

APPENDIX-L1

1.0. CONSTRUCTION, INSTALLATION, PRE-COMMISSIONING, COMMISSIONING AND START UP.

The construction progress will be measured in accordance with the standard Work Breakdown Structure (WBS), by quantitative work volume which will be based on the Bill of Quantities (BOQ).

The following functional work breakdown will be applied for the progress measurement of the construction:

Sr. No.	Discipline	Weighted %	Cumulative Weighted %
1.1	Construction Works	80.0%	80.0%
1.1.1	Civil Works	25.0%	20.0%
1.1.2	Mechanical Works	50.0%	60.0%
1.1.3	Electrical Works	15.0%	72.0%
1.1.4	Instrumentation Works	10.0%	80.0%
1.2	Commissioning & Start Up	20.0%	100.0%

1.1 Construction Works

1.1.1. CIVIL WORKS

The breakdown of the civil works into various sub-categories is given below:

Sr. No.	Discipline	Weighted %
1.1.1.1	Pipe Sleepers / Supports	15.0%
1.1.1.2	Equipment Foundations	40.0%
1.1.1.3	MCC Room/ Transformer Yard	15.0%
1.1.1.4	Sheds	5.0%
1.1.1.5	Culverts	5.0%
1.1.1.6	Underground Services	10.0%
1.1.1.7	Leveling / Grading Works, Concrete Paving, Gravel Works	10.0%

1.1.1.1. Pipe Sleepers / Supports

Stage	Weighted %	Cumulative Weighted %
Layout and Marking	4.0%	4.0%
Excavation for Foundation	15.0%	19.0%
Blinding Concrete	5.0%	24.0%
Formwork for Foundations	20.0%	44.0%
Rebar placing and binding	20.0%	64.0%
Concreting and Curing etc.	30.0%	94.0%
Back Filling	4.0%	98.0%
Punch list	2.0%	100.0%

1.1.1.2. Equipment Foundations

Stage	Weighted %	Cumulative Weighted %
Layout and Marking	5.0%	5.0%
Excavation for Foundation	10.0%	15.0%
Formwork for foundations	10.0%	25.0%
Blinding Concrete	5.0%	30.0%
Rebar placing and binding for Foundations	15.0%	45.0%
Concreting and curing etc.	48.0%	93.0%
Backfilling	5.0%	98.0%
Punch List	2.0%	100.0%

1.1.1.3. MCC Room / Transformer Yard

Stage	Weighted %	Cumulative Weighted %
Excavation, compaction, blinding, termite proofing and concrete of foundation	5.0%	5.0%
Concreting, cable channel, earth filling, stone soiling and termite proofing works upto plinth level.	15.0%	20.0%
All concrete and masonry works upto roof level including concrete of roof beam & slab	25.0%	45.0%
Plaster works including all conduiting piping and door frame fixing.	15.0%	60.0%
Roof screeding, water proofing, parapet wall and fixing of door & windows	10.0%	70.0%

Electrical, fixture, floor finishing and Painting	15.0%	85.0%
Testing / commissioning of electrical works and hardware	10.0%	95.0%
Punch List	5.0%	100.0%

1.1.1.4. Sheds

Stage	Weighted %	Cumulative Weighted %
Excavation, compaction, blinding, termite proofing and concrete of foundation	5.0%	5.0%
Concreting, cable channel, earth filling, stone soiling and termite proofing works upto plinth level.	15.0%	20.0%
Erection of Steel Structure & Welding etc.	25.0%	45.0%
Installation of Roofing and wall cladding	25.0%	70.0%
Electrical, fixture, floor finishing and Painting	15.0%	85.0%
Testing / commissioning of electrical works and hardware	10.0%	95.0%
Punch List	5.0%	100.0%

