

METHOD STATEMENT FOR INSTALLATION OF LV CABLES AND WIRES

RED LINE NORTH ELEVATED AND AT GRADE

Revision and Issue Records

Review History

Document No.	Revision	Title
M002-RLR-ELE-MES-00011	1	MS for Installation of LV Cables and Wires

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Document Review and Approval

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1 Definitions and Abbreviations:

Table 1: Definitions and Abbreviations

Abbreviation	Definition
BS	British Standard
PPE	Personal Protective Equipment
HS	Health, and Safety
ITP	Inspection and Test Plan
MSDS	Material Safety Data Sheet
PMC	Project Management Consultant
QA/QC	Quality Assurance / Quality Control
QCS	Qatar Construction Specification
SONO	Statement of No Objection
PPE	Personal Protective Equipment
RLN-EAG	Red Line North Elevated and At Grade
RLR JV	Rizzani de Eccher, Lotte and Redco - Joint Venture
MS	Method Statement

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Abbreviation	Definition
SWA	Steel Wire Armoured
LV	Low Voltage
LSOH	Low smoke zero Halogen
XLPE	Cross-linked polyethylene
VFD	Variable Frequency Drive
ECC	Earthing Continuity Connection
DMM	Digital Multimeter
QCS-2014	Qatar Construction Specification

2 Purpose:

The purpose of the method statement is to describe the procedure for material delivery inspection, installation and inspection of LV Cables and Wires at Stations. The Intent of this report is to explain, the methods to be adopted to ensure works conducted on site are in compliance with approved design, material approvals and as per project requirement.

3 Scope of Method Statement:

The scope of application of this method statement is the Installation and inspection of LV Cables and wires for Red Line North Elevated & At Grade. (Chainage: 25+285 to Chainage: 31+950, Section of the RLN-EAG Project.

4 Work Execution:

4.1 General Supplied Items:

4.1.1 Personnel:

Ref.	Trade & Despines	Responsibility
1	MEP Construction Manager	<ul style="list-style-type: none"> Delivering the overall works in a safe and timely manner, ensuring conformance with the approved design. Leading the team of engineers and surveyors, guiding them in the delivery of the works. Verifying that work done is in accordance with requirements of contract. Ensuring the quality standards set for the work are achieved and the work team adhere to the QA/QC and HS requirements of the contract.

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2	Systems Assurance Engineer	<ul style="list-style-type: none"> Establish the system assurance process. Manage the RAMS team and EMC team in delivering the system assurance submissions. <p>Liaise with the System Assurance Manager for all safety and RAM related activities respectively.</p>
3	Project/Site Engineer	<ul style="list-style-type: none"> Ensuring that the works are being carried out in accordance with contract requirements and this Method Statement. Management onsite to ensure that the team carries out the works in time with the delivery schedule. Implementation of and adherence of the team to the QA/QC and H&S policies and procedure.
3	QA/QC Manager	<ul style="list-style-type: none"> The preparation of the company's QA manual control and supervision of all amendments and revisions Monitor all quality related activities on the project Perform all internal and external audits on behalf of the company's management Preparation, monitoring, training of project staff on method statements, and control of material on site.
4	QA/QC Engineer	<ul style="list-style-type: none"> The QA/QC Engineer is the overall responsible for the implementations of this procedure and will carry out the material inspection to ensure that materials received on site are approved materials. He will be conducting surveillance and inspection duties at various stages of the project delivery to ensure compliance to contract requirements and to QA / QC requirements. He will monitor the installation works according to the approved drawing & method statement. He will coordinate with the Supervisory Consultant to carry out inspection/testing of the completed works. The QA/QC Engineer is responsible for the detail application of this procedure for the inspection and testing, to coordinate with the Construction Manager and Site Engineer for the inspection of on-going work.
5	Surveyor	<ul style="list-style-type: none"> Setting out all planned works. Monitoring the works being carried out to ensure they are at the correct levels and measurements. Maintaining documents relevant to alignment and height control.
6	Document Controller	<ul style="list-style-type: none"> Documenting, distributing and maintaining data in the prescribed format. Making the necessary data available as requested by the team or the client.
7	HS Inspector	<ul style="list-style-type: none"> Identify HS requirements, non-compliance or otherwise by conducting both formal and informal

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		<p>audits and communicate said to relevant site management</p> <ul style="list-style-type: none"> • Advise site management on HS substandard acts and HS substandard conditions on a continuous basis and record said. • Coordinate and record action by site management as identified and advised. • Verify actions taken by site management , record and report accordingly • Conduct relevant HS administrative functions and additional tasks as directed by HS Management.
8	Supervision Engineer	<ul style="list-style-type: none"> • Checking the compliance of works to the design. • Carrying out comprehensive supervision of all construction works. • Confirming that the work executed complies with the approved design and be responsible for checking the construction works.

All of the above will individually be responsible for a safe and healthy operational environment consideration of all the workers in their team related to the execution of their duties and any other personnel. Furthermore one group of workers is planned for execution of installation of LV Cables & Wires. This group will perform all activities. The group will have following labour profile.

Labours/Workers

No.	Description	No.	Description
1	Electrical Supervisor	3	Electrician
2	Electrical Forman	4	Labours

4.1.2 Equipment and tools :

The typical construction equipment requirements is as listed below, and will be used for Installation activities at site.

Plants

No.	Type	Use
1	Man Lift	For Installation of LV Cable / Wire
1	Scaffolding	For the LV Cable Installation
2	Lights	For use during night operations
3	Generator	For Power Generation for Lights

Small Tools and Equipment

- PPE for all staff and labour
- Measuring tapes and setting out markers
- Electrician Tool Box with all tools
- Markers / Whitener and Line Marker
- Spirit Level
- Nylon Rope
- Lugs Punch
- Cable Drum Jack & Stands
- Cable Rollers
- Cable Socks (Specific Cable Size)
- Steel Pulling Wire
- Cable Lugs and Heat Shrink Sleeve
- Identification Tags

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- Insulation Tape
- Flat file
- Spanners Set
- Heat Gun
- Cable/Wire Pulling lubricant
- Multimeter and Megger Meter
- Ladder (If Required)
- Cable Winch Machine

Note: All the powered tools shall be suitable for use of 220V - 240V power Supply.

The above tools and equipment shall be checked for operational suitability before each shift of commencement of works including, but not limited, to safety and operational compliance. The same shall be executed for all small tools and miscellaneous items.

4.1.3 Material

The following Points shall be observed while installing the LV Power Cables.

1. Material shall be as per Project specification and must be approved by the Engineer.
2. Installation and connection of Sub Mains (LV) Power Cables from main switchboard to the Distribution board, isolating switches and other plant shall be as detailed on the drawings and in the schedules. But below information shall be followed as per project specifications or otherwise advised by the Engineer.
3. Fire Rated Cables should comply BS 8519 (The fire Survival Times are allocated categories
 - A. Category 2 - 60 minute fire survival time
 - B. Category 3 - 120 minute fire survival time
4. LSOH cables and wired Rated 600/1000 V Single Core shall comply BS7655. Cable used as earth conductor is to have green or green/yellow striped colour.
5. For all LV Power Cables, it must be ensured that all cables comply with KAHARMAA Rules or otherwise advised by the Engineer.
6. For Emergency power supply LV Cables and wirings shall be according to Qatar Civil Defence requirement's or otherwise advised by the Engineer.

