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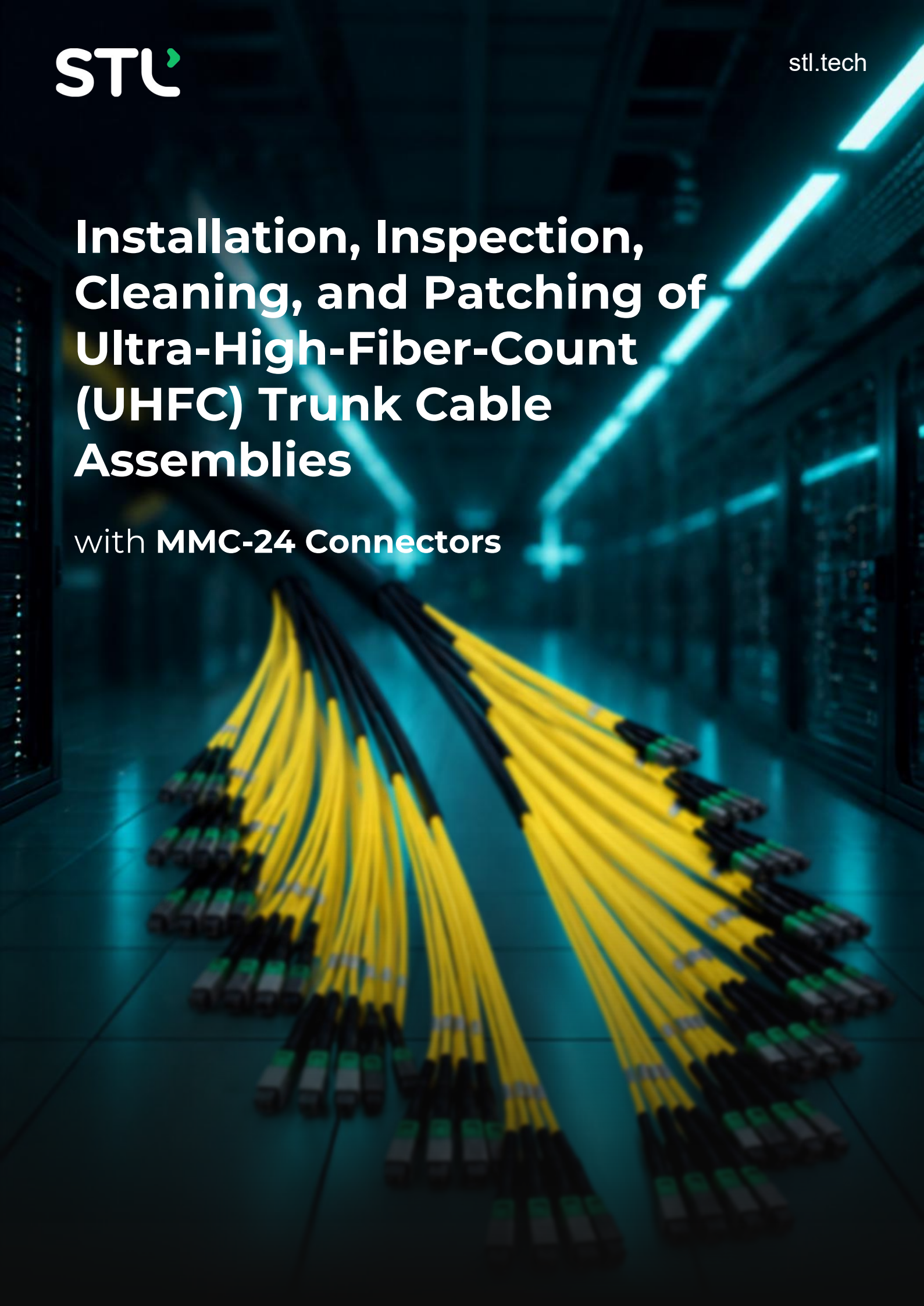
Installation, Inspection, Cleaning, and Patching of Ultra-High-Fiber-Count (UHFC) Trunk Cable Assemblies

with **MMC-24 Connectors**



Standard Operating Procedure

Standard Operating Procedure: Installation, Inspection, Cleaning, and Patching of Ultra-High-Fiber-Count (UHFC) Trunk Cable Assemblies with MMC-24 Connectors

