

**Technical Details
For the work of**

**Quick Watering arrangements at PF 7,8,9, & 10
of PRYJ station**

Scope Of Work for the work of Quick Watering arrangements at PF 7,8,9, & 10 of PRYJ station

- I. Improvement to the En-route watering system should be based on the report on “Standardization of En-route coach watering system issued by CAMTECH vide letter No. CAMTECH/2008/M/C/Watering/1.0 (Revised) October 2008”. However, changes as advised by Engineer in charge to suit the site conditions should be adhered to.
- II. The work involves, Design, Supply, erection, testing and commissioning of suitable Booster pumping arrangement, Control Panel, Instrumentations, Control valve, etc. for quick watering of trains at PF 7,8,9, & 10 of PRYJ station. This will also include incoming water connection to quick watering system and outgoing watering connection including all fittings, valves etc. and hydrant line for carriage watering system of Platform PF 7,8,9, & 10 of PRYJ station.
- III. Space near water source of existing watering system at PRYJ for installing quick watering system pump house.
- IV. Three phase power supply of approx. 180 HP load from available power source near quick watering system (No charges will be made by Railways).

1 System Requirement:

Quick watering system is being installed with a view to meet adequate water filling in passenger coaches within limited scheduled halt. This work for quick watering system at PRYJ shall be designed, supplied, installed and commissioned to meet or to better following basic requirements-

- a) For a train of 24 coach length on ICF stock quick watering system shall be able to meet water flow requirement of minimum 5184 l/min for watering within 05 minutes.
(04 tanks x 450 litres each x 60% filling enroute x 1/5 (within 05 mins))
- b) Similarly, for a train of 23 coach length on LHB stock, quick watering system shall be able to meet water flow requirement of minimum 5446 l/min for watering within 05 minutes.
((08 AC coaches x (685 litres x 2 + 450 litres) + 15 NAC coaches x 685 litres x 3) x 60% filling enroute x 1/5 (within 05 mins))
- c) Therefore, higher flow rate i.e. 5446 litres/min shall be governing flow rate for quick watering system.
- d) System shall be capable of maintaining flow rate mentioned above for minimum 02 full-length trains simultaneously for watering within 06 minutes time.
- e) Quick watering system shall be integrated with existing watering hydrant available at PRYJ. Any modification required in existing watering hydrant at PRYJ for quick watering purpose shall be under contractor's scope of work.
- f) Quick watering system shall be designed and automated with a view to achieve required water flow rate with minimal electricity consumption and without any wastage of water.
- g) Automation and remote monitoring shall be user friendly, easy to operate, better diagnostic and compatible for future changes.

2 Specifications regarding infrastructure of QWS

- a. Arrangement for the Quick Coach Watering System for PF7,8,9 & 10 of PRYJ station:

Booster Pump Details: -

Description	Quantity/ unit
Booster Pump flow rate	Minimum 320 m ³ /hr or 5333 lpm
Discharge head	Minimum 35 m
HP	60Hp
Number of pumps in one set	03 no's
• 3 Phase Induction motor, frequency 50 Hz, Motor Insulation Class H & efficiency IE3 or higher. • Three pumps integrated with Variable frequency variable speed with constant discharge (VVFD) & integrated with SCADA	

- General

- ❖ Provision of Pressure Gauge/sensor on the main header & the last of each hydrant line.
 - ❖ Provision of flow meter on each hydrant line.
- b. All sets of pumps should be interconnected through the header so that in case of failure of one pump set another pump set will feed the water supply.
- c. Report generation of all en-route coach watering may be generated in CMM for proper monitoring of coach watering and quantity of water filled in the train from SCADA. There may be a dashboard on CMM for all running trains for the watering status of all enroute coach watering stations.

3 Basic Principle:

Flow requirement shall be varying from 960m³/hr (maximum) to 320m³/hr (minimum) as required at PRYJ station but it is necessary to maintain constant pressure for feeding water to coaches while considering the following points.

- i. Optimum power consumption.
- ii. No wastage of water.
- iii. Minimum manual interface.
- iv. Flexibility of operation on D.G set.
- v. Flexibility of operation in auto and manual mode.
- vi. Dry-running protection for pumps.

One single large pumping unit is not suitable for the requirement instead of it multiple pumps parallel with speed control to optimize the power consumption in proportion of flow and complete control of system and automation will be based on header pressure and line pressure sensed by pressure transducers fitted on appropriate location.

4 Designing of Pipeline:

Total piping arrangement is divided in following segments -

- a. As per pipe layout given above under para 2.
- b. Piping from overhead tank/sump to pump house.
- c. Piping within Pump House, common manifold and Header.
- d. Feeder Pipe line from pump house to main distribution line along the track (duly crossing the track, wherever necessary).
- e. New Hydrant Distribution Pipeline 200mm GI at the height of 2.3 m from Rail Level or as per site condition including hydrants with ball valve outlet in every 2M as per the CAMTECH standards as per CAMTECH standards.
- f. Supply & fitment of all necessary control valves, and controlling system with SCADA.
- g. Size of all above piping will be dependent on required parameters for PRYJ station.
- h. Main distribution pipeline along and across the track as per actual requirement to connect carriage watering system of PRYJ.