Single/Multi Conductor

- A. Description: Conductor insulated wire, All cables will be LSOH type, except on areas Remarkd on drawings in which cable will be fir resistant rated to BS 6387.
- B. Conductor Stranding
 1. Feeders and branch Circuits: Stranded
 2. Control Circuits: Stranded.
- C. Insulation Voltage Rating:600v
- D. Insulation:
 1. Low Smoke Zero Halogen: LSOH

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4.1.4 Handling and storing of Material

- i. On receipt of LV Cables and Wires, the materials shall be handled & stored in line with the following procedure:
- ii. Delivered Material and its parts shall be completely identified in accordance with approved material and approved drawings prepared for this work.
- iii. Manufacture's test report shall be checked and Continuity Test shall be performed every delivery of Cables.
- iv. Store the identical material in accordance with the manufacturer's instructions, above ground, properly protected from the weather and construction activities.
- v. The Cable Drums storage area shall be kept in proper level, so that the LV Cables may not get damaged.
- vi. Any discrepancies, damage (Insulation sheet damage) found to the material will be notified any reported to QA/QC Engineer and Project Manager for further action.
- vii. Material found not suitable for site use should be removed from site immediately.
- viii. While unloading, shifting and storage, it should be ensured that there are no damages.
- ix. Leave sufficient space between individual cable drums and must be placed in upright position, (Fig 1)
- x. Wiring Rolls must be stocked in shelves and the storage shall be cool dry type. (Fig - 2 & Fig - 3)



Figure -1 (Sample Picture) Cable Drum Storage



Figure -2 (Sample Picture) Cable Drum Storage

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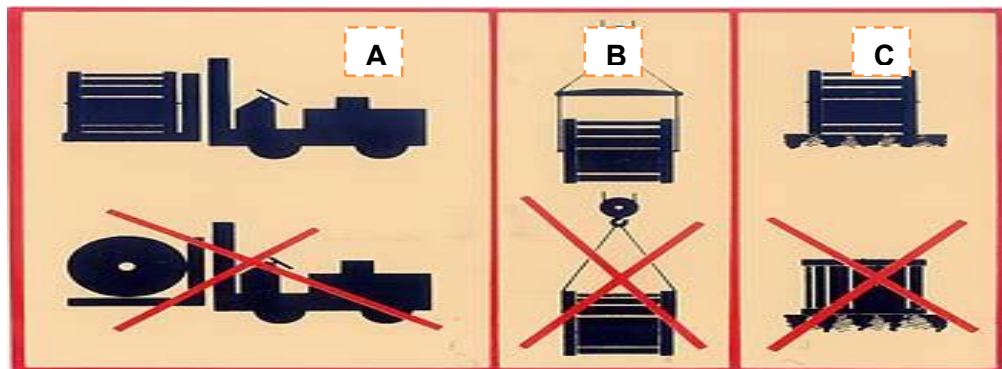
Figure -3 (Sample Picture) Wire & Cable Drum Storage

4.1.5 Handling and storing of Material

- i. Cable are generally rolled on Wooden Drum and shipped via trucks.
- ii. Cable Drums are to be checked on unloading. Possible damages must be reported on the delivery note.

4.1.6 When unloading and Transporting with a Crane or forklift truck

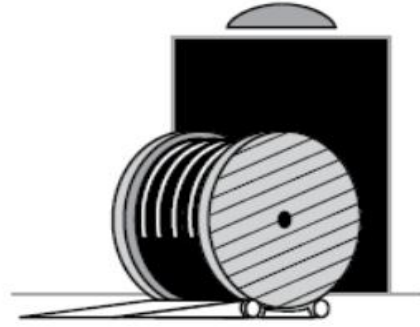
- i. When placing the Cable Drum on the forks, make sure the forks are positioned sufficiently widely apart. Place the Cable Drum Longitudinally on the forks for unloading and transporting as indicated in the (Fig – 4 - A)
- ii. When unloading and transporting the Cable Drum use lifting frame as shown In the (Fig – 4 - B)
- iii. When Storing the Cable Drums make sure that it rests in upright position and it rolling in stopped by the use of wedge as shown in (Fig – 4 - C)



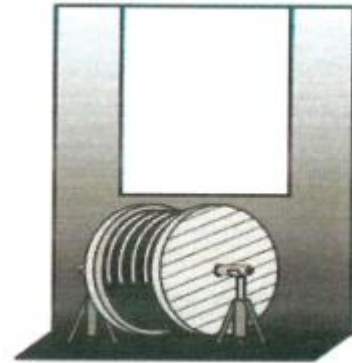
(Figure - 4) (Sample Picture) Correct Methods of Off Loading Cable Drums

4.1.7 Position the Cable for Unreeling

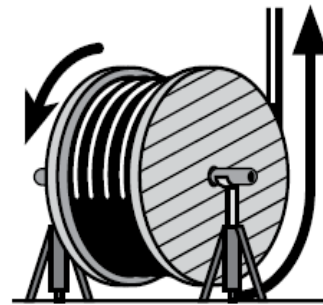
1. Place the cable reel in a convenient location near the elevator. Reel rollers are the preferred means of supporting the reel.



2. Another method is to run a strong rod or pipe through the hole in the center of the reel. Support the pipe ends so that the reel is off the floor enough to rotate freely.



3. Pay the cable off the bottom of the reel.



4. **NEVER** pay cable off the side of a reel as it causes the cable to twist.

NO



Note:

Material shifting on site shall follow the manufacturer's recommendation.

4.2 Site Execution

4.2.1 Program

Installation of Conduits is expected to be performed starting April-2017. Detail schedule of Installation activity will be provided in the weekly update of the 3-weeks look ahead construction schedule.

4.2.2 Pre-Requisites

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To make sure that the entire installation is in conformance and in accordance with design intent of the project for the LV power Cable and wires in addition to the specification and as per approved shop drawing and comply with Local and international Standards.

Adhere to the drawings as closely as possible. The right is reserved to vary the cable size (main or ECC – Earthling Continuity Conductor) according to the rules & Project specifications if any conflict arises in drawings and later, the resizing (if any) shall be mentioned in as built. Any change in cable route as per site condition then the same rule shall be followed.

Before beginning installation in any area, examine all parts of the containment work onto which applicable work is to be placed. Should any condition be found which will prevent the proper execution of the work, installation shall not proceed in that area until such conditions are correct.

4.2.3 Site Access

- i. Clearly designated walkways must be established to allow persons to access the site safely
- ii. Walkways must be maintained free from obstruction and any debris.
- iii. Adequate illumination must be provided for access routes and walkways.
- iv. Signs must be displayed to indicate the routes to be taken by persons, changes in routes must be clearly communicated.
- v. All safety measures shall be taken care as per the instruction of HS Department.

4.2.4 Pre Installation

Before the commencement of Installation the following are required to be carried out.

- i. No one shall be allowed to interfere installation work on going, or work in the immediate vicinity of installation without a valid permit to work signed by the QA/QC Engineer. This applies to both temporary and permanent electrical installations and equipment. It is to be done to avoid any damage to the equipment and injury to any workers.
- ii. Before the installation of cables containment of both Critical and Normal power supply is installed and inspected.
- iii. Prior to start installation, it shall be ensured that latest approved shop drawings /MEP Services coordination drawings related to the installation area are referred and the required materials are available at site as per approved material (Cables and wires).
- iv. Ensure that the factory test reports for continuity of the cable and site continuity test is approved and reviewed to ensure the fault free installation.
- v. Check that ladder/tray are free from any sharp edges and have sufficient space for installation the cable.
- vi. 20 % spare capacity shall be maintained once all cables have been installed or trays.
- vii. Double banking of cables shall not be permitted.
- viii. Trays shall not be smaller than the minimum size stated on the drawings or specified later and shall be so sized; if not specified, then it shall be ensured that calculated size is large enough for the requirements and provide 20% spare capacity for future use.
- ix. For spaces between the cables while installing, the details mentioned in the approved shop drawing shall be followed
- x. Spaces between adjacent cables, for information and Reference only please see KAHRAMAA Table 2A and Table 08 below.

