data sheet).</p> <p>2.10 The system should also include the main control panel, remote control panel for each unit and remote manual operation device for each unit (to be located in control room).</p> <p>In case of system with standby banks, in order to make use of the main and standby CO<sub>2</sub> battery banks effectively, a duty selector switch should be provided to select the following combination of CO<sub>2</sub> banks:</p> <ol style="list-style-type: none"> <li>a) Main initial and Main delayed,</li> <li>b) Main initial and Standby delayed,</li> <li>c) Standby initial and Main delayed,</li> <li>d) Standby initial and Standby delayed.</li> </ol>	


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<p style="writing-mode: vertical-rl; transform: rotate(180deg);">         गोपनीय एवं अधिकार सुरक्षित          इस प्रपत्र पर दी गई जानकारी भारत हेवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है इसे प्रत्यक्ष या अप्रत्यक्ष रूप से कम्पनी के हितों को नुकसान पहुंचाने के लिए कदापि उपयोग नहीं किया जाये       </p>	<p><b>2.11 Remote control panel (for each unit)</b></p> <p>Indicating lamps for indicating the combination of CO<sub>2</sub> banks selected and ready for operation along with guarded push button for manual electrical operation of the system shall be provided on remote control panel.</p> <p><b>2.12 Main control panel and control schematic:</b></p> <p>2.12.1 The control panel should be floor mounted, back opening type with a height of 2.3M.</p> <p>2.12.2 The panel should be provided with latched door lock, anti-condensation heater with thermostat and inside illumination to glow on opening of the door.</p> <p>2.12.3 Control panel wiring should be done on insulated channel with insulated cover. All wires should be provided with numbered ferrules. Wiring for smoke detector circuit should be run in separate independent insulated channel. Screened cable should be used for smoke detection circuit to avoid false alarms due to stray fluxes.</p> <p>2.12.4 No twisted wires are to be used for terminal connections .</p> <p>2.12.5 The terminals should be Elmex type with 20% terminals as spare.</p> <p>2.12.6 All components inside the control panel like relays, contactors, solenoids, time delay relays, indicating lamps, limit and pressure switches etc. must be of either Siemens, Larsen &amp; Toubro, Cutler Hammer or English Electric make. Prior permission of BHEL must be obtained, if any other make components are used.</p> <p>2.12.7 The test key on the panel should have following labels:</p> <ol style="list-style-type: none"> <li>Normal position</li> <li>Test position</li> </ol> <p>2.12.8 All electrical equipments under the system should operate satisfactorily with the station supply voltage (with variations) as specified at Annexure-1 (data sheet).</p> <p>2.12.9 The control schematic should include but not limited to the provision for alarm/indication for the following:</p> <ol style="list-style-type: none"> <li>Station supply failure (both AC &amp; DC). This feature is to be supplied with storage battery back up.</li> <li>CO<sub>2</sub> system faulty</li> <li>CO<sub>2</sub> released</li> <li>There may be a situation that fire occurred but CO<sub>2</sub> not discharged. The schematic is to be designed to identify this situation and provide alarm/indication so that power house personnel can initiate appropriate action to meet the eventuality.</li> </ol>		


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<p align="center">गोपनीय एवं अधिकार सुरक्षित इस प्रपत्र पर दी गई जानकारी भारत हेवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है इसे प्रत्यक्ष या अप्रत्यक्ष रूप से कम्पनी के हितों को नुकसान पहुंचाने के लिए कदापि उपयोग नहीं किया जावे</p>			<p>Additional 2 sets of each potential free contacts for all the above conditions shall be provided for further use. Additional push buttons for remote manual electrical operation of system should also be provided for each unit for mounting in main control room.</p> <p>2.12.10 The control schematic should contain the bill of material with their makes model no. and other details.</p> <p>2.12.11 The system should be so designed that the testing of the electrical circuit can be carried out without releasing CO<sub>2</sub> gas. It should also be possible to check the healthiness of all indicating lamps on the panel through the test switch, apart from checking for different operating condition.</p> <p>2.12.12 An interlock limit switch should be provided to prevent discharge of CO<sub>2</sub> on opening of generator barrel door.</p> <p>2.12.13 Apart from a hooter in smoke detection circuit, a separate continuous rated hooter should be provided to operate with heat detectors. This hooter also should be provided with accept switch.</p> <p>2.12.14 There should be one Fascia on main control panel “SYSTEM NOT RESET” to glow on operation of the system. The circuitry should be so designed that this Fascia indication will disappear only when “Reset Push Button” on main control panel and reset levers on Electric control heads are reset.</p> <p>2.13 An automatic weighing bridge shall be provided for each cylinder of CO<sub>2</sub> system so as to give indication &amp; audible annunciation for any leakage of CO<sub>2</sub>. Provision shall be made for alarm at 10% leakage of CO<sub>2</sub> content in any cylinder in any bank.</p> <p>2.14 All interconnecting wires/cables between different panel, and CO<sub>2</sub> banks, etc., should also be included in the scope of supply.</p> <p><b>3.0 DESIGN NORMS AND QUALITY REQUIREMENTS</b></p> <p>3.1 Various parts of the system shall be tested as per the code of practice of IS-6382/ NFPA-12 .</p> <p>3.2 Each cylinder shall be tested as per IS-2872 and shall be interchangeable and shall have the approval of Department of Explosives, Govt. of India. It shall be tested at a pressure of 236 kgf/cm<sup>2</sup> and shall have a minimum bursting pressure of not less than 420 Kg/cm<sup>2</sup>.</p> <p>3.3 The electric heater and solenoid coil should be designed for continuous duty.</p>	