Note:

1. Size of all above piping will depend on the required parameters available at PRYJ Station.
2. While executing earthwork in the site, the pipelines should be laid underground to a depth of 1m to 1.5 m without infringing the existing Signal cables, power lines and RCD pipelines in coordination to engineering department.
3. Standard of Dimensions (SOD) shall be followed while laying Pipelines near the track to avoid infringing.

5 Valves and Controls

- a) To avoid wastage of water and to maintain pressure in main distribution pipe line electrically operated valves can be provided in Pump rooms, Main distribution header and any Place of Hydrant Line. All these valves to be open /closed by GSM based mobile/ remote operation and same can be operated in auto / manual mode also. The entire Quick watering system shall be designated to have leak proof operation.
- b) Valve shall be of suitable size as per dia and flow rate of quick watering system. valve shall be installed as per revised size of Suction & Distribution Header at Booster Pump 500mm, Supply Line from Distribution Header to Hydrant line-400mm, Hydrant Distribution pipeline-200mm, Hydrant Valve-50 mm.
- c) Design of system must be based on requirements at designated site keeping in view the above principles and requirements according to CAMTECH guidelines referred above.
- d) For Maintenance and regulation of flow, manual valve (dummy) to be fitted in parallel to automatic Valve.
- e) Sluice valves, butterfly valves and non-return valves in pump house.
- f) Valves for isolation in feeder line before branching for maintenance purpose.
- g) Individual designing of system for PRYJ station must be based on system requirements and actual conditions at site.
- h) System is recommended to have 01 set of three numbers of centrifugal pumps of 60 HP suitable for pressure Boosting application.

- i) Working principle of Booster Pumps is recommended to be based on two parameters like pressure in delivery and suction line and Flow in main header.
- j) With the help of the pressure and feedbacks, speed of pump(s) and number of pumps; operations should be decided automatically.
- k) On/Off/Standby/sequence of operation everything must be governed and monitored by automation and controls provided and data sensed on continuous basis from the system.

6 System Automation and Controls:

Automation, Controls and Logic:

- a) It is recommended to design running of similar performance pumps in parallel to achieve required flow rate. Backpressure in system will decide flow requirement, because pressure is dependent on velocity and velocity is related to flow.
- b) Static head is fixed and total head will decrease or increase because of flow, as flow is increasing, velocity is increasing and correspondingly total head will increase.
- c) Total automation will depend on System Pressure therefore it should be planned to provide solenoid operated valves at every distribution branch, so system will be leak proof and always filled with water at set pressure. As soon as any valve is opened for a moment, immediately pump will be "ON" to fulfill the flow requirement.
- d) Cycle of operation of pump P1 will attain full speed start delivering a flow of 320 m³ /hr and if requirement is not fulfilled then second pump P2 will be 'ON' and total flow of 640 m³/hr will be available and still requirement is not fulfilled then third pump P3 will be 'ON' but at any state if put together flow is more means system pressure is increasing, then speed of pump will be regulated to deliver only required flow rate.
- e) Real time clock with the help of PLC will decide sequence of P1, P2, and P3. It means every time P1 will not start always at first position. Sequencer will maintain operational time of every pump equally. Same will be applicable for second set of pumps.
- f) System parameters must be preset and at the time of commissioning any change in parameters must be done only after verifying the theoretical calculations and site conditions.
- g) Pressure/flow sensors must be provided on header and average reading should decide the requirement of water in total circuit and on its basis number of pumps in operation and speed of pumps should be decided.
- h) Whole system must be any time switched over to manual in case of any fault, if one pump is defective or under maintenance then automatically it should be bypassed by system and next pump should start.
- i) Control system by using a suitable SCADA software should be able to collect, record, analyze all data that are collected through various sensors connected in the system and generate the desired output for facilitating optimum usage of its gadgets and resources so as to meet the required level of carriage watering functions.
- j) System should also retain the records that was captured during last 12 months and shall be able to generate record of activities in various formats as required by the consignee in the form of soft copy or printed hardcopy.

7 Technical Specification and Data.

- a) Centrifugal pump sets of high efficiency and reliability to operate under wide range of head and discharge.
- b) Design features of pump having radial flow GM/SS IMPELLER, closed coupled with energy efficient motor mounted on a common skid or platform.

- c) To ensure cavitation-free operation, each pump's NPSH requirement must be low enough to permit stable, continuous operation at 120% or greater of best efficiency point.
- d) Each Pump shall be hydrostatically factory tested as per HI standards.