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Table No.2A

Number of Cables that May Be Installed on Cable Trays

1. **Single core insulated and sheathed cables** and single core insulated non magnetic armoured cables:
 1. Where single cores cables are installed in ventilated cable trays, the sum of the combined cross sectional area of all cables installed in the tray shall **not exceed 50%** of the interior cross sectional area of the cable tray.
 2. Where single core cables are installed in solid bottom cable trays, the sum of the combined cross sectional area of all cables installed in the **tray shall not exceed 40%** of the interior cross sectional area of the cable tray.
2. **Multi core armoured or non armoured cables:**
 1. Where multi core cables are installed in ventilated cable trays, the sum of the diameters of all cables installed **shall not exceed 90%** of the cable tray width and the cable shall be installed in a single layer.
 2. Where multi core cables are installed in solid bottom cable trays, the sum of the diameters of all cables installed **shall not exceed 80%** of the cable tray width and the cables shall be installed in a single layer.

Table No. 08

Single Core PVC Insulated Cables in Conduit Or Trunking at an Air Temperature of 45 °C

mm ²	1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300	400
Current Rating Amperes 2 Cables Single Phase	14	19	25	33	44	60	80	100	114	150	182	205	250	277	350	402	486
Voltage Drop Per Ampere Per Meter Mv	27	16	10	6.8	4.0	2.6	1.6	1.2	0.97	0.71	0.56	0.48	0.41	0.38	0.37	0.36	0.34
Current Rating Amperes 3 Or 4 Cables Three Phase	12	17	23	30	41	53	70	90	100	140	170	200	215	250	300	350	407
Voltage Drop Per Ampere Per Meter Mv	23	14	8.8	5.9	3.5	2.2	1.4	1.0	0.84	0.62	0.48	0.42	0.39	0.36	0.35	0.34	0.33

All cables to be of 600/1000 Volts grade. Solid conductors permitted only in the case of 1.5 mm² and 2.5 mm² cable.

- xi. Ensure that Cable trays are provided with purpose made bends to accommodate the minimum bending radius of the cable. This to ensure that cable is not given undue stress.
- xii. In the Table – 06 of KAHARAMAA Minimum Internal Radius of Bends in Cables for Fixed Wiring is Provided as per KAHARAMAA.

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Table No. 06

Minimum Internal Radius of Bends in Cables for Fixed Wiring

Insulation Type	Armoured or Unarmoured	Overall Diameter mm	Multiplication Factor To Be Applied To Overall Diameter Of Cable To Determine Minimum Internal Bending Radius
Rubber Or PVC With Circular Standard Copper Or Aluminium Conductors	Non Armoured	Not Exceeding 25 mm	4
		Exceeding 25 mm	8
	Armoured	Any	12
PVC With Shaped Copper Or Solid Aluminium Conductors		Any	10
	Lead Or Aluminium Sheath With Or Without Armour	Any	15
Mineral	Copper Sheath Or Without PVC Covering	Any	6

- xiii. If any final circuit is added extra during the installation, the approval shall be taken from PMC and then upon approval it must be added in the DB/Lighting/Equipment schedule.
- xiv. PVC sleeves shall be installed for all cables passing through block or concrete or similar structures in case there is need for future withdrawal.
- xv. Collect and keep ready at site materials such as cable pulling sleeve, tools, rollers etc.
- xvi. Care shall be taken to avoid direct exposure of cables to solar radiation in storage area and at installed area.
- xvii. It shall be ensured that all cable identification labels (Figure - 5 & Figure - 6) are provided a 'unique reference number' which include the following information or otherwise advised by the Engineer:
 - Points of termination (i.e. the locations where the cable starts and finishes)
 - Size and number of conductors
 - Type of cable (e; LSOH, XLPE)
 - Operating voltage of cable



Figure-5 (Sample Picture) - Steel Cable Tags



Figure-6 (Sample Picture) - PVC Wire Tags

4.2.5 Continuity Test

A continuity test is done to determine whether a circuit is open or closed.

For example, a wall switch is closed when it is turned to the 'on' position and it is open when it is turned off. An open circuit cannot conduct electricity. A closed circuit has continuity. The following Set up Procedures should follow

- i. Turn the dial to Continuity Test **»»»** mode. It will likely share a spot on the dial with one or more functions, usually resistance (Ω).
- ii. With the test probes separated, the multi-meter's display may show OL and Ω .
- iii. If required, press the continuity button.
- iv. First insert the black test lead into the COM jack.
- v. Then insert the red lead into the V Ω jack. When finished, remove the leads in reverse order: red first, then black.
- vi. With the circuit de-energized, connect the test leads across the circuit being tested. The position of the test leads is arbitrary (random).
- vii. Note that the circuit may need to be isolated from components in the circuit.
- viii. The digital Multimeter (DMM) beeps if a complete path (Continuity) is detected. If the circuit is open (the switch is in the OFF position), the DMM will not beep.
- ix. When finished, turn the Multimeter OFF to preserve battery life.



Figure-7 (Sample Picture) – Multimeter for Continuity Test

4.2.6 Wire Installation

- i. The sub-circuit and final circuit wiring for lighting, small power and equipment power installation (wire size in mm²) shall be accordingly to the schedule provided in the approved shop drawing.

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- ii. Make sure that all conduits and boxes in both ends are free from damages and blockages etc and installation is approved.
- iii. Blockage shall be checked by inserting the draw wire and checking that it reaches to other end without any disturbance. Figure-8.



Figure-8 (Sample Picture) - Steel Draw Wire

- iv. Once the conduit is not blocked the wires shall be pulled using the draw wires. while ensuring no damage occurs while pulling. Figure-9



Figure – 9 (Sample Picture) Using Steel Draw Wire for Cable Pulling

- v. While pulling the wires care shall be taken to not insert the pull tension greater than the manufacturer allowed limits.
- vi. No two final circuits shall be run in any conduit.
- vii. Use the rolling wire Drum w/Axle to pull the cables stress free. Figure-10



Figure – 10 (Sample Picture) Wire Rolling Drum w/Axle Bearing

- viii. Apply wire pulling lubricant in conductor to avoid damage/stress

4.2.7 LV Cable Installation

- i. Transport and place the cable drums as per drum schedule and at locations where space is available for working. The cable drum shall be placed on jack & spindle arrangement to ensure free rotation of the drum. (Figure – 11 & 12)

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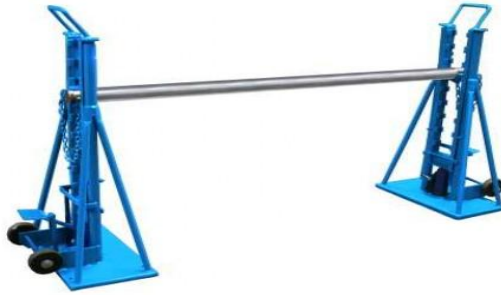


Figure – 11 (Sample Picture) Jacks with Spindle Stand for Cable Pulling



Figure – 12 (Sample Pic) Cable Drum installed on Jacks with Spindle

- ii. Erect scaffolding where required as per the site requirement.
- iii. The cable shall be pulled by using pulling means such as rope, cable pulling socks (Figure -13), and wrench machine so as not to damage cable or its containment system.