1. Scope

This Standard Operating Procedure (SOP) defines mandatory technical requirements, installation workflows, inspection criteria, and supplier-recommended cleaning procedures for the field deployment of Ultra-High-Fiber-Count (UHFC) trunk cable assemblies terminated with MMC-24 (Very High Density Very Small Form Factor - VSFF) connectors. This consolidated technical document is engineered specifically for System Integrator (SI) field deployment technicians, quality assurance (QA) auditors, and infrastructure installation engineers.

MMC multi-fiber connectors represent a step-change in optical density, housing up to 24 fibers within a footprint significantly smaller than traditional MPO/MTP connectors. Due to extremely tight mechanical tolerances and microscopic core spacing, the deployment of MMC-24 trunk cables strictly prohibits traditional standard fiber installation habits. Adherence to international standards and supplier-validated cleaning practices is contractually binding for installation certification.

1.1 Applicable International & Industry Standards

The deployment process detailed herein complies directly with the following global standards and manufacturer practice guides:

- **ANSI/TIA-568.3-E:** Optical Fiber Cabling and Components Standard - includes performance metrics for high-density multi-fiber connectivity.
- **IEC 61300-3-35:** Basic Test and Measurement Procedures - Visual inspection of fiber optic interconnections (defines automated PASS/FAIL end-face pass criteria).
- **BICSI Telecommunications Distribution Methods Manual (TDMM), 14th Edition:** Best practice guidelines for high-count fiber pulling, bend radius management, and pathway loading.
- **ANSI/TIA-607-D:** Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises - governs metallic armored trunk cable grounding.
- **ISO/IEC 11801-1:** Information Technology - Generic cabling for customer premises - General requirements.
- **IEC 61754-38:** Fiber optic interconnecting devices and passive components - Interface standard for Very Small Form Factor (VSFF) MMC connector family.
- **STL MMC Cleaning SOP:** STL procedures for cassette-type OptiPop cleaners, IBC push-style cleaners, optical solvents, and lint-free microfiber wipes.

2. Pre-Installation Precautions & Material Inspection

Before commencing physical pathway installation or reel handling, installers must perform comprehensive pre-installation checks to eliminate risks of implementing damaged components. Clean environment has to be ensured at the place of installation to avoid any possible contamination leading to damage to the connectors during the installation.

2.1 Reel Inspection & Transportation Damage Audit

UHFC trunk assemblies are high-value engineered assets shipped on heavy-duty spools. Upon offloading from transport:

Step 1: Visual Reel Audit: Inspect outer wooden flange integrity, lagging boards, and steel arbor hole bushings for structural fractures, liquid exposure, or mechanical crushing.

Step 2: Trunk Cable Jacket Integrity: Ensure the outer cable sheath shows no evidence of jacket tearing, kink marks, localized swelling, or severe pinching caused by binding straps.

Step 3: Serial Tag & Data Sheet Verification: Cross-reference cable reel serial tags against the factory R test reports provided inside the reel pouch.

MANDATORY RECEIVING CHECK

NEVER install a trunk cable assembly that exhibits outer sheath puncture or split pulling sock seals. Micro-fractures on internal glass ribbons caused by transportation impacts will cause delayed link failure after installation.

3. Unpacking Pulling Socks & IP67 Protection Tubes

UHFC trunk assemblies are factory-fitted with heavy-duty mesh pulling socks integrated with IP67-rated sealed protective tubes housing the breakout legs and delicate MMC connector terminations.