1.1.1.5. Culverts

Stage	Weighted %	Cumulative Weighted %
Layout and Marking	5.0%	5.0%
Excavation for Foundation	10.0%	15.0%
Formwork for foundations	10.0%	25.0%
Blinding Concrete	5.0%	30.0%
Rebar placing and binding for Foundations	15.0%	45.0%
Concreting and curing etc.	48.0%	93.0%
Backfilling	5.0%	98.0%
Punch List	2.0%	100.0%

1.1.1.6. Underground Services

Stage	Weighted %	Cumulative Weighted %
Layout and Marking	5.0%	5.0%
Excavation for Trenches / Crossings	23.0%	28.0%

Filling of fine sand	15.0%	48.0%
Blinding Concrete/Brick Laying	10.0%	58.0%
Rebar placing and binding	10.0%	68.0%
Concreting & Curing / Crossings	20.0%	88.0%
Backfilling	10.0%	98.0%
Punch List	2.0%	100.0%

1.1.1.7. Leveling / Grading Works, Concrete Paving, Gravel Works

a. Leveling / Grading Works (0.5%)

Stage	Weighted %	Cumulative Weighted %
Layout and Marking	10.0%	10.0%
Cutting	40.0%	50.0%
Filling and Compaction	48.0%	98.0%
Punch List	2.0%	100.0%

b. Concrete Paving (3.5%)

Stage	Weighted %	Cumulative Weighted %
Layout and Marking	10.0%	10.0%
Excavation	20.0%	30.0%
Blinding Concrete	10.0%	40.0%
Formwork	10.0%	50.0%
Rebar	10.0%	60.0%
Concreting / Curing etc.	28.0%	88.0%
Back Filling	10.0%	98.0%
Punch List	2.0%	100.0%

c. Gravel Works (1.0%)

Stage	Weighted %	Cumulative Weighted %
Layout and Marking	10.0%	10.0%
Surface Compaction	20.0%	30.0%
Base coarse, laying and compaction	68.0%	98.0%

Punch List	2.0%	100.0%
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1.1.2. **MECHANICAL WORKS**

The breakdown of the mechanical works into various sub-categories is given below:

Sr. No.	Stage	Weighted %
1.1.2.1	Centrifugal Compressor Packages Installation	32.0%
1.1.2.2	Instrument Air & Nitrogen generation Package Installation	6.0%
1.1.2.3	Cooling Tower Packages Installation	6.0%
1.1.2.4	Hydrate Injection Skids Installation	6.0%
1.1.2.5	Slug Catcher Installation	3.0%
1.1.2.6	LP Condensate Separators Installation	3.0%
1.1.2.7	Blow-case Vessel & Pumps Installation	3.0%
1.1.2.8	Piping Shop Fabrication	10.0%
1.1.2.9	Piping Field Fabrication Installation	25.0%
1.1.2.10	Misc. Steel Structure Fabrication & Installation	6.0%

1.1.2.1 Centrifugal Compressor Packages Installation

Stage	Weighted %	Cumulative Weighted %
Marking/level checking of foundation	5.0%	5.00%
Grouting of shims on foundation	10.0%	15.0%
Rigging study	10.0%	25.0%
Marking of Equipment	2.0%	27.0%
Placement and fixing on foundation	50.0%	77.0%
Initial alignment	5.0%	82.0%
Stress free connection checking	3.0%	85.0%
Final alignment	3.0%	88.0%
Protocol witness	3.0%	91.0%
Rotation check	2.0%	93.0%

Hot bolting	2.0%	95.0%
Punch List	5.0%	100.0%

1.1.2.2 Instrument Air & Nitrogen Generation Installation

Stage	Weighted %	Cumulative Weighted %
Marking/level checking of foundation	5.0%	5.0%
Grouting of shims on foundation	11.0%	16.0%
Rigging study	5.0%	21.0%
Marking of Equipment	5.0%	26.0%
Placement on foundation	45.0%	71.0%
Alignment on X, Y and Z axis	10.0%	81.0%
Fixing	5.0%	86.0%
Protocol witness	3.0%	89.0%
Hot bolting	5.0%	94.0%
Installation of Filters, Cartridge / Strainers Elements etc.	2.0%	96.0%
Punch List	4.0%	100.0%

