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AUTHOR Dean, Ann; Zagorac, Mike; Bumbaka, Nick

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ABSTRACT

This analysis covers tasks performed by an industrial instrument mechanic, an occupational title some provinces and territories of Canada have also identified as industrial instrumentation and instrument mechanic. A guide to analysis discusses development, structure, and validation method; scope of the occupation; trends; and safety. To facilitate understanding the nature of the occupation, work performed is divided into these categories: (1) blocks, the largest divisions in the analysis that reflect distinct operations relevant to the occupation; (2) tasks, the distinct activities that in combination make up the logical and necessary steps the worker is required to perform to complete a specific assignment in a block; and (3) sub-tasks, the smallest divisions into which it is practical to subdivide any work activity and which, in combination, fully describe all duties constituting a task. Other components of a task are trends, related components, tools and equipment, and supporting knowledge and abilities. Each sub-task is accompanied by results of a validation by all provinces/territories. The 8 blocks, which include 24 tasks, are occupational skills; new installations and efficient operation; field-mounted equipment; instrumentation and calibration; signal transmission; panel-mounted equipment; hydraulics and pneumatics; and distributed control and programmable logic controllers. Appendixes include a list of tools and equipment; glossary; blocks and tasks weighting; and task profile chart. (YLB)

Occupational Analyses Series

Industrial Instrument Mechanic

2000

Interprovincial Partnerships and Occupational Information Division

Division des Partenariats interprovinciaux et Information sur les carrières

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Mécanicien/mécanicienne d'instruments industriels

The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this occupational analysis as the national standard for the occupation of industrial instrument mechanic.

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This analysis was prepared by the Human Resources Partnerships Directorate of HRDC. The overall planning and coordination of the development of the analysis were undertaken by staff members of HRDC's Interprovincial Partnerships and Occupational Information Division.

OTHER RELATED OCCUPATIONAL TITLES

This analysis covers tasks performed by an industrial instrument mechanic whose occupational title has been identified by some provinces and territories of Canada under the following names:

- Industrial Instrumentation
- Instrument Mechanic

LIST OF PUBLISHED OCCUPATIONAL ANALYSES *

TITLE	NOC**Code
Appliance Service Technician (1997)	7332
Aquaculture Technician (1977)	2221
Arts Administrator (1989)	0114
Automotive Painter (1995)	7322
Automotive Service Technician (1998)	7321
Automotive Technician - Automatic Transmission (1990)	7321
Automotive Technician - Electrical/Electronics (1992)	7321
Automotive Technician - Engine Repair and Fuel Systems (1989)	7321
Automotive Technician - Front-End (1989)	7321
Automotive Technician - Manual Transmission, Driveline and Brakes (1990)	7321
Aviation Machinist (1994)	7231
Baker (1997)	6252
Blaster (Surface) (1987)	7372
Boilermaker (1994)	7262
Bricklayer (2000)	7281
Cabinetmaker (2000)	7272
Carpenter (1998)	7271
Cement Finisher (1995)	7282
Construction Electrician (1994)	7241
Cook (1997)	6242
Electrical Rewind Mechanic (1999)	7333
Electronics Technician - Consumer Products (1997)	2242
Electronics Technician Vol. I (1986) (Video Equipment)	2242
Electronics Technician Vol. II (1986) (Audio Equipment)	2242

* **Red Seal analyses are indicated in bold**

** **National Occupational Classification**

Electronics Technician Vol. III (1986) (Computer Equipment)	2242
Electronics Technician Vol. IV (1986) (Office Equipment)	2242
Electronics Technician Vol. VI (1986) (Communication Equipment)	2242
Electronics Technician Vol. VII (1986) (Signaling Equipment)	2242
Electronics Technician Vol. VIII (1986) (Navigation Equipment)	2242
Electronics Technician Vol. IX (1986) (Video Game Equipment)	2242
Electronics Technician Vol. X (1987) (CADD Equipment)	2242
Electronics Technician Vol. XI (1987) (CAM Equipment)	2242
Electronics Technician Vol. XII (1987) (Robotics Equipment)	2242
Electronics Technician Vol. XIII (1987) (Biomedical and Laboratory Equipment)	2242
Electronics Technician Vol. XIV (1987) (Industrial Process-Control Equipment)	2243
Farm Equipment Mechanic (2000)	7312
Floorcovering Installer (1997)	7295
Glazier (1994)	7292
Hairstylist (1997)	6271
Heating (Gas and Oil) Servicer - Commercial and Industrial (1978)	7331
Heavy Duty Equipment Mechanic (1998)	7312
Heavy Equipment Operator (1983)	7421
Industrial Electrician (1997)	7242
Industrial Instrument Mechanic (2000)	2243
Industrial Mechanic (Millwright) (1999)	7311
Insulator (Heat and Frost) (2000)	7293
Ironworker (Generalist) (1993)	7264
Lather (Interior Systems Mechanic) (1994)	7284

Logistics (1992)	0713
Machinist (1998)	7231
Major Electrical Appliance Repairer (1984)	7332
Mobile Crane Operator (1997)	7371
Motorcycle Mechanic (1995)	7334
Motor Vehicle Body Repairer (Metal and Paint) (1997)	7322
New Home Builder and Residential Renovation Contractor (1992)	0712
Oil Burner Mechanic (1997)	7331
Painter and Decorator (2000)	7294
Partsperson (1995)	1472
Plumber (1996)	7251
Power Engineer (1997)	7351
Powerline Technician (1996)	7244
Recreation Vehicle Mechanic (2000)	7383
Refrigeration and Air Conditioning Mechanic (1997)	7313
Roofer (1997)	7291
Sheet Metal Worker (1997)	7261
Sprinkler System Installer (1995)	7252
Steamfitter-Pipefitter (1996)	7252
Steel Fabricator (Fitter) (1994)	7263
Tool and Die Maker (1997)	7232
Truck-Trailer Repairer (1994)	7321
Truck and Transport Mechanic (2000)	7321
Welder (1996)	7265

REQUESTS FOR THESE PUBLICATIONS SHOULD BE FORWARDED TO:

Interprovincial Partnerships and Occupational Information Division
Human Resources Partnerships
Human Resources Development Canada
Place du Portage, Phase IV, 5th Floor
Hull, Quebec K1A 0J9

FOREWORD

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to co-operate with provincial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Human Resources Development Canada sponsors a program, under the guidance of the Canadian Council of Directors of Apprenticeship (CCDA), to develop a series of occupational analyses.

The Occupational Analysis Program has the following objectives:

- to identify and group the tasks performed by skilled workers in particular occupations;

- to identify those tasks that are performed by skilled workers in every province and territory;

- to develop instruments for use in the preparation of interprovincial standards "Red Seal" examinations and curricula for training leading to the certification of skilled workers;

- to facilitate the mobility, in Canada, of trainees and skilled workers;

- to supply employers and employees, and their associations, industries, training institutions and governments with analyses of the tasks performed in particular occupations.

TABLE OF CONTENTS

GUIDE TO ANALYSIS

DEVELOPMENT OF ANALYSIS

A draft analysis is developed by a knowledgeable consultant who, with the assistance of a committee of industry experts in the field, identifies all the tasks performed in the occupation.

The draft is then assigned to occupational analysts at Human Resources Development Canada for translation and then returned to the consultant for review to ensure conformity with the nationally approved format.

The consultant will then forward a copy of this analysis to provincial/territorial authorities for validation by specialists in the field. Their recommendations are assessed and incorporated into the final draft which also includes the identification of the common core tasks performed in the occupation.

The occupational analysis is published in both official languages.

STRUCTURE OF ANALYSIS

To facilitate the understanding of the nature of the occupation, the work performed is divided into the following divisions:

A. **BLOCK** - is the largest division within the analysis and reflects a distinct operation relevant to the occupation.

B. **TASK** - is the distinct activity that, combined with others, makes up the logical and necessary steps the worker is required to perform to complete a specific assignment within a "BLOCK".

C. **SUB-TASK** - is the smallest division into which it is practical to subdivide any work activity and, combined with others, fully describes all duties constituting a "TASK".

Supporting Knowledge & Abilities

The element of skill and knowledge that an individual must acquire to adequately perform the task is identified under this heading.

Trends

Any shifts or changes in technology which affects the block are identified under this heading.

Related Components

All components of a specified task being undertaken by the industrial instrument mechanic are identified under this heading.

Tools and Equipment

All tools and equipment necessary for the industrial instrument mechanic to complete a task are identified under this heading.

VALIDATION METHOD

At the request of the Canadian Council of Directors of Apprenticeship (CCDA), the Standardization SubCommittee developed a method for the validation of the national Red Seal occupational analyses.

A draft of the analysis is sent to all provinces/territories for validation. Each jurisdiction rates the sub-tasks and applies percentage ratings to blocks and tasks. This method for the validation of the national occupational analyses identifies common core tasks across Canada for a specific occupation. This feature facilitates the weighting of the Interprovincial Red Seal examinations.

DEFINITIONS

YES:	the sub-task is performed by workers in the occupation in a specific jurisdiction.
NO:	the sub-task is not performed by workers in the occupation in a specific jurisdiction.
BLOCK %:	the average number of questions (items), derived from the collective decision made by workers within the occupation from all areas of Canada, which will be placed on an interprovincial examination to assess each block of the analysis.
TASK %:	the average number of questions (items), derived from the collective decision made by workers within the occupation from all areas of Canada, which will be placed on an interprovincial examination to assess each task of the analysis.
NV:	Not Validated by a province/territory.
ND:	Not Designated in a province/territory.

PROVINCIAL/TERRITORIAL ABBREVIATIONS

NF:	Newfoundland and Labrador
NS:	Nova Scotia
PE:	Prince Edward Island
NB:	New Brunswick
QC:	Quebec
ON:	Ontario
MB:	Manitoba
SK:	Saskatchewan
AB:	Alberta
BC:	British Columbia
NT:	Northwest Territories
YK:	Yukon

COMMON CORE

The criteria for determining common core are dependant on the performance of sub-tasks. If 70 percent of the responding jurisdictions (excluding NVs and NDs) perform the sub-task, it shall be considered common core.

Interprovincial Red Seal examinations are based on the common core identified through this validation process. This process identifies what will be assessed through the interprovincial examination.

BLOCKS AND TASKS WEIGHTING (APPENDIX "C")

This appendix represents the block and task percentages as submitted by each jurisdiction.

Each jurisdiction, with the use of a provincial/territorial occupational advisory committee, validates the content, places percentages on blocks and tasks, and indicates whether or not the sub-tasks are performed by the skilled workers within the occupation. The results of this exercise are submitted to Human Resources Development Canada (HRDC). In turn, HRDC analyzes the data and develops this appendix which provides the individual jurisdictional validation results as well as the national averages of all responses.

PIE CHART (APPENDIX "D")

The graph depicts the national percentages assigned to blocks in the analysis.

SCOPE OF THE INDUSTRIAL INSTRUMENT MECHANIC OCCUPATION

The field of industrial instrumentation includes the science and art of measurement, control, and process manipulation.

Specifically, industrial instrumentation includes the ability to install, service, maintain and upgrade measuring and control devices and systems which equip process industries. The variables which are measured and controlled include temperature, pressure, flow, weight, vibration and many others.

Instrumentation is applied to practically all areas of research and industry to measure, record, analyze and control product output, as well as monitor and control emissions to protect the environment.

This analysis covers the tasks and sub-tasks which an industrial instrument mechanic will be required to master in order to properly function in the field.

OCCUPATIONAL OBSERVATIONS

In the updating of this analysis, it was discovered that there are many new trends in the industrial instrumentation field. Rapid changes in industrial computing technology have resulted in an increase in the integration of manufacturing and management systems. Workers in this field must understand these systems and their requirements, as well as the impact of the technology is having on human-machine interfaces. They will need greater exposure to devices and strategies used to measure productivity enhancements in addition to devices and systems designed to lower maintenance costs and increase plant performance.

The integration of personal computers in the industrial control environment continues to increase. Processes continue to be linked to plant networks, and industrial instrument mechanics will become more involved in linking plant processes to Internet and Intranet applications. New computer technology also allows for the development of on-line maintenance management systems and the skills required to use them.

In the future, there will be even more integration of statistical and automatic process controls. The industrial instrument mechanic will be expected to be able to configure and test enhanced smart field devices, design and tune feedback and regulatory control systems, evaluate control system safety and reliability and work with improved environmental technologies and products. Plant protection and safety devices continue to be a growing trend in this industry.

All of the technology improvements in this field require that the workers in this occupation have access to training that provides them with technical currency. In addition, the need to work in a team continues to be evident.

SAFETY

Safe working procedures and conditions, accident prevention and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that a safety-conscious attitude and work practices contribute to a healthy, safe and accident-free working environment.

It is imperative to apply and be familiar with the Occupational Health and Safety Act and Regulations. As well, it's essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

As safety education is an integral part of training in all jurisdictions, personal safety practices are not recorded in this document. However, the technical safety aspect relating to each task and sub-task are included throughout this analysis.

ANALYSIS

BLOCK A

OCCUPATIONAL SKILLS

Trends: *Towards multicrafting or multiskilling, where two or more trades are blended together; such as electrical and instrumentation where tradespeople learn key aspects or tasks usually associated with both trade areas. With technological changes occurring faster than ever before, tradespeople must be committed to lifelong learning to remain competent and current in their field.*

Task 1 **Demonstrates safe work practices and personal protection.**

Related Components: Guards, safety shields, dosimeters, personal protective clothing and equipment, safety locks and tags, blocks, chocks, barriers, signs, flags, material safety data sheets, government regulations, trade policies and practices, emergency response plan, hazard recognition, job planning, inspection procedures, organization policy and practices, scaffolding and ladders.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, job specific tools.

Sub-task

1.01 Complies with safety regulations and safe work practices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

1.01.01 knowledge of potential health and safety hazards

1.01.02 knowledge of safe handling and transportation of hydraulic fluids

1.01.03 knowledge of safe handling procedures for transferring liquids

1.01.04 knowledge of disposal procedures for radioactive units

1.01.05 knowledge of maximum allowable exposure time to radioactive substances

Supporting Knowledge & Abilities

1.01.06	knowledge of reaction plan in event of radioactive leak
1.01.07	ability to prepare safe work environment
1.01.08	ability to inspect and control exposure to fumes, vapour and dust
1.01.09	ability to recognize and handle hazardous materials
1.01.10	ability to adhere to government safety standards/regulations and company policies and procedures
1.01.11	ability to wear personal protective equipment and clothing
1.01.12	ability to measure level of radiation exposure
1.01.13	ability to maintain tools and equipment
1.01.14	ability to maintain good housekeeping
1.01.15	ability to assure protection from fire hazards

Sub-task

1.02 Determines safety lock out and tagging procedures.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

1.02.01	knowledge of safe practices for shutting down and isolating equipment including PLC's, electrical, mechanical and hydraulic
1.02.02	knowledge of safe practices and policies for locking and tagging equipment
1.02.03	knowledge of safe work practices for energizing equipment
1.02.04	ability to lock out equipment and instruments
1.02.05	ability to isolate and bypass instruments and equipment

Sub-task

1.03 Installs safety shields and guards.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

1.03.01	knowledge of workplace health and safety
1.03.02	knowledge of various types of guards and protective devices
1.03.03	knowledge of regulations and specifications governing safety shields and guards requirements
1.03.04	knowledge of regulations governing work performed in confined spaces
1.03.05	ability to select and install appropriate guards and protective devices for safe operation
1.03.06	ability to inspect shields and guards

Task 2 Utilizes drawings, codes, standards and government regulations.

Related Components: Blueprints, schematics, drawings, code books, logic drawings, requesting documentation.

Tools and Equipment: Computers, sketching equipment.

Sub-task

2.01 Interprets blueprints, schematics and drawings.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

2.01.01	knowledge of drafting techniques
2.01.02	knowledge of blueprint organization and layout
2.01.03	knowledge of precedence of drawings, details and specifications

Supporting Knowledge & Abilities

2.01.04	knowledge of basic blueprint symbols and conventions
2.01.05	knowledge of types of drawings
2.01.06	knowledge of blueprint title block information
2.01.07	ability to produce basic sketches
2.01.08	ability to identify the types of views displayed
2.01.09	ability to explain the role and placement of notes and specifications
2.01.10	ability to interpret hydraulic, system and logic drawings
2.01.11	ability to update drawings as per codes, trade standards and the organization's process
2.01.12	ability to interpret loop drawings
2.01.13	ability to identify and locate from drawings, physical equipment such as pumps turbines, fans, separators, dryers and crushers

Sub-task

2.02 Interprets codes, trade standards and government regulations.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

2.02.01	knowledge of the Atomic Energy of Canada regulations
2.02.02	knowledge of codes such as American Society for Testing and Materials (ASTM), the American National Standards Institute (ANSI)
2.02.03	knowledge of the Canadian Standards Association (CSA) standards

Supporting Knowledge & Abilities

2.02.04	knowledge of applicable Occupational Health and Safety Acts (OHSA) and Regulations, including the Canadian Labour Code and the Workplace Hazardous Material Information system (WHMIS)
2.02.05	knowledge of SAMA (Scientific Apparatus Makers Association) specifications
2.02.06	ability to comply with national, provincial and municipal codes and regulations (employment, health, environmental, security regulations and standards)

Task 3 **Utilizes tools and measuring equipment.**

Related Components: Safe work practices, inspection, metric and imperial measurement systems, drawing index system, personal protective equipment, lubricants, and layout.

Tools and Equipment: Hand tools, power tools, measuring tools, stationary tools.

Sub-task

3.01 Operates hand tools.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

3.01.01	knowledge of safe practices for using common hand tools
3.01.02	knowledge of types, purposes and use of all common hand tools
3.01.03	ability to sharpen and maintain tools
3.01.04	ability to use cutting, fastening, drilling, dismantling and abrading hand tools

Sub-task

3.02 Operates portable power tools.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

3.02.01	knowledge of safe practices for using portable power tools
3.02.02	knowledge of types, purposes and use of all portable power tools
3.02.03	ability to maintain portable power tools
3.02.04	ability to operate portable power tools including cutting, drilling, fastening, abrading and powder actuated fastening tools

Sub-task

3.03 Operates stationary power tools.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

3.03.01	knowledge of safe practices for using all common stationary power tools such as lathe, milling machines, drill press, stationary grinders, etc.
3.03.02	knowledge of types, purposes and application of all common shop machines
3.03.03	ability to set up and operate stationary power tools
3.03.04	ability to apply appropriate coolants
3.03.05	ability to determine depth of cut feeds and speeds and for various types of materials
3.03.06	ability to machine parts according to engineering drawings and specifications
3.03.07	ability to maintain stationary power tools

Sub-task

3.04 Operates measuring equipment. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

3.04.01	knowledge of care and maintenance procedures for all common precision measuring devices
3.04.02	knowledge of types, purposes and applications of all common precision measuring tools
3.04.03	ability to identify and operate measuring devices for specific tasks
3.04.04	ability to calibrate basic measuring devices
3.04.05	ability to verify tool calibration
3.04.06	ability to take measurements using all common precision measuring tools

Task 4 Demonstrates common work practices and procedures.

Related Components: Tubing and piping schedules, standards and practices, wiring terminations, welding, brazing and burning practices, standards and techniques, process equipment and operating conditions, adhesives, fasteners.

Tools and Equipment: Tube cutters, hand tools, power tools, reamers, pipe threaders, pipe flaring tools, soldering gun wire and irons, solders and fluxes, shrink wrap, wire cutters, wire markers, crimpers, gas welding equipment and accessories, arc welding equipment and accessories, layout tools, scribers, awls, thread forms and gauges.

Sub-task

4.01 Installs tubing and pipes. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

4.01.01	knowledge of types, sizes and material composition of tubing and piping
4.01.02	knowledge of techniques and procedures to swage pipe
4.01.03	knowledge of techniques and procedures to flare pipe
4.01.04	knowledge of techniques and procedures to thread pipe
4.01.05	knowledge of techniques and procedure to ream pipe
4.01.06	ability to size and select pipe or tubing based on application and environmental conditions
4.01.07	ability to assess tubing form, angles and joints
4.01.08	ability to mark, measure, cut and/or drill holes/passages for piping
4.01.09	ability to mark, measure and cut pipe into specified lengths
4.01.10	ability to contour pipe to fit pre-designed locations
4.01.11	ability to set up and operate tube bending jigs and machines

Sub-task

4.02 Performs hook-ups and terminates wiring.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

4.02.01	knowledge of wiring techniques and procedures
4.02.02	knowledge of electrical circuitry systems and patterns
4.02.03	knowledge of fibre optics, coaxal and twisted pair cable

Supporting Knowledge & Abilities

4.02.04	knowledge of grounding techniques
4.02.05	knowledge of procedures and techniques to splice wire fasteners
4.02.06	knowledge of application and types of termination components
4.02.07	knowledge of types, sizes of wiring and connections
4.02.08	knowledge of colour coding of wires
4.02.09	knowledge of electrical testing equipment such as ammeters, voltmeters, multimeters, and ohmmeters
4.02.10	ability to select wiring to match system specifications
4.02.11	ability to measure, splice, solder and insulate wire

Sub-task

4.03 Applies fasteners and adhesives.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

4.03.01	knowledge of types, sizes and functions of fasteners such as screws bolts and anchors
4.03.02	knowledge of screwed, flanged or welded methods for fittings
4.03.03	knowledge of types and application of adhesives
4.03.04	knowledge of the characteristics, uses and holding power of different types of fasteners and adhesives
4.03.05	knowledge of adhesive drying times
4.03.06	knowledge of adhesive resistance to substances such as water and oil

Supporting Knowledge & Abilities

4.03.07	knowledge of adhesive bonding strength and resistance to impact and tension
4.03.08	knowledge of torque values, tensile strength and metal compatibility
4.03.09	ability to select fittings to meet application requirements
4.03.10	ability to identify and operate tools to install/apply and remove fasteners and adhesives
4.03.11	ability to secure components according to specifications

Sub-task

4.04 Performs welding, cutting and brazing operations with gas welding equipment.

Supporting Knowledge & Abilities

(NOT COMMON CORE)

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
no	yes	no	yes	ND	no	no	yes	yes	no	NV	NV

4.04.01	knowledge of safe work practices when using gas welding equipment
4.04.02	knowledge of safe storage practices for all gas welding and cutting equipment
4.04.03	ability to clean, grind and position metal to be welded, brazed or cut
4.04.04	ability to set up gas welding equipment
4.04.05	ability to weld, braze or cut metal to blueprints or specifications
4.04.06	ability to clean and inspect joint for surface defects including undercuts, cracks and porosity

Sub-task

4.05 Performs welding operations using standard arc welding equipment.

Supporting Knowledge & Abilities

(NOT COMMON CORE)

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	no	no	yes	ND	no	no	yes	yes	no	NV	NV

4.05.01	knowledge of safe work practices when using arc welding equipment
4.05.02	knowledge of common types of arc welding equipment
4.05.03	knowledge of the care and handling of arc welding equipment
4.05.04	knowledge of welding procedures and techniques
4.05.05	ability to weld all types of common ferrous metals
4.05.06	ability to achieve proper fusion and penetration in all positions

Sub-task

4.06 Fabricates and mounts brackets.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	no	NV	NV

4.06.01	knowledge of techniques and procedures to fabricate brackets
4.06.02	knowledge of types and sizes of instruments
4.06.03	knowledge of installation requirements for instruments
4.06.04	knowledge of carrying capacity for brackets
4.06.05	knowledge of types, sizes and characteristics of fasteners

Supporting Knowledge & Abilities

4.06.06 knowledge of location and space requirements for instruments

4.06.07 ability to isolate brackets from vibrations

4.06.08 ability to measure, cut, form, machine and weld metal

4.06.09 ability to install supports

Sub-task

4.07 Installs valves and fittings.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	no	NV	NV

4.07.01 knowledge of hydraulic and pneumatic principles

4.07.02 knowledge of types, styles, construction, application and selection criteria for valves and fittings

4.07.03 knowledge of piping requirements for valves

4.07.04 knowledge of directional control, flow control, pressure regulation, counterbalance, pressure reduction, servo and proportional valves

4.07.05 ability to align valves and fittings

4.07.06 ability to interpret specification charts for torque requirements

Sub-task

4.08 Inspects removable components for wear or malfunction.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	no	NV	NV

4.08.01 knowledge of techniques and procedures to remove components

Supporting Knowledge & Abilities

4.08.02	knowledge of different types and functions of removable components
4.08.03	ability to inspect, test and examine components for damage, defects and wear
4.08.04	ability to recognize conditions that lead to failure/breakdown
4.08.05	ability to recognize common failures in components
4.08.06	ability to troubleshoot and identify faults and problems
4.08.07	ability to record damage, defects and wear

BLOCK B

NEW INSTALLATIONS AND EFFICIENT OPERATION

Trends: *There is a trend towards greater emphasis on preventative and predictive maintenance programs as well as an increase in the application of smart or intelligent system components that can run self-diagnostics and report findings automatically. New technology has also resulted in smaller, more compact panels that are prefabricated and delivered pre-wired and ready for field component connections.*

Task 5 **Maximizes operating efficiency of process control system.**

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, inspection procedures, hazard recognition, personal protective equipment, piping, wiring, valves and fittings, scaffolds, rigging, prints and drawings.