8 Control panel for the system should have following features: -

- i. CRC sheet fabricated weather proof powder coated from outside.
- ii. Suitable for 415 V, 3 phase AC supply to meet load of 01sets of 03 nos. 60 HP pumps with inbuilt auto Change over to DG set.
- iii. Star delta starters of adequate capacity.
- iv. PLC for smart controller. Power saving and proper utilization of 01 sets of 03 nos. 60 HP pumps.
- v. VVFD for speed control & energy saving.
- vi. Protections—Protections like single phasing, under voltage, over voltage, Earth leakage, Overload protection.
- vii. Indications: - Phase indication, voltage, Current, status On/OFF, fault indication.
- viii. Cable Entry provision in bottom.
- ix. Dry running protection for pumps.
- x. Motor protection Circuit Beakers (MPCBs)
- xi. Identifications of circuit cables etc.- Labels of permanent nature shall be provided on supports of all switches, fuses, contractor, relays etc. to facilitate identifications of circuits and replacements. All power cables, lighting and other cables shall be ferruled at both ends as per cable numbers indicated in the supplier's drawing. All equipment terminals shall be marked likewise.

9 Cables.

Cables should be ISI and as per specified conductor and number of cores with suitable glands for connection and lugs for termination.

NOTE:-

- 1 *RITES inspection of identified Items shall be limited to supply portion of items. Fitment and installation inspection of these RITES inspection item at site will be done by consignee.*
- 2 *Transportation, unloading, handling, security at site of all supplied material, equipment etc. shall be on part of Vendor for which no extra payment or claim shall be admissible.*
- 3 *Meeting system requirement and suitable to actual site condition contractor shall be responsible for submission of detailed layout and other drawings, specification etc. prior to supply of material and execution of work. It will be complete responsibility of contractor that supplied, installed and commissioned quick watering system is able to meet system requirement specified in SCC. Contractor shall have to prove out commissioned quick watering system on specified parameters.*

10 OPERATION OF PLANT:

After successful erection and commissioning of Quick Watering arrangement at PRYJ Station the contractor have to deploy a team of well qualified operators (round the clock) having at least diploma / ITI with sufficient experience in this field for a period of 3 months. During this period contractor operator shall provide training along with literature to Railway staff for successful operation of the plant. The cost of operation during this period shall be borne by contractor.

11 TRAINING TO RAILWAY STAFF:

Vendor shall provide operation and maintenance literature and manual for successful operation and maintenance of quick watering system. Training of operation and maintenance of quick watering system to railway staff shall be provided by contractor free of cost.

A. Technical Specifications, Recommended Make, Other requirement etc.

a) **ELECTRICAL MOTOR**

Description	Tech. Specification
Pump Make	KBL/ABB/Siemens. Since pump and motor are available as packaged unit therefore such unit of reputed OEM shall be preferred.
Type	3-phase TEFC SCR Induction Motor, High efficiency.
Voltage	415V ($\pm 10\%$)
Type	Squirrel cage(SER)
Frequency	50 $\pm 5\%$ Hz.
Motor capacity	60HP

i. Supply, erection, testing & commissioning of 5 ton chain electric pulley, Manual trolley with complete setup using ISMB 200X100 for support as per following technical specification:-

- 5 ton chain electric pulley with , Manual trolley
- Type: Manual Push/Pull Geared Trolley

Capacity (t)	Lifting Height (m)	Lifting Speed (m/min)	Lifting Motor					Beam (mm)
			Power (kw)	Rotation Speed (r/min)	Phase	Voltage (v)	Frequency (hz/s)	
5 Ton	3/9 (Adjustable based on specific requirements)	Approx. 2.8	3.0	1440	3	220-440	50/60	200x100 ISMB

- Hoist Control- Ground pendent control with Emergency Stop, remote control, wire control
- Grade 80 alloy steel load chain
- Safety Features:
 - Mechanical load brake
 - Overload protection
 - Forged swivel hooks with safety latches
 - Should be equipped with limit switches: Upper and lower limit switches for safe operation.
 - Overload Protection: Friction clutch or electronic overload device to prevent lifting beyond rated capacity
- Standards: Conforms to IS for 5 ton chain electric pulley with Manual trolley
- The above specification are appox and may vary as per OEM.

ii. **CHANGEOVER AND CONTROL PANEL FOR 03 PUMPS WITH VVFD, PLC, HMI FOR GROUP-WISE PUMPING WITH APFC AND SUITABLE CAPACITORS AND SMART CONTROL:**

A dedicated pump logic controller shall be a Multi Pump Controller or approved equal. The controller shall have a large graphical display with high pixels. The logic controller shall be modular in design and should be scalable based on the system requirement. The

controller should have following minimum communication ports:

- a) Ethernet port for remote connectivity
- b) Service port
- c) IO port for system expandability.
- d) The controller shall operate the pumps to maintain the required system pressure while using minimum energy.

As flow demand begins, one of the pumps will start at low speed. As demand increases, the pump will speed up until it reaches full RPM. At this point the second pump will start. The speed of the first pump will vary until it builds up required system pressure. This sequence will continue for additional pumps.

