

Trenchless Technology Operator Qualification Programme

Trade (Skill Development) at Competency level – 1

COMPETEENCE:	TTOQP 6	Microtunneling & Pipe Jacking Operator
BASIC COOMPETENCE	BC 6.1	BASIC OPERATOR

Background

Microtunneling & Pipe Jacking technique provide state-of-art solutions for developing subsurface piped networks in critical grades and alignment at several inaccessible locations where open cut pipe laying is not possible or uneconomical. Present document identifies a set of standards for a qualified professional operating a Microtunneling & Pipejacking Machine system. These sets of vocational qualification standards define the minimum technical qualifications one needs to possess for handling pipe installation through Microtunneling & Pipe Jacking successfully.

PRIOR ACHIEVEMENT EVIDENCE

Persons undergoing this certification should have a Degree/Diploma in Civil, Electrical, Mechanical or Trenchless Engineering from any recognized institution or 10th + 4 years relevant experience.

PERFORMANCE STANDARD

Qualified candidate should be able to display competence in the following sections of Microtunneling & Pipe Jacking works:

- Understanding of Microtunneling methods technique background, spoil removal and line & grade management, basic consideration for carrying out survey and geotechnical investigation, data interpretation evaluation and planning of the project including mapping and subsurface exploration, flushing fluids equipment and procedures.
- Ability to consider the most important basics of jobsite preparation when planning the complete project.
- Ability to understand the site challenges, shaft condition,
- Assemble and set up the tunneling unit, pipe stack, waste recycling system, jacking system, and other related systems like power supply systems, waste disposal systems, water injection systems etc. correctly under varying job site conditions.

MINIMUM PERFORMANCE STANDARDS

While executing the work the operators need to display the following minimum qualifications:

1. Safety during work

- i. General precautions necessary for safety of structure and operators;
- ii. General precautions necessary for safety of machine;
- iii. Necessary Aids for safety are used without fail;

2. Read working drawings / Sketches and proceed with work

- i. Given a set of drawings / sketch requirement of machine and related tooling worked out and the scope of work understood;
- ii. The work is executed as per drawings / sketches;

3. Knowledge and use of equipment and tooling

- i. Proper identification of equipment tools.
- ii. Proper parking/storage of equipment and tooling;
- iii. Proper use of consumables;
- iv. Proper use of tools.

4. Knowledge of machine operating procedure and sequence

- i. Machine is properly connected to desired power points and all related accessories are connected properly.
- ii. Voltage, frequency, current potential, and polarity are checked.

5. Knowledge about defects, their remedy and acceptance limit

- i. Identified the defects of machine.
- ii. Remedy to the defects is known.
- iii. Acceptance limit as per standard code is known.

PERFORMANCE EVIDENCE

1. Helmet, Hand Shields, Safety Goggles, Gloves etc. are used.
2. Operator's health is fit before he goes to job.
3. The machine operator identified the proper tools for work.
4. The machine operator knows the use of specific tool.
5. For a set of approved bore plan drawings comprising type, size and location of all machine tools demonstrated for all requirements as per performance criteria.
6. The work is done as per demand of drawings.
7. Operator knows how to make machine ready for use.
8. Proper earthing is provided.
9. Proper polarity is confirmed.
10. Loose connections are checked.
11. All the defects in different type of machine are clearly identified.
12. Possible remedy to the defects identified is given.
13. Variation allowed as per codes are very well known.

SUPPLEMENTARY (KNOWLEDGE) EVIDENCE

In addition to the prior achievement evidence a trainee needs to display the following supplementary knowledge evidence for the course completion and being permitted to operate the HDD Machines independently:

1. Reading and writing in vernacular language.
2. Ability to conduct area and volume calculations.
3. Understanding about drilling fluid mix.
4. Understanding about different types of cuttings coming out of the drill holes and actions needed to avoid related accidents.
5. Possession of knowledge of various basic construction norms;
6. Possession of knowledge of basic electrical hazard prevention methods;
7. Awareness about basic operator's manual for Microtunneling & Pipe Jacking machines required for site works.

PERFORMANCE EVIDENCE

1. Helmet, Hand Shields, Safety Goggles, Gloves etc. are used.
2. Operator's health is fit before he goes to job.
3. The machine operator identified the proper tools for work.
4. The machine operator knows the use of specific tool.
5. For a set of approved bore plan drawings comprising type, size and location of all machine tools demonstrated for all requirements
6. The work is done as per demand of drawings.
7. Operator knows how to make machine ready for use.
8. Proper earthing is given.
9. Loose connections are checked as per performance criteria.
10. All the defects in different type of machine are clearly identified.
11. Possible remedy to the defects identified is given
12. Variation allowed as per codes are very well known.