Tools and Equipment: Personal computers, software programs, reports, operator stations, calculators.

Sub-task

5.01 Reviews maintenance and operations report.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

5.01.01	knowledge of maintenance schedules and requirements
5.01.02	knowledge of equipment operation and performance expectations
5.01.03	ability to source maintenance and operation data
5.01.04	ability to interpret reports for efficiency issues and errors
5.01.05	ability to validate reports against process control operation
5.01.06	ability to set work priorities

Sub-task

5.02 Evaluates operation of panel mounted equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

5.02.01	knowledge of purpose and function of equipment
5.02.02	knowledge of operating parameters and conditions for panel equipment
5.02.03	ability to verify operation of panel equipment such as annunciators, alarms, indicators, controls recorders, operator work stations and other peripheral equipment
5.02.04	ability to test operation of panel mounted equipment without disrupting process operations

Sub-task

5.03 Investigates "out of spec", unusual reading and responses (low/high flows, temperatures, pressures, panel alarms, operator concerns).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

5.03.01	knowledge of equipment specifications and performance characteristics
5.03.02	knowledge of process characteristics
5.03.03	knowledge of types of common problems relating to responses from variables such as flow, temperature, pressure panel alarms and operator concerns
5.03.04	ability to review equipment/system concerns with manufacturer, process specialists, operators, maintenance and other personnel
5.03.05	ability to perform a root cause analysis to determine origin of unusual readings and responses

Sub-task

5.04 Tunes process control systems (feedback loops, feed-forward, cascade, ratio, batch, on-off).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

5.04.01	knowledge of process characteristics
5.04.02	knowledge of procedures and techniques for tuning control system
5.04.03	knowledge of applications, types and operating features of control systems such as feedback loops, feed-forward, cascade, ratio, batch, and on-off

Supporting Knowledge & Abilities

5.04.04	knowledge of sequence of operations and operations performed control system such as measurement, decision, manipulation
5.04.05	ability to determine control settings such as proportional, integral, derivative
5.04.06	ability to differentiate between a tuning problem and a problem with equipment components
5.04.07	ability to analyze equipment response to determine tuning requirements

Sub-task

5.05 Inspects field mounted equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

5.05.01	knowledge of manufacturers specifications
5.05.02	knowledge of inspection procedures and techniques
5.05.03	knowledge of types of field equipment such as sensing elements, transducers, final control elements
5.05.04	ability to locate, access and verify identification of field mounted equipment
5.05.05	ability to assess equipment appearance and operation to determine the cause of any "out of spec" conditions

Sub-task

5.06 Develops preventative and predictive maintenance programs.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

5.06.01	knowledge of manufacturers specifications
5.06.02	knowledge of manufacturers recommended maintenance schedule
5.06.03	knowledge of equipment history and operating specifications
5.06.04	knowledge of lubrication techniques
5.06.05	knowledge of maintenance schedules, systems and programs
5.06.06	knowledge of equipment operating requirements
5.06.07	ability to interpret production data and maintenance data to determine preventive requirements
5.06.08	ability to revise preventative maintenance programs due to process changes, manufacturers recommendations or equipment failure analysis
5.06.09	ability to prepare paper-based and electronic documents to format specifications

Sub-task

5.07 Develops standard operating procedures (SOPs).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	no	ND	yes	yes	yes	yes	yes	NV	NV

5.07.01	knowledge of process flow and sequence of operations
5.07.02	knowledge of operating conditions
5.07.03	knowledge of standard operating procedure development format and approval process
5.07.04	knowledge of operating performance steps, standards and duration of performance
5.07.05	knowledge of manufacturers specifications
5.07.06	knowledge of inspection procedures and techniques

Supporting Knowledge & Abilities

5.07.07	ability to locate, access and verify identification of field mounted equipment
5.07.08	ability to prepare paper-based and electronic documents to format specifications

Sub-task

5.08 Performs operational checks of process control systems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

5.08.01	knowledge of process control system operating conditions and requirements
5.08.02	knowledge of acceptable performance ranges for systems
5.08.03	knowledge of operational problems
5.08.04	ability to test system with little or no disruption to the process
5.08.05	ability to assess equipment appearance and operation to determine the cause of any "out of spec" conditions

Task 6 Facilitates new installations.

Related Components: Manufacturer specifications, layout, blueprints, trade codes, fasteners, project planning, maintenance scheduling, lubrication, data storage systems, material safety data sheets, standard operation procedures, trade codes, governmental regulations, inspection procedures, hazard recognition, piping, wiring, valves and fittings, scaffolds, riggings, prints and drawings.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

6.01 Advises on system requirements.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

6.01.01	knowledge of maintenance schedules and requirements
6.01.02	knowledge of process characteristics
6.01.03	knowledge of equipment operation and performance expectations features of instrumentation under consideration
6.01.04	ability to verify equipment/process and instrumentation match and selection
6.01.05	ability to interpret manufacturers' recommendations for operating limits, tolerances, specifications and start-up process

Sub-task

6.02 Verifies process drawings and documentation.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

6.02.01	knowledge of maintenance schedules and requirements
6.02.02	knowledge of process characteristics
6.02.03	knowledge of equipment operation and performance expectations features of instrumentation under consideration
6.02.04	knowledge of process areas and conditions
6.02.05	ability to verify equipment/process and instrumentation match and selection
6.02.06	ability to validate drawings against actual installations

Sub-task

6.03 Verifies new equipment against specifications on data sheets. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

6.03.01	knowledge of manufacturers specifications, equipment requirements and operating specifications
6.03.02	ability to interpret data sheets to determine equipment specification requested

Sub-task

6.04 Fabricates brackets and mounts. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

6.04.01	knowledge of equipment installation specifications
6.04.02	knowledge of material characteristics and requirements
6.04.03	knowledge of process impact on materials
6.04.04	knowledge of environmental and operating conditions
6.04.05	ability to select material to meet process and environmental conditions

Sub-task

6.05 Fabricates field enclosures. **Supporting Knowledge & Abilities**

(NOT COMMON CORE)

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	no	ND	yes	no	yes	yes	yes	NV	NV

6.05.01	knowledge of purpose of field enclosure
6.05.02	knowledge of process impact on enclosure

Supporting Knowledge & Abilities

6.05.03	knowledge of environmental and operating conditions
6.05.04	ability to design an enclosure to meet the equipment and process needs
6.05.05	ability to select material to meet process and environmental conditions
6.05.06	ability to layout material for cutting and fabricating

Sub-task

6.06 Fabricates panels.

Supporting Knowledge & Abilities

(NOT COMMON CORE)

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	no	ND	yes	no	yes	yes	yes	NV	NV

6.06.01	knowledge of purpose of panels
6.06.02	knowledge of process impact on panels
6.06.03	knowledge of environmental and operating conditions
6.06.04	ability to determine power and supply considerations for panel mounted equipment such as pneumatic and electrical
6.06.05	ability to mount equipment shelves and racks on panels
6.06.06	ability to select material to meet process and environmental conditions
6.06.07	ability to layout a panel

Sub-task

6.07 Coordinates equipment and field enclosure installations.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

6.07.01	knowledge of installation techniques and procedures
6.07.02	knowledge of sequence of installation
6.07.03	knowledge of job conditions
6.07.04	knowledge of labour requirements and agreements
6.07.05	knowledge of time requirements
6.07.06	ability to assess types and amount of work to be completed and set priorities
6.07.07	ability to design a project plan
6.07.08	ability to schedule material, work and workers
6.07.09	ability to obtain permits
6.07.10	ability to inspect the work in progress and maintain critical path

Sub-task

6.08 Performs operational check outs of new equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

6.08.01	knowledge of maintenance schedules and requirements
6.08.02	knowledge of equipment operation and performance expectations
6.08.03	knowledge of operating parameters for new equipment including pre-installation calibration methods
6.08.04	ability to perform pre-installation calibration verification
6.08.05	ability to confirm equipment capabilities against work order or purchase requisitions

Sub-task

6.09 Verifies equipment installations and calibrations.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

6.09.01	knowledge of maintenance schedules and requirements
6.09.02	knowledge of equipment operation and performance expectations
6.09.03	ability to locate, access and identify field mounted equipment
6.09.04	ability to confirm equipment installation specifications against work order or purchase requisitions

Sub-task

6.10 Coordinates changeovers to new systems from old.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

6.10.01	knowledge of maintenance schedules and requirements
6.10.02	knowledge of equipment operation and performance expectations
6.10.03	knowledge of removal and installation techniques and procedures
6.10.04	knowledge of job conditions, time requirements, labour requirements and agreements
6.10.05	ability to design a project plan
6.10.06	ability to schedule material, work and workers

Supporting Knowledge & Abilities

6.10.07 ability to obtain permits

6.10.08 ability to label all loops, instruments and cables

6.10.09 ability to inspect the work in progress and maintain critical path

Sub-task

6.11 Configures process control systems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

6.11.01 knowledge of process control requirements

6.11.02 knowledge of process control configuration procedures and techniques

6.11.03 knowledge of types of process and control systems such as Scada, P/C and DSC

6.11.04 ability to input process control data and verify settings

Sub-task

6.12 Installs auxiliary equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

6.12.01 knowledge of installation requirements, procedures and techniques for auxiliary equipment such as alarms and gauges

6.12.02 ability to select auxiliary equipment to meet application requirements

BLOCK C

FIELD MOUNTED EQUIPMENT

Trends: *There is a trend towards smart or intelligent system components that are capable of self-diagnostics. Calibration and set-up can be done utilizing personal computers, microprocessors and customized software. Transmitters that use force balance principles are no longer the norm.*

Task 7 **Maintains field mounted pressure equipment.**

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, standard operation procedures, trade codes, governmental regulations, inspection procedures, hazard recognition, piping, wiring, valves and fittings, drawing index systems.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment, gauges, vacuum, differential pressure and pressure, transmitters, electrical and pneumatic force balance, inductance transmitters, multi-pressure scanners, dedicated pressure multiplexors, pressure switches.

Sub-task

7.01 Installs pressure gauges (pressure, vacuum and differential pressure).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

7.01.01 knowledge of equipment operation and performance expectations

7.01.02 knowledge of application, installation procedures and techniques for pressure gauges

7.01.03 knowledge of types of pressure gauges for measuring pressure, vacuum and differential pressure such as back flange, differential, front flange, turret types and diaphragm and vacuum gauges

7.01.04 knowledge of the impact of environmental factors and materials on gauge operation and visibility

Supporting Knowledge & Abilities

7.01.05 ability to size and select pressure gauge to meet application requirements

7.01.06 ability to connect and secure pressure gauges

7.01.07 ability to verify operation of device

Sub-task

7.02 Installs electronic pressure transmitters (pressure and vacuum).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

7.02.01 knowledge of equipment operation and performance expectations

7.02.02 knowledge of installation procedures and techniques for electronic pressure transmitter

7.02.03 knowledge of types of electronic pressure transmitters used to measure pressure and vacuum such as inductance, electronic force balance pressure transmitter and variable reluctance electronic force balance pressure devices

7.02.04 ability to select electronic pressure transmitter to meet application requirements

7.02.05 ability to connect and secure electronic pressure transmitters

7.02.06 ability to verify operation of device

Sub-task

7.03 Installs pneumatic pressure transmitters (pressure and vacuum).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

7.03.01	knowledge of equipment operation and performance expectations
7.03.02	knowledge of installation procedures and techniques for pneumatic pressure transmitter
7.03.03	knowledge of types of pneumatic pressure transmitters such as force-balance pressure transmitters and multiple pressure scanners including rotary pressure scanners, high-speed pressure scanners, dedicated pressure multiplexers
7.03.04	ability to select pneumatic pressure transmitter to meet application requirements
7.03.05	ability to connect and secure pneumatic pressure transmitters
7.03.06	ability to verify operation of device

Sub-task

7.04 Installs pressure regulators. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

7.04.01	knowledge of equipment operation and performance expectations
7.04.02	knowledge of installation procedures and techniques for pressure regulators
7.04.03	knowledge of types of pressure regulators such as standard and relief
7.04.04	ability to size and select pressure regulators to meet application requirements
7.04.05	ability to connect and secure pressure regulators
7.04.06	ability to verify operation of device

Sub-task

7.05 Installs pressure switches (pressure, vacuum and differential pressure).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

7.05.01	knowledge of installation procedures and techniques for pressure switches
7.05.02	knowledge of operating requirements for sensing elements
7.05.03	knowledge of types of pressure switches such as dual control and fixed differential
7.05.04	knowledge of case designs for pressure switches including weather resistant and explosion proof
7.05.05	ability to size and select pressure switches to meet application requirements
7.05.06	ability to connect and secure pressure switches
7.05.07	ability to verify operation of device

Sub-task

7.06 Calibrates pressure gauges (pressure, vacuum and differential pressure).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	yes	NV	NV

7.06.01	knowledge of equipment operation and performance expectations
7.06.02	knowledge of calibration procedures and techniques for pressure gauges
7.06.03	knowledge of cause and effect of calibration errors
7.06.04	knowledge of calibration standards for pressure gauges

Supporting Knowledge & Abilities

7.06.05	ability to assess the installation
7.06.06	ability to introduce a reference standard and assess the status of the calibration
7.06.07	ability to adjust the calibration instrument/device
7.06.08	ability to verify the operation of the device and its components

Sub-task

7.07 Calibrates electronic pressure transmitters (pressure and vacuum).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

7.07.01	knowledge of equipment operation and performance expectations
7.07.02	knowledge of calibration procedures and techniques for electronic pressure transmitters
7.07.03	knowledge of cause and effect of calibration errors
7.07.04	knowledge of calibration standards for electronic pressure transmitters
7.07.05	ability to assess the installation
7.07.06	ability to introduce a reference standard and assess the status of the calibration
7.07.07	ability to adjust the calibration instrument/device
7.07.08	ability to verify the operation of the device and its components

Sub-task

7.08 Calibrates pneumatic pressure transmitters (pressure and vacuum).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

7.08.01	knowledge of equipment operation and performance expectations
7.08.02	knowledge of calibration procedures and techniques for pneumatic pressure transmitters including computer driven recalibration
7.08.03	knowledge of cause and effect of calibration errors
7.08.04	knowledge of calibration standards for pneumatic pressure transmitters
7.08.05	ability to assess the installation
7.08.06	ability to introduce a reference standard and assess the status of the calibration
7.08.07	ability to adjust the calibration instrument/device
7.08.08	ability to verify the operation of the device and its components

Sub-task

7.09 Calibrates pressure switches (pressure, vacuum and differential pressure).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

7.09.01	knowledge of equipment operation and performance expectations
7.09.02	knowledge of calibration procedures and techniques for pressure switches
7.09.03	knowledge of cause and effect of calibration errors

Supporting Knowledge & Abilities

7.09.04	knowledge of calibration standards and set points for pressure switches
7.09.05	ability to assess the installation
7.09.06	ability to introduce a reference standard and assess the status of the calibration
7.09.07	ability to adjust the calibration instrument/device
7.09.08	ability to verify the operation of the device

Sub-task

7.10 Tests pressure regulators.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

7.10.01	knowledge of equipment operation and performance expectations
7.10.02	knowledge of test procedures and techniques for pressure regulators
7.10.03	knowledge of cause and effect of operation errors
7.10.04	knowledge of system requirements for the pressure regulator
7.10.05	ability to assess the installation
7.10.06	ability to operate the pressure regulator and observe its response

Sub-task

7.11 Replaces pressure gauge components (pressure, vacuum and differential pressure).

Supporting Knowledge & Abilities

(NOT COMMON CORE)

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	no	ND	yes	no	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

7.11.01 knowledge of equipment operation and performance expectations

7.11.02 knowledge of removal and installation procedures and techniques for pressure gauge components

7.11.03 knowledge of types of components that can be replaced such as ring, glass lens, gaskets, pointers and dials

7.11.04 ability to select components to meet application requirements

7.11.05 ability to verify operation and calibration of device and replaced components

Sub-task

7.12 Replaces electronic pressure transmitter components (pressure and vacuum).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	yes	NV	NV

7.12.01 knowledge of equipment operation and performance expectations

7.12.02 knowledge of removal and installation procedures and techniques for electronic pressure transmitter components

7.12.03 knowledge of types of components that can be replaced such as seals, springs and levers

7.12.04 ability to select components to meet application requirements

7.12.05 ability to verify operation and calibration of device and replaced components

Sub-task

7.13 Replaces pneumatic pressure transmitter components (pressure and vacuum).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

7.13.01 knowledge of equipment operation and performance expectations

7.13.02 knowledge of removal and installation procedures and techniques for pneumatic pressure transmitter components

7.13.03 knowledge of types of components that can be replaced such as pressure gauges and bellows, rotors, bearings and stators for rotary pressure scanners

7.13.04 ability to select components to meet application requirements

7.13.05 ability to verify operation and calibration of device and replaced components

Sub-task

7.14 Replaces pressure switch components (pressure, vacuum and differential pressure).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	no	yes	yes	yes	NV	NV

7.14.01 knowledge of equipment operation and performance expectations

7.14.02 knowledge of removal and installation procedures and techniques for pressure switch components

7.14.03 knowledge of operating requirements for components such as switch elements

Supporting Knowledge & Abilities

7.14.04 knowledge of types of components that can be replaced such as switching assemblies, discs and springs

7.14.05 ability to select components to meet application requirements

7.14.06 ability to verify operation and calibration of device and replaced components

Sub-task

7.15 Replaces components on pressure regulators.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	yes	NV	NV

7.15.01 knowledge of equipment operation and performance expectations

7.15.02 knowledge of removal and installation procedures and techniques for pressure regulators

7.15.03 knowledge of types of components that can be replaced such as springs and diaphragms

7.15.04 ability to select components to meet application requirements

7.15.05 ability to verify operation of device and replaced components

Task 8 **Maintains field mounted flow equipment.**

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding, drawing index system, primary flow elements such as annubars, orifice plates (concentric, thin plate, sharp-edged), venturi tubes, flow nozzles, flumes (Parshall flume, Palmer Bowlus flume, Parabolic flume) and weirs (rectangular weir, Cippolette weir, vee notch weir), solid flowmeters, mechanical, electronic and nuclear, fluid flowmeters- electronic and pneumatic differential pressure, mass flowmeters gyroscopic mass, coriolis mass, angular-momentum mass, U-shaped gyroscopic mass, pressure differential and thermal class, vortex shedding meters, turbine flowmeters, liquid, gas, cryogenic, quantum dynamics, auto adjust turbo, propeller-type, rotor-type, turbine compound, aerovane vortex velocity, cup-type, bi-directional, flow switches, ultrasonic (time of flight, Doppler beam deflection and frequency difference), thermal (hot wire anemometer, hot film anemometer, thermocouple anemometer, Thomas meter, boundary layer mass), variable area, paddle, bypass, capacitance or capacitance noise, valve body, calorimetric flowmeter.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

8.01 **Installs primary flow elements (annubars, orifice plates, venturi tubes, flow nozzles, flumes and weirs).**

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.01.01 knowledge of equipment operation and performance expectations for primary flow elements

8.01.02 knowledge of installation requirements, procedures and techniques for primary flow elements

Supporting Knowledge & Abilities

8.01.03 knowledge of classes and types and sizing expectations of primary flow elements such as annubars, orifice plates (concentric, thin plate, sharp-edged), venturi tubes, flow nozzles, flumes (Parshall flume, Palmer Bowlus flume, Parabolic flume) and weirs (rectangular weir, Cippolette weir, vee notch weir)

8.01.04 ability to assess the process system characteristics for conditions that will impact on selection of primary element materials such as corrosive media

8.01.05 ability to size and select primary flow element to meet specified application requirements

Sub-task

8.02 Evaluates primary flow element condition.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.02.01 knowledge of equipment operation and performance expectations of primary elements such as annubars, orifice plates, venturi tubes, flow nozzles, flumes (Parshall flume, Palmer Bowlus flume, Parabolic flume) and weirs (rectangular weir, Cippolette weir, vee notch weir)

8.02.02 ability to establish the relationships between flow and measured head for weirs

8.02.03 ability to measure differential pressure, fluid viscosity for orifice plates

8.02.04 ability to assess primary element against specification

Sub-task

8.03 Installs mechanical solid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	no	ND	yes	yes	yes	yes	yes	NV	NV

8.03.01	knowledge of equipment operation and performance expectations of mechanical solid flowmeters
8.03.02	knowledge of installation requirements, procedures and techniques for mechanical solid flowmeters
8.03.03	knowledge of classes and types of mechanical solid flowmeters
8.03.04	knowledge of types and sizes of flowmeter accessories
8.03.05	ability to assess the process system characteristics for conditions that will impact on selection of device such as corrosive media
8.03.06	ability to size and select device to meet specified application requirements
8.03.07	ability to verify the operation of the device and its components

Sub-task

8.04 Installs electronic solid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.04.01	knowledge of equipment operation and performance expectations for electronic solid flowmeters
8.04.02	knowledge of installation requirements, procedures and techniques for electronic solid flowmeters
8.04.03	knowledge of types and sizes of flowmeter accessories

Supporting Knowledge & Abilities

8.04.04	knowledge of classes and types of electronic solid flowmeters
8.04.05	knowledge of flow performance and measurement terminology
8.04.06	knowledge of digital principles and techniques used in control systems
8.04.07	ability to assess the process system characteristics for conditions that will impact on selection of device such as corrosive media
8.04.08	ability to size and select device to meet specified application requirements
8.04.09	ability to verify the operation of the device and its components

Sub-task

8.05 Installs nuclear solid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.05.01	knowledge of equipment operation and performance expectations for nuclear solid flowmeters
8.05.02	knowledge of installation requirements, procedures and techniques for nuclear solid flowmeters
8.05.03	knowledge of classes and types of nuclear solid flowmeters
8.05.04	knowledge of types and characteristics of radioactive substances used in nuclear solid flowmeters
8.05.05	knowledge of flow performance and measurement terminology
8.05.06	knowledge of types and sizes of nuclear flowmeter accessories

Supporting Knowledge & Abilities

8.05.07	ability to assess the process system characteristics for conditions that will impact on selection of device such as corrosive media
8.05.08	ability to size and select device to meet specified application requirements
8.05.09	ability to verify the operation of the device and its components