3.1 Mechanical Pulling Specifications

During pathway pulling (in tray, basket, or conduit pathways), the following physical constraints MUST be enforced without exception:

Parameter / Constraint	Maximum / Mandatory Value	Engineering Notes & Standards
Maximum Pulling Tension	220 N (50 lbf) - Direct Sock Eye	Must use calibrated tension-limiting swivel pulling eye.
Minimum Dynamic Bend Radius	20x Outer Cable Diameter (OD)	Applies during active pulling through turns/bends.
Minimum Static Bend Radius	10x Outer Cable Diameter (OD)	Applies when cable is fully secured in tray/rack.
IP67 Tube Removal Point	ONLY at Final Termination Rack	**Do NOT unseal protective tube until reaching patch panel.**

3.2 Step-by-Step Unpacking Procedure

Step 1: Lay the trunk cable carefully in the designated pathway. It is recommended to place the cable inside the patch way rather than pulling through the path way to avoid any damage to the outer jacket of the cable due rubbing on the ribs of the metal basket.

Step 2: Anchor Cable Trunk: Secure the trunk cable main body behind the breakout point to the rack framework using hook-and-loop cable ties. Ensure no strain is placed on the breakout legs.

Step 2: Removal of Pulling Sock Ties: Carefully unlock the outer zip-ties securing the mesh pulling sock to the IP67 tube. Do NOT use standard utility knives near the cable legs. Follow the defined procedure provided for unpacking the IP67 protection system.

Step 3: Unpack Individual MMC Breakout Legs: Remove protective wrap sleeving surrounding individual 24-fiber leg bundles. **Retain protective dust covers ON all MMC connectors until the exact patch moment.**

4. Connectivity Mapping & Patch Panel Port Identification

Accurate port identification is critical for UHFC deployments to prevent mapping errors in high-density multi-lane parallel optics (e.g., 400G-DR4, 800G-SR8/DR8, or 1.6T applications).

4.1 MMC Pinning Architecture (Pinned vs. Un-pinned)

MMC connectors are supplied in two distinct mating configurations based on alignment pin positioning on the ferrule housing. Mating incompatible genders (pinned-to-pinned or unpinned-to-unpinned) results in physical ferrule damage leading to complete link failure.

MMC Connector Gender Alignment Overview (Pinned Trunk Cable Assembly)

- **MMC Pinned / Male Connector:** Factory trunk assemblies are typically supplied PINNED (featuring external metal guide pins) to protect core infrastructure investments.
- **MMC Un-pinned / Female Connector:** Patch panel adapter housings, cassettes, and active transceiver interfaces are UN-PINNED (featuring guide pin alignment sockets).
- **Gender Verification Rule:** Technicians must visually verify that EVERY trunk connection mates a Pinned (Trunk Plug) to an Un-pinned (Panel Adapter / Cassette Port) interface.

4.2 Patch Panel Labeling & Port Routing

A. Routing: Route breakout legs through panel cable management arms, maintaining a minimum bend radius of 30 mm (1.2 in).
B. Identification: Align trunk breakout leg labels (e.g., Leg 01, Leg 02) with corresponding patch panel adapter housing ports (e.g., Port A1, Port A2) as specified in the site Connectivity Matrix.
C. Keying Alignment: Observe Connector Keying: MMC connectors feature keyway slots to ensure correct polarity. Ensure key-up orientation matches panel adapter slots prior to insertion.

5. Microscopic Inspection Protocol (IEC 61300-3-35 Compliance)

Fiber optic core contamination is the primary cause of optical insertion loss, high back-reflection, and permanent ferrule damage. '**INSPECT BEFORE YOU CONNECT**' is mandatory.

5.1 Handheld Video Inspection Microscope Setup

1. Attach the dedicated MMC inspection tip (ensuring tip configuration matches PINNED or UN-PINNED interface) to the handheld digital probe microscope.
2. Calibrate probe focus and set automated PASS/FAIL analysis profile to IEC 61300-3-35 (Single-mode APC or Multimode UPC depending on trunk spec).
3. Inspect BOTH connector ferrule end-face AND patch panel adapter internal ports prior to mating.

5.2 Inspection Criteria & Pass/Fail Zone Limits

According to IEC 61300-3-35, the ferrule surface is divided into discrete zones. Any contamination in Zone A results in immediate failure:

Zone Name	Diameter Limits	Acceptance Criteria (IEC 61300-3-35)
Zone A: Core Zone	0 µm to 25 µm	ZERO defects, pits, scratches, or oil contamination allowed.
Zone B: Cladding Zone	25 µm to 115 µm	No scratches >3µm; max 5 minor non-continuous debris spots.
Zone C: Adhesive Zone	115 µm to 135 µm	No loose debris that can migrate into Zone A/B during insertion.
Zone D: Contact Zone	Ferrule surface top/pins	Guide pins must be completely free of dust, metal burrs.