1.1.2.3 Cooling Tower Packages Installation

Stage	Weighted %	Cumulative Weighted %
After erection/installation at foundation	50.0%	50.0%
Punch list clearance	50.0%	100.0%

1.1.2.4 Hydrate Injection Skids Installation

Stage	Weighted %	Cumulative Weighted %
After erection/installation at foundation	50.0%	50.0%
Punch list clearance	50.0%	100.0%

1.1.2.5 Slug Catcher Installation

Stage	Weighted %	Cumulative Weighted %
After erection/installation at foundation	50.0%	50.0%
Punch list clearance	50.0%	100.0%

1.1.2.6 LP Condensate Separator

Stage	Weighted %	Cumulative Weighted %
After erection/installation at foundation	50.0%	50.0%
Punch list clearance	50.0%	100.0%

1.1.2.7 Blow-Case Vessel & Pumps Installation

Stage	Weighted %	Cumulative Weighted %
After erection/installation at foundation	50.0%	50.0%
Punch list clearance	50.0%	100.0%

1.1.2.8 Piping Shop Fabrication

Stage	Weighted %	Cumulative Weighted %
Marking and cutting of pipes	14.0%	14.0%
Fit up	10.0%	24.0%
Inspection	3.0%	27.0%
Welding	15.0%	42.0%
Inspection (Radiography)	5.0%	47.0%
Inspection (Visual)	1.0%	48.0%
Marking and cutting of support material	3.0%	51.0%
Fit up	10.0%	61.0%
Inspection	3.0%	64.0%

Welding	15.0%	79.0%
Inspection	2.0%	81.0%
Inspection (Visual)	1.0%	82.0%
Sand Blasting and Painting	5.0%	87.0%
Stacking of spools in the yard	5.0%	92.0%
Leak Test	2.0%	94.0%
Flushing / Air Blowing	2.0%	96.0%
Punch list	4.0%	100.0%

1.1.2.9 Piping Field Fabrication Installation

Stage	Weighted %	Cumulative Weighted %
Fit up for support installation	13.0%	13.0%
Welding	15.0%	28.0%
Inspection	2.0%	30.0%
Inspection (Visual)	1.0%	31.0%
Shifting of prefabricated spools at site	3.0%	34.0%
Fit up of Piping spools at site	10.0%	44.0%
Inspection	2.0%	46.0%
Welding	15.0%	61.0%
Inspection (Radiography)	5.0%	66.0%
Inspection (Visual)	1.0%	67.0%
Pressure test	12.0%	79.0%
Sand Blasting and Painting	12.0%	91.0%
Hot bolting	3.0%	94.0%
Leak Test	2.0%	96.0%
Flushing / Air Blowing	2.0%	98.0%
Punch list	2.0%	100.0%

1.1.2.10. Structure Fabrication Installation

Stage	Weighted %	Cumulative Weighted %
Marking and cutting of material	10.0%	10.00%
Cutting of main members	10.0%	20.0%
Cutting of base plates	10.0%	30.0%
Drilling	13.0%	43.0%
Cutting of Secondary members	15.0%	58.0%
Drilling of secondary members	10.0%	68.0%
Welding	20.0%	88.0%
Sand Blasting and Painting	10.0%	98.0%
Punch List	2.0%	100.0%

1.1.3. ELECTRICAL WORKS

The breakdown of the electrical works into various sub-categories is given below:

Sr. No.	Stage	Weighted %
1.1.3.1	Cable Laying (MCC-CCR / Field Package)	15.0%
1.1.3.2	Panel Installation / Modification Works	15.0%
1.1.3.3	Step down Transformer	10.0%
1.1.3.4	Earthing Work & Lightning Protection	15.0%
1.1.3.5	Plant Lighting Work	10.0%
1.1.3.6	Electrical Heat Tracing	5.0%
1.1.3.7	Electrical Equipment Installation	10.0%
1.1.3.8	Cathodic Protection	10.0%
1.1.3.9	Cable Termination	10.0%