Pumps will changeover automatically to maintain the system pressure depending on demand, time, and fault.

When flow demand is zero, the system shall shut off. If the system runs continuously, the lead pump shall alternate every 24 hours. If the system includes an optional standby pump, the controller shall exercise the standby pump as a part of the system and equally run the pump as other pumps in the system. The controller shall accept a low-suction pressure or other suction fault input to shut down/protect the system. Booster set should incorporate following "Power saving features" as standard.

- Selection of 3 basis set points for pressure relative to time.
- Pipe compensation i.e. Change of set point depending on water consumption.
- Compulsory change of starting of sequence, i.e. Equal operating time for Pump, both for frequency control and ON/OFF regulation.
- Inputs and outputs for external communication.
- A small sized pressure tank to provide for reducing impact of water hammer. Diaphragm pressure tank shall be in MS construction, suitable for 10 bar pressure rating. The tank should have an interchangeable membrane with tiered membrane design and with built – in pressure gauge.

a) **Specifications/feature of controller:**

The functions of the Controller should incorporate the following features

- a. Ethernet connectivity for remote monitoring and control
- b. Graphical view of the system with status indication of the complete system.
- c. Trouble free step by step installation Wizard.
- d. Open loop control.
- e. On / Off operation at low flow.
- f. Automatic cascade control of pumps
- g. Selection of switching sequences , automatic pump change and pump priority.
- h. Manual Operation.
- i. Analog set point influence
- j. Friction loss compensation
- k. Set point adjustment

b) **Variable frequency variable Speed drive with constant discharge (VVFD)**

Variable frequency variable Speed drive with constant discharge (VVFD for 03 nos. 60HP pumps of leading manufacturers. VVFD recommended by OEM of pump/motor shall be preferred.

c) **PLC**

The display shall be menu driven for Status indication, Operation, Alarm and Settings. System functions shall be programmable through the display. These programmable menu functions / settings and information shall include, but not be limited to:

- a. Large graphical display with overview of the system including key measuring points.

- b. Backlight display
- c. Menu bar for easy navigation
- d. System information and Status
- e. Control Functions
- f. PI control setting
- g. Setting of alternative set points
- h. Setting of primary Sensor
- i. Setting of Redundant primary sensor
- j. Automatic pump alterations
- k. Automatic cascade control of pumps
- l. Set point adjustment and control
- m. Pump priority
- n. Standby pump designation
- o. Friction Loss Compensation (set point)
- p. System pressure set point
- q. Actual system pressure
- r. System faults
- s. High and low discharge pressure shut-down limit
- t. Analog input for remote set-point control
- u. Digital input for remote stop/start
- v. Data communication for remote control

d) SPECIFICATIONS/FEATURE OF LOG AND STATISTICS

The system shall be capable of obtaining and logging the valid operation data and statistics such as System performance, Energy consumption, Alarm and Warning Log etc.

e) Specifications/feature of monitoring function

- a. Pressure Loop
- b. Pre pressure
- c. Motor protection
- d. Water shortage monitoring
- e. Data of VVFD through RS - 485 (Modbus protocol)

f) Specifications/feature of smart/remote control

- a. control and monitoring of the system from remote location on Ethernet/Internet.
- b. Remote system On / Off - Hardwired Interface
- c. Switching of individual pumps.
- d. Remote common alarm - Hardwired interface
- e. Individual pump status through potential free contacts.
- f. All hardware and software for this shall be supplied by contractor.

iii. CONTROL PANEL:

Control Panel (inclusion of the following (a) to (i))

- a) Design, fabrication, transportation, supply, erection and commissioning of LT cubical panel 3 Phase and neutral 415V. 4 Wire, free standing floor mounted, LT panel made up of 14SWG CRCA (Cold Rolled Carbon Annealed) sheet after seven tank process and painting with EPOXY powder coating. The panel shall consist of suitable rating TPN (Triple pole neutral) tinned copper bus bar supported with DMC/AMC barriers and colour coded with heat shrinkable sleeves. The metering shall be provided as specified The panel shall have short circuit with standing capacity of minimum 50KA (RMS) power frequency test and consist of the switch gear as mentioned below. The panel shall be mounted on

channels including supply and fixing as per specification. The complete work has to be carried out by the contractor including masonry work. After execution, all the feeder cables have to be connected to new panels with suitable cable glands as per the requirement of Engineer at site. Air condition provision is to be made for entire control panel.