Sub-task

8.06 Installs mechanical fluid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.06.01	knowledge of equipment operation and performance expectations for mechanical fluid flowmeters
8.06.02	knowledge of installation requirements, procedures and techniques for mechanical fluid flowmeters such as open channels, variable area, differential
8.06.03	knowledge of classes and types of mechanical fluid flowmeters
8.06.04	knowledge of types, performance and terminology of flow measurement such as head-class open channel flow measurement
8.06.05	knowledge of types, characteristics and configurations of weirs and flumes
8.06.06	knowledge of types and sizes of flowmeter accessories
8.06.07	ability to interpret blueprints and drawings
8.06.08	ability to calculate flow rates for weirs, flumes, and nozzles
8.06.09	ability to size an open channel flowmeter
8.06.10	ability to install purges and purge water

Supporting Knowledge & Abilities

8.06.11 ability to select flowmeter to meet application requirements

8.06.12 ability to verify the operation of the device and its components

Sub-task

8.07 Installs electronic fluid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.07.01 knowledge of equipment operation and performance expectations for electronic fluid flowmeters

8.07.02 knowledge of orifice installation requirements, procedures and techniques for electronic fluid flowmeters

8.07.03 knowledge of classes and types of electronic fluid flowmeters such as magnetic flowmeters, mass vortex, ultrasonic and thermal

8.07.04 knowledge of types and sizes of flowmeter accessories

8.07.05 knowledge of purpose and principles, performance and terminology of flow measurement such as inferential and true mass-flow measurement

8.07.06 knowledge of purpose and principle of operation of electronic fluid flowmeters

8.07.07 ability to size pulse-class devices

8.07.08 ability to size and select device to meet specified application requirements

8.07.09 ability to verify the operation of the device and its components

Sub-task

8.08 Installs magnetic fluid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.08.01	knowledge of equipment operation and performance expectations for magnetic fluid flowmeters
8.08.02	knowledge of installation requirements, procedures and techniques for magnetic fluid flowmeters (avoiding high points in piping runs and lines with vertical downward flow)
8.08.03	knowledge of classes and types of magnetic fluid flowmeters
8.08.04	knowledge of Faraday's Law of electromagnetic induction
8.08.05	knowledge of the principle of an electric gene
8.08.06	knowledge of flow performance and measurement terminology
8.08.07	knowledge of types and sizes of magnetic fluid flowmeter accessories
8.08.08	ability to size and select device to meet specified application requirements
8.08.09	ability to clean liner and electrodes
8.08.10	ability to mount electrodes
8.08.11	ability to determine grounding techniques
8.08.12	ability to verify the operation of the device and its components

Sub-task

8.09 Installs mass flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

8.09.01	knowledge of equipment operation and performance expectations for mass flowmeters
8.09.02	knowledge of installation requirements, procedures and techniques for mass flowmeters
8.09.03	knowledge of classes and types of mass flowmeters such as gyroscopic mass, coriolis mass, angular-momentum mass, U-shaped gyroscopic mass, pressure-differential and thermal-class
8.09.04	knowledge of types and sizes of flowmeter
8.09.05	knowledge of the principles and differences between inferential and true mass-flow measurement
8.09.06	ability to calculate mass flow
8.09.07	ability to size and select device to meet specified application requirements
8.09.08	ability to perform hookups and terminate wiring
8.09.09	ability to verify the operation of the device and its components

Sub-task

8.10 Installs vortex shedding flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.10.01	knowledge of equipment operation and performance expectations for vortex shedding flowmeter
8.10.02	knowledge of installation requirements, procedures and techniques for vortex shedding flowmeter
8.10.03	knowledge of classes, types and sizes of vortex shedding flowmeters such as swirl-meter and strut or bluff-body style

Supporting Knowledge & Abilities

8.10.04 knowledge of types and sizes of vortex shedding flowmeter accessories

8.10.05 knowledge of analog and digital electronics

8.10.06 ability to size and select device to meet specified application requirements

8.10.07 ability to verify the operation of the device and its components

Sub-task

8.11 Installs turbine flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.11.01 knowledge of equipment operation and performance expectations for turbine flowmeters

8.11.02 knowledge of installation requirements, procedures and techniques for turbine flowmeters

8.11.03 knowledge of classes, types and sizes of turbine flowmeters such as liquid, gas, cryogenic, quantum dynamics, auto adjust turbo, propeller-type, rotor-type, turbine compound, aerovane, vortex velocity, cup-type, bi-directional

8.11.04 knowledge of types, characteristics and sizes of turbine flowmeter add-ons such as bearings (journal, ball, pivot), strainers, turbine flow transducers and probes and terminology such as flow straightener, rotational velocity, pulses, concept of proportionality and linear relationship, laminar and tubular flow, pressure and viscosity effects

8.11.05 knowledge of analog and digital electronics

8.11.06 ability to size and select device to meet specified application requirements

Supporting Knowledge & Abilities

8.11.07	ability to select turbine flowmeter measuring technique
8.11.08	ability to eliminate eddies and swirls in the turbine flowmeters
8.11.09	ability to determine pressure drop across a turbine flowmeter
8.11.10	ability to verify the operation of the device and its components

Sub-task

8.12 Installs flow switches

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.12.01	knowledge of equipment operation and performance expectations for flow switches (for liquid, gases, and solids)
8.12.02	knowledge of installation requirements, procedures and techniques for flow switches
8.12.03	knowledge of classes and types of flow switches such as ultrasonic (time of flight, Doppler beam-deflection and frequency difference), thermal (hot wire anemometer, hot film anemometer, thermocouple anemometer, Thomas meter, boundary layer mass), variable area, paddle, bypass, capacitance or capacitance noise, valve body, calorimetric flowmeter
8.12.04	knowledge of types and sizes of flow switches add-ons such as components of ultrasonic flowmeter, adhesives (transient time), valves, coupling, protective devices (filters, strainers, and traps) used in piping systems, vibration dampeners
8.12.05	knowledge of type and characteristics of variable-area flow-measuring instrument

Supporting Knowledge & Abilities

8.12.06	knowledge of type and characteristics of variable-area flow-measuring instrument
8.12.07	ability to size and select device to meet specified application requirements
8.12.08	ability to mount, clamp, glue sensor (open channels, transient time)
8.12.09	ability to install acoustics (transient time)
8.12.10	ability to verify the operation of the device and its components

Sub-task

8.13 Calibrates mechanical solid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.13.01	knowledge of equipment operation and performance expectations
8.13.02	knowledge of calibration procedures and techniques
8.13.03	knowledge of the cause and effect of calibration errors
8.13.04	ability to assess the installation of mechanical solid flowmeter
8.13.05	ability to introduce a reference standard and assess the status of the calibration
8.13.06	ability to read out instrumentation of mechanical solid flow device
8.13.07	ability to perform precalibration of mechanical solid flow device
8.13.08	ability to adjust instrument such as leveling and aligning planes
8.13.09	ability to verify operation of mechanical solid flow device

Supporting Knowledge & Abilities

8.13.10 ability to verify the operation of the device and its components

Sub-task

8.14 Calibrates electronic solid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.14.01 knowledge of equipment operation and performance expectations

8.14.02 knowledge of calibration procedures and techniques

8.14.03 knowledge of the cause and effect of calibration errors

8.14.04 ability to assess installation of electronic solid flow device

8.14.05 ability to introduce a reference standard and assess the status of the calibration

8.14.06 ability to read out instrumentation of electronic solid flow device

8.14.07 ability to perform precalibration of electronic solid flow device

8.14.08 ability to test circuits

8.14.09 ability to adjust instrument such as leveling and aligning planes

8.14.10 ability to verify operation of electronic solid flow device

8.14.11 ability to verify the operation of the device and its components

Sub-task

8.15 Calibrates nuclear solid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.15.01	knowledge of equipment operation and performance expectations
8.15.02	knowledge of calibration procedures and techniques
8.15.03	knowledge of cause and effect of calibration errors
8.15.04	knowledge of types and characteristics of radioactive substances used in nuclear solid flowmeters
8.15.05	ability to assess installation of nuclear solid flow device
8.15.06	ability to introduce a reference standard and assess the status of the calibration
8.15.07	ability to read out instrumentation of nuclear solid flow device
8.15.08	ability to perform precalibration of nuclear solid flow device
8.15.09	ability to test circuits
8.15.10	ability to adjust instrument such as leveling and aligning planes
8.15.11	ability to verify operation of nuclear solid flow device
8.15.12	ability to verify the operation of the device and its components

Sub-task

8.16 Calibrates mechanical fluid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

8.16.01	knowledge of equipment operation and performance expectations
8.16.02	knowledge of calibration procedures and techniques
8.16.03	knowledge of the cause and effect of calibration errors
8.16.04	ability to assess the installation of the mechanical fluid flowmeter
8.16.05	ability to introduce a reference standard and assess the status of the calibration
8.16.06	ability to read out instrumentation of mechanical fluid flow device
8.16.07	ability to perform precalibration of mechanical fluid flow device
8.16.08	ability to adjust instrument such as leveling and aligning planes
8.16.09	ability to verify operation of mechanical fluid flowmeter
8.16.10	ability to verify the operation of the device and its components

Sub-task

8.17 Calibrates electronic fluid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.17.01	knowledge of equipment operation and performance expectations
8.17.02	knowledge of calibration procedures and techniques
8.17.03	knowledge of the cause and effect of calibration errors
8.17.04	knowledge of sizing of pulse-class devices

Supporting Knowledge & Abilities

8.17.05	ability to assess orifice installation of electronic fluid flow device
8.17.06	ability to introduce a reference standard and assess the status of the calibration
8.17.07	ability to read out instrumentation of electronic fluid flow device
8.17.08	ability to perform precalibration of electronic fluid flow device
8.17.09	ability to verify operation of electronic fluid flow device
8.17.10	ability to verify the operation of the device and its components

Sub-task

8.18 Calibrates magnetic fluid flowmeters.

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

8.18.01	knowledge of equipment operation and performance expectations
8.18.02	knowledge of calibration procedures and techniques
8.18.03	knowledge of types of fluid measurement
8.18.04	knowledge of the cause and effect of calibration errors
8.18.05	ability to assess installation of magnetic fluid flow device
8.18.06	ability to introduce a reference standard and assess the status of the calibration
8.18.07	ability to read out instrumentation of magnetic fluid flow device
8.18.08	ability to verify operation of magnetic fluid flow device

Supporting Knowledge & Abilities

8.18.09 ability to verify the operation of the device and its components

Sub-task

8.19 Calibrates mass flowmeters. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.19.01 knowledge of equipment operation and performance expectations

8.19.02 knowledge of purpose and principle of operation of mass flowmeters

8.19.03 knowledge of calibration procedures and techniques

8.19.04 knowledge of types of mass flowmeter measurement

8.19.05 knowledge of the cause and effect of calibration errors

8.19.06 ability to assess installation of mass flowmeter

8.19.07 ability to introduce a reference standard and assess the status of the calibration

8.19.08 ability to read out instrumentation of mass flowmeter

8.19.09 ability to perform precalibration of mass flowmeter

8.19.10 ability to verify operation of mass flowmeter

8.19.11 ability to verify the operation of the device and its components

Sub-task

8.20 Calibrates turbine flowmeters. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

8.20.01	knowledge of equipment operation and performance expectations
8.20.02	knowledge of calibration procedures and techniques such as universal viscosity calibration and universal viscosity curve, standard liquid calibration , K-factor calibration
8.20.03	knowledge of types of turbine flowmeter measurement
8.20.04	knowledge of the cause and effect of calibration errors
8.20.05	ability to assess installation of turbine flowmeters
8.20.06	ability to introduce a reference standard and assess the status of the calibration
8.20.07	ability to read out instrumentation of categories such as totalizer, rate indicators
8.20.08	ability to perform precalibration of turbine flowmeters
8.20.09	ability to verify operation of turbine flowmeters
8.20.10	ability to verify the operation of the device and its components

Sub-task

8.21 Calibrates flow switches.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.21.01	knowledge of equipment operation and performance expectations
8.21.02	knowledge of calibration procedures and techniques
8.21.03	knowledge of types of flow switches measurement

Supporting Knowledge & Abilities

8.21.04	knowledge of the cause and effect of calibration errors
8.21.05	ability to assess installation of flow switches
8.21.06	ability to introduce a reference standard and assess the status of the calibration
8.21.07	ability to read out instrumentation of flow switches
8.21.08	ability to perform precalibration of flow switches
8.21.09	ability to verify operation of flow switches
8.21.10	ability to verify the operation of the device and its components

Sub-task

8.22 Replaces components on mechanical solid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.22.01	knowledge of equipment operation and performance expectations
8.22.02	knowledge of removal and installation procedures and techniques for components on mechanical solid flowmeters
8.22.03	knowledge of operating requirements for components
8.22.04	ability to select components to meet application requirements
8.22.05	ability to verify operation of device and replaced components on mechanical solid flowmeters
8.22.06	ability to verify the operation of the device and its components

Sub-task

8.23 Replaces components on electronic solid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.23.01	knowledge of equipment operation and performance expectations
8.23.02	knowledge of removal and installation procedures and techniques for components on electronic solid flowmeters
8.23.03	knowledge of operating requirements for components
8.23.04	ability to select components to meet application requirements
8.23.05	ability to verify operation of device and replaced components on electronic solid flowmeters
8.23.06	ability to verify the operation of the device and its components
8.23.07	ability to verify calibration of the device

Sub-task

8.24 Replaces components on nuclear solid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.24.01	knowledge of equipment operation and performance expectations
8.24.02	knowledge of removal and installation procedures and techniques for components on nuclear solid flowmeters
8.24.03	knowledge of operating requirements for components

Supporting Knowledge & Abilities

8.24.04	knowledge of the disassembly/assembly techniques
8.24.05	knowledge of types and characteristics of radioactive substances used in components of nuclear solid flowmeters
8.24.06	ability to select components to meet application requirements
8.24.07	ability to verify operation of device and replaced components on nuclear solid flowmeters
8.24.08	ability to verify calibration of the device

Sub-task

8.25 Replaces components on mechanical fluid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.25.01	knowledge of equipment operation and performance expectations
8.25.02	knowledge of removal and installation procedures and techniques for components on mechanical fluid flowmeters
8.25.03	knowledge of operating requirements for components
8.25.04	knowledge of types, characteristics of components of weirs and flumes
8.25.05	ability to select components to meet application requirements
8.25.06	ability to verify operation of device and replaced components on mechanical fluid flowmeters
8.25.07	ability to verify calibration of the device

Sub-task

8.26 Replaces components on electronic fluid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.26.01	knowledge of equipment operation and performance expectations
8.26.02	knowledge of removal and installation procedures and techniques for components on electronic fluid flowmeters such as gyroscopic mass, coriolis mass, angular-momentum mass, U-shaped gyroscopic mass, pressure-differential and thermal-class
8.26.03	knowledge of operating requirements for components
8.26.04	knowledge of types, characteristics of components of weirs and flumes
8.26.05	ability to select components to meet application requirements
8.26.06	ability to verify operation of device and replaced components on electronic fluid flowmeters
8.26.07	ability to verify calibration of the device

Sub-task

8.27 Replaces components on magnetic fluid flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.27.01	knowledge of equipment operation and performance expectations
8.27.02	knowledge of removal and installation procedures and techniques for components on magnetic fluid flowmeters such as powered flowmeters

Supporting Knowledge & Abilities

8.27.03	knowledge of Faraday's Law of Electromagnetic Induction
8.27.04	ability to select components to meet application requirements
8.27.05	ability to clean liner and electrodes
8.27.06	ability to verify operation of device and replaced components on electronic fluid flowmeters
8.27.07	ability to verify calibration of the device

Sub-task

8.28 Replaces components on mass flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.28.01	knowledge of equipment operation and performance expectations
8.28.02	knowledge of removal and installation procedures and techniques for components on mass flowmeters such as gyroscopic mass, coriolis mass, angular-momentum mass, U-shaped gyroscopic mass, pressure-differential and thermal-class
8.28.03	ability to select components to meet application requirements
8.28.04	ability to verify operation of device and replaced components on mass flowmeters
8.28.05	ability to verify calibration of the device

Sub-task

8.29 Replaces components on turbine flowmeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

8.29.01 knowledge of equipment operation and performance expectations

8.29.02 knowledge of removal and installation procedures and techniques for components on turbine flowmeters such as liquid, gas, cryogenic, quantum dynamics, auto adjust turbo, propeller-type, rotor-type, turbine compound, aerovane, vortex velocity, cup-type, bi-directional

8.29.03 knowledge of operating requirements for components such as bearings (journal, ball, pivot), strainers, turbine flow transducers and probes, pick-offs

8.29.04 ability to select components to meet application requirements

8.29.05 ability to verify operation of device and replaced components on turbine flowmeters

8.29.06 ability to verify calibration of the device

Sub-task

8.30 Replaces components on flow switches.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

8.30.01 knowledge of equipment operation and performance expectations

8.30.02 knowledge of removal and installation procedures and techniques for components on flow switches for liquid, gases, solids such as ultrasonic (time of flight, Doppler beam deflection and frequency difference), thermal (hot wire anemometer, hot film anemometer, thermocouple anemometer, Thomas meter, boundary layer mass), variable area, paddle, bypass, capacitance or capacitance noise, valve body, calorimetric flowmeter

Supporting Knowledge & Abilities

8.30.03	knowledge of operating requirements for components such as adhesives (transient time), valves, coupling, protective devices (filters, strainers, traps) used in piping systems, vibration dampeners, sensors
8.30.04	knowledge of types of components that can be replaced
8.30.05	ability to select components to meet application requirements
8.30.06	ability to verify operation of device and replaced components on flow switches
8.30.07	ability to verify calibration of the device

Task 9 **Maintains field mounted level equipment.**

Related Components: Manufacturer specifications, maintenance schedules, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, equipment, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding, sight glass, mechanical level indicators, mechanical floats and displacers, electronic and pneumatic differential pressure level, transmitters, nuclear level indicators, bubble pipes, open tank and closed vessel level systems, electronic level measuring devices, ultrasonic and thermal devices, flushing water and purge lines.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

9.01 Installs sight glasses.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	no	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

9.01.01	knowledge of equipment operation and performance expectations for sight glasses

Supporting Knowledge & Abilities

9.01.02	knowledge of installation requirements, procedures and techniques for sight glasses
9.01.03	knowledge of construction of storage units and containers for sight glass usage
9.01.04	knowledge of applications and types of sight glasses
9.01.05	knowledge of the impact of environmental factors and materials on sight glass operation
9.01.06	ability to size and select device to meet specified application requirements
9.01.07	ability to connect, secure and level sight glasses
9.01.08	ability to verify operation of device

Sub-task

9.02 Installs mechanical level indicators.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	yes	NV	NV

9.02.01	knowledge of equipment operation and performance expectations for mechanical level indicators such as range values, conditions of liquid and tank
9.02.02	knowledge of installation requirements, procedures and techniques for mechanical level indicators
9.02.03	knowledge of application and types of mechanical level indicators such as mechanical floats and displacers and differential-pressure instruments
9.02.04	ability to determine site for mechanical level indicator
9.02.05	ability to select mechanical level indicator to meet application requirements

Supporting Knowledge & Abilities

9.02.06 ability to support device during installation

9.02.07 ability to secure and level instruments

9.02.08 ability to verify operation of device

Sub-task

9.03 Installs nuclear level measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

9.03.01 knowledge of equipment operation and performance expectations for nuclear level measuring device such as range values, condition of liquid and tank

9.03.02 knowledge of installation requirements, procedures and techniques for nuclear level measuring device

9.03.03 knowledge of application and types of nuclear level measuring devices

9.03.04 knowledge of types and characteristics of radioactive substances used in devices such as radium

9.03.05 ability to determine site for nuclear level measuring device

9.03.06 ability to select nuclear level measuring device to meet application requirements

9.03.07 ability to mount and secure nuclear level measuring device

9.03.08 ability to verify operation of device

Sub-task

9.04 Installs pneumatic level measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

9.04.01	knowledge of equipment operation and performance expectations for pneumatic level measuring devices such as range values, condition of liquid and tank
9.04.02	knowledge of installation requirements, procedures and techniques for pneumatic level measuring devices
9.04.03	knowledge of application and types of pneumatic level measuring devices such as pneumatic displacers, purged-pipe system/bubble-tube systems and differential-pressure instruments
9.04.04	ability to determine site for pneumatic level measuring device
9.04.05	ability to size and select pneumatic level measuring device and associated devices to meet application requirements
9.04.06	ability to secure and level instruments
9.04.07	ability to verify operation of device

Sub-task

9.05 Installs electronic level measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

9.05.01	knowledge of equipment operation and performance expectations for electronic level measuring devices such as range values, condition of liquid and tank
9.05.02	knowledge of installation requirements, procedures and techniques for electronic level measuring devices

Supporting Knowledge & Abilities

9.05.03	knowledge of applications and types of electronic level measuring devices including ultrasonic and thermal devices
9.05.04	ability to determine site for electronic level measuring device
9.05.05	ability to size and select electronic level measuring device, associated sensors and mounting brackets to meet application requirements
9.05.06	ability to secure and level instruments
9.05.07	ability to verify operation of device

Sub-task

9.06 Installs level switches.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

9.06.01	knowledge of equipment operation and performance expectations for level switches
9.06.02	knowledge of installation requirements, procedures and techniques for level switches
9.06.03	knowledge of applications and types of level switches
9.06.04	ability to determine site for level switch
9.06.05	ability to size and select level switches to meet application requirements
9.06.06	ability to secure and level switch
9.06.07	ability to verify operation of switch

Sub-task

9.07 Replaces mechanical level measuring device components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	yes	NV	NV

9.07.01 knowledge of equipment operation and performance expectations

9.07.02 knowledge of removal and installation procedures and techniques for mechanical level measuring device components

9.07.03 knowledge of operating requirements for components such as condition and velocity of liquids

9.07.04 ability to rig and hoist equipment

9.07.05 ability to select components to meet application requirements

9.07.06 ability to verify operation and calibration of device and operation of replaced components

Sub-task

9.08 Replaces nuclear level measuring device components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

9.08.01 knowledge of equipment operation and performance expectations for nuclear level measuring device components

9.08.02 knowledge of removal and installation procedures and techniques for nuclear level measuring device components

9.08.03 knowledge of types and characteristics of radioactive substances used in devices such as radium

Supporting Knowledge & Abilities

9.08.04 ability to select components to meet application requirements

9.08.05 ability to verify operation and calibration of device and operation of replaced components

Sub-task

9.09 Replaces pneumatic level measuring device components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

9.09.01 knowledge of equipment operation and performance expectations for pneumatic level measuring device components

9.09.02 knowledge of removal and installation procedures and techniques for pneumatic level measuring device components

9.09.03 knowledge of operating considerations for components such as condition and velocity of liquids

9.09.04 ability to rig and hoist equipment

9.09.05 ability to select components to meet application requirements

9.09.06 ability to verify operation and calibration of device and operation of replaced components

Sub-task

9.10 Replaces level switch components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

9.10.01	knowledge of equipment operation and performance expectations for level switch components
9.10.02	knowledge of removal and installation procedures and techniques for level switch components
9.10.03	knowledge of operating requirements for components
9.10.04	ability to select components to meet application requirements
9.10.05	ability to verify operation and calibration of device and operation of replaced components

Sub-task

9.11 Replaces electronic measuring device components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

9.11.01	knowledge of equipment operation and performance expectations for electronic measuring device components
9.11.02	knowledge of removal and installation procedures and techniques for electronic components
9.11.03	knowledge of operating requirements for components
9.11.04	ability to select components to meet application requirements
9.11.05	ability to verify operation and calibration of device and operation of replaced components

Task 10 Maintains field mounted temperature devices.