Figure – 13 (Sample Pic) Cable Sock

- iv. Care will be taken to ensure that the maximum pulling tension of all cables is not exceeded at any time with using Winch Machine (Figure -14)

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Figure – 14 (Sample Pic) Cable Sock and Winch Machine for Cable Pulling

- v. Cable roller shall be placed under the cable during pulling over longer distance and standoff rollers for acute bends, to ensure that the cable is pulled with minimum effort and the cable outer jacket is free of scouring lines (Figure - 15).
- vi. Do not allow cable to twist or rotate about its longitudinal axis.
- vii. In Cable pulling lubrications can be used where it is difficult to pull the cable or otherwise advised by the Supervisor Engineer.

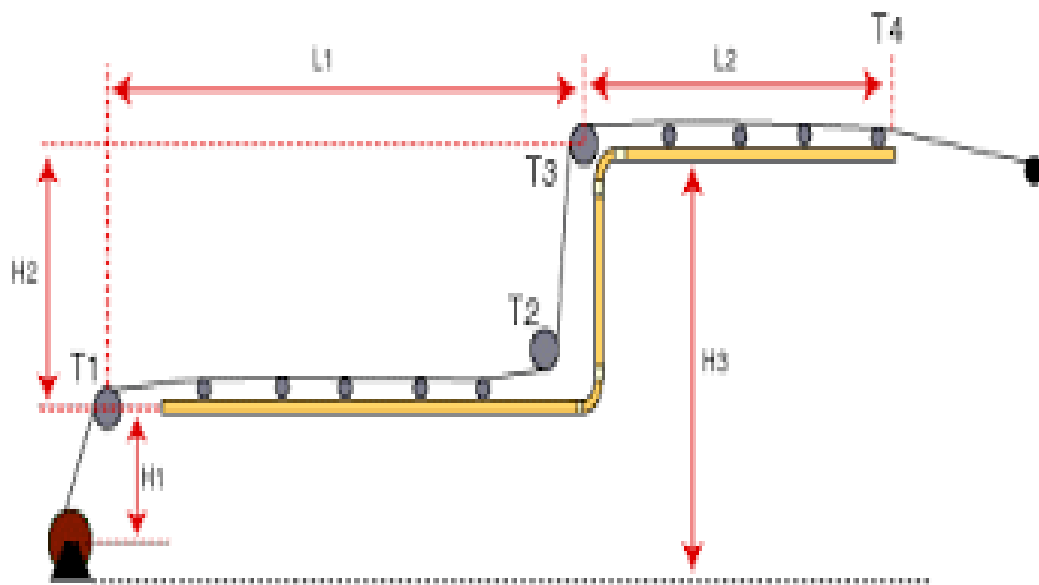


Figure – 15 (Sample Pic) Reel Roller Setup for Cable Pulling

- viii. It shall be ensured that correct set and type of reel roller to be used for cable pulling (Figure - 16)

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Figure – 16 (Sample Pic) Reel Roller Types

- ix. Cable should be free of any static load i.e. to be placed side by side parallel on the cable tray or ladders. Any kind of dead weight on the cable shall be avoided.
- x. At all-time the cable schedule & section drawings for the relevant area will be referred to ensure proper location on cable on the required ladder/tray and to ensure compliance with project specification & QCS.
- xi. The cable shall be secured to the containment system using approved cable tie for horizontal runs and cable cleats for vertical runs. The minimum distance between the cable tie shall be 0.5m or otherwise advise by the Supervisor Engineer. Figure-17

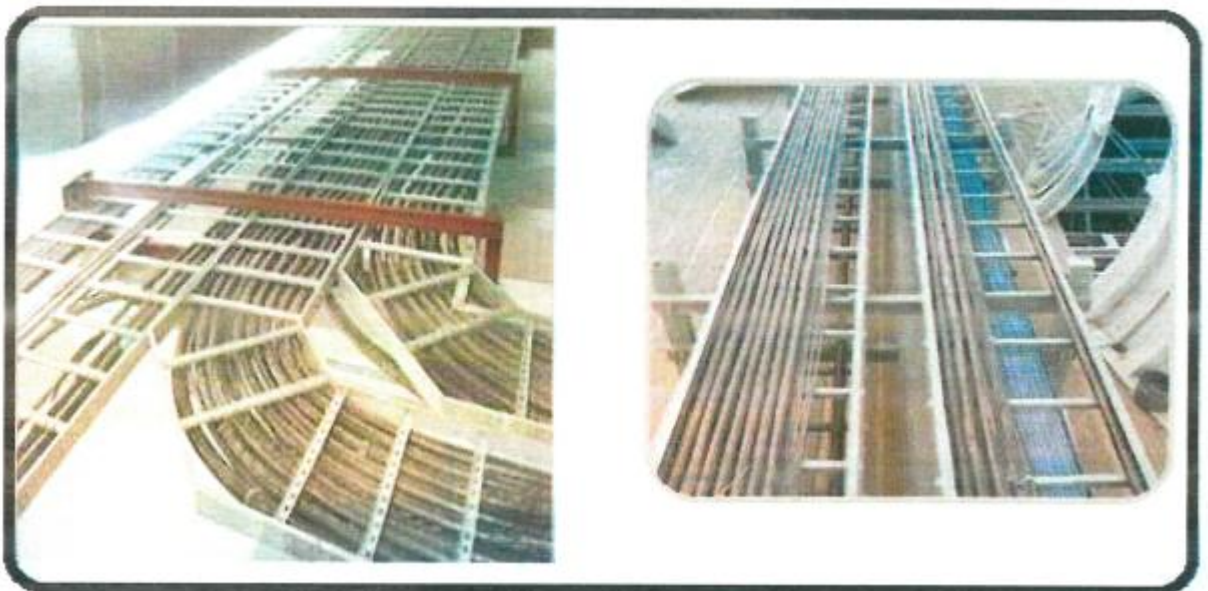


Figure – 17 (Sample Pic) Cable bedding

- xii. Earth (Yellow/Green) Cables shall also be pulled along with LV Cables. Figure - 18

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Figure – 18 (Sample Pic) Cable Dressing with Earthing Cables

- xiii. At all-time of pulling, mark both power and earth cables for pairing them on both side of connection i-e at sending and receiving ends.
- xiv. Before termination complete length and route of the cable shall be inspected by engineer.
- xv. Termination shall be done by using the approved termination materials that include glands, lugs and other accessories part of termination kit, by using proper crimping tools.

4.2.8 Wire Pulling in Trunking

Following step shall be adopted for pulling wires in the trunking

- i. Make sure that the trunking is inspected for wire pulling system.
- i. Make sure that all trunking and terminals boxes in both ends are free from damages and blockages.
- ii. Once the trunking is checked, the wires shall be pulled using the draw wires while ensuring no damage occurs while pulling.
- iii. Pulling compound or lubricant shall be used for pulling the wires where required.
- iv. Pulling compound for short runs i-e 20 meters for semi conductive insulated wires.
- v. While pulling the wires care should be taken to not insert the pull tension greater than the manufacturer allowed limits.
- vi. Transport and place the wire rolling drums at the locations where space is available for working. The wiring rolling drum shall be placed in such a way, to ensure free rotation of the drum.
- vii. Erect scaffolding where required as per the site requirements.
- viii. At actual bends, to ensure that the cable is pulled with minimum effort, pull manually by using the safe erected scaffolding.
- ix. At all times the wiring schedule & section drawings for the relevant area will be referred to ensure proper location of wiring on the required trunking and to ensure compliance with project specifications.
- x. Before termination completer length and route of the wring shall be inspected by QA/QC engineer.
- xi. Cable Joints

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- xii. Accessories for jointing the cables shall be selected accordingly to approve material.
- xiii. Check if the appropriate colour of wires has been used from the source to destination.
- xiv. Jointing of different colours of wires shall not be allowed under any circumstances.
- xv. QC inspection shall be done after each jointing a continuity and insulation shall be conducted.