6. Detailed MMC Cleaning Procedures

If microscopic inspection reveals contamination, technicians must execute standardized cleaning routines using supplier-validated cleaning tools, approved cleaning fluids, and lint-free microfiber wipes. These procedures incorporate official **Sterlite Technologies Ltd (STL) Recommended Practices for MMC connectors.**

Approved Cleaning Tooling & Consumables Specification Matrix

Standard MPO or LC cleaners are strictly incompatible with MMC connector bodies. Technicians must utilize the designated OptiPop cassette cleaners and One-Click tools shown below:

Figure 6A: OptiPop ATC-RE-01 Cassette Reel Cleaner (For Un-pinned Connectors)

Figure 6B: OptiPop ATC-RE-03 Cassette Reel Cleaner Window (For Pinned Connectors)

Figure 7A: CONEC / US Conec One-Click Push Cleaner Tool (PN 25802 MMC II)

Figure 7B: Sticklers Fiber Optic Cleaning Solvent & Microfiber Clean Wipes

Cleaner Format / Fluid	Part Number / Specification	Application / Compatibility
One-Click / Push Cleaner (12/24F)	CONEC / US Conec 25802 MMC II	For Pinned & Un-pinned MMC 12/24 and MMC Jr connectors.
One-Click / Push Cleaner (16F)	CONEC / US Conec 25803 MMC-16 II	For Pinned & Un-pinned MMC 16F connectors.
Cassette Reel Cleaner (Un-pinned)	OptiPop ATC-RE-01	Dedicated for Un-pinned / Female MMC connectors.
Cassette Reel Cleaner (Pinned)	OptiPop ATC-RE-03	Dedicated for Pinned / Male MMC connectors (fits guide pins).
Optical Fiber Cleaning Fluid	Sticklers Fluid or 99% Optical IPA	For dissolving heavy oils, lubricants, and residue in Wet cleaning.
Lint-Free Microfiber Wipes	30% Nylon / 70% Polyester Wipes	Lint-free substrate used for wet-to-dry cleaning transfers.

7. Final Patching, Dust Capping & Future-Proof Securing

Once inspection confirms a PASS result for both plug and port under IEC 61300-3-35, final physical patching must occur immediately to prevent re-contamination.

7.1 Patching Execution

Step 1: Align connector latching keyway with adapter slot.

Step 2: Push connector straight into adapter until tactile latch click engages fully.

Step 3: Perform light tug test (apply <2 N [0.45 lbf] force backward on black boot) to ensure mechanical retention latches are locked.

7.2 Securing Unused Ports & Dust Protection

Unused patch panel adapter ports and un-mated trunk connectors are highly susceptible to ambient airflow contamination:

Rule 1: Immediate Protection: Any port not patched within 30 seconds of cleaning must be covered with an approved MMC rubber dust cap.
Rule 2: Dust Cap Cleanliness: Inspect dust caps prior to insertion. Never reuse dust caps that have fallen onto floor surfaces or tray beds.
Rule 3: Long-term Storage: Secure unused trunk breakout legs in designated panel slack trays using hook-and-loop wraps. Maintain soft cable loops with a radius >50 mm (2.0 in).

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About STL – Sterlite Technologies Ltd:

STL is a global leader in advanced connectivity solutions, providing end-to-end solutions for building AI-ready infrastructure, FTTx, Rural, Enterprise and Data Center networks. With manufacturing facilities in North America, Europe and Asia, we deliver our solutions in more than 100 countries. Data Center & Cloud companies, Telecom operators, Internet service providers and Large enterprises collaborate with STL to build their future-ready digital infrastructure. STL's business goals are driven by customer-centricity, R&D and sustainability.

This document is provided for guidance only. Always follow site-specific safety and quality procedures. Product names and part numbers are illustrative of the cleaner types referenced and may vary by supplier.