Related Components: Manufacturer specifications, maintenance schedules, lubrication, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding, temperature conversion tables, resistance thermal devices (RTDs), infrared devices, thermocouples-copper-constantan, iron-constantan, chromel-alumel and rhodium-platinum, thermistors, pyrometers, thermal switches, thermal filled systems-liquid, vapour and gas, thermometers-liquid filled and bimetallic types.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

10.01 Installs mechanical temperature measuring devices (bimetallic thermometers).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

10.01.01 knowledge of equipment operation and performance expectations

10.01.02 knowledge of installation requirements, procedures and techniques for mechanical temperature measuring devices

10.01.03 knowledge of control requirements for instrument selection such as cost, explosion hazards, maintenance requirements and reliability

10.01.04 knowledge of types of mechanical temperature measuring devices such as thermistors and pyrometers

10.01.05 ability to size and select temperature measuring device to meet application requirements

10.01.06 ability to secure device

10.01.07 ability to verify operation of device

Sub-task

10.02 Installs primary temperature element (thermistors, thermocouples, RTD's and pyrometers).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

10.02.01	knowledge of equipment operation and performance expectations
10.02.02	knowledge of installation requirements, procedures and techniques for primary temperature elements and accessories (e.g. thermowells)
10.02.03	knowledge of control requirements for instrument selection such as cost, explosion hazards, maintenance requirements and reliability
10.02.04	knowledge of application and types of primary temperature elements such as thermocouples, resistance temperature detectors (RTDs) and galvanometers
10.02.05	knowledge of application and types of non-contact measuring devices such as pyrometers and infrared devices
10.02.06	ability to interpret standard limits of error for a variety of couples/wires such as copper-constantan, iron-constantan, chromel-alumel and platinum rhodium-platinum
10.02.07	ability to select primary temperature element to meet application requirements
10.02.08	ability to perform hookups and terminate wiring
10.02.09	ability to verify operation of element

Sub-task

10.03 Evaluates primary temperature element condition.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

10.03.01	knowledge of equipment operation and performance expectations
10.03.02	knowledge of inspection and testing procedures and techniques for primary elements
10.03.03	ability to inspect condition of primary element, accessories (thermowell), piping, tubing and wiring

Sub-task

10.04 Installs filled thermal systems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

10.04.01	knowledge of equipment operation and performance expectations
10.04.02	knowledge of installation requirements, procedures and techniques for thermal systems
10.04.03	knowledge of control requirements for instrument selection such as cost, explosion hazards, maintenance requirements and reliability
10.04.04	knowledge of applications and types of thermal systems including liquid-expansion, vapour-pressure and gas pressure
10.04.05	ability to select and secure thermal systems to meet application requirements
10.04.06	ability to verify operation of thermal systems

Sub-task

10.05 Installs temperature switches.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

10.05.01	knowledge of equipment operation and performance expectations
10.05.02	knowledge of installation procedures and techniques for temperature switches
10.05.03	knowledge of control requirements for instrument selection such as cost, explosion hazards, maintenance requirements and reliability
10.05.04	knowledge of application and types of temperature switches
10.05.05	ability to select temperature switches to meet application requirements
10.05.06	ability to secure temperature switch
10.05.07	ability to verify operation of temperature switch

Sub-task

10.06 Calibrates mechanical temperature measuring systems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

10.06.01	knowledge of equipment operation and performance expectations
10.06.02	knowledge of calibration procedures and techniques
10.06.03	knowledge of cause and effect of calibration errors
10.06.04	ability to assess the installation

Supporting Knowledge & Abilities

10.06.05	ability to introduce a mechanical level reference standard and assess the status of the mechanical temperature measuring system
10.06.06	ability to adjust the calibration instrument/process
10.06.07	ability to verify operation of mechanical level measuring system

Sub-task

10.07 Calibrates filled thermal systems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

10.07.01	knowledge of equipment operation and performance expectations
10.07.02	knowledge of calibration procedures and techniques for thermal systems such as liquid-expansion, vapour pressure and gas pressure
10.07.03	knowledge of cause and effect of calibration errors
10.07.04	knowledge of calibration standards for thermal systems
10.07.05	ability to assess the installation
10.07.06	ability to introduce a thermal reference standard (e.g. a temperature bath) and the calibration instrument/device
10.07.07	ability to verify operation of the thermal system

Sub-task

10.08 Calibrates temperature switches.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

10.08.01	knowledge of equipment operation and performance expectations
10.08.02	knowledge of purpose and principles of operation of temperature switches
10.08.03	knowledge of calibration procedures and techniques
10.08.04	knowledge of cause and effect of calibration errors
10.08.05	knowledge of types of temperature measurement
10.08.06	ability to assess the installation
10.08.07	ability to introduce a temperature reference standard and assess the status of the calibration
10.08.08	ability to interpret temperature-EMF values
10.08.09	ability to adjust the calibration of the of instrument to the process requirements
10.08.10	ability to verify operation of a temperature switch

Sub-task

10.09 Replaces components on mechanical temperature measuring systems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	yes	NV	NV

10.09.01	knowledge of equipment operation and performance expectations
10.09.02	knowledge of removal and installation procedures and techniques for mechanical temperature measuring devices
10.09.03	knowledge of plant process and process system requirements

Supporting Knowledge & Abilities

10.09.04	knowledge of control requirements for instrument selection such as cost, explosion hazards, maintenance requirements and reliability
10.09.05	knowledge of applications and types of mechanical temperature measuring devices such as bimetallic thermometers
10.09.06	ability to assess the installation
10.09.07	ability to select temperature measuring device to meet application requirements
10.09.08	ability to secure device
10.09.09	ability to verify operation and calibration of device

Sub-task

10.10 Replaces components on filled thermal systems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

10.10.01	knowledge of equipment operation and performance expectations
10.10.02	knowledge of removal and installation procedures and techniques for thermal systems
10.10.03	knowledge of applications and types of thermal systems such as liquid-expansion systems, vapour-pressure systems and gas-pressure systems
10.10.04	ability to test sensor operation
10.10.05	ability to select sensors and system elements to meet application requirements
10.10.06	ability to verify operation of system and replaced components
10.10.07	ability to verify calibration of the device

Sub-task

10.11 Replaces temperature switch components. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

10.11.01	knowledge of equipment operation and performance expectations
10.11.02	knowledge of removal and installation procedures and techniques for temperature switch components
10.11.03	knowledge of application and types of temperature switches
10.11.04	knowledge of temperature switch components such as thermocouples, extension wires, connection boxes
10.11.05	ability to assess switches for defects and operation
10.11.06	ability to select switches to meet application requirements
10.11.07	ability to verify operation and calibration of switch and operation of replaced components

BLOCK D

INSTRUMENTATION AND CALIBRATION

Trends: *New technology has resulted in more compact and rugged analyzers that function with a greater degree of reliability. There are also more manufacturers bringing a greater variety of analyzers to the market. The calibration and set-up of many measuring devices can be done using personal computers, microprocessors and customized software. Training and licencing for radiation emitting devices is becoming mandatory.*

Task 11 Maintains analyzers.

Related Components: Manufacturer specifications, maintenance scheduling, lubrication, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding, pH analyzers, chromatographs, mass spectrometers, colorimetry, combustion analysis, oxidation-reduction detectors, reaction product analyzers, liquid chemical analyzers conductance type meters, capacitance type meters, optical spectroscopy, infrared spectroscopy and microwave spectroscopy, radioactive analyzers, nuclear level measuring devices, X-ray instruments, thermal analyzers, magnetic analyzers, of electromagnetic radiation instruments such as ultraviolet detectors (opposed-beam analyzer, split beam, dual-beam, flicker photometer), infrared instruments (grating spectrophotometer, filter spectrometer, tunable lasers) and colorimeters, energy analyzers of air quality instruments ozone detectors, humidity detectors, chlorine, carbon monoxide and carbon dioxide detectors), stack emission analyzers, high volume samplers, dichotomous, tape and manual stack and radiometric, turbidity analyzers, liquid chemical analyzers, process gas analyzers, thermoconductive and thermomagnetic, samplers and sample conditioning systems, and continuous moisture analyzers.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

11.01 Installs process gas analyzers (thermomagnetic, thermoconductive, infrared, ultraviolet and temperature sensor type).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.01.01	knowledge of equipment operation and performance expectations for gas analyzers such as gas chromatographs and mass spectrometers
11.01.02	knowledge of installation requirements, procedures and techniques for gas analyzers
11.01.03	knowledge of gas laws and gas flow rates
11.01.04	ability to select analyzer to meet application requirements

Supporting Knowledge & Abilities

11.01.05 ability to secure device

11.01.06 ability to verify operation of process gas analyzer

Sub-task

11.02 Installs sample conditioning system.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.02.01 knowledge of equipment operation and performance expectations

11.02.02 knowledge of installation requirements, procedures and techniques for sampling conditioning systems

11.02.03 knowledge of application, conditioning methods and processes such as filtering, vaporizing samples, washing samples and entrapments removal

11.02.04 ability to select, mount and secure sampling conditioning systems

11.02.05 ability to clean components

11.02.06 ability to protect system from ambients

11.02.07 ability to adjust flow rates and pressure rates

11.02.08 ability to set up multi-stream switching systems

11.02.09 ability to set up and adjust sample disposal systems such as flare and treatment ponds

11.02.10 ability to test for process solution leakage and check for coatings over electrode tips

11.02.11 ability to verify operation of analyzer

Sub-task

11.03 Installs liquid chemical analyzers. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.03.01	knowledge of equipment operation and performance expectations for liquid chemical analyzers
11.03.02	knowledge of installation requirements, procedures and techniques for chemical analyzers
11.03.03	knowledge of colorimetry, combustion analysis, oxidation-reduction detectors and reaction product analyzers
11.03.04	knowledge of applications, types and characteristics of liquid chemical analyzers such as conductance-type meters, capacitance-type meters, optical spectroscopy, infrared spectroscopy and microwave spectroscopy
11.03.05	ability to select analyzer to meet application requirements
11.03.06	ability to secure device
11.03.07	ability to verify operation of device

Sub-task

11.04 Installs turbidity analyzers. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.04.01	knowledge of equipment operation and performance expectations for turbidity analyzers
11.04.02	knowledge of installation requirements, procedures and techniques for turbidity analyzers

Supporting Knowledge & Abilities

11.04.03	knowledge of applications, types and characteristics of turbidity meters such as flow chambers or meters that have sample cells
11.04.04	knowledge of protective devices used in piping systems such as filters, strainers and traps
11.04.05	ability to remove deposits from analyzers with optical windows
11.04.06	ability to select analyzer to meet application requirements
11.04.07	ability to install components of particle size monitoring system
11.04.08	ability to secure device
11.04.09	ability to verify operation of device

Sub-task

11.05 Installs radioactive analyzers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.05.01	knowledge of purpose and principle of operation of radioactive analyzers
11.05.02	knowledge of installation requirements, procedures and techniques for radioactive analyzers
11.05.03	knowledge of applications and types of radioactive analyzers
11.05.04	knowledge of types of radioactive instruments such as nuclear level measuring devices and X-ray instruments
11.05.05	knowledge of licencing requirements for working with radioactive devices
11.05.06	ability to select radioactive analyzers to meet application requirements
11.05.07	ability to mount and secure analyzer

Supporting Knowledge & Abilities

11.05.08 ability to test radioactive instruments for leakage

11.05.09 ability to verify operation of analyzer

Sub-task

11.06 Installs pH meters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.06.01 knowledge of equipment operation and performance expectations for pH meters

11.06.02 knowledge of installation requirements, procedures and techniques for pH meters

11.06.03 knowledge of applications and types of pH meters including those with electrodes and those without electrodes

11.06.04 ability to select pH meters to meet application requirements

11.06.05 ability to mount and secure pH meters

11.06.06 ability to test for process solution leakage and check for coatings over electrode tips

11.06.07 ability to verify operation of analyzer

Sub-task

11.07 Installs thermal or magnetic field analyzers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.07.01 knowledge of equipment operation and performance expectations for thermal and magnetic analyzers

Supporting Knowledge & Abilities

11.07.02	knowledge of installation requirements, procedures and techniques for thermal and magnetic analyzers
11.07.03	knowledge of applications and types of thermal and magnetic analyzers
11.07.04	ability to select thermal and magnetic analyzers to meet application requirements
11.07.05	ability to mount and secure thermal and magnetic analyzers
11.07.06	ability to verify operation of analyzer

Sub-task

11.08 Installs electromagnetic radiation instrument.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.08.01	knowledge of equipment operation and performance expectations for electromagnetic radiation instruments
11.08.02	knowledge of installation requirements, procedures and techniques for electromagnetic radiation instruments
11.08.03	knowledge of applications and types of electromagnetic radiation instruments such as ultraviolet detectors (opposed-beam analyzer, split beam, dual-beam, flicker photometer), infrared instruments (grating spectrophotometer, filter spectrometer, tunable lasers) and colorimeters
11.08.04	knowledge of types of radioactive instruments such as nuclear level measuring devices and X-ray instruments
11.08.05	knowledge of licencing requirements for working with radioactive devices

Supporting Knowledge & Abilities

11.08.06	ability to select electromagnetic radiation instruments to meet application requirements
11.08.07	ability to mount and secure electromagnetic radiation instruments
11.08.08	ability to verify operation of instruments

Sub-task

11.09 Installs energy analyzers. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.09.01	knowledge of equipment operation and performance expectations for energy analyzers
11.09.02	knowledge of installation requirements, procedures and techniques for energy analyzers
11.09.03	knowledge of applications and types of energy analyzers such as types of mass spectrometers
11.09.04	ability to select energy analyzers to meet application requirements
11.09.05	ability to mount and secure energy analyzers
11.09.06	ability to verify operation of analyzer

Sub-task

11.10 Installs air quality analyzers. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.10.01	knowledge of equipment operation and performance expectations for air quality analyzers
11.10.02	knowledge of installation requirements, procedures and techniques for air quality analyzers

Supporting Knowledge & Abilities

11.10.03	knowledge of applications and types of air quality instruments such as ozone detectors, humidity detectors, chlorine, carbon monoxide and carbon dioxide detectors
11.10.04	ability to select air quality analyzers to meet application requirements
11.10.05	ability to mount and secure air quality analyzers
11.10.06	ability to verify operation of analyzer

Sub-task

11.11 Installs stack emission analyzers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.11.01	knowledge of equipment operation and performance expectations for stack emission analyzers
11.11.02	knowledge of installation requirements, procedures and techniques for stack emission analyzers
11.11.03	knowledge of applications and types of stack emission analyzers such as high volume samplers, dichotomous, tape and manual stack and radiometric
11.11.04	ability to determine sampling points and traverse points in stack
11.11.05	ability to select stack emission analyzers to meet application requirements
11.11.06	ability to mount and secure stack emission analyzers
11.11.07	ability to set up sampling units and operating/control units
11.11.08	ability to verify operation of analyzer

Sub-task

11.12 Installs fluid samplers. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.12.01	knowledge of equipment operation and performance expectations for fluid samplers
11.12.02	knowledge of installation requirements, procedures and techniques for fluid samplers
11.12.03	knowledge of applications and types of fluid samplers such as single-line transport, bypass steam and bypass return
11.12.04	ability to select fluid samplers to meet application requirements
11.12.05	ability to mount and secure fluid samplers
11.12.06	ability to verify operation of analyzer

Sub-task

11.13 Installs gas samplers. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.13.01	knowledge of equipment operation and performance expectations for gas samplers
11.13.02	knowledge of installation requirements, procedures and techniques for gas samplers
11.13.03	knowledge of applications and types of detectors used in samplers such as thermal conductivity, flame ionization detector, flame photoelectric differential pressure
11.13.04	knowledge of types of gas samplers such as gas density balance detectors, flame photometric detectors, and differential pressure detectors
11.13.05	ability to select gas samplers and valves to meet application requirements
11.13.06	ability to mount and secure gas samplers

Supporting Knowledge & Abilities

11.13.07 ability to verify operation of analyzer

Sub-task

11.14 Installs on-line moisture analyzers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.14.01 knowledge of equipment operation and performance expectations for moisture analyzers

11.14.02 knowledge of installation requirements, procedures and techniques for moisture analyzers

11.14.03 knowledge of applications and types of analyzers such as Quadra-Beam 6600

11.14.04 ability to select moisture analyzers and sensors to meet application requirements

11.14.05 ability to mount and secure moisture analyzers

11.14.06 ability to verify operation of analyzers

Sub-task

11.15 Calibrates process gas analyzers (thermomagnetic, thermoconductive, infrared, sensor type).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.15.01 knowledge of equipment operation and performance expectations for process gas analyzers

11.15.02 knowledge of calibration procedures and techniques for process gas analyzers

Supporting Knowledge & Abilities

11.15.03	knowledge of cause and effect of calibration errors
11.15.04	knowledge of calibration standards for process gas analyzers
11.15.05	ability to assess the installation
11.15.06	ability to introduce a gas reference standard and assess the status of the calibration
11.15.07	ability to adjust the calibration instrument/process
11.15.08	ability to verify the operation of the process gas analyzer

Sub-task

11.16 Calibrates liquid chemical analyzers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.16.01	knowledge of equipment operation and performance expectations for liquid chemical analyzers
11.16.02	knowledge of calibration procedures and techniques for liquid chemical analyzers
11.16.03	knowledge of cause and effect of calibration errors
11.16.04	knowledge of calibration standards for liquid chemical analyzers
11.16.05	ability to assess the installation
11.16.06	ability to introduce a liquid chemical reference standard and assess the status of the calibration
11.16.07	ability to adjust the calibration instrument/process
11.16.08	ability to verify the operation of the liquid chemical analyzer

Sub-task

11.17 Calibrates turbidity analyzers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.17.01	knowledge of equipment operation and performance expectations for turbidity analyzers
11.17.02	knowledge of calibration procedures and techniques for turbidity analyzers
11.17.03	knowledge of cause and effect of calibration errors
11.17.04	knowledge of calibration standards for turbidity analyzers
11.17.05	ability to assess the installation
11.17.06	ability to introduce a reference standard and assess the status of the calibration
11.17.07	ability to adjust the calibration instrument/process
11.17.08	ability to verify the operation of the turbidity analyzer

Sub-task

11.18 Calibrates radioactive analyzers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.18.01	knowledge of equipment operation and performance expectations for radioactive analyzers
11.18.02	knowledge of calibration procedures and techniques for radioactive analyzers
11.18.03	knowledge of cause and effect of calibration errors

Supporting Knowledge & Abilities

11.18.04	knowledge of types of radioactive analyzers
11.18.05	knowledge of licencing requirements for working with radioactive devices
11.18.06	knowledge of calibration standards for radioactive analyzers
11.18.07	ability to assess the installation
11.18.08	ability to introduce a reference standard and assess the status of the calibration
11.18.09	ability to adjust the calibration instrument/process
11.18.10	ability to verify the operation of the radioactive analyzer

Sub-task

11.19 Calibrates pH meters.

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

11.19.01	knowledge of equipment operation and performance expectations for pH meters
11.19.02	knowledge of calibration procedures and techniques for pH meters
11.19.03	knowledge of cause and effect of calibration errors
11.19.04	knowledge of calibration standards for pH meters
11.19.05	ability to assess the installation
11.19.06	ability to introduce a reference standard and assess the status of the calibration
11.19.07	ability to adjust the calibration instrument/process
11.19.08	ability to verify the operation of the pH analyzer

Sub-task

11.20 Calibrates thermal or magnetic field analyzers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.20.01	knowledge of equipment operation and performance expectations for thermal and magnetic field analyzers
11.20.02	knowledge of calibration procedures and techniques for thermal and magnetic field analyzers
11.20.03	knowledge of cause and effect of calibration errors
11.20.04	knowledge of calibration standards for thermal and magnetic field analyzers
11.20.05	ability to assess the installation
11.20.06	ability to introduce a thermal or magnetic reference standard and assess the status of the calibration
11.20.07	ability to verify the operation of the thermal and magnetic field analyzer

Sub-task

11.21 Calibrates electromagnetic radiation instrument.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.21.01	knowledge of equipment operation and performance expectations for electromagnetic radiation instruments
11.21.02	knowledge of calibration procedures and techniques for electromagnetic radiation instruments
11.21.03	knowledge of cause and effect of calibration errors

Supporting Knowledge & Abilities

11.21.04	knowledge of calibration standards for electromagnetic radiation instruments
11.21.05	ability to assess the installation
11.21.06	ability to introduce a reference standard and assess the status of the calibration
11.21.07	ability to adjust the calibration instrument/process
11.21.08	ability to verify the operation of the electromagnetic radiation instrument

Sub-task

11.22 Calibrates energy analyzers (chemical, thermal, mechanical).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.22.01	knowledge of equipment operation and performance expectations for energy analyzers
11.22.02	knowledge of calibration procedures and techniques for energy analyzers
11.22.03	knowledge of cause and effect of calibration errors
11.22.04	knowledge of calibration standards for energy analyzers
11.22.05	ability to assess the installation
11.22.06	ability to introduce an energy reference standard and assess the status of the calibration
11.22.07	ability to adjust the calibration instrument/process
11.22.08	ability to verify the operation of the energy analyzer

Sub-task

11.23 Calibrates air quality analyzers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.23.01	knowledge of equipment operation and performance expectations for air quality analyzers
11.23.02	knowledge of calibration procedures and techniques for air quality analyzers
11.23.03	knowledge of cause and effect of calibration errors
11.23.04	knowledge of calibration standards for air quality analyzers
11.23.05	ability to assess the installation
11.23.06	ability to introduce a reference standard and assess the status of the calibration
11.23.07	ability to adjust the calibration instrument/process
11.23.08	ability to verify the operation of the air quality analyzer

Sub-task

11.24 Calibrates stack emission analyzers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.24.01	knowledge of equipment operation and performance expectations for stack emission analyzers
11.24.02	knowledge of calibration procedures and techniques for stack emission analyzers
11.24.03	knowledge of cause and effect of calibration errors

Supporting Knowledge & Abilities

11.24.04	knowledge of calibration standards for stack emission analyzers
11.24.05	ability to assess the installation
11.24.06	ability to introduce an emission reference standard and assess the status of the calibration
11.24.07	ability to adjust the calibration instrument/process
11.24.08	ability to verify the operation of the stack emission analyzer

Sub-task

11.25 Calibrates on-line moisture analyzers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.25.01	knowledge of equipment operation and performance expectations for moisture analyzers
11.25.02	knowledge of calibration procedures and techniques for moisture analyzers
11.25.03	knowledge of cause and effect of calibration errors
11.25.04	knowledge of calibration standards for moisture analyzers
11.25.05	ability to assess the installation
11.25.06	ability to introduce a moisture reference standard and assess the status of the calibration
11.25.07	ability to adjust the calibration
11.25.08	ability to verify the operation of the moisture analyzers

Sub-task

11.26 Replaces process gas analyzer components (thermomagnetic, thermoconductive, infrared, sensor type).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.26.01	knowledge of equipment operation and performance expectations for process gas analyzers
11.26.02	knowledge of removal and installation requirements, procedures for gas analyzer components
11.26.03	knowledge of operating requirements for components
11.26.04	knowledge of types of components that can be replaced such as detectors, valves, pumps, vents and filters
11.26.05	ability to select components to meet application requirements
11.26.06	ability to verify operation and calibration of analyzer and operation of replaced components

Sub-task

11.27 Replaces sample conditioning system components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.27.01	knowledge of equipment operation and performance expectations for sampling conditioning system components
11.27.02	knowledge of removal and installation requirements, procedures for sample conditioning system components

Supporting Knowledge & Abilities

11.27.03	knowledge of operating requirements for components
11.27.04	knowledge of types of components that can be replaced such as valves, separators, solenoids, pressure gauges
11.27.05	ability to select components to meet application requirements
11.27.06	ability to verify operation of conditioner and replaced components

Sub-task

11.28 Replaces liquid chemical analyzer components.

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

11.28.01	knowledge of equipment operation and performance expectations for liquid chemical analyzer components
11.28.02	knowledge of removal and installation requirements, procedures for liquid chemical analyzer components
11.28.03	knowledge of operating requirements for components
11.28.04	knowledge of types of components that can be replaced such as detectors, pumps, filters and valves
11.28.05	ability to select components to meet application requirements
11.28.06	ability to verify operation and calibration of analyzer and operation of replaced components