The panel consists: -

- b) 1 No. of 400A, 4 Pole, 36KA, MCCB (Moulded case circuit breaker) & 400 AP changeover for incoming
- c) 5 No. of 125A, 10KA 4 Pole MCCB out going.
- d) 1 No. of 36A, 10KA 4 Pole MCB (Miniature circuit breaker) out going
- e) 5 No. of 32 A, 10KA 4 Pole MCB out going
- f) Along with multifunctional digital meter similar to model No: EM-VIFPE of M/s HPL make with suitable ratios CTs (Current transformer) along with the selector switches, LED phase indication pilot lamps (3No's), and tinned copper bus bar of 1000V along with rubber chequered sheets of size 1m length of panel of 12 mm thick as per IS 5424-1 No. complete
- g) Suitable set of capacitor as per pump capacity required with auto manual APF Relay.
- h) VVFD (Variable frequency variable speed with constant discharge) 60HP 1 No. PLC 1 No. HMI, with pressure transducers.
- i) Suitable 60 HP star delta starter with auto manual selection mode and same starter will work on VVFD and command will be to VVFD by PLC (Programmed Logic Control).

Control panel consist of-

- a. POWER CONTROL CENTRE PANEL (PCC) & DISTRIBUTION BOX (DB) PANEL.
- b. MOTOR CONTROL CENTRE PANEL (MCC)
- c. APFC PANEL.

Scope shall be Design, fabrication, transportation, supply, erection and commissioning of LT cubicle panels 3phase and neutral 415V, 4 wire, free standing floor mounted. LT Panel should be made up of 14/16 SWG CRCA sheet with EPOXY powder coating. The panel shall consist of suitable rating Electrical Grade copper bus bar supported with DMC/SMC/POLYAMIDE barriers and color coded with Heat shrinkable sleeves. The metering shall be able to meet requirement of pumping system being installed.

The panels shall have short circuit withstanding capacity of minimum 50KA. The insulation level of the panel shall withstand to 2.5KV (RMS) power frequency test and consist of the required switch gears of reputed leading brands. The panel shall be mounted on channels including supply and fixing. The complete work has to be carried out by the contractor including masonry work. After execution, all the feeder cables have to be connected to new panel with suitable cable glands as per the requirement of engineer at site.

- a) **WIRING:** The entire wiring shall be done with high grade bright copper annealed standard PVC or FRLS or HR FR insulated flexible wires. Control wiring shall be done with minimum 1.5 sqmm Gray wire & CT wiring shall be done with 2.5 sqmm Gray wires. DC wiring shall be done with 2.5 / 1.5 sqmm white wire. All doors are to be earthed with the help of 1.5 sqmm yellow green wire. Electronic Card signal wiring shall be done with 1 sqmm Shielded wire.
- b) **Cable Chamber:** Cable Chamber of adequate size shall be provided on the side of Each Vertical with sufficient no of Cable Tie bars. Each Terminal block shall be provided with the identification markers & feeder designation sticker. Control & Power TB's are separated from each other. Each Cable Chamber shall be provided with panel

illumination CFL/LED lamp with door switch & heater & Thermostats are provided optionally.

- c) **Component Identification:** All the base plates shall be neatly mounted with necessary electrical components to ease the wire routings & wherever necessary PVC Trufs shall be provided. The component Identification stickers shall be provided both on the components & base plates.
- d) Data monitoring system along with complete system viewing for one PC, printer, mouse, 32" LED monitor, and cloud based SCADA. Internet connection with minimum 20 Mbps downlink speed will be provided by railways. At the time of commissioning temporary internet facility shall be provided by contractor.

Recommended makes		
S.no.	Equipment	Recommended makes
1	PCC/DB/MCC/APFC Panel	SAMCON
2	Air Circuit Breakers	Siemens/ ABB/Schneider/L&T
3	Moulded Case Circuit Breakers	Siemens / ABB /Schneider/L&T
4	MCB's, ELMCB and ELCB's	Siemens / ABB /Schneider/L&T
6	Current Transformers	AE/RISHAB/NEWTEK
7	CT Test Link	Elmex type CST / CONNECTWEL
8	Protection relays	Alstom / C & S / PC / Siemens
9	Meters	CONZERVE / SECURE
10	Control switches.	Alstom / Kaycee / L & T.
11	Control Fuses	Siemens / BUSMAN
12	Indicating Lamps, Push Buttons. Printer	TEKNIK/ESSEN.
13	Contactor	Siemens / L & T /Schneider/ABB
14	Terminal block	Elmex type CST / equivalent
15	Industrial Capacitor s Bank Suitable maintain power factor between 0.9 to 0.95	Siemens / L & T /Schneider/ABB
16	Star delta starter for 60HP Pump	Siemens / L & T /Schneider/ABB
17	VFD for 60 HP pump.	Siemens / L & T /Schneider/ABB
18	Indicating Lamps	Tecknic or equivalent
19	Ampere meter + set of CT +ASS	Reshab or equivalent.
20	Auto Manual Selector switch	Tecknic or equivalent
21	Cycle start & cycle Off	Tecnik or equivalent
22	HMI	Siemens /Schneider/ABB/Rockwell Automation/Honeywell International
23	PLC With Suitable IOS and complete with all accessories.	DELTA/Siemens /Schneider/Mitsubishi/Omron
24	SCADA For Automation	Siemens /Schneider/ABB/Rockwell Automation/Honeywell International
25	Rubber insulating mat in front of the switchboard for its entire length	Reputed brand
26	MS & GI Pipe	TATA/Jindal/Apollo
27	32" monitor	SONY/Samsung/LG
28	Computer (PC)	HP/Lenovo/Dell
29	Printer	HP/Canon

