Rehabilitation Products Considered For Inspection

Cured-In-Place Pipe (CIPP)

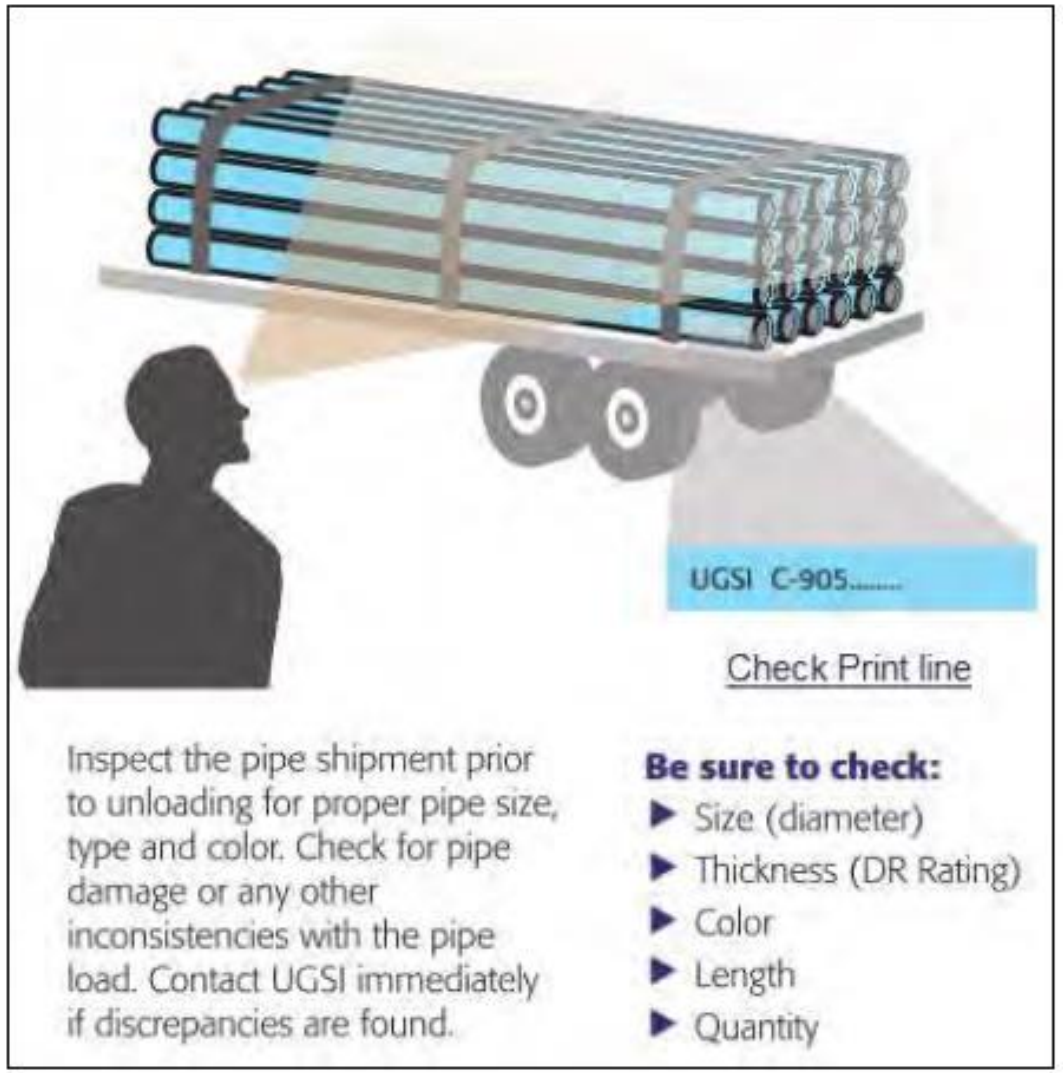
Compressed-fit HDPE

Conventional Sliplining HDPE & Fusible PVC

Carbon/Glass Fiber (FRP)