Sub-task

11.29 Replaces turbidity analyzer components. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.29.01	knowledge of equipment operation and performance expectations turbidity analyzer components
11.29.02	knowledge of removal and installation requirements, procedures for turbidity analyzer components
11.29.03	knowledge of operating requirements for components
11.29.04	ability to select components to meet application requirements
11.29.05	ability to verify operation and calibration of analyzer and operation of replaced components

Sub-task

11.30 Replaces radioactive analyzer components. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.30.01	knowledge of equipment operation and performance expectations for radioactive analyzer components
11.30.02	knowledge of removal and installation requirements, procedures for radioactive analyzer components
11.30.03	knowledge of operating requirements for components
11.30.04	knowledge of types of radioactive instruments such as nuclear level measuring devices and X-ray instruments
11.30.05	knowledge of licencing requirements for working with radioactive devices

Supporting Knowledge & Abilities

11.30.06 ability to select components to meet application requirements

11.30.07 ability to verify operation and calibration of analyzer and operation of replaced components

Sub-task

11.31 Replaces pH meter components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.31.01 knowledge of equipment operation and performance expectations for pH meter components

11.31.02 knowledge of removal and installation requirements, procedures for pH meter components

11.31.03 knowledge of operating requirements for components

11.31.04 knowledge of types of components that can be replaced such as caps, cables, plugs as well as control system components such as tanks, pumps, mixers and valves

11.31.05 ability to select components to meet application requirements

11.31.06 ability to verify operation of analyzer and replaced components

Sub-task

11.32 Replaces thermal or magnetic field analyzer components (thermistors, coils).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

11.32.01	knowledge of equipment operation and performance expectations thermal and magnetic field analyzer components
11.32.02	knowledge of removal and installation requirements, procedures for magnetic field analyzer components
11.32.03	knowledge of operating requirements for components
11.32.04	ability to select components to meet application requirements
11.32.05	ability to verify operation and calibration of analyzer and operation of replaced components

Sub-task

11.33 Replaces electromagnetic radiation instrument components (light sensitive diodes and FET's).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	yes	NV	NV

11.33.01	knowledge of equipment operation and performance expectations for electromagnetic radiation instrument components
11.33.02	knowledge of removal and installation requirements, procedures for electromagnetic radiation instrument components such as ultraviolet and infrared detectors as well as colorimeters
11.33.03	knowledge of operating requirements for components
11.33.04	knowledge of types of components for ultraviolet instruments that can be replaced such as meters, amplifiers, filters and detectors
11.33.05	knowledge of types of components for infrared instruments that can be replaced such as detectors, cells, choppers and source beams

Supporting Knowledge & Abilities

11.33.06	knowledge of maximum allowable exposure to gamma sources
11.33.07	ability to select components to meet application requirements
11.33.08	ability to verify operation and calibration of analyzer and operation of replaced components

Sub-task

11.34 Replaces energy instrument analyzer components (chemical, thermal, mechanical).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.34.01	knowledge of equipment operation and performance expectations for energy instrument analyzer
11.34.02	knowledge of removal and installation requirements, procedures for energy instrument analyzer components that belong to mass spectrometers
11.34.03	knowledge of operating requirements for mass spectrometer components such as inlet leak, evacuation pumps and magnets
11.34.04	ability to select components to meet application requirements
11.34.05	ability to verify operation of analyzer and replaced components

Sub-task

11.35 Replaces air quality analyzer components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

11.35.01	knowledge of equipment operation and performance expectations of air quality analyzer components
11.35.02	knowledge of removal and installation requirements, procedures for air quality analyzer components
11.35.03	knowledge of operating requirements for components
11.35.04	ability to select components to meet application requirements
11.35.05	ability to verify operation and calibration of analyzer and operation of replaced components

Sub-task

11.36 Replaces stack emission analyzer components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.36.01	knowledge of equipment operation and performance expectations for stack emission analyzer components
11.36.02	knowledge of removal and installation requirements, procedures for stack emission analyzer components
11.36.03	knowledge of operating requirements for components
11.36.04	ability to select components to meet application requirements
11.36.05	ability to verify operation of analyzer and replaced components

Sub-task

11.37 Replaces fluid sampler components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.37.01	knowledge of equipment operation and performance expectations for fluid sampler components
11.37.02	knowledge of removal and installation requirements, procedures for fluid sampler components
11.37.03	knowledge of operating requirements for components
11.37.04	ability to select components to meet application requirements
11.37.05	ability to verify operation and calibration of analyzer and operation of replaced components

Sub-task

11.38 Replaces gas sampler components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

11.38.01	knowledge of equipment operation and performance expectations for gas sampler components
11.38.02	knowledge of removal and installation requirements, procedures for gas sampler components
11.38.03	knowledge of operating requirements for components such as the Pitot tube assembly, sampling unit, operating/control unit
11.38.04	ability to select components to meet application requirements
11.38.05	ability to verify operation and calibration of analyzer and operation of replaced components

Task 12 Maintains speed measuring devices.

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding, mechanical tachometers, DC tacho-generator, mechanical displacement transducers, velocity transducers, electromagnetic angular-speed transducers, optical devices for measuring speed, stroboscope and photocells, optical flow detectors, linear optical gratings, light-beam interferometer, optical encoders, optical transducers.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

12.01 Installs mechanical devices for measuring speed.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

12.01.01 knowledge of equipment operation and performance expectations for mechanical devices for measuring speed

12.01.02 knowledge of installation requirements, procedures and techniques for mechanical devices for measuring speed

12.01.03 knowledge of applications, classes and types of mechanical devices for measuring speed such as mechanical tachometers, DC tacho-generator, mechanical displacement transducers, velocity transducers, electromagnetic angular-speed transducers

12.01.04 knowledge of types and sizes of add–ons for mechanical devices for measuring speed such as brackets, pipe hangers, safety shields and guards, cable, wiring, rotor

12.01.05 knowledge of electrical motors and shafts

12.01.06 knowledge of speed and velocity laws

Supporting Knowledge & Abilities

12.01.07	ability to select mechanical device for measuring speed to meet application requirements
12.01.08	ability to verify operation of device

Sub-task

12.02 Installs optical devices for measuring speed.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

12.02.01	knowledge of equipment operation and performance expectations for optical devices for measuring speed
12.02.02	knowledge of installation requirements, procedures and techniques for optical devices for measuring speed
12.02.03	knowledge of applications, classes and types of optical devices for measuring speed such as stroboscope and photocells, optical flow detectors, linear optical gratings, light-beam interferometer, optical encoders, optical transducers
12.02.04	knowledge of types and sizes of add–ons for optical devices for measuring speed such as receiver photocell, optical ring, wiring, brackets
12.02.05	knowledge of speed and velocity laws
12.02.06	ability to select optical device for measuring speed to meet application requirements
12.02.07	ability to verify operation of device

Sub-task

12.03 Installs electrical devices for measuring speed. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

12.03.01	knowledge of equipment operation and performance expectations for electrical devices for measuring speed
12.03.02	knowledge of installation requirements, procedures and techniques for electrical devices for measuring speed
12.03.03	knowledge of classes and types of electrical devices for measuring speed such as electrical motors and shafts
12.03.04	knowledge of electricity theory
12.03.05	knowledge of types and sizes of add–ons for electrical devices for measuring speed such as brackets, safety shields, guards
12.03.06	knowledge of speed and velocity laws
12.03.07	ability to select electrical device for measuring speed to meet application requirements
12.03.08	ability to verify operation of device

Sub-task

12.04 Calibrates mechanical devices for measuring speed. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

12.04.01	knowledge of equipment operation and performance expectations for mechanical devices for measuring speed
12.04.02	knowledge of calibration procedures and techniques
12.04.03	knowledge of types of measurement for mechanical devices for measuring speed

Supporting Knowledge & Abilities

12.04.04	knowledge of the cause and effect of calibration errors
12.04.05	ability to assess installation requirements of mechanical devices for measuring speed
12.04.06	ability to perform precalibration of mechanical devices for measuring speed
12.04.07	ability to introduce a reference standard and assess the status of the calibration
12.04.08	ability to interpret instrumentation read-out
12.04.09	ability to verify operation of mechanical devices for measuring speed, at operating temperature

Sub-task

12.05 Calibrates optical devices for measuring speed.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

12.05.01	knowledge of equipment operation and performance expectations for optical devices for measuring speed
12.05.02	knowledge of calibration procedures and techniques
12.05.03	knowledge of types of measurement for optical devices for measuring speed
12.05.04	knowledge of the cause and effect of calibration errors
12.05.05	ability to assess installation requirements of optical devices for measuring speed
12.05.06	ability to introduce a reference standard and assess the status of the calibration
12.05.07	ability to interpret instrumentation read-out
12.05.08	ability to adjust instrument
12.05.09	ability to verify operation of optical devices for measuring speed

Sub-task

12.06 Calibrates electrical devices for measuring speed.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

12.06.01	knowledge of equipment operation and performance expectations for electrical devices for measuring speed
12.06.02	knowledge of calibration procedures and techniques
12.06.03	knowledge of types of measurement for electrical devices for measuring speed
12.06.04	knowledge of the cause and effect of calibration errors
12.06.05	ability to assess installation requirements of electrical devices for measuring speed
12.06.06	ability to introduce a reference standard and assess the status of the calibration
12.06.07	ability to interpret instrumentation read-out
12.06.08	ability to adjust instrument
12.06.09	ability to verify operation of electrical devices for measuring speed

Sub-task

12.07 Replaces components on mechanical devices for measuring speed.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

12.07.01	knowledge of equipment operation and performance expectations components on mechanical devices for measuring speed
12.07.02	knowledge of removal and installation requirements, procedures and techniques for components on mechanical devices (tachometers) for measuring speed

Supporting Knowledge & Abilities

12.07.03	knowledge of operating requirements for components
12.07.04	ability to select components to meet application requirements
12.07.05	ability to verify operation and calibration of device and replaced components on mechanical devices for measuring speed

Sub-task

12.08 Replaces components on optical devices for measuring speed.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

12.08.01	knowledge of equipment operation and performance expectations for components on optical devices for measuring speed
12.08.02	knowledge of removal and installation requirements, procedures and techniques for components on optical devices for measuring speed
12.08.03	knowledge of operating requirements for components
12.08.04	ability to select components to meet application requirements
12.08.05	ability to verify operation and calibration of device and operation of replaced components on optical devices for measuring speed

Sub-task

12.09 Replaces components on electrical devices for measuring speed.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

12.09.01	knowledge of equipment operation and performance expectations for components on electrical devices for measuring speed
12.09.02	knowledge of removal and installation requirements, procedures and techniques for components on electrical devices for measuring speed
12.09.03	knowledge of operating requirements for components
12.09.04	ability to select components to meet application requirements
12.09.05	ability to verify operation and calibration of device and operation of replaced components on electrical devices for measuring speed

Task 13 Maintains weight and density measuring devices.

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, government regulations, equipment, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding, mechanical weight measuring devices, spring balance scales and mechanical lever systems such as hopper scales, platform scales and crane scales, hydraulic weight measuring devices, rolling diaphragm hydraulic load cell and the all-metal hydraulic load cell, electronic weight measuring devices, strain gauge load cells and inductive sensing techniques, nuclear density measuring devices, Geiger-Meuller (GM) tube, scintillation detector, gas ionization chamber, nuclear-radiation transducers, amplifier and power supply, beta radiation densitometers, mechanical density measuring devices such as mechanical-bubble tube, mechanical brix spindle, U-tubes (vibrating U-tube transducer, direct weighing U-tube transducer), mechanical displacer/floats, chain balanced float density transducers, continuous weight measurement devices.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

13.01 Installs mechanical weight measurement devices (non-continuous).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.01.01	knowledge of equipment operation and performance expectations for mechanical weight measuring devices
13.01.02	knowledge of installation requirements, procedures and techniques for mechanical weight measuring devices
13.01.03	knowledge of operating requirements and limitation of spring balance scales and mechanical lever systems
13.01.04	knowledge of types of mechanical weight measuring devices including spring balance scales and mechanical lever systems such as hopper scales, platform scales and crane scales
13.01.05	knowledge of vessel stabilizing devices
13.01.06	knowledge of factors affecting weighing system performance such as temperature, vibration, ambient conditions and maintenance
13.01.07	ability to select device to meet application requirements
13.01.08	ability to position and secure device
13.01.09	ability to verify operation of process mechanical weight measuring devices

Sub-task

13.02 Installs hydraulic weight measurement devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

13.02.01	knowledge of equipment operation and performance expectations for hydraulic weight measurement devices
13.02.02	knowledge of installation requirements, procedures and techniques for hydraulic weight measuring devices
13.02.03	knowledge of operating requirements including maximum pressures for hydraulic weight measuring devices
13.02.04	knowledge of types of hydraulic weight measuring devices such as the rolling diaphragm hydraulic load cell and the all-metal hydraulic load cell
13.02.05	knowledge of the installation requirements, procedures and operating requirements for hydraulic totalisers
13.02.06	knowledge of factors affecting weighing system performance such as temperature, vibration, ambient conditions and maintenance
13.02.07	ability to select and secure device to meet application requirements
13.02.08	ability to verify operation of process hydraulic weight measuring devices

Sub-task

13.03 Installs electronic weight measurement devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.03.01	knowledge of equipment operation and performance expectations for electronic weight measuring devices
13.03.02	knowledge of installation requirements, procedures and techniques for electronic weight measuring devices

Supporting Knowledge & Abilities

13.03.03 knowledge of types of electronic weight measuring devices such as strain gauge load cells and inductive sensing techniques

13.03.04 knowledge of factors affecting weighing system performance such as temperature, vibration, ambient conditions and maintenance

13.03.05 ability to select, position and secure device to meet application requirements

13.03.06 ability to verify operation of process electronic weight measuring devices

Sub-task

13.04 Installs nuclear density measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.04.01 knowledge of equipment operation and performance expectations for nuclear density measuring devices

13.04.02 knowledge of installation requirements, procedures and techniques for nuclear density measuring devices

13.04.03 knowledge of applications, classes and types of nuclear density measuring devices such as Geiger-Meuller (GM) tube, scintillation detector, gas ionization chamber, nuclear-radiation transducers, amplifier and power supply, beta radiation densitometers

13.04.04 knowledge of nuclear licensing requirements

13.04.05 knowledge of types and sizes of nuclear density measuring devices accessories such as brackets, pipes, "U" bolt, vessel clip, support plate, radiation level gauges (dosimeters), shutter mechanism, shutter switch, film badges, pocket ion chambers, pocket electroscopes, proportional counter, Geiger counters

13.04.06 knowledge of transduction methods

Supporting Knowledge & Abilities

13.04.07	ability to select nuclear density measuring device to meet application requirements
13.04.08	ability to select installation requirements, location
13.04.09	ability to mount source and detector
13.04.10	ability to mount warning signs

Sub-task

13.05 Installs mechanical density measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.05.01	knowledge of equipment operation and performance expectations for mechanical density measuring devices
13.05.02	knowledge of purpose and principle of operation of mechanical density measuring devices
13.05.03	knowledge of installation requirements, procedures and techniques for mechanical density measuring devices
13.05.04	knowledge of applications, classes and types of mechanical density measuring devices such as mechanical-bubble tube, mechanical brix spindle, U tubes (vibrating U-tube transducer, direct weighing U-tube transducer), mechanical displacer/floats, chain balanced float density transducers
13.05.05	knowledge of types, sizes and characteristics of mechanical density measuring devices add-ons such as brackets, pipes (metal and non-metallic), protective devices (filters, strainers, traps), tubing, clean-out devices, float/displacer level sensors (e.g., shaft-type ball float sensor) and gauges, chain weights, pick-up coil, peizometer ring, torque arm

Supporting Knowledge & Abilities

13.05.06	knowledge of inferential and true mass-flow measurement
13.05.07	knowledge of gyroscopic mass flowmeter, coriolis mass flowmeter, angular-momentum mass flowmeter, U-shaped gyroscopic mass flowmeter, pressure-differential and thermal-class flowmeter
13.05.08	knowledge of level determination and buoyant-force principles
13.05.09	knowledge of vessel entry permits, process sewer permits and line-opening permits
13.05.10	ability to select installation requirements, location
13.05.11	ability to select mechanical density measuring device to meet application requirements
13.05.12	ability to calculate distances and lengths between taps
13.05.13	ability to provide air, water and/or purge system

Sub-task

13.06 Installs electronic density measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.06.01	knowledge of equipment operation and performance expectations electronic density measuring devices
13.06.02	knowledge of installation requirements, procedures and techniques for electronic density measuring devices
13.06.03	knowledge of applications, classes and types of electronic density measuring devices such as electronic refractometer, electronic tuning fork, electronic optical density device, electronic mass flow device

Supporting Knowledge & Abilities

13.06.04	knowledge of speed and velocity laws
13.06.05	knowledge of operation of mechanical displacement transducers and velocity transducers, types and operations of mechanical tachometers, electromagnetic angular-speed transducers
13.06.06	knowledge of alignment procedures
13.06.07	knowledge of gas analysis methods
13.06.08	knowledge of float meter for gas density and gas density balance
13.06.09	knowledge of inferential and true mass-flow measurement
13.06.10	knowledge of gyroscopic mass flowmeter, coriolis mass flowmeter, angular-momentum mass flowmeter, U-shaped gyroscopic mass flowmeter, pressure-differential and thermal-class flowmeter
13.06.11	knowledge of types, sizes and characteristics of electornic density measuring devices add-ons such as brackets, pipes (metal and non-metallic), protective devices (filters, strainers, traps), tubing, clean-out devices, pipe fittings, expansion joints, vibration dampeners
13.06.12	ability to select electronic density measuring device to meet application requirements
13.06.13	ability to select installation requirements, location
13.06.14	ability to select and apply angular-speed transducers
13.06.15	ability to install gas/dust/smoke sensors
13.06.16	ability to calculate mass flow

Sub-task

13.07 Calibrates nuclear density measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.07.01	knowledge of equipment operation and performance expectations for nuclear density measuring devices
13.07.02	knowledge of calibration procedures and techniques
13.07.03	knowledge of applications and types of nuclear density measurement devices
13.07.04	knowledge of calibration standards for nuclear density measuring devices
13.07.05	knowledge of types and characteristics of radioactive substances used in nuclear density measuring devices
13.07.06	knowledge of cause and effect of calibration errors
13.07.07	ability to assess installation requirements of nuclear density measuring devices
13.07.08	ability to introduce a reference standard and assess the status of the calibration
13.07.09	ability to interpret instrumentation read-out
13.07.10	ability to perform precalibration of nuclear density measuring devices
13.07.11	ability to test circuits
13.07.12	ability to adjust instrument such as leveling and aligning planes
13.07.13	ability to verify operation of nuclear density measuring devices

Sub-task

13.08 Calibrates mechanical density measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.08.01	knowledge of equipment operation and performance expectations for mechanical density measuring devices
13.08.02	knowledge of calibration procedures and techniques
13.08.03	knowledge of applications and types of density measurement
13.08.04	knowledge of cause and effect of calibration errors
13.08.05	ability to assess installation requirements of mechanical density measuring devices
13.08.06	ability to introduce a reference standard and assess the status of the calibration
13.08.07	ability to interpret instrumentation read-out
13.08.08	ability to perform precalibration of mechanical density measuring devices
13.08.09	ability to adjust instrument such as leveling and aligning planes
13.08.10	ability to verify operation of mechanical density measuring devices

Sub-task

13.09 Calibrates electronic density measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.09.01	knowledge of equipment operation and performance expectations for electronic density measuring devices

Supporting Knowledge & Abilities

13.09.02	knowledge of calibration procedures and techniques (e.g., when calibrating thermocouples, using fixed points - freezing and melting points, for gas indicators and sensors, for known gas samples, for portable gas detectors)
13.09.03	knowledge of applications and types of density measurement such as liquid, smoke, gas, dust, air
13.09.04	knowledge of cause and effect of calibration errors
13.09.05	knowledge of temperature scale, annealing, measurement of EMF and nomogencity
13.09.06	ability to assess installation requirements of electronic density measuring devices
13.09.07	ability to introduce a reference standard (e.g., air pollution standards) and assess the status of the calibration
13.09.08	ability to interpret instrumentation read-out
13.09.09	ability to perform precalibration of electronic density measuring devices
13.09.10	ability to adjust instrument
13.09.11	ability to verify operation of electronic density measuring devices

Sub-task

13.10 Calibrates mechanical weight measurement devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.10.01	knowledge of equipment operation and performance expectations for weight measurement devices
13.10.02	knowledge of calibration procedures and techniques for weight measurement

Supporting Knowledge & Abilities

13.10.03	knowledge of cause and effect of calibration
13.10.04	knowledge of calibration standards for weight measurement devices
13.10.05	ability to assess the installation requirements
13.10.06	ability to introduce a weight measurement reference standard and assess the status of the calibration
13.10.07	ability to interpret standard limits of error
13.10.08	ability to adjust the calibration of the device
13.10.09	ability to verify the operation of the weight measurement device

Sub-task

13.11 Calibrates hydraulic weight measurement devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	no	yes	yes	yes	yes	NV	NV

13.11.01	knowledge of equipment operation and performance expectations for hydraulic weight measurement devices
13.11.02	knowledge of calibration procedures and techniques for hydraulic weight measurement
13.11.03	knowledge of cause and effect of calibration errors
13.11.04	knowledge of calibration standards for weight measurement devices
13.11.05	ability to assess the installation requirements
13.11.06	ability to introduce a hydraulic weight measurement reference standard and assess the status of the calibration
13.11.07	ability to interpret standard limits of error
13.11.08	ability to adjust the calibration of the device

Supporting Knowledge & Abilities

13.11.09 ability to verify the operation of the hydraulic weight measurement device

Sub-task

13.12 Calibrates electronic weight measurement devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.12.01 knowledge of equipment operation and performance expectations for electronic weight measurement devices

13.12.02 knowledge of calibration procedures and techniques for electronic weight measurement

13.12.03 knowledge of cause and effect of calibration errors

13.12.04 knowledge of calibration standards for electronic weight measurement devices

13.12.05 ability to assess the installation requirements

13.12.06 ability to introduce an electronic weight measurement reference standard and assess the status of the calibration

13.12.07 ability to interpret standard limits of error

13.12.08 ability to adjust the calibration of the device

13.12.09 ability to verify the operation of the electronic weight measurement device

Sub-task

13.13 Replaces mechanical weight measurement device components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

13.13.01	knowledge of equipment operation and performance expectations for mechanical weight measurement device components
13.13.02	knowledge of removal and installation requirements, procedures for mechanical weight measurement device components
13.13.03	knowledge of operating requirements for components including the use of electrical output devices
13.13.04	ability to select components to meet application requirements
13.13.05	ability to verify operation of device and replaced components
13.13.06	ability to verify calibration of the device

Sub-task

13.14 Replaces hydraulic weight measurement device components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	yes	NV	NV

13.14.01	knowledge of equipment operation and performance expectations for hydraulic weight measurement device components
13.14.02	knowledge of removal and installation requirements, procedures for hydraulic weight measurement device components
13.14.03	knowledge of operating requirements for components
13.14.04	ability to select components to meet application requirements
13.14.05	ability to verify operation and calibration of device and operation of replaced components

Sub-task

13.15 Replaces electronic weight measurement device components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.15.01	knowledge of equipment operation and performance expectations for electronic weight measurement device components
13.15.02	knowledge of removal and installation requirements, procedures for electronic weight measurement device components
13.15.03	knowledge of operating requirements for components that measure weight in addition to other variables such as thrust and wind
13.15.04	ability to select components to meet application requirements
13.15.05	ability to verify operation and calibration of device and operation of replaced components

Sub-task

13.16 Replaces components on nuclear density measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.16.01	knowledge of equipment operation and performance expectations for components on nuclear density measuring devices
13.16.02	knowledge of removal and installation requirements, procedures and techniques for components on nuclear density measuring devices
13.16.03	knowledge of operating requirements for components such as U bolt, support plate, radiation level gauges (dosimeters), shutter mechanism, shutter switch, Geiger counters, proportional counters

Supporting Knowledge & Abilities

13.16.04 knowledge of the disassembly/assembly techniques

13.16.05 knowledge of types and characteristics of radioactive substances used in components of nuclear density measuring devices

13.16.06 ability to select components to meet application requirements

13.16.07 ability to assess installation requirements, location

13.16.08 ability to verify operation and calibration of device and replaced components

Sub-task

13.17 Replaces components on mechanical density measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.17.01 knowledge of equipment operation and performance expectations for components on mechanical density measuring devices

13.17.02 knowledge of purpose and principle of operation of mechanical density measuring devices

13.17.03 knowledge of removal and installation requirements, procedures and techniques for components on mechanical density measuring devices

13.17.04 knowledge of operating requirements for components

13.17.05 knowledge of the disassembly/assembly techniques

13.17.06 ability to select components to meet application requirements

Supporting Knowledge & Abilities

13.17.07	ability to verify operation and calibration of device and operation of replaced components

Sub-task

13.18 Replaces components on electronic density measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

13.18.01	knowledge of equipment operation and performance expectations for components on electronic density measuring devices
13.18.02	knowledge of equipment operation and performance expectations for components on electronic density measuring devices
13.18.03	knowledge of operating requirements for components
13.18.04	ability to select components to meet application requirements
13.18.05	ability to verify operation and calibration of device and operation of replaced components

Task 14 Maintains vibration measurement devices.