SUPPLEMENTARY (KNOWLEDGE) EVIDENCE

In addition to the prior achievement evidence a candidate needs to display the following supplementary knowledge evidence for the competency independently:

1. Reading and writing in vernacular language.
2. Ability to conduct area and volume calculations
3. Understanding about flushing fluid mix being permitted to operate
4. Understanding about different types of cuttings coming out of with the flushing fluid and actions needed to avoid related accidents.
5. Possession of knowledge of various basic construction norms;
6. Possession of knowledge of basic electrical hazard prevention methods;
7. Awareness about basic operator's manual for Microtunneling machines required for site works.

TEST COVERAGE

In order to verify the above competencies, the test is aimed to evaluate the workers' knowledge in the following fields:

A. Basics of mathematics / natural sciences

- Units and their conversion
- Calculation of cross-section and volumes (i.e. annuli, pits)
- Basic of technical mechanics (power, torque, tension)
- Work, energy, capacity
- Basics of fluid mechanics (hydrostatic pressure, flow-rate, viscosity, pressure loss in fluids)

B. Microtunneling & Pipe jacking units

- General operation techniques;
- Type of drilling units and basic selection criteria;
- Laser guidance and remote control system;
- Spoil removal system;
- Pipe lubrication system;
- Jacking or propulsion system;

C. Project basics

- Location plans and terrain profiles;
- Basics of classification of soils and physical characteristics of subsoil;
- Basics of detection techniques like cable locator, GPR.
- Classification of the subsoil;
- Ground water conditions;
- Line installation plans (overhead lines, lines installed underground);
- Basics of bore path investigation (geo-radar);
- Practical training.
- Pollution hazards of drilling spoils with remedial measures / precautions;

D. Project realization

- Job site set-up;
- Documentation of system basics;
- Daily job reports;

E. Pipe lubrication Selection

- Fluid types;
- Functions and compositions;
- Measuring lubricating fluid requirements;
- Selection criteria;
- Lubrication plant.

F. Spoil removal system

- Slurry system:
 - ⇒ Fluid composition
 - ⇒ Slurry pumps;

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- ⇒ Slurry supply/discharge line;
- ⇒ Slurry tanks;
- ⇒ Slurry separation plants;
- ⇒ Disposal of slurry.

- Mucking screw system

G. Shaft design and construction

- Sizing shafts;
- Shaft excavation support methods;
- Groundwater control methods;
- Lateral earth, groundwater and surcharge pressure considerations;
- Lateral resistance for the thrust block;
- Launching and exit seal requirements.

H. Tunneling

- Cutter heads;
 - ⇒ Types of cutter heads
 - ⇒ Cutter heads selection considerations
 - ⇒ Construction and mode of operation;
- Cone section
- Over cut:
 - ⇒ Considerations;
 - ⇒ Requirements.

I. Guidance and control system

- Laser guidance system;
 - ⇒ Passive system
 - ⇒ Active system
- CCTV monitoring;

J. Casing/Jacking pipe materials & design considerations

Pipe materials;

- Investigation of the various pipe materials
 - ⇒ Steel;
 - ⇒ Concrete pipe;
 - ⇒ Glass-Fiber reinforced pipe
- Basics of the technical standards and norms

Pipe Design considerations;

- Cased installations
 - ⇒ Rigid casing design
 - ⇒ Flexible casing design
 - ⇒ Axial loads
 - ⇒ Dimension tolerance
 - ⇒ Grouting of annular space
- Uncased installation
 - ⇒ Corrosion consideration
 - ⇒ Corrosion protection
 - ⇒ Product pipe testing

K. Jacking system

- Jacking frame
- Hydraulic jacks
- Hydraulic pressures pump
- Thrust block
- Anchoring system
- Intermediate jacking station

L. Recording and monitoring

- Distance
- Machine torque & thrust
- Steering jack pressure and position
- Inclination and position
- Slurry charge and discharge pressures and flow rates
- Rate of excavation and penetration

M. Authority regulations / safety at work / environmental protection / work sheets

- Responsible persons;
- Work safety;
- Water protection;
- Pollutant and noise emission;
- Regulations for handling dangerous materials and agents;
- Basics of working and civil laws for drilling operations (liability, negligence etc.);
- Regulatory guidelines;
- Relevant laws, rules and regulations;
- Work sheet standards.