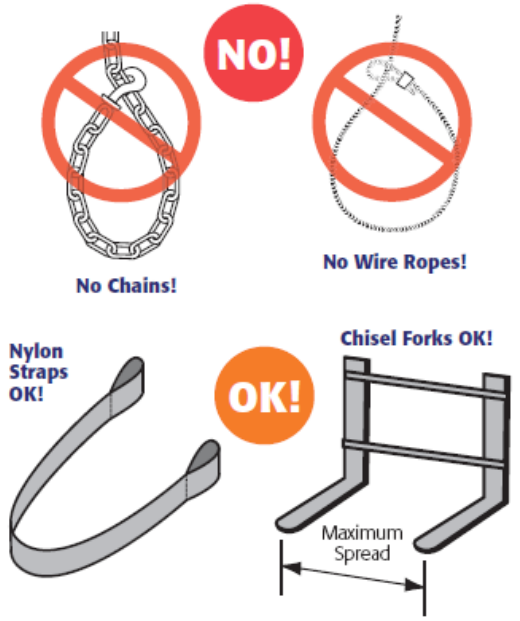
General Safety

- Personal Protective Equipment
- OSHA (if required)
- Heavy equipment training
- Trench sizing
- Proper shoring
- Overhead Power line safety
- Inspect pipe before unloading



General Safety

- Material handling
  - Refrigerated truck with conveyor system and/or spreader bar recommended for CIPP
  - Nylon straps and tapered forks recommended for FPVC and HDPE



Pre-Install CCTV Inspection

- Joint deflection within the pipe as it relates to rehab technology
- Length of install
- Pipe ovality?
- Obstructions?
- Consistent materials to confirm pipe ID?
- Identify services and connections
- Proper cleaning completed

CLEANING RESULTS: before and after

Loose graphitic corrosion is removed from pipe wall to increase pipe capacity and ensure excellent liner adhesion

Fusible C-900® Pipe and HDPE: Fusion Process

- FPVC Qualified fusion technicians trained and retrained every year by Underground Solutions.
- HDPE Field trains technicians
- Fusion equipment must meet minimum standards to approved for fusion
- Heating and Fusion Pressure Vary for FPVC & HDPE; follow proper standards for each material
- Cooling Times
- Facing Blades: Carbon vs. Steel

Fusible C-900® FPVC and HDPE: Fusion Process (cont)

- Data loggers are required for FPVC & recommended for HDPE
  - Record critical fusion data for each joint
  - Provide real time feedback on joint integrity
  - Provide record of “as-built” for entire project

- Fusion conditions logged by technician and “as-built” fusion joint record can be provided for the owner

Was the pipe damaged before installation?

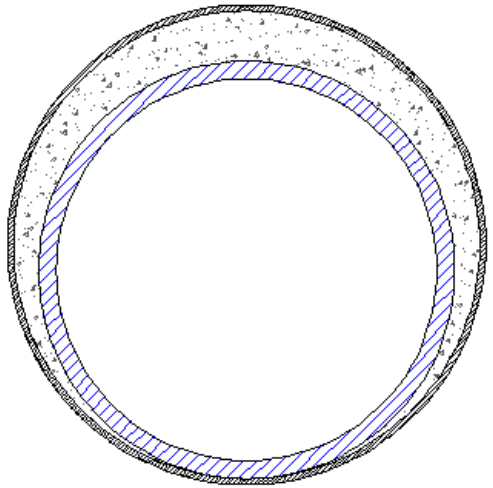
- FPVC is NOT sensitive to wear and tear associated with trenchless installations
- FPVC/ HDPE pipe allowed a 10% gouge in the pipe wall
- UGS commissioned an independent laboratory for AWWA C900 DR 18 sustained pressure test at 500 psi for 5,000 hours with 5-10% gouges.