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding, vibration measuring devices, mechanical-magnetic switches, piezoelectric accelerometers and strain gauge accelerometer, velocity sensors and non-contacting vibration sensors, proximeters.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

14.01 Installs probes. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

14.01.01	knowledge of equipment operation and performance expectations for probes
14.01.02	knowledge of installation requirements, procedures and techniques for probes
14.01.03	ability to select, position and secure probe to meet application requirements
14.01.04	ability to verify operation of probes

Sub-task

14.02 Installs amplifiers. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

14.02.01	knowledge of equipment operation and performance expectations for amplifiers
14.02.02	knowledge of installation requirements, procedures and techniques for amplifiers
14.02.03	ability to select, position and secure amplifier to meet application requirements
14.02.04	ability to verify operation of amplifier

Sub-task

14.03 Installs proximeters. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

14.03.01	knowledge of equipment operation and performance expectations for proximeters
14.03.02	knowledge of installation requirements, procedures and techniques for proximeters

Supporting Knowledge & Abilities

14.03.03 ability to select, position and secure proximeter to meet application requirements

14.03.04 ability to verify operation of proximeter

Sub-task

14.04 Calibrates amplifiers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

14.04.01 knowledge of equipment operation and performance expectations for amplifiers

14.04.02 knowledge of calibration procedures and techniques for amplifiers

14.04.03 knowledge of cause and effect of calibration errors

14.04.04 knowledge of calibration standards for amplifiers

14.04.05 ability to assess the installation requirements

14.04.06 ability to introduce a reference standard and assess the status of the calibration

14.04.07 ability to interpret standard limits of error

14.04.08 ability to adjust the calibration of the device

14.04.09 ability to verify the operation of the amplifier

Sub-task

14.05 Calibrates proximeters.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

14.05.01 knowledge of equipment operation and performance expectations for proximeters

Supporting Knowledge & Abilities

14.05.02	knowledge of calibration procedures and techniques for proximeters
14.05.03	knowledge of cause and effect of calibration errors
14.05.04	knowledge of calibration standards for proximeters
14.05.05	ability to assess the installation requirements
14.05.06	ability to introduce a reference standard and assess the status of the calibration
14.05.07	ability to interpret standard limits of error
14.05.08	ability to adjust the calibration of the device
14.05.09	ability to verify the operation of the amplifier

Sub-task

14.06 Replaces vibration measurement device components.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

14.06.01	knowledge of equipment operation and performance expectations for vibration measurement device components
14.06.02	knowledge of removal and installation requirements, procedures for vibration measurement device components
14.06.03	knowledge of operating requirements for components
14.06.04	knowledge of the disassembly/assembly techniques
14.06.05	ability to select components to meet application requirements
14.06.06	ability to verify operation and calibration of device and operation of replaced components

Task 15 **Maintains consistency measuring devices.**

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment, adhesives, strain gauge detectors, optical consistency measuring devices, level switches and sensors, rotary and blade type consistency measurement devices.

Sub-task

15.01 Installs mechanical consistency measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

15.01.01	knowledge of equipment operation and performance expectations for mechanical consistency measuring devices
15.01.02	knowledge of installation requirements, procedures and techniques for mechanical consistency measuring devices
15.01.03	knowledge of operating requirements for mechanical consistency measuring devices
15.01.04	knowledge of types of mechanical consistency measuring devices such as a strain gauge detectors
15.01.05	knowledge of types and qualities of adhesives
15.01.06	knowledge of parameters affecting the installation requirements, and operation of strain gauges such as strain-sensitive alloy, backing material and grid resistance
15.01.07	ability to select installation requirements, location
15.01.08	ability to select device to meet application requirements
15.01.09	ability to verify operation of device

Sub-task

15.02 Installs optical consistency measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

15.02.01	knowledge of equipment operation and performance expectations for optical consistency measuring devices
15.02.02	knowledge of installation requirements, procedures and techniques for optical consistency measuring devices
15.02.03	knowledge of operating requirements for optical consistency measuring devices
15.02.04	knowledge of types of optical consistency measuring devices such as level switches and sensors
15.02.05	knowledge of the impact of environmental factors and materials devices
15.02.06	ability to select installation requirements, location
15.02.07	ability to select sight glass to meet application requirements
15.02.08	ability to connect, secure and level optical consistency devices
15.02.09	ability to verify operation of device

Sub-task

15.03 Installs rotary and blade type consistency measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

15.03.01	knowledge of equipment operation and performance expectations for rotary and blade type consistency measuring devices

Supporting Knowledge & Abilities

15.03.02	knowledge of purpose and principle of operation of rotary and blade type consistency measuring devices
15.03.03	knowledge of installation requirements, procedures and techniques for rotary and blade consistency measuring devices
15.03.04	knowledge of operating requirements for rotary and blade consistency measuring devices
15.03.05	knowledge of types of rotary and blade type devices such as a force balance indicator and rotating sensors
15.03.06	knowledge of the impact of environmental factors and materials on rotary and blade type consistency measuring devices
15.03.07	knowledge of types of signal tubing/wiring and methods of connecting tubing/wiring
15.03.08	ability to select sight glass to meet application requirements
15.03.09	ability to select installation requirements, location
15.03.10	ability to connect and secure rotary and blade type consistency measuring devices
15.03.11	ability to check seals and oil levels in gearboxes
15.03.12	ability to verify operation of device

Sub-task

15.04 Calibrates mechanical consistency measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

15.04.01	knowledge of equipment operation and performance expectations for mechanical consistency measuring devices

Supporting Knowledge & Abilities

15.04.02	knowledge of calibration procedures and techniques for mechanical consistency measuring devices
15.04.03	knowledge of cause and effect of calibration errors
15.04.04	knowledge of calibration standards for mechanical consistency measuring devices
15.04.05	ability to assess the installation requirements
15.04.06	ability to introduce a reference standard and assess the status of the calibration
15.04.07	ability to adjust the calibration instrument/device
15.04.08	ability to verify the operation of the mechanical consistency measuring device

Sub-task

15.05 Calibrates optical consistency measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

15.05.01	knowledge of equipment operation and performance expectations for optical consistency measuring devices
15.05.02	knowledge of calibration procedures and techniques for optical consistency measuring devices
15.05.03	knowledge of cause and effect of calibration errors
15.05.04	knowledge of calibration standards for optical consistency measuring devices
15.05.05	ability to assess the installation requirements
15.05.06	ability to introduce a reference standard and assess the status of the calibration

Supporting Knowledge & Abilities

15.05.07	ability to adjust the calibration instrument/device
15.05.08	ability to verify the operation of the optical consistency measuring device

Sub-task

15.06 Calibrates rotary and blade type consistency measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

15.06.01	knowledge of equipment operation and performance expectations for rotary and blade type consistency measuring devices
15.06.02	knowledge of calibration procedures and techniques for rotary and blade type consistency measuring devices
15.06.03	knowledge of cause and effect of calibration errors
15.06.04	knowledge of calibration standards for rotary and blade type consistency measuring devices
15.06.05	ability to assess the installation requirements
15.06.06	ability to introduce a reference standard and assess the status of the calibration
15.06.07	ability to adjust the calibration instrument/device
15.06.08	ability to verify the operation of the rotary and blade type consistency measuring device

Sub-task

15.07 Replaces components on mechanical consistency measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

15.07.01 knowledge of equipment operation and performance expectations for components on mechanical consistency measuring devices

15.07.02 knowledge of removal and installation requirements, procedures for mechanical consistency measuring devices

15.07.03 knowledge of operating requirements for components

15.07.04 ability to select components to meet application requirements

15.07.05 ability to verify operation of device and replaced components

15.07.06 ability to verify calibration and operation of the device

Sub-task

15.08 Replaces components on optical consistency measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

15.08.01 knowledge of equipment operation and performance expectations for components on optical consistency measuring devices

15.08.02 knowledge of removal and installation requirements, procedures for optical consistency measuring devices

15.08.03 knowledge of operating requirements for components

15.08.04 ability to select components to meet application requirements

15.08.05 ability to verify operation and calibration of device and operation of replaced components

Sub-task

15.09 Replaces components on rotary and blade type consistency measuring devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

15.09.01	knowledge of equipment operation and performance expectations for components on rotary and blade type consistency measuring devices
15.09.02	knowledge of removal and installation requirements, procedures for rotary and blade type consistency measuring devices
15.09.03	knowledge of operating requirements for components
15.09.04	ability to select components to meet application requirements
15.09.05	ability to verify operation of device and replaced components
15.09.06	ability to verify operation and calibration of analyzer and operation of replaced components

Task 16 Maintains final control elements.

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding, variable speed and variable frequency drives, electrical drives (variable frequency, wound rotor regenerative, direct current, variable voltage, two-speed motors), electromechanical drives (V-belt drives, hydraulic couplings, and hydro viscous couplings, eddy current couplings), electrical drives (variable frequency, wound rotor regenerative, direct current, variable voltage, two-speed motors), electromechanical drives (V-belt drives, hydraulic couplings, and hydro viscous couplings, eddy current couplings), power controllers, pneumatic drives, hydraulic cylinders, control valves, ball, vee-ball, plug, butterfly, actuators, positioners.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

16.01 Installs variable speed and variable frequency drives.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	no	yes	yes	yes	NV	NV

16.01.01	knowledge of equipment operation and performance expectations for variable speed and variable frequency drives
16.01.02	knowledge of installation requirements, procedures and techniques for variable speed and variable frequency drives
16.01.03	knowledge of application, classes and types of variable speed and variable frequency drives such as electrical drives (variable frequency, wound rotor regenerative, direct current, variable voltage, two-speed motors), electromechanical drives (V-belt drives, hydraulic couplings, and hydro viscous couplings, eddy current couplings)
16.01.04	knowledge of types and sizes and characteristics of variable speed and variable frequency drive add-ons such as brackets, piping, tubing, final control elements, wiring, cabling, pump, heating or cooling coils, control valves, storage tanks
16.01.05	ability to select variable speed and variable frequency drives to meet application requirements
16.01.06	ability to select installation requirements, location

Sub-task

16.02 Installs electric actuators.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

16.02.01	knowledge of equipment operation and performance expectations for electric actuators
16.02.02	knowledge of installation requirements, procedures and techniques for electric actuators

Supporting Knowledge & Abilities

16.02.03	knowledge of application, classes and types of electric actuators
16.02.04	knowledge of three-phase and single-phase induction motors, stepper motors
16.02.05	knowledge of types, sizes and characteristics of electric actuator add-ons such as brackets, wiring, solenoids, solenoid-operated valves, industrial relays
16.02.06	knowledge of types of pneumatic controls such as pilot operated valves, switches and electro-pneumatic solenoids
16.02.07	knowledge of pneumatic logic
16.02.08	ability to select electric actuators to meet application requirements (e.g., the use of DC, AC and universal motors)
16.02.09	ability to determine lengths, angles and levers

Sub-task

16.03 Installs power controllers. **Supporting Knowledge & Abilities**

(NOT COMMON CORE)

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	no	ND	yes	yes	yes	yes	no	NV	NV

16.03.01	knowledge of equipment operation and performance expectations for power controllers
16.03.02	knowledge of installation requirements, procedures and techniques for power controllers
16.03.03	knowledge of application classes and types of power controllers
16.03.04	knowledge of types and sizes and characteristics of power controller add-ons such as brackets, wiring
16.03.05	ability to select power controllers to meet application requirements

Sub-task

16.04 Installs pneumatic drives. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

16.04.01	knowledge of equipment operation and performance expectations for pneumatic drives
16.04.02	knowledge of installation requirements, procedures and techniques for pneumatic drives
16.04.03	knowledge of classes and types of pneumatic drives
16.04.04	knowledge of types and sizes and characteristics of pneumatic drive add-ons such as brackets, piping (metal and non-metallic), tubing, wiring, cabling, protective devices (filters, strainers, traps), clean-out devices, flameless fittings, speed controls
16.04.05	ability to select installation requirements, location
16.04.06	ability to select pneumatic drives to meet application requirements
16.04.07	ability to calculate linkage lengths, lever lengths and angles
16.04.08	ability to fabricate linkages

Sub-task

16.05 Installs pneumatic cylinders. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	no	NV	NV

16.05.01	knowledge of equipment operation and performance expectations for pneumatic cylinders
16.05.02	knowledge of installation requirements, procedures and techniques for pneumatic cylinders

Supporting Knowledge & Abilities

16.05.03	knowledge of applications, classes and types of pneumatic cylinders
16.05.04	knowledge of types and sizes and characteristics of pneumatic cylinder add-ons such as piping (metal and non-metallic), tubing, flexible hoses
16.05.05	ability to select installation requirements, location
16.05.06	ability to select pneumatic cylinders to meet application requirements

Sub-task

16.06 Installs hydraulic cylinders. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	no	NV	NV

16.06.01	knowledge of equipment operation and performance expectations for hydraulic cylinders
16.06.02	knowledge of installation requirements, procedures and techniques for hydraulic cylinders
16.06.03	knowledge of application, classes and types of hydraulic cylinders such as double-acting cylinder
16.06.04	knowledge of types, sizes and characteristics of hydraulic cylinder add-ons such as piping (metal and non-metallic), tubing
16.06.05	ability to select hydraulic cylinders to meet application requirements

Sub-task

16.07 Installs mechanical control valves, actuators and positioners (ball, vee-ball, plug, butterfly).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

16.07.01 knowledge of equipment operation and performance expectations for mechanical control valves, actuators (hydraulic, diaphragm and piston pneumatic actuators, direct and reverse-acting pneumatic actuators) and positioners

16.07.02 knowledge of purpose and principle of operation of control valves (ball, vee-ball, plug, butterfly), actuators and positioners

16.07.03 knowledge of installation requirements, procedures and techniques for mechanical control valves, actuators and positioners

16.07.04 knowledge of applications, classes and types of mechanical control valves, actuators and positioners such as ball, vee-ball, plug, butterfly, globe, cage, sliding-gate, diaphragm, split body valves

16.07.05 knowledge of applications, types, sizes and characteristics of mechanical control valves, actuators and positioner add-ons such as pipes (metal and non-metallic)

16.07.06 knowledge of the material used for components (e.g. valve seat and packing) construction

16.07.07 ability to select installation and location requirements

16.07.08 ability to select mechanical control valves, actuators and positioners to meet application requirements

16.07.09 ability to calculate linkage lengths, lever lengths and angles

16.07.10 ability to fabricate linkages

Sub-task

16.08 Calibrates variable speed and variable frequency drives. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	no	yes	yes	yes	yes	NV	NV

16.08.01	knowledge of equipment operation and performance expectations for variable speed and variable frequency drives
16.08.02	knowledge of calibration procedures and techniques
16.08.03	knowledge of the cause and effect of calibration errors
16.08.04	ability to assess the installation requirements of variable speed and variable frequency drives
16.08.05	ability to introduce a reference standard and assess the status of the calibration
16.08.06	ability to interpret instrumentation read-out
16.08.07	ability to adjust the calibration instrument/device
16.08.08	ability to verify operation of variable speed and variable frequency drives

Sub-task

16.09 Calibrates electric actuators. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

16.09.01	knowledge of equipment operation and performance expectations for electric actuators
16.09.02	knowledge of calibration procedures and techniques
16.09.03	knowledge of the cause and effect of calibration errors

Supporting Knowledge & Abilities

16.09.04	ability to assess the installation requirements of electric actuators
16.09.05	ability to introduce a reference standard and assess the status of the calibration
16.09.06	ability to interpret instrumentation read-out
16.09.07	ability to adjust the calibration instrument/device
16.09.08	ability to verify operation of electric actuators

Sub-task

16.10 Calibrates power controllers. **Supporting Knowledge & Abilities**

(NOT COMMON CORE)

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	no	ND	yes	yes	yes	yes	no	NV	NV

16.10.01	knowledge of equipment operation and performance expectations for power controllers
16.10.02	knowledge of calibration procedures and techniques
16.10.03	knowledge of the cause and effect of calibration errors
16.10.04	ability to assess the installation requirements of power controllers
16.10.05	ability to introduce a reference standard and assess the status of the calibration
16.10.06	ability to perform precalibration of power controller
16.10.07	ability to interpret instrumentation read-out
16.10.08	ability to adjust the calibration instrument/device
16.10.09	ability to verify operation of power controller

Sub-task

16.11 Calibrates pneumatic drives. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	no	NV	NV

16.11.01	knowledge of equipment operation and performance expectations for pneumatic drives
16.11.02	knowledge of calibration procedures and techniques
16.11.03	knowledge of the cause and effect of calibration errors
16.11.04	ability to assess the installation requirements of pneumatic drives
16.11.05	ability to introduce a reference standard and assess the status of the calibration
16.11.06	ability to perform precalibration of pneumatic drives
16.11.07	ability to interpret instrumentation read-out
16.11.08	ability to adjust the calibration instrument/device
16.11.09	ability to verify operation of pneumatic drives

Sub-task

16.12 Calibrates control valves, actuators and positioners (ball, vee-ball, plug, butterfly). **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

16.12.01	knowledge of equipment operation and performance expectations for control valves (ball, vee-ball, plug, butterfly), actuators and positioners
16.12.02	knowledge of calibration procedures and techniques

Supporting Knowledge & Abilities

16.12.03	knowledge of the cause and effect of calibration errors
16.12.04	ability to assess the installation requirements of control valves, actuators, positioners
16.12.05	ability to introduce a reference standard and assess the status of the calibration
16.12.06	ability to perform precalibration (bench test) of control valves, actuators and positioners
16.12.07	ability to interpret instrumentation read-out
16.12.08	ability to adjust the calibration instrument/device
16.12.09	ability to verify operation of control valves, actuators and positioners

Sub-task

16.13 Replaces components on variable speed and variable frequency drives.

Supporting Knowledge & Abilities

(NOT COMMON CORE)

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	no	no	yes	yes	yes	NV	NV

16.13.01	knowledge of equipment operation and performance expectations for components on variable speed and variable frequency drives
16.13.02	knowledge of removal and installation requirements, procedures and techniques for components on variable speed and variable frequency drives
16.13.03	knowledge of operating requirements for components
16.13.04	ability to select components to meet application requirements

Supporting Knowledge & Abilities

16.13.05 ability to verify operation and calibration of device and operation of drives and replaced components on variable speed and variable frequency drives

Sub-task

16.14 Replaces components on electric actuators.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

16.14.01 knowledge of equipment operation and performance expectations for components on electric actuators

16.14.02 knowledge of removal and installation requirements, procedures and techniques for components on electric actuators

16.14.03 knowledge of operating requirements for components such as three-phase and single-phase induction motors, stepper motors

16.14.04 ability to select components to meet application requirements

16.14.05 ability to verify operation on electric actuators and its replaced components

16.14.06 ability to verify calibration of the device

Sub-task

16.15 Replaces components on pneumatic drives.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

16.15.01 knowledge of equipment operation and performance expectations for components on pneumatic drives

Supporting Knowledge & Abilities

16.15.02 knowledge of removal and installation requirements, procedures and techniques for components on pneumatic drives

16.15.03 knowledge of operating requirements for components

16.15.04 ability to select components to meet application requirements

16.15.05 ability to verify operation and calibration of device and operation of driver and replaced components on pneumatic drives

Sub-task

16.16 Replaces components on pneumatic cylinders.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

16.16.01 knowledge of equipment operation and performance expectations for components on pneumatic cylinders

16.16.02 knowledge of removal and installation requirements, procedures and techniques for components on pneumatic cylinders

16.16.03 knowledge of operating requirements for components such as tubing, piping, valves, lower components

16.16.04 ability to select components to meet application requirements

16.16.05 ability to verify operation and calibration of device and operation of pneumatic system and replaced components on pneumatic cylinders

Sub-task

16.17 Replaces components on hydraulic cylinders.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	no	NV	NV

Supporting Knowledge & Abilities

16.17.01 knowledge of equipment operation and performance expectations for components on hydraulic cylinders

16.17.02 knowledge of removal and installation requirements, procedures and techniques for components on hydraulic cylinders

16.17.03 knowledge of operating requirements for components such as tubing, piping, feed line, return line

16.17.04 ability to select components to meet application requirements

16.17.05 ability to verify operation and calibration of the device and operation of hydraulic system and replaced components on hydraulic cylinders

Sub-task

16.18 Replaces components on mechanical control valves, actuators and positioners (ball, vee-ball, plug, butterfly).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

16.18.01 knowledge of equipment operation and performance expectations for components on mechanical control valves (ball, vee-ball, plug, butterfly), actuators and positioners

16.18.02 knowledge of removal and installation requirements, procedures and techniques for components on control valves, actuators and positioners

16.18.03 knowledge of operating requirements for components on control valves (globe, cage, butterfly, ball, sliding-gate, diaphragm and split body valves), actuators and positioners

16.18.04 ability to select components to meet application requirements

Supporting Knowledge & Abilities

16.18.05	ability to verify operation and calibration of device and operation of replaced components on mechanical control valves, actuators and positioners

Task 17 Maintains calibration, reference, comparison standards and test equipment.

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, standard operation procedures, trade codes, governmental regulations, prints and drawings, electrical/electronic potentiometers, temperature baths, pH probes, oscilloscopes, recording instruments and thermometer bridges, multimeters, voltmeters and ohmmeters, bridge test sets (Whetstone Bridge).

Tools and Equipment: Hand tools, power tools, test equipment and accessories, personal protective equipment, reference standards, buffer solutions.