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<p style="writing-mode: vertical-rl; transform: rotate(180deg);">         इस प्रपत्र पर दी गई जानकारी भारत हेवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है इसे प्रत्यक्ष या अप्रत्यक्ष रूप से कम्पनी के हितों को नुकसान पहुंचाने के लिए कदापि उपयोग नहीं किया जावे          गोपनीय एवं अधिकार सुरक्षित       </p>	<p><b>3.4 Design pressure of few important components:</b></p> <p>3.4.1 Seating of steel ball of the non-return valve shall be designed so as to prevent leakage even up to a pressure of 175 kgf/cm<sup>2</sup>. The valve is to be designed to withstand a minimum bursting pressure of 420 kgf/cm<sup>2</sup>.</p> <p>3.4.2 The H.P. hose is to be designed to withstand a minimum bursting pressure of 350 kgf/cm<sup>2</sup>.</p> <p>3.4.3 Cylinder valve is to be designed for a minimum bursting pressure of not less than 420 kgf/cm<sup>2</sup> and tested to a pressure of not less than 236 kgf/cm<sup>2</sup>.</p> <p>3.4.4 The design of safety outlet valve is to be set to operate at a pressure between 168 kgf/cm<sup>2</sup> and 210 kgf/cm<sup>2</sup>.</p> <p>3.4.5 The discharge nozzles are to be designed to withstand pressure upto 140 kgf/cm<sup>2</sup>. The initial discharge nozzles should be so designed to facilitate quick discharge of CO<sub>2</sub> into the barrel while the delayed discharge nozzles should be hooded type to give slow discharge. Particular care is to be taken to ensure that CO<sub>2</sub> gas does not condense as ice on the nozzles.</p> <p>3.4.6 Pressure switch is to be designed for operation at a minimum pressure between 20 to 100 psi, but to with stand a test pressure of 210 kgf/cm<sup>2</sup>.</p> <p>3.4.7 Directional valve is to be designed for a bursting pressure of not less than 350 kgf/cm<sup>2</sup> and is to be tested to withstand a pressure of 236 kgf/cm<sup>2</sup>.</p> <p>3.4.8 Seating of directional valve/non return valve: Seating provided inside directional valves and non-return valves should be flat type. Conical/taper seating will not be accepted since they can cause leakage of CO<sub>2</sub> gas even when the system is not in use.</p> <p>3.4.9 The electrical insulation system of the control panel should withstand H.V. test of 2 kV (rms), 50 Hz A. C. for one minute</p> <p><b>4.0 MATERIALS</b></p> <p>4.1 Gas cylinders used for the storage of CO<sub>2</sub> shall conform to IS: 2872.</p> <p>4.2 The alloys used for CO<sub>2</sub> cylinder discharge heads, tripping mechanism, directional valve and other fittings conform to IS: 318.</p> <p>4.3 All pipes and fittings made out of seamless steel tube (Schedule 80 upto 1" &amp; above; schedule 40 below 1") and fittings will be of forged steel. No welded fittings are acceptable.</p>		


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<p style="writing-mode: vertical-rl; transform: rotate(180deg);"> गोपनीय एवं अधिकार सुरक्षित  इस प्रपत्र पर दी गई जानकारी भारत हेवी इलेक्ट्रिकल्स लिमिटेड की संपत्ति है इसे प्रत्यक्ष या अप्रत्यक्ष रूप से कम्पनी के हितों को नुकसान पहुंचाने के लिए कदापि उपयोग नहीं किया जावे </p>	<p>given to BHEL for such inspection. Inspection &amp; testing at supplier's works shall include but not limited to the following :</p> <p>7.1 Inspection of components/ assemblies as per supplier's approved drawings and QA Plan.</p> <p>7.2 Testing of electrical circuits under various combination for selection of main / standby CO<sub>2</sub> banks without releasing CO<sub>2</sub> gas.</p> <p>7.3 Functional testing of weighing bridges to detect 10% leakage of CO<sub>2</sub> gas content in a cylinder alongwith indication / annunciation without releasing of CO<sub>2</sub> gas from the cylinders.</p> <p>7.4 Partial assembly of CO<sub>2</sub> battery and associated components upto directional valves &amp; pressure switch and checking of operation of electrical / pressure operated control heads, directional valves, pressure relief valves, squeeze grip valve etc. for initial &amp; delayed pipe lines by discharging CO<sub>2</sub> gas from two CO<sub>2</sub> cylinders (one for initial and one for delayed) from main &amp; remote control panels through auto / manual electrical operation.</p> <p>7.5 Ensure adhesion of point as per ASTM D-3359 for all painted surfaces.</p> <p><b>8.0 PACKING AND SHIPPING</b></p> <p>(a) All items should be identified by its corresponding item number of drawing.</p> <p>(b) Loose items should be put in a cotton bag and identified. Tag should be attached to it.</p> <p>(c) Protection caps should be used to protect the pipe end from damage.</p> <p>(d) Before actual dispatch of equipment, TEN copies of total shipping list of items covering all the items of scope of supply will be furnished to BHEL.</p> <p><b>9.0 INFORMATION TO BE FURNISHED</b></p> <p><b>9.1 ALONGWITH OFFER : 2 COPIES EACH OF FOLLOWING :</b></p> <p>(1) Supplier's leaflets / catalogues on CO<sub>2</sub></p> <p>(2) Schematic diagram of the control equipment</p> <p>(3) Layout of CO<sub>2</sub> piping, cylinders, etc., alongwith complete bill of material</p> <p>(4) Calculation for selection of number of cylinders, pipe sizes, giving reference to relevant standards and their clauses.</p> <p><b>9.2 DURING EXECUTION OF THE ORDER</b></p> <p>9.2.1 Four sets of drawings and QAP (quality assurance plans) are to be submitted, within a fortnight of the award of purchase order, for approval of BHEL and their customer/consultant.</p>		

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