Field Leakage Testing Pre-Install

- Conventional slipline & pipeburst
- Low pressure air test
  - ASTM F1417 & UNI-B-6
- 3-5 PSI
- Expect slight changes due to expansion and contraction of air with thermal fluctuations
- Pre-chlorination of potable water main pipe burst
- Chlorination and Bac T testing for bypass for pipe burst

Grout Submittal

- Conventional slipline is recommended to grout annular space
- >2” annular space recommended
- Low density cellular grout



Pressure Testing

- 2X Operating pressure or operating pressure plus 50 PSI per ASTM F1216-16
- 1.5X operating pressure per AWWA
- Sometimes engineers may specify a higher pressure than necessary (+$)
- 3 volumes of water at 3 fps, if possible, to flush and purge the air out of the pipe filling from the low side
- Proper blocking required

Pressure Testing

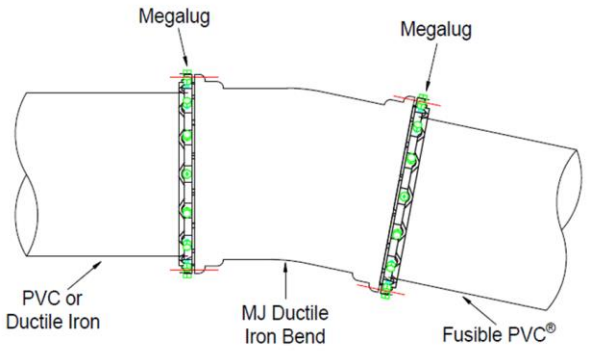
- Hold the specified pressure for 2-hours
- Visually inspect there are no changes in the pressure gauge
- If it takes a long time to bring pipe up to test pressure, this may be a sign there is free air in the pipe
- If pressure gauge fluctuates, this can indicate free air