Sub-task

17.01 Verifies calibration of temperature baths and controls.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.01.01	knowledge of calibration procedures and techniques for temperature baths
17.01.02	knowledge of cause and effect of calibration errors
17.01.03	knowledge of calibration standards for temperature baths
17.01.04	ability to operate temperature bath and interpret equipment signals with given reference standards
17.01.05	ability to adjust temperature bath

Sub-task

17.02 Verifies calibration of electrical/electronic potentiometer.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.02.01	knowledge of calibration procedures and techniques for electrical/electronic potentiometers
17.02.02	knowledge of cause and effect of calibration errors
17.02.03	knowledge of calibration standards for electrical and electronic potentiometers
17.02.04	knowledge of Ohm's law and direct current
17.02.05	ability to operate potentiometer and interpret equipment signals with given reference standards
17.02.06	ability to adjust resistance

Sub-task

17.03 Replaces components on electrical potentiometers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	yes	NV	NV

17.03.01	knowledge of removal and installation procedures for potentiometer components
17.03.02	knowledge of operating requirements for components
17.03.03	ability to select components to meet application requirements
17.03.04	ability to verify operation of instrument

Sub-task

17.04 Replaces components on manometers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.04.01	knowledge of application and types of manometers such as U-tube and well-types
17.04.02	knowledge of removal and installation procedures for manometers components
17.04.03	knowledge of operating requirements for components
17.04.04	ability to assess fill liquid condition
17.04.05	ability to replace fill liquid
17.04.06	ability to select components to meet application requirements
17.04.07	ability to verify operation of instrument

Sub-task

17.05 Replaces components on deadweight testers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.05.01	knowledge of removal and installation procedures for deadweight tester components
17.05.02	knowledge of operating requirements for components
17.05.03	ability to assess fill liquid condition
17.05.04	ability to replace fill liquid
17.05.05	ability to select components to meet application requirements
17.05.06	ability to verify operation of instrument

Sub-task

17.06 Verifies calibration of bridge test sets.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.06.01	knowledge of calibration procedures and techniques for bridge test sets (Whetstone Bridge)
17.06.02	knowledge of cause and effect of calibration errors
17.06.03	knowledge of calibration standards for bridge test sets
17.06.04	ability to operate bridge test sets and interpret equipment signals with given reference standards
17.06.05	ability to adjust bridge test sets

Sub-task

17.07 Replaces components on bridge test sets.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.07.01	knowledge of removal and installation procedures for bridge test set (Whetstone Bridge) components
17.07.02	knowledge of operating requirements for components
17.07.03	ability to select components to meet application requirements
17.07.04	ability to verify operation of instrument

Sub-task

17.08 Verifies calibration of resistance, voltage and current reference devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.08.01	knowledge of calibration procedures and techniques for equipment used to measure resistance, voltage and current such as multimeters, ohmmeters, ammeters and voltmeters
17.08.02	knowledge of cause and effect of calibration errors
17.08.03	knowledge of calibration standards for instruments
17.08.04	ability to operate instruments and interpret equipment signals with given reference standards
17.08.05	ability to adjust instruments

Sub-task

17.09 Replaces components on resistance, voltage and current reference devices.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.09.01	knowledge of removal and installation procedures for devices such as multimeters, voltmeters and ohmmeters
17.09.02	knowledge of operating requirements for components
17.09.03	ability to select components to meet application requirements
17.09.04	ability to verify operation of instrument

Sub-task

17.10 Verifies calibration of analyzer test equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.10.01	knowledge of types of analyzer test equipment such as pH probes, oscilloscopes, recording instruments and thermometer bridges
17.10.02	knowledge of calibration procedures and techniques for test equipment
17.10.03	knowledge of cause and effect of calibration errors
17.10.04	knowledge of calibration standards for test equipment
17.10.05	ability to operate test equipment and interpret equipment signals/readings with given reference standards
17.10.06	ability to adjust test equipment

Sub-task

17.11 Replaces components on analyzer test equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.11.01	knowledge of removal and installation procedures for analyzer components such as pH probes, oscilloscopes, and thermometer bridges
17.11.02	knowledge of operating requirements for components
17.11.03	ability to select components to meet application requirements
17.11.04	ability to verify operation of instrument

Sub-task

17.12 Verifies calibration of digital test equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	no	ND	yes	yes	yes	yes	yes	NV	NV

17.12.01	knowledge of purpose of equipment used to measure variables such as flow rate, pressure and distance
17.12.02	knowledge of calibration procedures and techniques for digital test equipment
17.12.03	knowledge of cause and effect of calibration errors
17.12.04	knowledge of calibration standards for digital test equipment
17.12.05	ability to operate bridge test sets and interpret equipment signals with given reference standards
17.12.06	ability to adjust digital equipment

Sub-task

17.13 Replaces components on digital test equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.13.01	knowledge of removal and installation procedures for digital test equipment
17.13.02	knowledge of operating requirements for components such as circuit boards, LED's and probes
17.13.03	ability to select components to meet application requirements
17.13.04	ability to verify operation of instrument

Sub-task

17.14 Verifies calibration of pneumatic test equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.14.01 knowledge of differences in differential, gauge and absolute pressures

17.14.02 knowledge of calibration procedures and techniques for pneumatic test equipment such as Limp-diaphragm, pressure indicators, manometers, Bourdon elements

17.14.03 knowledge of cause and effect of calibration errors

17.14.04 knowledge of calibration standards for pneumatic test equipment

17.14.05 ability to operate pneumatic test equipment and interpret equipment signals with given reference standards

17.14.06 ability to adjust pneumatic test equipment

Sub-task

17.15 Replaces components on pneumatic test equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

17.15.01 knowledge of removal and installation procedures for pneumatic test equipment such as Limp-diaphragm, pressure indicators, manometers, Bourdon elements

17.15.02 knowledge of operating requirements for components

17.15.03 ability to select components to meet application requirements

17.15.04 ability to verify operation of instrument

BLOCK E

SIGNAL TRANSMISSION

Trends: *There is a trend towards more fibre optics in transmission signal systems as well as smaller, more compact systems.*

Task 18 **Maintains signal transmission systems.**

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, piping - ferrous and non-ferrous, tubing - copper, stainless steel, and plastic, wiring - fibre optics, twisted pair and coaxial, valves and fittings, raceways, conduit - flexible and rigid, scaffolds, prints and drawings, rigging, scaffolding, flanges, gaskets, identification practices, heat trace systems, insulation, brackets, mounts, fasteners, soldering, brazing, cutting and welding, adhesives, shielding and grounding practices.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment - benders, reamers, flaring tools, cutters, personal protective equipment.

Sub-task

18.01 Blows down impulse lines. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.01.01 knowledge of equipment operation and performance expectations for impulse lines and signal transmission systems

18.01.02 knowledge of types and characteristics of impulse lines for both metal piping and non-metallic tubing

18.01.03 knowledge of isolation procedures for impulse lines and system components

18.01.04 knowledge of procedures and techniques to blow down impulse lines

Supporting Knowledge & Abilities

18.01.05	knowledge of application, types and characteristics of components on signal transmission systems such as valves (hand shut off, four way, pressure relief), load devices, electric motors, gauges, regulators, actuators, positioners, indictors, switches (limit, pressure, vacuum, differential)
18.01.06	ability to assess impulse line operation and condition
18.01.07	ability to operate compressed air devices

Sub-task

18.02 Fabricates impulse and signal lines (pipe and tube).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.02.01	knowledge of equipment operation and performance expectations for impulse and signal lines (pipe and tube)
18.02.02	knowledge of fabrication procedures for impulse and signal lines (pipe and tube)
18.02.03	knowledge of raceways and conduits
18.02.04	knowledge of types and characteristics of add-ons for impulse and signal lines such as protective devices (filters, strainers, traps), clean-out devices, flameless fittings
18.02.05	knowledge of piping and tubing schedules and applications
18.02.06	ability to select piping and tubing mounts and accessories
18.02.07	ability to select installation location and isolate protected lines from unprotected lines
18.02.08	ability to select fabrication method and materials to meet application requirements
18.02.09	ability to form impulse and signal lines

Supporting Knowledge & Abilities

18.02.10	ability to determine mounting location of junction box
18.02.11	ability to assemble, weld, install junction box
18.02.12	ability to verify operation of impulse and signal lines

Sub-task

18.03 Installs impulse and signal lines (pipe and tube).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.03.01	knowledge of equipment operation and performance expectations for impulse and signal lines (pipe and tube)
18.03.02	knowledge of installation procedures and techniques for impulse and signal lines
18.03.03	knowledge of operating requirements for impulse and signal lines
18.03.04	knowledge of types and characteristics of impulse and signal lines (piping – metal and non-metallic, tubing) and materials used for fabrication
18.03.05	knowledge of types and characteristics of add-ons for impulse and signal lines such as protective devices (filters, strainers, traps), clean-out devices, flameless fittings
18.03.06	knowledge of types and sizes of add-ons for impulse and signal lines
18.03.07	ability to install pipe or tubing for based on application and environmental considerations
18.03.08	ability to select impulse and signal lines to meet application requirements
18.03.09	ability to assess tubing form, angles and joints
18.03.10	ability to perform pressure check of system

Sub-task

18.04 Installs heat tracing on impulse lines. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	yes	NV	NV

18.04.01	knowledge of equipment operation and performance expectations for impulse and signal lines (pipe and tube)
18.04.02	knowledge of the various types of heat tracing, their components and application
18.04.03	knowledge of tubing practices
18.04.04	knowledge of installation procedures and techniques for heat tracing on impulse lines
18.04.05	knowledge of operating requirements for heat tracing on impulse lines
18.04.06	ability to size and select heat trace system for the application

Sub-task

18.05 Installs insulation on impulse lines. **Supporting Knowledge & Abilities**

(NOT COMMON CORE)

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	no	no	yes	yes	yes	NV	NV

18.05.01	knowledge of equipment operation and performance expectations for impulse and signal lines (pipe and tube)
18.05.02	knowledge of various types of pipe insulation and their applications
18.05.03	knowledge of installation procedures and techniques for insulation on impulse lines
18.05.04	knowledge of the various types of protective covers and their applications for insulation

Supporting Knowledge & Abilities

18.05.05 ability to size and select insulation for impulse lines to meet application and environmental requirements

Sub-task

18.06 Replaces damaged impulse lines (pipe, tube and fittings).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.06.01 knowledge of equipment operation and performance expectations for impulse and signal lines (pipe and tube)

18.06.02 knowledge of isolation procedures for impulse lines and system components

18.06.03 knowledge of operating requirements for impulse lines

18.06.04 knowledge of removal and installation procedures and techniques for impulse lines

18.06.05 ability to perform isolation of impulse lines and system components

18.06.06 ability to select replacement components to meet application and environmental requirements

18.06.07 ability to verify operation of impulse line

18.06.08 ability to perform pressure check of system

Sub-task

18.07 "Runs" signal wiring.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.07.01 knowledge of equipment operation and performance expectations for signal wiring

18.07.02 knowledge of raceways and conduits

Supporting Knowledge & Abilities

18.07.03	knowledge of signal wiring procedures and techniques
18.07.04	knowledge of grounding techniques
18.07.05	knowledge of field wiring, input and output devices for programmable controllers
18.07.06	knowledge of pilot devices such as limit switches, pushbuttons, photocells and transducers
18.07.07	knowledge of output devices such as solenoids, indicating lamps, motor starter and relays
18.07.08	knowledge of remote input/output racks
18.07.09	ability to size and select cables and wiring to meet application requirements
18.07.10	ability to isolate protected lines from unprotected lines
18.07.11	ability to interconnect cables

Sub-task

18.08 Terminates signal wiring.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.08.01	knowledge of equipment operation and performance expectations
18.08.02	knowledge of signal wiring procedures and techniques
18.08.03	knowledge of power wiring and signal wiring
18.08.04	knowledge of pilot devices such as limit switches, pushbuttons, photocells and transducers
18.08.05	knowledge of output devices such as solenoids, indicating lamps, motor starter and relays
18.08.06	knowledge of remote input/output racks

Supporting Knowledge & Abilities

18.08.07	knowledge of cable connections for temperature compensation
18.08.08	ability to join connections
18.08.09	ability to connect and disconnect signal lines and fibre optics, coaxial and twisted pair cable
18.08.10	ability to verify operation of signal wiring
18.08.11	ability to ring out and identify wiring

Sub-task

18.09 Splices signal wiring.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.09.01	knowledge of equipment operation and performance expectations for signal wiring
18.09.02	knowledge of isolation procedures for signal systems
18.09.03	knowledge of cable assemblies and cable pulling techniques
18.09.04	knowledge of splicing techniques for wiring, fibre optics, coaxial and twisted pair cables
18.09.05	ability to locate fault or failure in cables or wiring
18.09.06	ability to isolate protected lines from unprotected lines
18.09.07	ability to size and select replacement cables and wiring to meet application requirements
18.09.08	ability to ring out and identify wiring
18.09.09	ability to verify operation of signal wiring

Sub-task

18.10 Fabricates conduit (flexible and rigid).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.10.01	knowledge of equipment operation and performance expectations of conduit
18.10.02	knowledge of conduit installation practices
18.10.03	knowledge of fabrication procedures and techniques for conduit (flexible and rigid)
18.10.04	knowledge of application, types, sizes and characteristics of conduits and raceways such as pipe, channel or tile, elastic pipe/tube, woven metallic wire, metallized polyester material
18.10.05	knowledge of application, types, sizes and characteristics of conduit fittings
18.10.06	knowledge of materials used for fabrication
18.10.07	knowledge of types and characteristics of add-ons for conduits such as mounts and brackets
18.10.08	ability to select fabrication method and materials to meet application requirements
18.10.09	ability to select installation location
18.10.10	ability to verify conduit installation to specifications

Sub-task

18.11 Replaces damaged conduit and fittings (flexible and rigid).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.11.01	knowledge of equipment operation and performance expectations for conduit and fittings

Supporting Knowledge & Abilities

18.11.02	knowledge of isolation procedures for signal systems
18.11.03	knowledge of conduit installation practices
18.11.04	knowledge of removal and installation procedures and techniques for conduit and fittings
18.11.05	knowledge of operating requirements for conduit and fittings
18.11.06	ability to assess conduit and fittings for wear or damage
18.11.07	ability to verify conduit installation to specifications

Sub-task

18.12 Installs signal conditioning devices (surge suppressors, multiplexors).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.12.01	knowledge of equipment operation and performance expectations for signal conditioning devices (surge suppressors, multiplexors)
18.12.02	knowledge of isolation procedures for signal systems
18.12.03	knowledge of system requirements for signal conditioning
18.12.04	knowledge of installation procedures and techniques for signal conditioning devices such as surge suppressors, multiplexors
18.12.05	knowledge of operating requirements for signal conditioning devices

Supporting Knowledge & Abilities

18.12.06	knowledge of types and sizes of add-ons for signal conditioning devices such as shielded connectors, cables and metal hoods, foil shields and drain wipes, subcarrier discriminators, switches
18.12.07	knowledge of modes of protection such as AC power, data line and lightning rods, shielding of transmitters
18.12.08	knowledge of transzorbs, gas-filled breakdown devices, metal-oxide varistor (MOV), resistor-capacitor (R-C) networks and opto-isolators
18.12.09	knowledge of radio telemetry systems
18.12.10	knowledge of types of oscillators, conduits
18.12.11	knowledge of the multiplexing process
18.12.12	knowledge of frequency-division and time division, frequency selection, transmitting antennas, receiving antennas and receivers
18.12.13	knowledge of power sources such as batteries, solar cells, atomic batteries and fuel cells
18.12.14	knowledge of construction techniques in fabricating transmitters
18.12.15	ability to select signal conditioning devices to meet application requirements

Sub-task

18.13 Installs intrinsic signal conditioner.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.13.01	knowledge of equipment operation and performance expectations for intrinsic safety barrier
18.13.02	knowledge of isolation procedures for signal systems

Supporting Knowledge & Abilities

18.13.03	knowledge of intrinsic safety (e.g., ia and ib subdivisions of intrinsically safe equipment)
18.13.04	knowledge of installation procedures and techniques for intrinsic safety barrier
18.13.05	knowledge of operating requirements for intrinsic safety barrier
18.13.06	knowledge of Zener barrier
18.13.07	knowledge of legislation, regulations concerning the use of equipment in explosive atmospheres
18.13.08	knowledge of power wiring and signal wiring
18.13.09	knowledge of conduits
18.13.10	knowledge of types and sizes of add-ons for intrinsic safety barrier
18.13.11	ability to select barrier device to meet application requirements
18.13.12	ability to determine location for barrier device
18.13.13	ability to detect compatibility of components in loop to qualify
18.13.14	ability to verify operation of intrinsic safety barrier

Sub-task

18.14 Performs operation check of signal transmission system.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

18.14.01	knowledge of equipment operation and performance expectations for signal transmission system
18.14.02	knowledge of isolation procedures for signal transmission systems

Supporting Knowledge & Abilities

18.14.03	knowledge of operation procedures for signal transmission system
18.14.04	knowledge of calibration methods and procedures
18.14.05	knowledge of run in commissioning
18.14.06	ability to isolate signal conditioning components
18.14.07	ability to calibrate signal transmission system
18.14.08	ability to verify operation of signal transmission system
18.14.09	ability to make adjustments to signal transmission system

Task 19 **Maintains transducers (signal conditioners) (current/pressure, pressure/current, current/voltage, voltage/current, current/current, current/digital, frequency/ voltage).**

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding, shielding and grounding practices, sensors - sonic, magnetic, peizoelectric, voltage, variable-resistance, variable-capacitance, variable-inductance, variable-reluctance, electromagnetic, thermoelectric and photoconductive, photoemissive and photovoltaic.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

19.01 Installs transducers. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

19.01.01	knowledge of equipment operation and performance expectations for transducers
19.01.02	knowledge of isolation procedures for transducers
19.01.03	knowledge of the application for transducers and operation procedures for transducers and signal transmission system
19.01.04	knowledge of installation procedures and techniques for transducers
19.01.05	knowledge of forms of transducer outputs including analog signals, digital signals and carrier signals
19.01.06	knowledge of types of circuits
19.01.07	knowledge of the differences between contacting and non-contacting sensors
19.01.08	knowledge of types of sensors such as sonic, magnetic, peizoelectric, voltage, variable-resistance, variable-capacitance, variable-inductance, variable-reluctance, electromagnetic, thermoelectric and photoconductive, photoemissive and photovolatic
19.01.09	knowledge of the measurements for each type of transducer such as position, motion, sound, light and electromagnetic radiation
19.01.10	knowledge of methods for signal conditioning
19.01.11	ability to interpret transducer data
19.01.12	ability to select transducer/sensor to meet application requirements
19.01.13	ability to verify operation of device

Sub-task

19.02 Calibrates transducers. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

19.02.01	knowledge of equipment operation and performance expectations for transducers
19.02.02	knowledge of calibration procedures and techniques for transducers
19.02.03	knowledge of cause and effect of calibration errors
19.02.04	knowledge of calibration standards for transducers
19.02.05	ability to assess the installation
19.02.06	ability to introduce a reference standard and assess the status of the calibration
19.02.07	ability to adjust the calibration instrument/device
19.02.08	ability to verify the operation of the transducer

Sub-task

19.03 Replaces components on transducers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	yes	NV	NV

19.03.01	knowledge of equipment operation and performance expectations for components on transducers
19.03.02	knowledge of removal and installation procedures for transducers/sensors
19.03.03	knowledge of operating requirements for components
19.03.04	knowledge of types of transducers and the corresponding components that can be replaced such as wiring, insulators, connectors, circuits, probes
19.03.05	knowledge of the differences between contacting and non-contacting sensors

Supporting Knowledge & Abilities

19.03.06	knowledge of types of sensors such as sonic, magnetic, peizoelectric, voltage, variable-resistance, variable-capacitance, variable-inductance, variable-reluctance, electromagnetic, thermoelectric and photoconductive, photoemissive and photovolatic
19.03.07	knowledge of the measurands for each type of transducer such as position, motion, sound, light and electromagnetic radiation
19.03.08	knowledge of method for signal conditioning
19.03.09	ability to perform calculation for variables such as linear velocity, linear acceleration, speed, Doppler effect, light temperature, flow and force
19.03.10	ability to select components to meet application requirements
19.03.11	ability to verify operation of device and replaced components

BLOCK F

PANEL MOUNTED EQUIPMENT

Trends: *New technology has resulted in personal computers that support control systems causing a decrease in the need for fixed panels.*

Task 20 **Maintains operator interface (panel mounted) equipment.**

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, piping, wiring, valves and fittings, grounding and shielding practices, layout, mounts and brackets, alarms and annunciators - dry contact, analogue and low voltage, drawings, pneumatic indicators, recorders, controllers - direct pressure and signal conditioned, electronic indicators, recorders and controllers, printers, keyboards, monitors - standard and touch screen, data loggers and data storage systems - tape and disk drive, HART, Ethernet and FIELD-BUS communication systems.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

20.01 **Installs pneumatic indicators, recorders, controllers and associated components (auto/manual transfer stations).**

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.01.01 knowledge of equipment operation and performance expectations for pneumatic indicators recorders, controllers and associated components

20.01.02 knowledge of instrumentation and installation requirements such as signal, output and feed lines, power requirements

20.01.03 knowledge of installation procedures and techniques for pneumatic indicators, recorders, controllers and associated components

Supporting Knowledge & Abilities

20.01.04	knowledge of application and types of pneumatic controllers such as narrow-band proportioning, low-gain controllers, adjustable gain mechanisms (parallel/ample) and proportional plus automatic reset and proportional plus automatic reset plus derivative
20.01.05	knowledge of types of recorders such as pen recorders, UV recorders and X-Y plotters
20.01.06	knowledge of types of indicators such as draft gauges
20.01.07	ability to determine instrumentation panel layout
20.01.08	ability to select pneumatic indicators, recorders, controllers and associated components to meet application requirements
20.01.09	ability to select and install instrument accessories (e.g. racks, raceways wiring trays and terminals)
20.01.10	ability to verify precalibration operation and response of pneumatic indicators, recorders, controllers and associated components

Sub-task

20.02 Installs electronic indicators, recorders, controllers and associated components (auto/manual transfer stations).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.02.01	knowledge of equipment operation and performance expectations for electronic indicators recorders, controllers and associated components
20.02.02	knowledge of instrumentation installation requirements such as input, output and power requirements

Supporting Knowledge & Abilities

20.02.03	knowledge of installation procedures and techniques for electronic indicators, recorders, controllers
20.02.04	knowledge of types of electronic controllers such as integral, proportional, proportional-plus-derivative, proportional-plus-integral and three-mode
20.02.05	knowledge of display area components such as control stations and indicators and nest area components such as alarms, signal conditioning and input/output converter units
20.02.06	knowledge of types of recorders
20.02.07	knowledge of types of indicators
20.02.08	ability to determine instrumentation panel layout
20.02.09	ability to select electronic indicators, recorders, controllers and associated components to meet application requirements
20.02.10	ability to verify precalibration operation and response of electronic indicators, recorders, controllers and associated components

Sub-task

20.03 Installs alarm/shutdown systems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.03.01	knowledge of equipment operation and performance expectations for requirements for alarms/shutdown systems
20.03.02	knowledge of purpose and principle of operation of alarm/shutdown panels
20.03.03	knowledge of installation requirements such as power, signal in, signal out

Supporting Knowledge & Abilities

20.03.04 knowledge of installation procedures and techniques for alarm/shutdown systems

20.03.05 knowledge of types of alarm/shutdown systems such as radiation monitors, gas and metal detectors and general purpose emergency shutdown alarms

20.03.06 knowledge of display area components such as control stations, indicators and nest area components such as alarms, signal conditioning and input/output converter units

20.03.07 ability to select installation location

20.03.08 ability to select and set up alarms and shutdown systems and associated components to meet application requirements

20.03.09 ability to verify operation of alarm and shutdown systems

Sub-task

20.04 Installs annunciators.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.04.01 knowledge of equipment operation and performance expectations for annunciators

20.04.02 knowledge of installation requirements such as power, signal in, signal out

20.04.03 knowledge of installation procedures and techniques for annunciators

20.04.04 knowledge of alarm features of annunciators such as normally open, normally closed contacts

20.04.05 ability to select installation location

20.04.06 ability to select and set up annunciators and associated components to meet application requirements

Supporting Knowledge & Abilities

20.04.07 ability to cut and fit annunciators in panels

20.04.08 ability to verify operation of annunciators

Sub-task

20.05 Installs communication equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.05.01 knowledge of equipment operation and performance expectations for communication panels

20.05.02 knowledge of installation requirements such as power, signal in, signal out

20.05.03 knowledge of installation procedures and techniques for communications panel