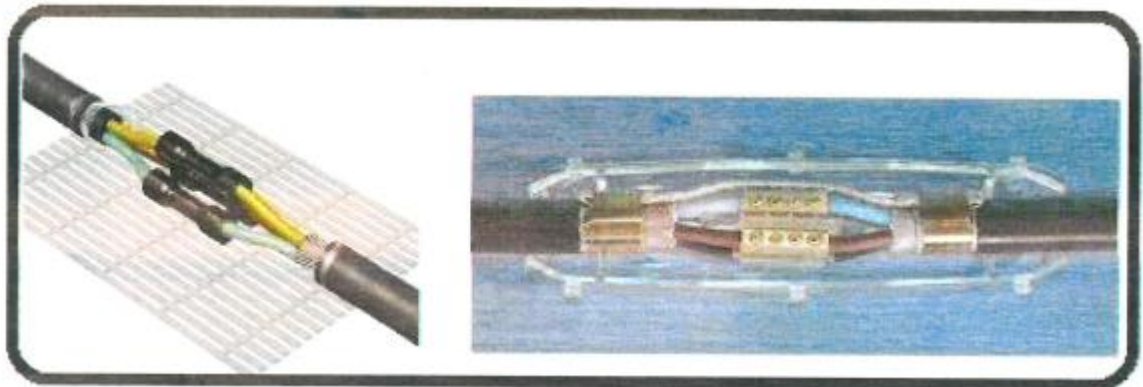


Figure – 18 (Sample Pic) Cable Jointing

4.2.9 Insulation Resistance Test

- i. A Megger test shall be conducted before the cable termination.
- ii. Taking reading between phase, phase and neutral, phase and earth, neutral and earth
- iii. And record the resistance value (mega-ohms (M Ω)) must not exceed the value as detailed by QA/QC Engineer.
- iv. The resistance reading shall be complied and recorded as per specification for approval from Engineer.
- v. Cable Glands, Cable dressing and Termination in also described in Appendix C.
- vi. Testing of Electrical LV Cable and Wire System
- vii. The entire LV Cables and wire installation shall be tested for.
- viii. Insulation resistance.
- ix. Earth Continuity
- x. All test result shall be submitted in standard Performa as directed by Supervising Engineer.
- xi. Certification of Satisfactory Commission shall be obtained for these tests from Supervisor Engineer.

⚠ Note/Warning

When testing long cables that probably have considerable capacitance, be aware of the Dangers of stored energy and the need to earth down, in a controlled manner, all cores after each test.

4.2.10 Cable Gland

A Cable Gland (also known as a cable connector or fitting) is a device design to attached and secure the end of a cable to the equipment.

4.2.11 Cable Termination

Cable Termination is an electrical industry term used to describe the specific point at which a conductive device, such as wire or cable, ends or starts. The conductive device passes

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the carried electricity or signal onto another conductive device at this point. A common point of electrical termination is at a terminal block. A wire typically ends, or terminates, at the terminal block; but the electricity or signal may be passed onto terminal connectors.

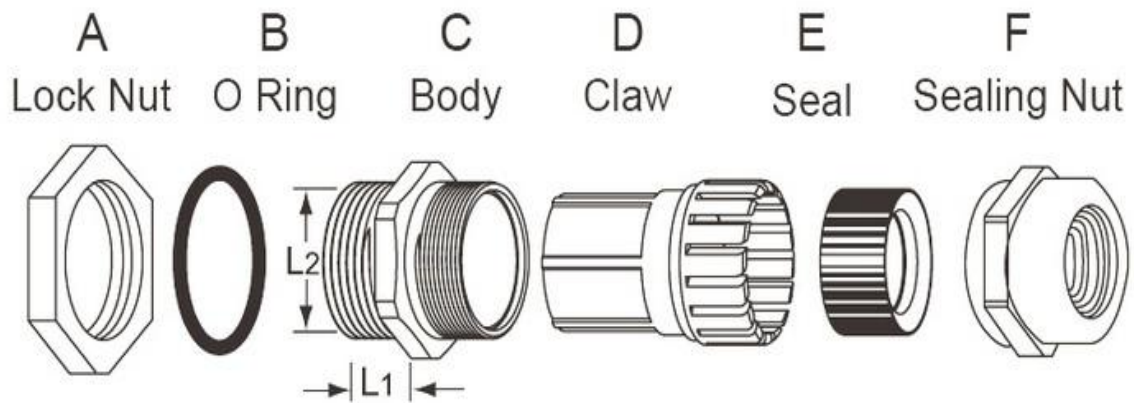


Figure – 19 (Sample Pic) Cable Gland Parts

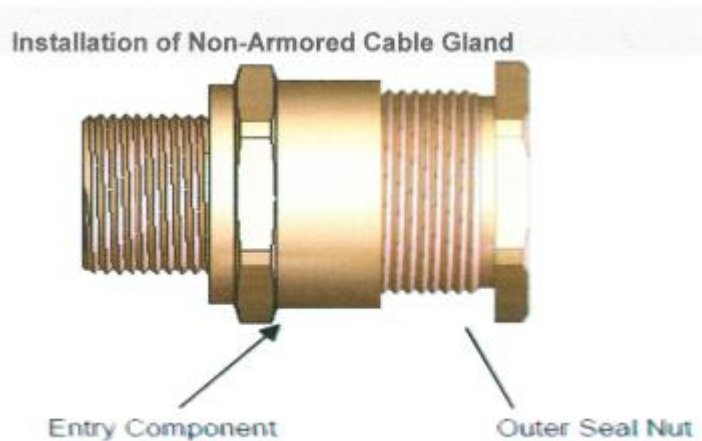


Figure – 20 (Sample Pic) Cable Gland

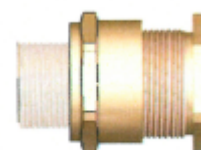
Step 1: Secure the Complete gland into the equipment



Step 2: Determine the conductor length required to suite the geometry of the equipment and prepare the cable accordingly, removing part of the outer sheath where required to reveal the insulated conductors.



Step 3: Ensure that the seal (located within the entry item) is in relaxed state by losing the outer seal nut.



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Step 4: if required pass the shroud over the cable. Pass the cable through the gland to desired position, then tighten the outer seal nut by hand into the entry item until heavy resistance is felt, then rotate one full turn with Spanner.