Pipe and Connections

FPVC

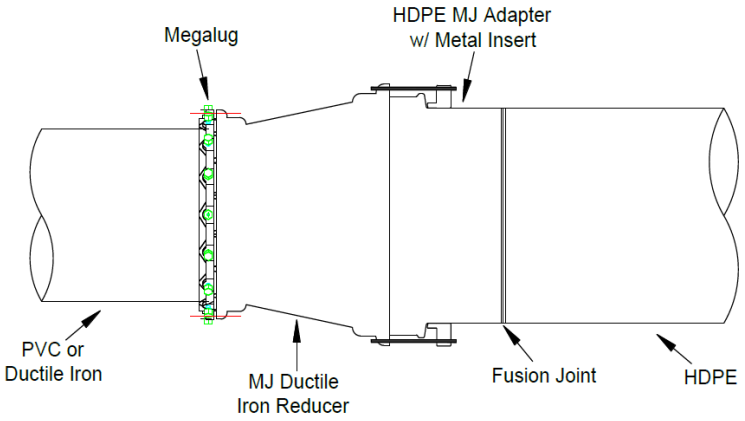
Reconnection Details

Fusible PVC® Pipe Detail

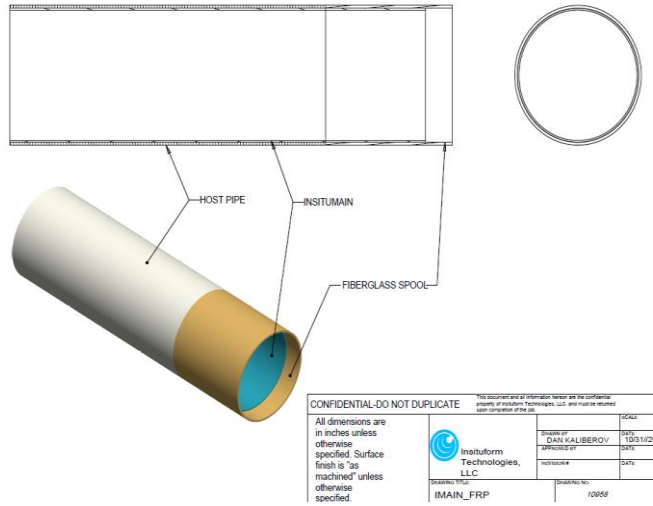


HDPE

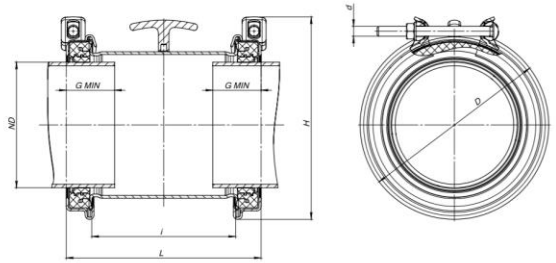
HDPE Pipe Detail



CIPP



Hymax Couplings



FRP QA/QC Process (CTQ) – Field Install

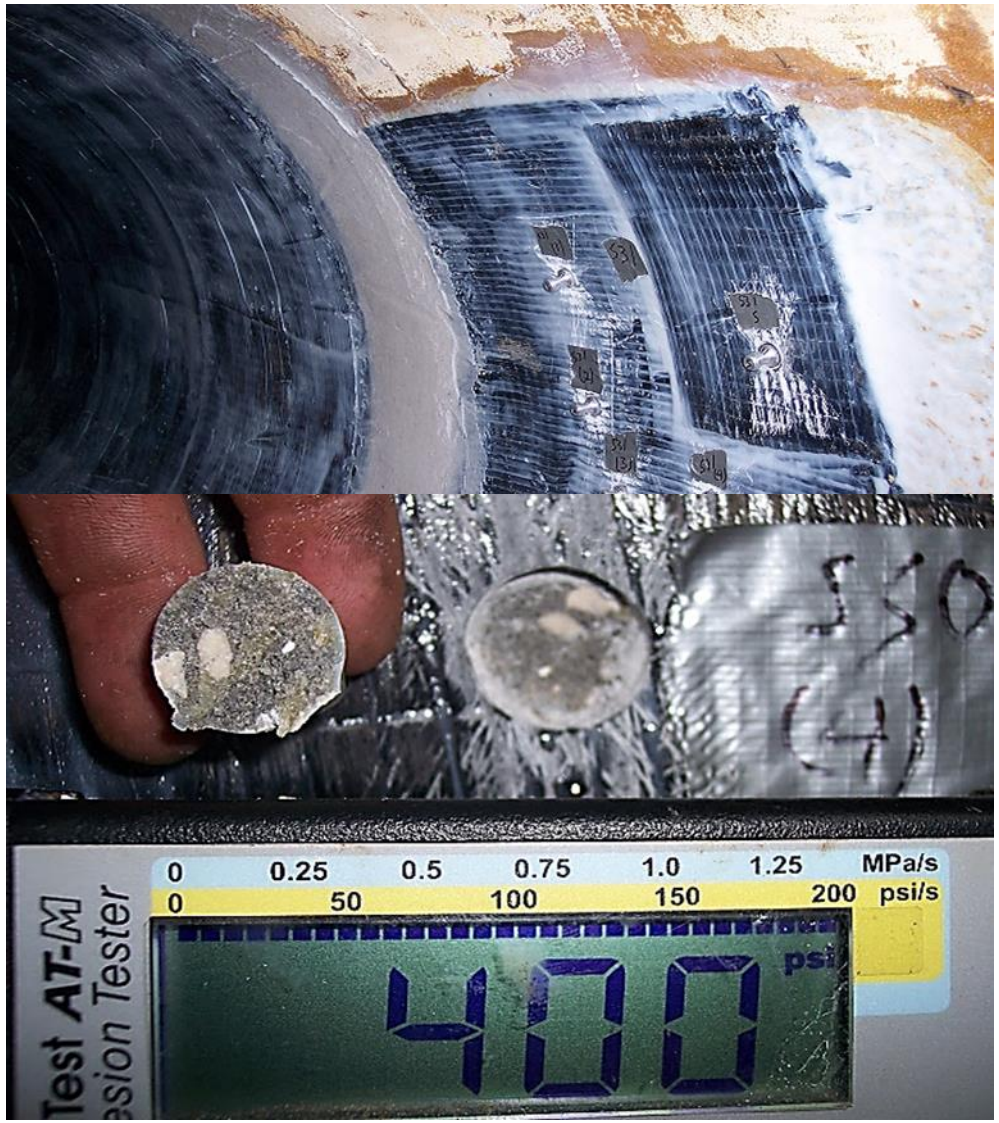
- Continuous field observation of installation conducted by Quality Control Specialist (QCS) and/or Third-party Inspector.
- CFRP material manufactured by an ISO 9001 certified company with ICC-ESR.
- Installer certified by the Manufacturer with proper qualifications and project experience.
- Verify installation is in accordance with approved shop drawings and specifications.
- Document all site activities, timing and logging of material lot numbers.
- Document the condition of host pipe.
- Maintain control of air flow, temperature, and humidity.
- Continuous Time-Temperature logs to document cure conditions.