NOTE :-

- (1) After award of contract contractor shall be required submit complete list of make and model items to be supplied and installed for approval of Railway. The Make & model other than specified shall be of only reputed brand as approved by Railway. Railway may approve/reject proposed brand other than specified here. Decision of railway shall be final and binding of contractor.
- (2) After award of work before manufacturing and supply of control panel, vendor should submit his complete logic for automation, along with all Drawing.

iv. **GENERAL SPECIFICATION FOR ELECTRICAL INSTALLATIONS:**

a. **General:**

The Contractor staffs, who are working with Electrical works in this contract, should possess valid competency certificate. This section covers the general requirements for electrical work to be installed under this specification.

The Contractor shall supply and install all electric wiring, switchgear etc., necessary for the complete, safe and satisfactory operation of the QWP to meet system requirement. All electrical wiring and cables shall be properly tagged.

All equipment, materials, workmanship and fittings shall comply with the appropriate Indian Standard or Code of Practice or any approved equivalent international standards.

b. **Electrical Supply:**

The electricity supply shall be 415/240 Volts, 50 Hz, 3 phase, 4 wire. All equipment shall be designed to operate with a + 10% voltage tolerance without a loss of rated output. However, the electrical system design shall include the voltage stabilizing system so as to take care of extreme voltage fluctuation. **All equipment shall be connected to ensure that the phases are balanced, to the requirements of the local supply authority.**

c. **WIRING:**

- The current carrying capacity is to be in accordance with IEE Wiring Regulations and is to be limited by the allowable voltage drop.
- All wiring shall be carried out on the loop-in system. For conduit wiring systems, wiring shall be drawn into the conduits after the whole of the conduit installation has been completed. No joints or connectors will be allowed in any such cables, except that connectors may be used in accessible positions within lighting fittings or device outlet boxes.
- All cables shall be colour coded consistently over their entire length. Red, yellow and blue shall be used for phase conductor and black and green for neutral and earth respectively.
- The maximum number of cables that may be accommodated in a given size of conduit, cable tray, trunking is not to exceed the number given in the Indian Standard.
- Where wiring penetrates fire walls, then these shall be sealed using fire retardant pillows packed tightly on both sides of the penetration. Internal fire barriers within trunking shall also be provided. All fire retardant materials used shall be to the approval of the Architect and local authorities.
- Floor penetrations for cable risers shall be made weatherproof progressively during construction to minimize damage due to the weather.
- Where wiring penetrates vapor barriers, adequate air tight seals shall be provided. Wiring shall enter the low temperature area via conduit and the conduit itself shall be sealed internally to provide an airtight barrier within the conduit.
- All wiring associated with equipment necessary for fire and smoke control shall be provided.

d. **CONDUIT:**

- All conduits shall be heavy gauge galvanized/black enameled ERW steel complying with relevant Indian Standard. No conduits shall be less than 25 mm nominal diameter.
- Conduit shall be concealed in concrete as construction proceeds, and so arranged as to drain naturally to outlet boxes. Prior to laying, this Contractor shall check with the Contractor responsible for the building work that conduits of the sizes proposed will not affect the structural integrity of the concrete. Sealing caps shall be placed on all conduits before concrete pouring commences to ensure no water enters the conduit. Expansion couplings shall be fitted at all building expansion joints.
- Surface conduits shall in no circumstances be fixed to floor slabs.
- All conduit systems are to be installed fully in accordance with the requirements of the

IEE Regulations.

- All conduits shall be swabbed through to clean out all dirt, burrs and moisture.
- All sets and bends in conduit runs are to be formed on site with bending machines. Distortion of conduits due to bending is not acceptable.
- Runs between draw-in boxes are not to have more than two right angle bends or their equivalent and the length of such runs shall be limited to 12 m to permit easy drawing-in of cables.
- Flexible conduit shall be used for final connections to equipment subject to vibration.
- The conduit shall be watertight with the provision of separate earth wire enclosed for earth continuity. All flexible steel conduit shall be PVC sheathed.
- The contractor shall make good any damage to the finish of all conduits including threads cut at site, by painting damaged areas with two coats of aluminum primer paint.
- Supply for review prior to installation conduit layout drawings for the entire installation. The approved set shall be kept upto date on site and on completion, three sets of record drawings shall be provided for record purposes.
- All conduit junction boxes are to be malleable iron (surface mounted) or mild steel (concealed) and of standard pattern. Standard pattern boxes are to be used with conduits up to and including 25 mm diameter. Rectangular pattern boxes are to be used for conduits of 25 mm diameter and larger. For the drawing-in of cables, standard pattern through boxes are to be used. All conduit boxes are to be galvanized finish.
- Cable trunking shall be done in accordance to IEE regulations.
- Cable trays shall be of perforated pattern 1.6mm minimum mild steel with returned edges galvanized overall and properly fixed. Trays shall be supported from the soffit of structural slabs and beams by mild steel rods not less than 6mm diameter and under slung mild steel angles, or alternatively, supported on steel angle brackets secured to walls. The former method shall be preferred where practicable. All supports and hangers shall be hot-dipped galvanized with bolts and nuts electroplated.