Installation for Armored Cable Gland

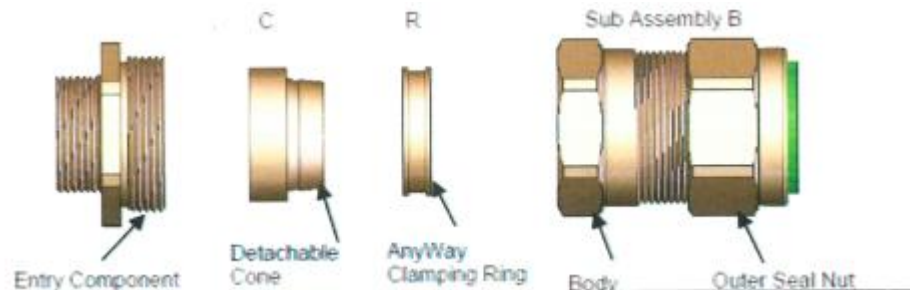


Figure – 21 (Sample Pic) Armored Cable Gland Parts

Step 1: if required fit shroud over the cable outer sheath prepare the cable by removing the cable outer sheath and the armour to suit the geometry of the equipment. Remove a further 18mm (maximum) of outer sheath to expose the armour. If applicable remove any tapes or wrappings to expose the cable inner sheath. Separate the cable gland entry component from sub-assembly “B” Ensuring that the outer seal is relaxed, pass sub-assembly “B” over the cable outer sheath and armour followed by the “Anyway” clamping ring (R).

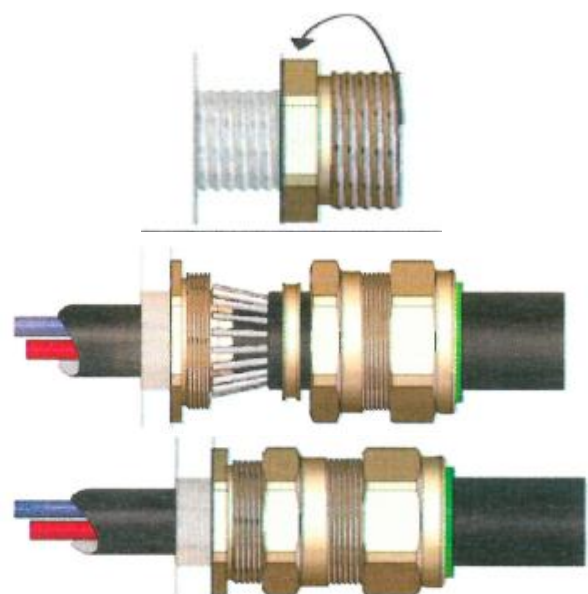
Note: On maximum size cables the clamping ring may only pass over the armour.



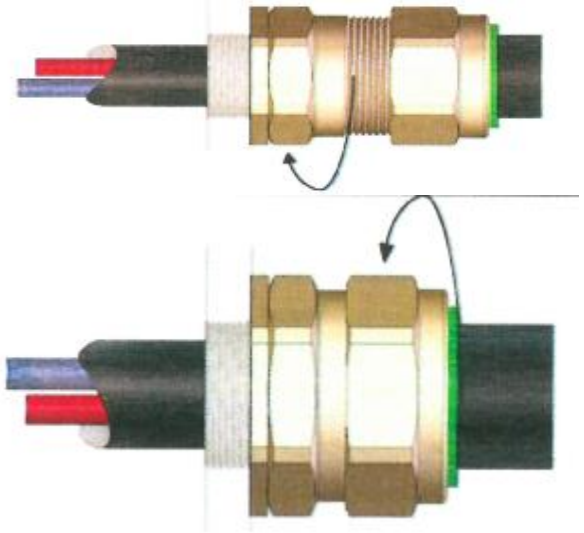
Step 2: Secure the entry component into the equipment as indicated.

Step 3: Locate the detachable armour cone (C) into the recess of the entry component. Pass cable through entry component and evenly spacing the armour around the cone.

Step 4: Whilst continuing to push the cable forward to maintain the armour in contact with the cone tighten the body of sub-assembly B onto entry component (as illustrated below).



Step 5: Ensure the two components make “metal to metal” contact



Step 6: Tighten the outer seal nut until either:

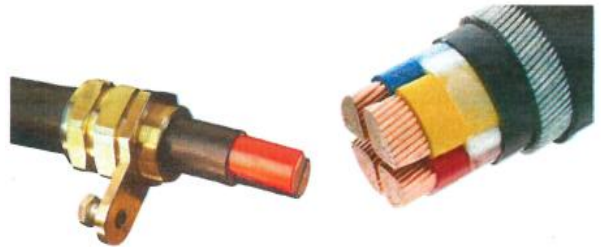
- i) The outer seal nut makes metal to metal contact with gland body, or
- ii) The outer seal nut has clearly engaged the cable and cannot be further tightened without the use of excessive force by the installer. This completes the procedure for direct entry installations

Step 7: Cable Gland Earthing: When cable glands are used to terminate SWA (Steel Wire Armour) cables, the gland will provide earth continuity from the termination of the armour through to the body of the equipment, either via the enclosure itself (if it is metallic), via a gland plate or through an external earth path with the use of an earth tag.

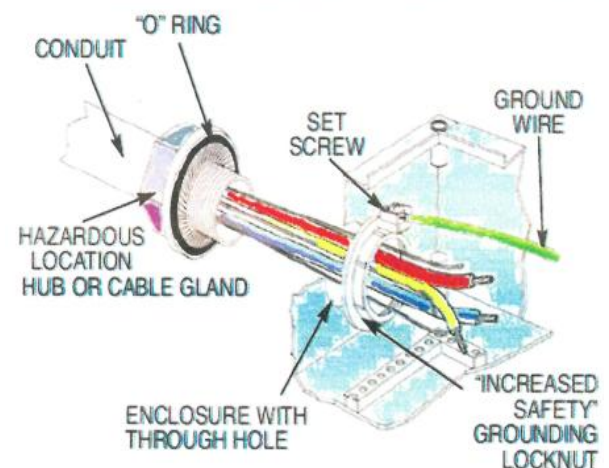


Direct to Ground Earthing:

Typically when earthing an armoured cable, a number of direct-to-ground external earth link cables shall be gland through an earth tag. As a minimum requirement, the cable will be earthed at least one of its two ends, meaning in the event of a fault or short-circuit the most direct route to ground will be achieved.



The figures presented, shows the earthing of cable gland in different ways.



4.2.12 Cable Dressing & Termination

1. Cables shall be identified at the both ends and in between convenience interval or riser, identification bands as per approved material and approved cable schedule.

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2. Cables shall be dressed properly, secure cables to cable tray using straps/heavy duty ties where the cables are fixed to a vertical tray or ties where the cable tray surface is horizontal, without any overlapping as shown in **figure - (22 & 23)**
3. Ensure that the cable distance is maintained as per approved shop drawing, as per manufacturer's recommendation and as per general engineering practices as shown in **figure-24**.
4. Earth conductor shall be laid parallel along with cables and tied along with the cable at suitable intervals.
5. Where cables passes through a floor or wall, sealing material should be provided and that area should be sealed properly (From both Sides).
6. On Completion of cable laying and dressing, continuity and insulation resistance tests with (1000 V insulation tester) shall be carried out and shall be recorded. Cable ends shall be sealed properly, till the glanding and termination.
7. All conductors requiring **bolted connection** shall be terminated with compression lugs using an automatic compression crimping type tool as shown in **figure-25**.
8. Cable lugs shall be tinned copper compression type.
9. Terminations to be carried out as per standard and approved procedure.
10. Cable glands to be used of approved and quality as per manufacturers recommendations.
11. **Crimped terminations** shall be used for cables above 6 sq. mm and pinch screw should not be used **figure-26**.
12. LV cable termination and connections shall be done by experienced electrical technician under the supervision of site supervisor or Site Engineer.