FRP QA/QC Process (CTQ) – Field Testing

- Curing Tables (85% cure before service)
- DSC Testing to ensure minimum epoxy cure – ASTM E2160
- Shore “D” Hardness Testing
- Surface preparation (visual)
- Material saturation – on-site weight test dry fiber to epoxy ratio
- Adhesion Testing – ASTM D4541
- Preparation of witness panels for Tensile Testing – ASTM D3039
- End Termination details
- Post-installation inspection (visual)
- Corrective actions including Engineer-approved, standard details to repair defects
- Thickness measuring device (optional)

FRP Field QC – Adhesion Testing

- Minimum of (3) 2 ft. x 2 ft. panels on adjacent non-repair pipes
- Prepared and tested by the Installer (ASTM D4541)
- Witnessed by Inspector
- >200-psi required for at least 3 tests per panel for concrete and >1,000-psi for steel and iron substrates, or as dictated by specification and project requirements.



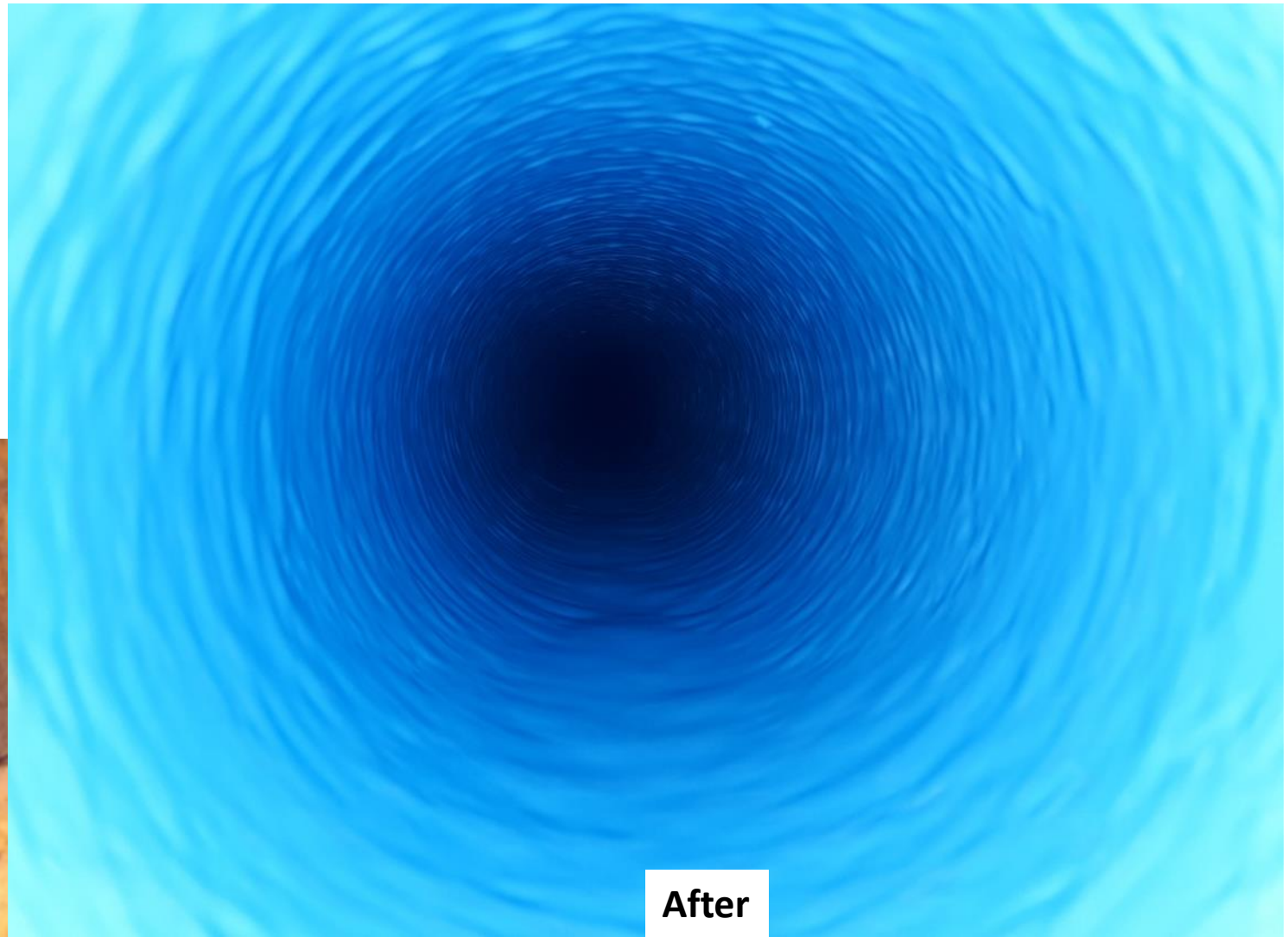
FRP - Field QC - Field Witness Panels