e. EARTHING:

- All metal work associated with the electrical installation but not forming part of a phase of neutral circuit shall be bonded together and solidly and effectively earthed. Metal conduit, ducts and cable armour shall be earthed at the switch-board at which they originate by means of locknuts, screwed connection or cable gland.
- The electrical resistance of metallic enclosures or framework to earth shall be low enough to permit the passage of current necessary to operate the device protecting the associated circuit.
- The size of all earth continuity and bonding conductors shall be in accordance to RDSO/approved equivalent norms. (RDSO Specification No. RDSO/ PE/ SPEC / 0109/Rev.0)-2008 or latest)
- All earth conductors fixed or run outside the building shall be protected against corrosion and mechanical damage.

f. RADIO INTERFERENCE:

- All equipment and systems shall be properly designed to ensure that there is no interference caused to any transmitters, receivers or other electronic equipment in the near vicinity. Should interference be detected, the Contractor shall provide free of charge devices capable of eliminating such interference.

g. ISOLATING SWITCHES:

- All items of equipment shall be provided with isolating switches adjacent to the item of equipment in an accessible position.
- Isolators shall be capable of being padlocked in either the on, auto or off positions.
- Isolators for motors and equipment which are essential for fire and smoke control shall be labeled as specified elsewhere and in addition a second label with white lettering on a red background reading:
WARNING - ESSENTIAL FOR LIFE SAFETY
- Do not switch off except in absolute emergency shall be provided.

12 HYDRANT PIPING WORK:

- a) The main carriage watering hydrant lines shall be of GI material confirming to IS-1239 class B. Height at which the hydrant has to be laid and other supports shall be as per the above-referred CAMTECH guidelines, subject to fulfillment of the conditions stipulated in Indian Railway schedule of dimensions.
- b) The main header should be GI water pipe line of 200 mm Dia medium class conforming to IS-1239 class-B including all fittings at a height of 2.3 meter from rail level if feasible or as per site condition with supporting frame/structure at a distance of 06 meter each and hydrants at a distance of 02 meter each. The existing support structure of may be utilized for the work subject to condition of MS support is good. The ISMB pole for support will be provided by railway.
- c) The GI hydrant main pipeline proposed at a height of 2.3 m from rail level as per **CAMTECH**. However, this height (2.3 M from rail level) is not fixed and actual height may be fixed as per actual site condition and feasibility. Contractor shall have to execute work with necessary design changes in hydrant pipe including all support and fixing arrangement as per approved design scheme of railway.
- d) The length of the TPU pipe will be 1.9 meter for hydrant pipeline height of 2.3 meter from rail level or as per site condition so that when it hangs does not touch ground and at the same time, it covers all the coach inlets irrespective of location of the coach.
- e) From the main carriage-watering pipe, at every 2.0 meter, hydrants should open vertically downwards with its ball valve's handle at a height of 1.8 meter or as per site condition decided by Railway representative. Ball valve should be fitted such that its operating lever, in closed condition should be parallel to the axis of main carriage watering pipe. The existing hydrant riser pipe may be utilized subject to condition of pipe is good. Hydrant riser pipe will be provided by railway
- f) The pipes should be fixed with bellow expansion joints to compensate for shrinkage & Expansion due to weather conditions.
- g) The valves should be ball cock type with stainless steel body and stainless steel balls with Teflon lining for ease of operation. These shall be at a height of six feet to facilitate operation from the ground. The length of pipe should be such that it does not touches ground at the time of detachment.

h) Major items to be executed for Hydrant pipeline is as under-

- 1 Supply & fixing of G.I Pipe 200 mm & fabrication of pipes. The pipes should be fixed with bellow expansion joints to compensate for shrinkage & Expansion due to weather conditions including all necessary bends, necessary flanged arrangement, bolt nut, packing, Bellow seal Joint etc.
- 2 Supply & fixing of 50 mm Air Release Valve to be installed in hydrant Pipe Line.
- 3 Supply and commissioning of MS 200 mm flange welded with nut bolt
- 4 Making Hole in Hydrant Pipe Line in every two meter S i z e 50 mm and welding of M.S. Coupling. Supply and commissioning of MS socket 50 mm
- 5 Supply and commissioning of galvanized steel Nipple 50 mm, 75mm length, B class both sides threaded
- 6 Supply, installation & commissioning of Hydrant control valve 50 mm
- 7 Supply and commissioning of Nipple with reducer 50 mm to 28mm
- 8 Supply and commissioning of Hose clip of suitable size
- 9 Supply and commissioning of Hanger pipe support for flexible pipe.