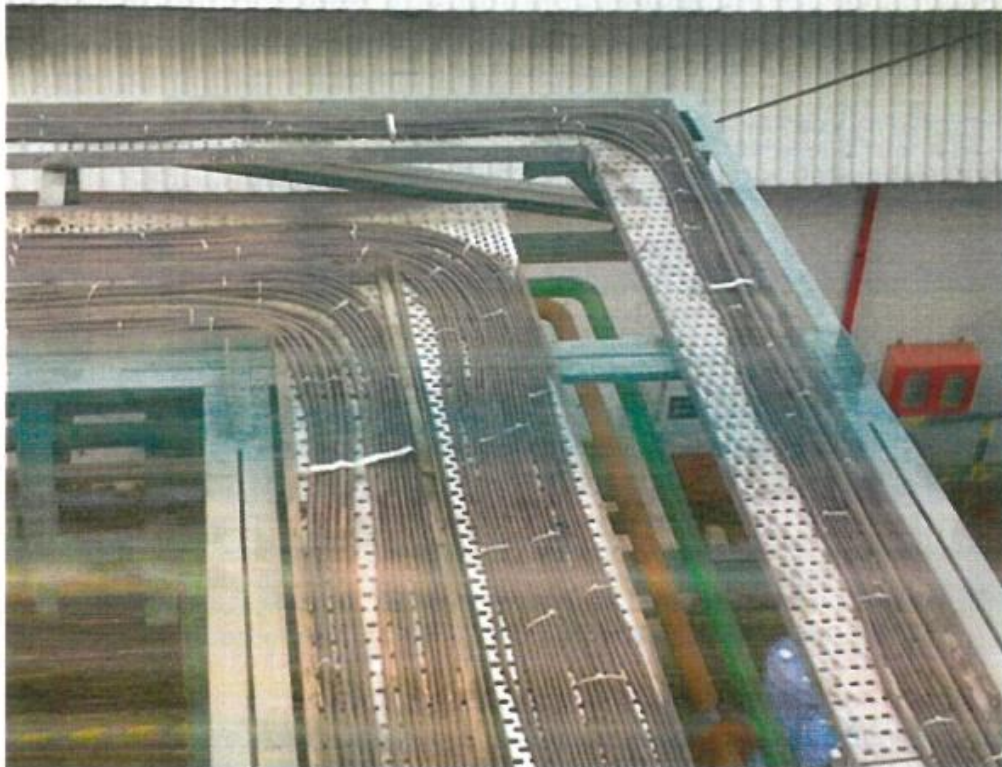


Figure – 22 (Sample Pic) Horizontal Cable dressing

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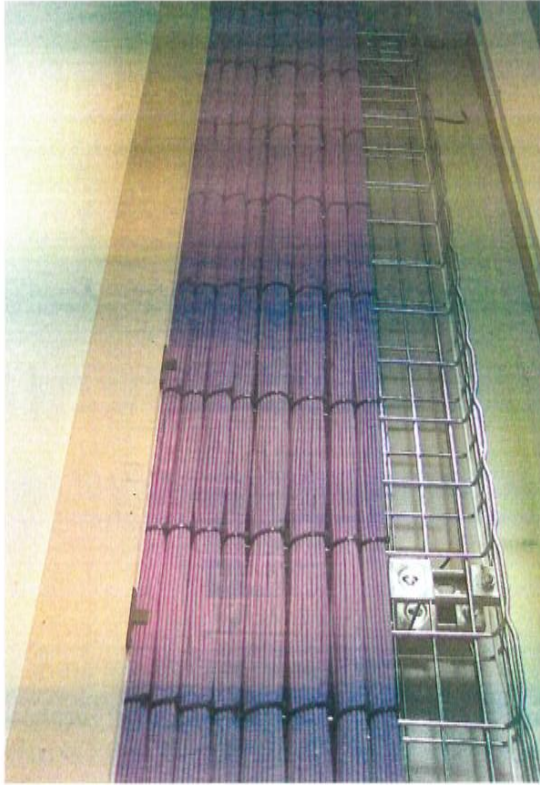


Figure – 23 (Sample Pic) Vertical Cable dressing



Figure – 24 (Sample Pic) Horizontal & Vertical Cable dressing

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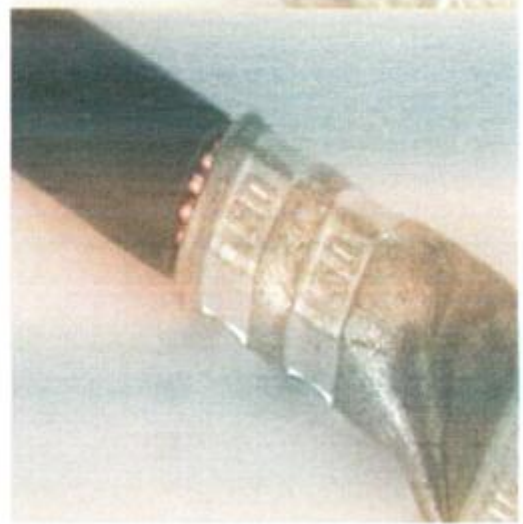
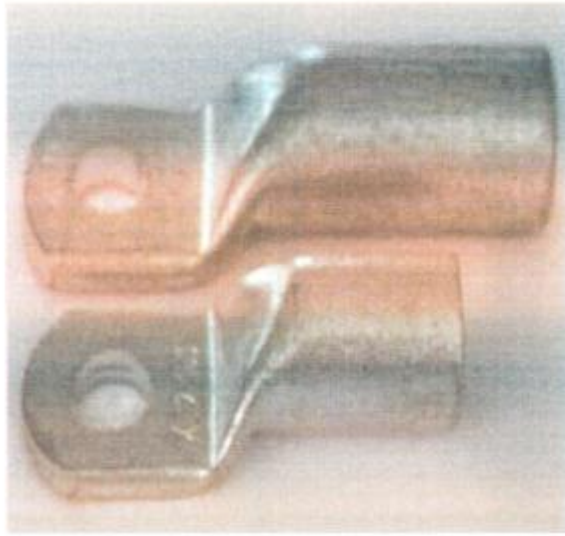


Figure – 25 (Sample Pic) Bolted connection & terminated with compression lugs

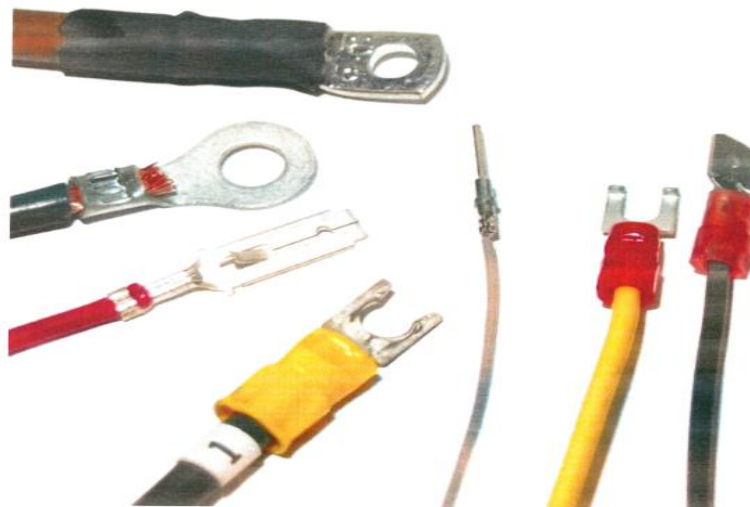


Figure – 26 (Sample Pic) Crimped terminations

Note:

Cable lugs types shall be used according to the requirements for each equipment or as per manufactures recommendations.