- Prepared by the Installer, witnessed by the Inspector, tested by the Independent Testing Agency
- Typically, two panels per day per work shift
- Typically, two layers unless otherwise specified
- Preparation of panels spread throughout construction
- Mean tensile strength and modulus obtained per ASTM D3039 should be greater than the characteristic values used in design

CIPP – Post-Install CCTV Review

- Soft spots/improper curing
- Sags or Lifts
- Blistering
- Significant wrinkling

Before



After

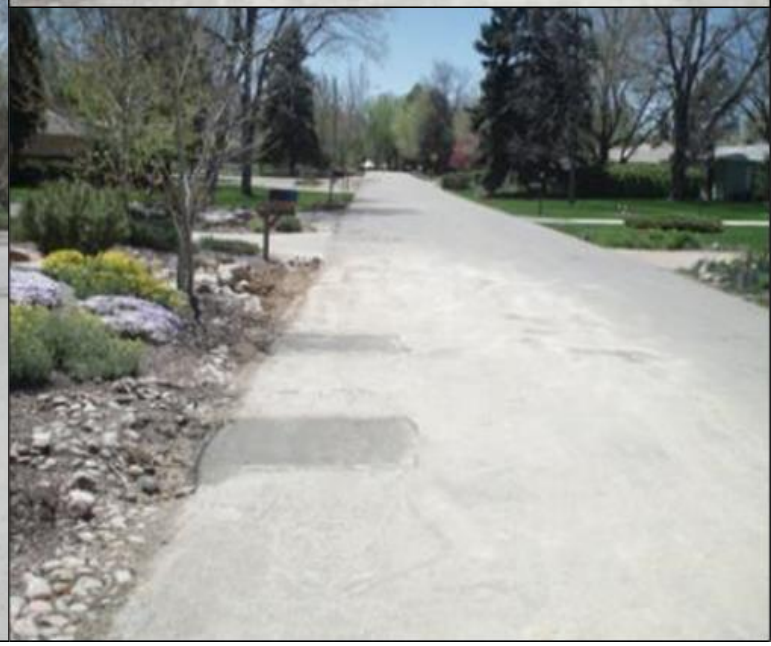
Pressure Testing/Disinfection

- 2X Operating pressure or operating pressure plus 50 PSI per ASTM F1216-16
- Chlorination and Bac T testing for the new CIPP water main
- AWWA C605 & AWWA M23 include standard procedures for disinfecting water mains

Access/Restoration

- While gravity sewer CIPP may be completely trenchless, pressure CIPP will have entry/exit pits for installation/reconnection.
- Concrete Repair
- Asphalt Repair
- Sodding



Questions?

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