1.1.3.1. Cable Laying

Stage	Weighted %	Cumulative Weighted %
Laying of power cable and tagging at both ends	17.0%	17.0%
Laying of control cable and tagging at both ends	17.0%	34.0%

Cable dressing	5.0%	39.0%
Excavation & Back filling of cable trench(caution tape, sand and bricks to be required)	5.0%	44.0%
Installation of Cable Trays	20%	64.0%
Termination of power cables	17.0%	81.0%
Termination of control cables	17.0%	98.0%
Punch List	2.0%	100.0%

1.1.3.2. Panel Installation (Lighting Distribution Boards) / Modification Works (MCC ROOM / UPS)

Stage	Weighted %	Cumulative Weighted %
Case opening and inspection of Package MCC Panels, LDBs for any damage due to transportation	5.0%	5.0%
Package MCC Panel & LDB Placement at field /MCC Room, leveling and grouting etc.	40.0%	45.0%
Cable tray (ladder type) installation/fixing in the trench for Power & control cables	10.0%	55.0%
Check & verification of existing spare breakers to be used in MDB, UPS DB & MCC, & Termination of power cables.	35.0%	90.0%
Earthing of panels	8.0%	98.0%
Punch List	2.0%	100.0%

1.1.3.3. Step-down Transformer Installation

Stage	Weighted %	Cumulative Weighted %
Inspection for any damage due to transportation	5.0%	5.0%
Installation/Placement of equipment	40.0%	45.0%
Grouting/Leveling	10.0%	55.0%

Laying, termination and tagging of incoming and outgoing cables/BTD	35.0%	90.0%
Earthing of transformer	8.0%	98.0%
Punch List	2.0%	100.0%

1.1.3.4. Earthing Works & Lightning Protection

Stage	Weighted %	Cumulative Weighted %
Preparation of earthing pits	25.0%	25.0%
Insertion of earthing rods into pits and interconnection of earthing pits	20.0%	45.0%
Laying of earthing conductor	15.0%	60.0%
Termination of earthing conductor to individual equipment	15.0%	75.0%
Installation of lightning arrestors	15.0%	90.0%
Termination of earthing conductor to each arrestor	8.0%	98.0%
Punch List	2.0%	100.0%

1.1.3.5. Plant Lighting Works

Stage	Weighted %	Cumulative Weighted %
Checking of pole foundation	5.0%	5.0%
Pole installation	20.0%	25.0%
Installation of lighting fixture and JBs on each pole	28.0%	53.0%
Fixing of cable Glands	20.0%	73.0%
Cable termination	20.0%	93.0%
Earthing of each pole	5.0%	98.0%
Punch List	2.0%	100.0%

1.1.3.6. Electrical Heat Tracing

Stage	Weighted %	Cumulative Weighted %
Case opening and inspection of Heat Tracing material for any damage due to transportation	5.0%	5.0%
Installation of complete Heat Tracing Material including of Junction boxes	35.0%	45.0%
Fixing of cable Glands	25.0%	65.0%
Cable termination	25.0%	90.0%
Earthing of Heat Tracing JB	8.0%	98.0%
Punch List	2.0%	100.0%

1.1.3.7. Electrical Equipment Installation

Stage	Weighted %	Cumulative Weighted %
Case opening and inspection for any damage due to transportation	5.0%	5.0%
Installation/Placement of equipment	10.0%	15.0%
Grouting/Leveling	5.0%	20.0%
Laying and tagging of incoming and out-going cables / tubing	25.0%	45.0%
Fixing of cable Glands / tube fittings	25.0%	70.0%
Cable termination	28.0%	98.0%
Punch List	2.0%	100.0%

1.1.3.8. Cathodic Protection

Stage	Weighted %	Cumulative Weighted %
Case opening and inspection of Transformer Rectifier for any damage due to transportation	5.0%	5.0%
Installation of CP Transformer Rectifier with complete accessories for piping.	35.0%	40.0%
Installation of CP Test Station	30.0%	70.0%

