

DHRUVA Reactor's Cut End of Fuel Rod Handling Mechanisation and Automation System

(Year 2020)

Heavy Engineering Decontamination (HED) Area located at Decontamination centre Building of Effluent Treatment Plant (ETP) of WMD receives used Cut End Aluminium Rods on regular basis. These rods which are radioactive on receipt are stored on interim basis and subsequently de-contaminated and recycled to Atomic Fuel Division for reuse. In the existing system most of the material handling operations are carried out manually thus involving lot of man power. The existing semi-automatic system has undergone its useful service life and has aged significantly. System has been completely re-designed incorporating automation as well as safety features for operational ease, safe handling, man-rem expenditure reduction & optimization of manpower requirement. Development of this vital equipment is First of AKind in BARC for automation based handling. This will minimize the Man-Rem expenditure of the facility achieving As Low As Reasonably Achievable (ALARA) principle, which is judiciously followed in nuclear facilities. The complete system has been manufactured, assembled and tested simulating all the handling operations as part of Factory Acceptance Test at Vendor's end.

The system is a custom designed special purpose electrical manipulator. It is a bridge mounted electrical manipulator with FOUR degrees of freedom. Out of these four degrees of freedom three are in Cartesian frame work i.e. bridge travel (X), cross travel of trolley (Y), and elbow arm (Z). At the end of the elbow arm rotation of Gripper Frame has been provided. End-effectors are 03 sets of pneumatic grippers for holding the Rod. Payload Capacity of the grappler at all positions is be 70 Kg. It has to handle fuel rod having 60 mm diameter, 5700 mm long and unbalanced weight. Equipment will be operated from a Programmable Logic Controller based Supervisory Control and Data Acquisition Control Terminal (01 No. Computer Terminal with GUI Interface) with a provision of a radio operated push button pendant as an overriding Operation feature. The equipment is provided with two PTZ Cameras, one for global view of the work volume and another for local viewing of working area. The system is designed considering all the site constraints such as low head room due to ventilation cross duct in that area and rod spacing in the box.

The design features of the system are given below:

- 1) FRHMAS is capable of picking the cut-end rod from Rod box in horizontal balanced condition.
- 2) It is also capable of rotating $\pm 90^{\circ}$ near rod box location.
- 3) Entire HED area is accessible with the system.
- 4) Grappler has been designed for picking & placing of cut end rods from/at predetermined locations (Rod Box & DC Tanks)

- 5) Emergency manual operation has been provided to unload the rod in case of drive failure or total power failure.
- 6) Industrial safety aspects to avoid toppling, derailing, collisions etc. has been taken care during design of the system.
- 7) Equipment is designed for remote operation and contact maintenance.



Fuel Rod Handling & Automation System ready for dispatch at Supplier's end



SCADA, PLC & DRIVE (VFD & SERVO) PANELS for FRHMAS



SCADA & VIEWING SCREENS for FRHMAS