- 10 Supply and commissioning of pressure Gauge.
- 11 Supply & fixing of G.I. /M.S. Plate (300 x 150 x 8) mm over Support pole along with the clamp 2 Nos and nuts duly making holes on both the end with arrangement to hold and keep end of flexible hose pipe clean and safe.
- 12 Supply and fitting of SS 304 PTFE seat 50 mm Dia Ball valve KOR valve India(P) Ltd, or TBS Engineers (P) Ltd or similar make with IS 9001-2000 certificate or ISI standard Ball valve SS 304.
- 13 Painting of main hydrant pipeline including all fittings including rail post and fixtures with two coats of Anti corrosive primer followed by two coats of synthetic enamel paint of colour as per IS 2379-1990 or latest.

13 DRAWINGS:

- a) After award of work contractor will submit detailed layout drawing, piping diagram, control circuit diagram, complete working principle, wiring diagram and any other drawing/scheme etc. relevant to the execution of this work to meet or to better basic system requirement given at para 2.1 of SCC within 30 days from start of work. Drawing, schemes, working principles as approved by railways shall be used for execution of work however, any such approval will not absolve contractor from his responsibility for satisfactory execution of work to meet basic system requirements.
- b) Contractor will also submit a detailed stage wise testing, commissioning and prove out scheme for quick watering system being installed at PRYJ fulfilling basic system requirement within 30 days from start of work. Testing and prove out scheme as accepted by railways shall be final and binding on contractor.

14 INSPECTION:

(i) For Supply of Material: -

A. Items to be inspected by M/s RITES Ltd.

Under para 11 Tentative list of materials/Items of quick watering system Items to be inspected by M/s RITES Ltd has been given. These items shall get inspected by M/s RITES Ltd. before supply material on GC/TC of OEM/Contractor as applicable. The cost of RITES inspection will be borne by Contractor.

B. Items to be inspected by consignee (nominated SSE/C&W).

Under para 11 tentative list of materials/Items of quick watering system Items to be inspected by consignee has been given.

Items majorly supply in nature (i.e. Other than fabrication installation at site) shall be get inspected by consignee before supply material on GC/TC of OEM/contractor as applicable.

Items majorly involving fabrication, installation at site in nature shall be inspected under stage inspection as below.

(ii) Stage wise work execution and final commissioning & prove out inspection shall be done under.

Delivery inspection -Material ,machine/equipment in the railway premise shall be delivered in good condition at nominated place in presence of the nominated representative of Sr.DME (Coaching)PRYJ along with inspection certificate and original test and warranty certificate from OEM.

The contractor shall provide General/Test Certificate of OEM for all the main equipment.

Stage wise work execution and final commissioning & prove out inspection shall be done as under:

15 GUARANTY , WARRANTY AND MAINTENANCE DURING WARRANTY PERIOD:

- i Complete quick watering system including all equipment's, accessories, software, hardware etc. and all associated items of this work shall bear **a comprehensive warranty of 36 months** from date of successful commissioning of quick watering system of PRYJ against any material, manufacturing, installation and commissioning defects.
- ii Failure of electrical equipment, VVFD, PLC, HMI & SCADA system etc. on account of voltage fluctuation will also be covered under warranty.
- iii Any warranty defect shall be attended/replaced/rectified by contractor. Non-compliance shall be dealt as per penalty clause.
- iv Railway reserves its rights to claim warranty from OEM even after lapse of 36 months contractor's warranty wherever OEM specified warranty is more than this period. **After warranty the contractor MUST submit and handover all warranty certificate for equipment, materials and accessories supplied by him applicable as per OEM specified warranty.**
- v The persons deputed should be able to work in a proper way as per maintenance manuals of respective equipment and as per good engineering practices.
- vi Attending complaints of system which includes routine as well as preventive & break down maintenance.
- vii All tools and tackles, material ,manpower and other resources required for executing the maintenance during warranty period shall be in the scope of the contractor and no extra charges shall be paid for this.
- viii Required spares for the sub-system which may be required during operation and maintenance of all the system under warranty period should be supplied by the contractor.
- ix Maintenance register should be provided and should be kept in updated position including records/entries of each failure taken place / attended.
- x All consumables shall be borne by the contractor only at his/her own cost. For regular working/operation of all equipment.
- xi Electricity will be provided by Railways at free of cost for operation.
- xii The warranty period shall be extended for the period of breakdown of quick watering system under warranty.

16 ADDITIONAL DOCUMENT TO BE SUBMITTED:

Vendor shall also handover following additional documents -

- a) Maintenance manual, operation manuals, spare parts catalogue of different systems equipment and devices.
- b) Electrical circuit diagram of different control system and schematic of power system.
- c) Soft copy of all logic, algorithm, programme and software of PLC system, HMI system, VFD system and SCADA system in an external storage device as backup.
- d) OEM warranty certificate of Individual subsystem and equipment's as applicable.