Cathodic Protection Cable Termination	28.0%	98.0%
Punch List	2.0%	100.0%

1.1.3.9. Cable Termination

Stage	Weighted %	Cumulative Weighted %
Installation of Glands	25.0%	25.0%
Fixing of Thimbles	25.0%	50.0%
Cable fixing (with proper Nut Bolts)	25.0%	75.0%
Cable Dressing	23.0%	98.0%
Punch List	2.0%	100.0%

1.1.4. INSTRUMENTATION WORKS

The breakdown of the Instrument works into various sub-categories is given below:

Sr. No.	Stage	Weighted %
1.1.4.1	Cable Laying (Rack / Area)	15.0%
1.1.4.2	Control Room Installation Works	15.0%
1.1.4.3	Mounting and Installation of Instruments & F&G Detectors	40.0%
1.1.4.4	Cable termination from individual instrument to the respective JBs/Control Panels	10.0%
1.1.4.5	Cable termination from JBs/Control Panels to Control Room	10.0%
1.1.4.6	Tube Work	10.0%

1.1.4.1. Cable Laying (Rack / Area)

Stage	Weighted %	Cumulative Weighted %
Dismantling / Disconnection of Instrument cables of relocated instruments	10.0%	10.0%
Laying of Instruments / Control cables and tagging at both ends	30.0%	40.0%
Cable dressing	10.0%	50.0%

Installation of Cable Trays	20.0%	70.0%
Excavation and Back filling of cable Trench (caution tape, sand and bricks to be required)	25.0%	95.0%
Punch List	5.0%	100.0%

1.1.4.2. Control Room Installation Works

Stage	Weighted %	Cumulative Weighted %
Case opening and inspection for any damage due to transportation	20.0%	20.0%
Console / Panel placements, leveling and grouting	25.0%	45.0%
Installation of communication switches / equipments etc in Control room	25.0%	70.0%
Termination of instruments and communication cables in control room	20.0%	90.0%
Earthing of panels/consoles	5.0%	95.0%
Punch List	5.0%	100.0%

1.1.4.3. Mounting and Installation of Instruments and F&G Detectors

Stage	Weighted %	Cumulative Weighted %
Installation of Supplies	10.0%	10.0%
Dismantling, Relocation and Re-installation of existing Instruments	15.0%	25.0%
Installation of Instruments and F&G Detectors	30.0%	55.0%
Instrument Earthing	10.0%	65.0%
Fabrication and Installation of Mounting Supports for field	30.0%	95.0%
Punch List	5.0%	100.0%

1.1.4.4. Cable Termination from Individual Instrument to the Respective JBS/Control Panels

Stage	Weighted %	Cumulative Weighted %
Installation of Junction Boxes	15.0%	15.0%
Installation of Glands	25.0%	40.0%
Fixing of Thimbles	10.0%	50.0%
Cable fixing (with proper Nut Bolts)	20.0%	70.0%
JB earthing	10%	80%
Cable Dressing	15.0%	95.0%
Punch List	5.0%	100.0%

1.1.4.5. Cable Termination from JBS/Control Panels to CCR

Stage	Weighted %	Cumulative Weighted %
Installation of Glands	30.0%	30.0%
Fixing of Thimbles	15.0%	45.0%
Cable fixing (with proper Nut Bolts)	30.0%	75.0%
Cable Dressing	20.0%	95.0%
Punch List	5.0%	100.0%

1.1.4.6. Tube Works

Stage	Weighted %	Cumulative Weighted %
Installation of Supports	20.0%	20.0%
Installation of Tube Tray	20.0%	40.0%
Cutting and Bending of Tubes	20.0%	60.0%
Installation & Ferrule Fittings	30.0%	90.0%
Tube Alignment	5.0%	95.0%
Punch List	5.0%	100.0%