➤ **RedLine** Mark Up & As Built

- i. If due to any conditions that arises during the construction phase that construction team is unable to follow the IFC/Approved drawings. The following procedure shall be followed.
- ii. Mark the new routes (Non Adherence to the approved shop drawings) then this information shall be detailed in the drawings with **Red Lines** and shall be part of the documents during the inspection (According to ITP).

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- iii. After approval of inspection with changes (**Red Lines Drawing**). This information will be incorporated in the AS-Built Drawings.
- iv. Identification Cable and Wires
- v. Temporary Identification labels and notices shall be provided immediately after installation inspection is approved.
- vi. Warning, Caution and instruction notices where indicated in the engineering system sections of this Specification or on the drawings shall be provided temporarily.
- vii. It shall be ensured that all identification labels and notices installed in visible position.
- viii. When cable fixing and termination is completer then Permanent label and notices shall be provided according to the Approved Method Statement of "TAG and Marking (M002-RLR-ELE-MES-00018)

5 Quality

The Inspection and Test Plan (ITP) for this Method Statement summarizes various characteristics to be checked. The concerned Site Engineer or Site Supervisor will be responsible to ensure compliance for these operations and the site QA/QC Engineer will carry out quality control checks and report the inspection results.

5.1 Quality Records:

ITP reference No: M002-RLR-ELE-ITP-00011.

Quality records shall be provided as identified in the ITP and maintained as per ISO 9001/QCS 2014 part section 2 QR Quality Guidelines.

Required form of records and reports are defined in the Inspection and Test Plans. Refer to Doc. No: M002-RLR-ELE-ITP-00011.

6 Health and Safety Plan:

- a) The Health and Safety Plan: M002-RLR-HMS-PLN-00001 will be strictly adhered to at all times.
- b) Compulsory RLR HSE induction is required before access to workplace is permitted. PPE relevant to the scope of work risks as identified must be utilized.
- c) Compliance with the HS Summer working plan is compulsory Ref: M002-RLR-HMS-00003.
- d) Expose to direct sunlight; including Installation of LV Cables and Wires shall be avoided 11.30 AM to 3.00PM hours during Hot seasons. Prcaution shall be taken on heat strokes, dusty winds and other unsuitable weather conditions.
- e) Workplace HS communication ie Toolbox talks, task briefings and HS non compliant notices / closeouts are compulsory.
- f) The health and safety Department shall create and approve tool box talks which the safety office shall conduct such meetings shall cover, at various times and before use of equipment, the respective matters consisting of, but not limited, to:
 - i. Use of tools including specialised equipment;
 - ii. Personal protective equipment;
 - iii. Smoking;
 - iv. Handling of waste material;
 - v. Use of ablution facilities;
 - vi. Barricades, signs and warning tape;

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- v. Wear suitable eye and ear protectors while operating a cartridge-operated fixing tool.
- vi. Use a cartridge-operated fixing tool with great care.

5. Scaffold (Mobile)

- i. Do not use scaffolds unless they have been erected by trained workmen and under the supervision of a Supervisor.
- ii. Do not use a scaffold unless it has been inspected and certified safe (A Green Tag to visibly hoist on the scaffolds) by a Certified Supervisor before use.
- iii. Strictly follow the instructions of a Supervisor. Do not alter the scaffold unless authorized to do so.
- iv. Do not work on an unfinished scaffold.
- v. When it is necessary to work on a mobile scaffold, lock the wheels of the scaffold before you start working.
- vi. Do not work on a scaffold unless it has been provided with a suitable working platform.
- vii. Ladders shall be used where no other means of access is possible.

6. Safety Requirements.

- i. First Aid Kit to be provided at Station working areas in consultation with HSE officer.
- ii. Clean up work area immediately after each task; never leave an area that is cluttered
- iii. with tools or supplies that could present tripping hazard.
- iv. Barriers as required shall be in place wherever necessary.
- v. Visible "Safety sign" shall be provided where necessary as per HSE requirements.
- vi. Good quality gloves are to be worn to protect your hands when using the equipment or handling materials.
- vii. The basic Personal Protective Equipment for this particular job are:
 - a. Hard Hats (Hat Colours as specified by HSE Department)
 - b. Gloves (Must Be Task Specific)
 - c. Goggles (Clear Glasses for underground areas and Black Glasses for work in Sun Light)
 - d. Reflective Vest
 - e. Safety Boots (High Ankle as Qatar Rail)

Note: Always wear safety spectacles when using the equipment.

Other specific risks & measures are addressed in the Risk assessment attached in Appendix B.

7 Environmental:

The site team including subcontractors shall implement the following environmental controls measures:

- a) The waste material from the installation of LV Cables and Wires (insulation etc.) are to be placed in waste skips provided at site.
- b) Unused materials shall be returned to the stores for appropriate storage according to manufactures' instructions for potential reuse;
- c) Colour coded skips with signage shall be provided for waste segregation (general waste, metals, and plastics). Separate colour coded storage skips to be used for hazardous material.
- d) Good housekeeping shall be maintained regularly at job site.

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8 Interfaces and Permits

8.1 Interfaces

- Not Applicable

8.2 Permits

- Not Applicable

9 Appendices / References:

9.1 Appendices:

- Appendix A – Inspection and Test plan;
- Appendix B – Risk Assessment;
- Appendix C – Test Report

9.2 References:

This Method Statement shall be read in conjunction with the following documents:

Material Submittal:

Material submittal for Fire Resistance Multicore Armoured Cables

Material submittal for Low voltage LSOH Cables & Wires

Material submittal for Cable lugs

Material Submittal for Cable Tray, Trunking ladder & Accessories

Material submittal for GI Conduit, Flexible Metallic Conduit & Fittings, GI Back boxes.

Material submittal for Cable Glands

Method Statement For:

Document No.	Document Title
M002-RLR-ELE-MES-00001	Installation of Cable Containment System
M002-RLR-ELE-MES-00002	Installation of GI Conduit, Flexible Metallic Conduits & Accessories
M002-RLR-ELE-MES-00015	Installation of Distribution Boards & Accessories
M002-RLR-ELE-MES-00015	Installation of Sub-Distribution Boards & Accessories
M002-RLR-ELE-MES-00015	Installation of Distribution Boards & Accessories

Specifications:

Document No.	Document Title
M002-RLR-MEP-TEN-00008	Material and Workshop Specifications Volume 7
M002-RLR-MEP-SPE-27005	DD2 –Qatar University Station-WP11.2 MEP Specifications
QCS 2014	QCS 2014 Section 21 Part 6
KAHRAMAA	Section 506 Armoured Cables, Section 507 Un-armoured Cables

Document No.	Revision	Title
M002-RLR-ELE-MES-00011	1	MS for Installation of LV Cables and Wires

BS EN 7671	Standards for Electrical Insulation
BS 6387	Cables Requirement to maintain circuit integrity under fire conditions
BS 8519	Selection and insulation of Fire-Resistant cables for life Safety and Fire
NFPA 70	National Electrical Code ®
NFPA 130	Standard for Fixed Guide way Transit and Passenger Rail system

Reports:

Document No.	Document Title
M002-RLR-MEP-RPT-27003	DD2- Qatar University Station Earthling & Bonding Report
M002-RLR-ELE-RPT-26000	DD2- Qatar University Station WP11.2 – MEP Design Report

Document No.	Revision	Title
M002-RLR-ELE-MES-00011	1	MS for Installation of LV Cables and Wires