20.05.04 knowledge of panel off-limit levels

20.05.05 knowledge of display components such as annunciators, scanning systems, analyzers

20.05.06 ability to select installation location

20.05.07 ability to select panels and components to meet application requirements

20.05.08 ability to position, fit and secure panels

20.05.09 ability to verify operation of panel components

Sub-task

20.06 Installs data management storage equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.06.01 knowledge of equipment operation and performance expectations for data management storage equipment

Supporting Knowledge & Abilities

20.06.02	knowledge of installation requirements such as power, signal in, signal out
20.06.03	knowledge of installation procedures and techniques for data management storage equipment
20.06.04	knowledge of types and capabilities of data management storage equipment such as hard drives, magnetic tapes and portable data loggers
20.06.05	ability to select installation location
20.06.06	ability to select equipment to meet application requirements
20.06.07	ability to connect serial and parallel ports
20.06.08	ability to verify operation of data management system

Sub-task

20.07 Installs printers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.07.01	knowledge of equipment operation and performance expectations for printers
20.07.02	knowledge of installation requirements such as power, signal in, signal out
20.07.03	knowledge of installation procedures and techniques for printers
20.07.04	knowledge of operating requirements of the printer
20.07.05	knowledge of types and capabilities of printers
20.07.06	ability to select installation location
20.07.07	ability to select printers to meet application requirements

Supporting Knowledge & Abilities

20.07.08 ability to connect serial and parallel ports

20.07.09 ability to verify operation of printer

Sub-task

20.08 Installs operator stations.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.08.01 knowledge of equipment operation and performance expectations for operator stations

20.08.02 knowledge of installation requirements such as power, signal in, signal out

20.08.03 knowledge of installation and configuration of PC based MMI controls and software

20.08.04 knowledge of installation procedures and techniques for operator stations

20.08.05 knowledge of operating requirements of the station

20.08.06 knowledge of station components such as monitors, keyboards

20.08.07 ability to select installation location

20.08.08 ability to select, position and secure station components to meet application requirements

20.08.09 ability to connect serial and parallel ports

20.08.10 ability to verify operation of operator station

Sub-task

20.09 Calibrates pneumatic indicators, recorders, controllers and associated components (auto/manual transfer stations).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

20.09.01	knowledge of equipment operation and performance expectations for pneumatic indicators, recorders, controllers and associated components
20.09.02	knowledge of calibration procedures and techniques for pneumatic indicators, recorders, controllers and associated components
20.09.03	knowledge of cause and effect of calibration errors
20.09.04	knowledge of calibration standards for pneumatic indicators, recorders, and controllers
20.09.05	ability to introduce a reference standard and assess the status of the calibration
20.09.06	ability to adjust the calibration instrument/device
20.09.07	ability to verify the operation of the device and its components

Sub-task

20.10 Calibrates electronic indicators, recorders, controllers and associated components (auto/manual transfer stations).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.10.01	knowledge of equipment operation and performance expectations for electronic indicators, recorders, controllers and associated components
20.10.02	knowledge of calibration procedures and techniques for electronic indicators, recorders, controllers and associated components
20.10.03	knowledge of cause and effect of calibration errors

Supporting Knowledge & Abilities

20.10.04 knowledge of calibration standards for electronic indicators, recorders, and controllers

20.10.05 ability to introduce a reference standard and assess the status of the calibration

20.10.06 ability to adjust the calibration instrument/device

20.10.07 ability to verify the operation of the device and its components

Sub-task

20.11 Calibrates alarm/shutdown panels.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.11.01 knowledge of equipment operation and performance expectations for alarm/shutdown panels

20.11.02 knowledge of calibration procedures and techniques for alarm/shutdown panels

20.11.03 knowledge of cause and effect of calibration errors

20.11.04 knowledge of calibration standards for alarm/shutdown panels

20.11.05 ability to introduce a reference standard and assess the status of the calibration

20.11.06 ability to adjust the calibration instrument/device

20.11.07 ability to verify the operation of the device and its components

Sub-task

20.12 Calibrates annunciators. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.12.01	knowledge of equipment operation and performance expectations for annunciators
20.12.02	knowledge of calibration procedures and techniques for annunciators
20.12.03	knowledge of cause and effect of calibration errors
20.12.04	knowledge of calibration standards for annunciators
20.12.05	ability to introduce a reference standard and assess the status of the calibration
20.12.06	ability to adjust the calibration instrument/device
20.12.07	ability to verify the operation of the device and its components

Sub-task

20.13 Calibrates communication panels. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.13.01	knowledge of equipment operation and performance expectations for communication panels
20.13.02	knowledge of calibration procedures and techniques for communication panels
20.13.03	knowledge of cause and effect of calibration errors
20.13.04	knowledge of calibration standards for communication panels

Supporting Knowledge & Abilities

20.13.05	ability to introduce a reference standard and assess the status of the calibration
20.13.06	ability to adjust the calibration instrument/device
20.13.07	ability to verify the operation of the device and its components

Sub-task

20.14 Performs operational checks of data management storage equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.14.01	knowledge of operating parameters for data management storage equipment
20.14.02	knowledge of calibration procedures and techniques for data management storage equipment such as data loggers
20.14.03	knowledge of calibration and operating standards for data management storage equipment
20.14.04	ability to assess operating condition
20.14.05	ability to introduce a reference standard and assess the status of the calibration
20.14.06	ability to verify operation of the device and its components

Sub-task

20.15 Replaces components on pneumatic indicators, recorders, controllers and associated components (auto/manual transfer stations).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

20.15.01 knowledge of equipment operation and performance expectations for components on pneumatic indicators, recorders, controllers and associated components

20.15.02 knowledge of removal and installation procedures for pneumatic indicators, recorders and controllers

20.15.03 knowledge of operating requirements for components

20.15.04 knowledge of types of pneumatic indicators, recorders and controllers components such as pipes, tubing, valves, regulators, detectors, springs, diaphragms, cables and pointers

20.15.05 ability to select components to meet application requirements

20.15.06 ability to verify operation of device and replaced components

Sub-task

20.16 Replaces components on electronic indicators, recorders, controllers and associated components (auto/manual transfer stations).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.16.01 knowledge of equipment operation and performance expectations for components on electronic indicators, recorders, controllers and associated components

20.16.02 knowledge of removal and installation procedures for electronic indicators, recorders and controllers

20.16.03 knowledge of operating requirements for components

Supporting Knowledge & Abilities

20.16.04 knowledge of types of electronic indicators, recorders and controllers components such as sensors, motors, pen carriages, gantries, galvanometers, thermocouples and resistors

20.16.05 ability to select components to meet application requirements

20.16.06 ability to verify operation of device and replaced components

Sub-task

20.17 Replaces components on alarm/shutdown panels.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.17.01 knowledge of equipment operation and performance expectations for alarm/shutdown panels

20.17.02 knowledge of removal and installation procedures for alarm/shutdown panels

20.17.03 knowledge of operating requirements for components

20.17.04 ability to select components to meet application requirements

20.17.05 ability to verify operation of alarm/shutdown panel and replaced components

Sub-task

20.18 Replaces components on annunciators.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.18.01 knowledge of equipment operation and performance expectations for components on annunciators

Supporting Knowledge & Abilities

20.18.02 knowledge of removal and installation procedures for annunciators

20.18.03 knowledge of operating requirements for components

20.18.04 ability to select components to meet application requirements

20.18.05 ability to verify operation of annunciator and replaced components

Sub-task

20.19 Replaces components on communication panels.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.19.01 knowledge of equipment operation and performance expectations for communication panels

20.19.02 knowledge of removal and installation procedures for communication panels

20.19.03 knowledge of operating requirements for components

20.19.04 ability to select components to meet application requirements

20.19.05 ability to verify operation of panel and replaced components

Sub-task

20.20 Replaces components on data management storage equipment.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

Supporting Knowledge & Abilities

20.20.01 knowledge of equipment operation and performance expectations for components on data management storage equipment

20.20.02 knowledge of removal and installation procedures for data management storage equipment components

20.20.03 knowledge of operating requirements for components

20.20.04 knowledge of types of components such as cards, boards, disk drives, tape drives

20.20.05 ability to select components to meet application requirements

20.20.06 ability to verify operation of equipment and replaced components

Sub-task

20.21 Replaces components on printers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	no	yes	yes	yes	NV	NV

20.21.01 knowledge of equipment operation and performance expectations for printers

20.21.02 knowledge of removal and installation procedures for printers

20.21.03 knowledge of operating requirements for components

20.21.04 ability to select components to meet application requirements

20.21.05 ability to verify operation of printer and replaced components

Sub-task

20.22 Replaces components on operator stations.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

20.22.01	knowledge of equipment operation and performance expectations for operator stations
20.22.02	knowledge of removal and installation procedures for operator stations
20.22.03	knowledge of operating requirements for components
20.22.04	ability to select components to meet application requirements
20.22.05	ability to verify operation of operator station and replaced components

BLOCK G

HYDRAULICS AND PNEUMATICS

Trends: *No new trends.*

Task 21 Maintains hydraulic systems.

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding, fluid analysis, spill or loss control.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

21.01 Visually assesses hydraulic fluid condition.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	no	NV	NV

21.01.01	knowledge of equipment operation and performance expectations for hydraulic systems
21.01.02	knowledge of application, types and grades of hydraulic fluids such as petroleum based, fire resistant and synthetic
21.01.03	knowledge of procedures to remove fluid for inspection
21.01.04	knowledge of the causes and symptoms of hydraulic fluid contamination or failure
21.01.05	ability to interpret hydraulic drawings
21.01.06	ability to sample fluid and visually assess for level and contaminants
21.01.07	ability to bleed air from system

Sub-task

21.02 Replaces hydraulic fluids.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	no	NV	NV

21.02.01	knowledge of equipment operation and performance expectations for hydraulic fluids
21.02.02	knowledge of shutdown and isolation procedures for hydraulic system
21.02.03	knowledge of fluid replacement procedures and techniques
21.02.04	knowledge of hydraulic fluid feed and return lines and reservoirs for equipment
21.02.05	knowledge of operating requirements for system and hydraulic fluid requirements

Supporting Knowledge & Abilities

21.02.06	ability to select fluid to meet system requirements
21.02.07	ability to locate fluid drain and collect fluid
21.02.08	ability to fill system to required level
21.02.09	ability to bleed air from system

Sub-task

21.03 Replaces hydraulic filters. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	no	NV	NV

21.03.01	knowledge of equipment operation and performance expectations for hydraulic systems
21.03.02	knowledge of filter replacement procedures and techniques
21.03.03	knowledge of application, types and sizes of filters
21.03.04	knowledge of operating requirements for system filters
21.03.05	ability to size and select filter to meet system requirements
21.03.06	ability to position and secure filter
21.03.07	ability to bleed air from system
21.03.08	ability to assess used filter condition

Sub-task

21.04 Installs hydraulic pumps. **Supporting Knowledge & Abilities**

(NOT COMMON CORE)

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
no	yes	yes	yes	ND	no	no	yes	yes	no	NV	NV

Supporting Knowledge & Abilities

21.04.01	knowledge of equipment operation and performance expectations for hydraulic systems
21.04.02	knowledge of installation procedures and techniques for hydraulic pumps
21.04.03	knowledge of operating requirements for hydraulic pumps
21.04.04	knowledge of application and types of pumps such as vane, gear and piston
21.04.05	ability to size and select pump to meet system operating requirements
21.04.06	ability to verify operation of pump

Sub-task

21.05 Replaces components on hydraulic pumps.

Supporting Knowledge & Abilities

(NOT COMMON CORE)

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
no	yes	yes	yes	ND	no	no	yes	yes	no	NV	NV

21.05.01	knowledge of equipment operation and performance expectations for hydraulic systems
21.05.02	knowledge of installation procedures and techniques for hydraulic pump components
21.05.03	knowledge of operating requirements for hydraulic pumps and components
21.05.04	knowledge of application and types of pump components such as gear trains and gears (gear pumps), wobble plates and pistons (piston pumps), and rotors and vanes (vane pumps)
21.05.05	ability to select pump components to meet pump operating requirements
21.05.06	ability to verify operation of pump and associated components

Sub-task

21.06 Installs hydraulic control systems and valves.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	no	NV	NV

21.06.01	knowledge of equipment operation and performance expectations for hydraulic control systems
21.06.02	knowledge of process system requirements and environmental factors that impact hydraulic control systems
21.06.03	knowledge of installation procedures and techniques for hydraulic control systems and control valves
21.06.04	knowledge of operating requirements for hydraulic control systems
21.06.05	knowledge of application and types of valves used in hydraulic control systems such as proportional control valves, piston valves and jet-pipe valves
21.06.06	ability to size and select control system to meet system operating requirements
21.06.07	ability to verify system components to design specification
21.06.08	ability to verify operation of system

Sub-task

21.07 Sets up hydraulic control systems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	no	NV	NV

21.07.01	knowledge of equipment operation and performance expectations for hydraulic control systems

Supporting Knowledge & Abilities

21.07.02	knowledge of process system requirements and environmental factors that impact hydraulic control systems
21.07.02	knowledge of process system requirements and environmental factors that impact hydraulic control systems
21.07.03	knowledge of set-up procedures and techniques for hydraulic control systems
21.07.04	knowledge of operating requirements for hydraulic control systems including constant flow and constant pressure requirements
21.07.05	knowledge of common errors and their causes
21.07.06	knowledge of application and types of hydraulic systems such as hydraulic servosystems with mechanical feedbacks or electronic feedbacks and systems with speed controls
21.07.07	ability to calibrate control valves
21.07.08	ability to make adjustments/tune hydraulic control systems
21.07.09	ability to verify operation of system and components

Sub-task

21.08 Replaces components on hydraulic control systems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	no	NV	NV

21.08.01	knowledge of equipment operation and performance expectations for hydraulic control systems
21.08.02	knowledge of process system requirements and environmental factors that impact hydraulic control systems

Supporting Knowledge & Abilities

21.08.03	knowledge of installation procedures and techniques for hydraulic control system components
21.08.04	knowledge of operating requirements for hydraulic control systems
21.08.05	knowledge of application and types of hydraulic control system components such as pumps
21.08.06	knowledge of types of pressure indicators and relief valves, cylinders, and actuators
21.08.07	ability to size and select control system components to meet system operating requirements
21.08.08	ability to verify operation of hydraulic control system components and system
21.08.09	ability to replace diaphragms, seals, needles, springs, and bushings

Sub-task

21.09 Installs hydraulic lines.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	no	NV	NV

21.09.01	knowledge of equipment operation and performance expectations for hydraulic control systems
21.09.02	knowledge of process system requirements and environmental factors that impact hydraulic control systems
21.09.03	knowledge of installation procedures and techniques for hydraulic lines
21.09.04	knowledge of operating requirements for hydraulic lines including flow and return lines
21.09.05	knowledge of application and types of hydraulic lines such as metal tubes and flexible tubing/hoses

Supporting Knowledge & Abilities

21.09.06 ability to size and select lines to meet system operating requirements

21.09.07 ability to inspect and pressure check hydraulic lines

Sub-task

21.10 Bleeds air from hydraulic lines.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	no	NV	NV

21.10.01 knowledge of equipment operation and performance expectations for hydraulic control systems

21.10.02 knowledge of process system requirements and environmental factors that impact hydraulic control systems

21.10.03 knowledge of bleeding procedures and techniques

21.10.04 knowledge of pressure values for flow and return lines

21.10.05 knowledge of application and types of hydraulic lines

21.10.06 ability to inspect and assess system operation to determine location of air in system

21.10.07 ability to verify operation of system and components

Task 22 Maintains pneumatic systems.

Related Components: Manufacturer specifications, maintenance schedules and requirements, lubricants, data storage systems, material safety data sheets, isolation procedures, standard operation procedures, trade codes, governmental regulations, piping, wiring, valves and fittings, scaffolds, prints and drawings, rigging, scaffolding, fluid analysis, spill or loss control.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

22.01 Installs instrument air dryers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

22.01.01	knowledge of equipment operation and performance expectations for pneumatic systems
22.01.02	knowledge of process system requirements and environmental factors that impact on air dryers
22.01.03	knowledge of installation procedures and techniques and operating requirements for air dryers
22.01.04	knowledge of types of air dryers
22.01.05	ability to size and select air dryers to meet application requirements

Sub-task

22.02 Tests the efficiency of instrument air dryers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	no	yes	ND	yes	yes	yes	yes	yes	NV	NV

22.02.01	knowledge of equipment operation and performance expectations for pneumatic systems
22.02.02	knowledge of process system requirements and environmental factors that impact on air dryers
22.02.03	knowledge of testing procedures and techniques
22.02.04	knowledge of operating conditions and temperature standards
22.02.05	ability to assess differential pressure drops across dryer and components
22.02.06	ability to perform a dew point analysis of the dryer

Supporting Knowledge & Abilities

22.02.07 ability to assess the filter and desiccant conditions

Sub-task

22.03 Replaces components on instrument air dryers.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

22.03.01 knowledge of equipment operation and performance expectations for components on instrument air dryers

22.03.02 knowledge of process system requirements and environmental factors that impact on air dryers

22.03.03 knowledge of replacement procedures and techniques

22.03.04 knowledge of operating requirements for air dryers

22.03.05 ability to size and select components to meet application requirements

22.03.06 ability to verify operation of components and dryers

Sub-task

22.04 Installs pneumatic conditioning components (filter assemblies, volume boosters, pneumatic relays).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

22.04.01 knowledge of equipment operation and performance expectations for pneumatic conditioning systems

Supporting Knowledge & Abilities

22.04.02 knowledge of process system requirements and environmental factors that impact on pneumatic conditioning components

22.04.03 knowledge of installation procedures and techniques

22.04.04 knowledge of operating requirements for pneumatic conditioning components

22.04.05 knowledge of types of pneumatic conditioning components such as filter assemblies, volume boosters, pneumatic relays and oilers

22.04.06 ability to size and select components to meet application requirements

22.04.07 ability to verify operation of components and pneumatic conditioning system

Sub-task

22.05 Replaces components on pneumatic conditioning components (filter assemblies, volume boosters, pneumatic relays).

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

22.05.01 knowledge of equipment operation and performance expectations for pneumatic conditioning systems

22.05.02 knowledge of process system requirements and environmental factors that impact on pneumatic conditioning components

22.05.03 knowledge of replacement procedures and techniques

22.05.04 knowledge of operating requirements for pneumatic conditioning components

Supporting Knowledge & Abilities

22.05.05	knowledge of types of components for pneumatic conditioning components such as filter assemblies, volume boosters and pneumatic relays
22.05.06	ability to select components to meet application requirements
22.05.07	ability to verify operation of components and pneumatic conditioning system

BLOCK H

DISTRIBUTED CONTROL AND PLC'S

Trends: *There is a trend towards smart or intelligent field components capable of self-diagnostics. The set-up and calibration of distributed control systems can be done using personal computers and microprocessors. There is also a trend towards more interfaces between PLC's and communication networks.*

Task 23 Maintains distributed control systems (DCS).

Related Components: Manufacturer specifications, maintenance schedules and requirements, data storage systems, isolation procedures, standard operation procedures, trade codes, governmental regulations, wiring, prints and drawings, grounding and shielding practices, HART, Ethernet and FIELD-BUS communication systems.

Tools and Equipment: Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

23.01 Diagnoses hardware problems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

23.01.01	knowledge of equipment operation and performance expectations for distributed control systems
23.01.02	knowledge of process system requirements and environmental factors that impact distributed control systems and associated components
23.01.03	knowledge of analog and digital systems
23.01.04	knowledge of system operating conditions and associated process systems
23.01.05	knowledge of cabling requirement for DCS's including the use of fibre optic cable, twisted pair of wires and coaxial cable
23.01.06	knowledge of types of inputs and their associated conditioning components
23.01.07	knowledge of types of outputs and their associated conditioning components
23.01.08	knowledge of diagnostic tools, programs and processes
23.01.09	ability to run diagnostic software and identify hardware malfunctions
23.01.10	ability to tune a process control loop

Sub-task

23.02 Replaces DCS boards.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

23.02.01	knowledge of equipment operation and performance expectations for distributed control systems

Supporting Knowledge & Abilities

23.02.02	knowledge of process system requirements and environmental factors that impact distributed control systems and associated components
23.02.03	knowledge of replacement procedures and techniques
23.02.04	knowledge of board configuration and back up procedures
23.02.05	knowledge of types of DCS boards in relation to operations
23.02.06	ability to select and configure board to meet application requirements
23.02.07	ability to perform backup for system and board configurations
23.02.08	ability to verify operation of replaced board

Sub-task

23.03 Diagnoses software problems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

23.03.01	knowledge of equipment operation and performance expectations for distributed control systems
23.03.02	knowledge of applications and types of software programs
23.03.03	knowledge of process system requirements for software programs
23.03.04	knowledge of Boolean variables and expressions, logic diagrams, truth tables and Karnaugh maps
23.03.05	ability to run troubleshooting software and interpret findings
23.03.06	ability to interpret logic circuit and compare findings with system performance data

Sub-task

23.04 Reloads system memory. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

23.04.01	knowledge of equipment operation and performance expectations for distributed control systems
23.04.02	knowledge of process system requirements that impact memory reload
23.04.03	knowledge of applications, types of systems and procedures and techniques for reloading system memory
23.04.04	knowledge of programmable read-only memory systems (PROM) and erasable programmable read-only memory systems (EROM)
23.04.05	ability to verify and select information for reload
23.04.06	ability to verify that memory has been reloaded
23.04.07	ability to assess system operation

Sub-task

23.05 Configures control loops. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

23.05.01	knowledge of equipment operation and performance expectations for distributed control systems
23.05.02	knowledge of procedures and techniques for configuring control loops
23.05.03	knowledge of sequence of operations and operations performed control system such as measurement, decision, manipulation
23.05.04	ability to differentiate between process system and control problems

Supporting Knowledge & Abilities

23.05.05	ability to determine control settings such as proportional, integral, derivative
23.05.06	ability to assess system operation

Sub-task

23.06 Backs up system memory. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

23.06.01	knowledge of equipment operation and performance expectations for distributed control systems
23.06.02	knowledge of system backup requirements
23.06.03	Knowledge of equipment, procedures and techniques for backing up system
23.06.04	knowledge of memory archiving
23.06.05	ability to verify that memory has been backed up to tape/disk

Task 24 Maintains programmable logic controllers (PLC).

Related Components:	Manufacturer specifications, maintenance schedules and requirements, data storage systems, isolation procedures, standard operation procedures, trade codes, governmental regulations, wiring, prints and drawings, grounding and shielding practices, HART, Ethernet and FIELD-BUS communication systems.
Tools and Equipment:	Hand tools, power tools, test equipment and accessories, related tools and equipment, personal protective equipment.

Sub-task

24.01 Diagnoses hardware problems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	yes	NV	NV

24.01.01	knowledge of equipment operation and performance expectations for PLCs programmable logic control systems and associated components
24.01.02	knowledge of PLC components such as program monitor, CPU and input/output modules and their operating features and characteristics
24.01.03	knowledge of cabling requirement for PLC's including the use of fibre optic cable, twisted pair of wires and coaxial cable
24.01.04	knowledge of PLC diagnostic software
24.01.05	ability to run troubleshooting software and interpret findings
24.01.06	ability to select and configure board to meet application requirements
24.01.07	ability to interpret logic circuit and compare findings with system performance data
24.01.08	ability to force a bit

Sub-task

24.02 Replaces PLC boards.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	yes	NV	NV

24.02.01	knowledge of equipment operation and performance expectations for PLCs
24.02.02	knowledge of replacement procedures and techniques
24.02.03	knowledge of types of PLC boards in relation to operations

Supporting Knowledge & Abilities

24.02.04	knowledge of board configuration and backup procedures
24.02.05	ability to select board to meet application requirements
24.02.06	ability to perform backup for system and board configurations
24.02.07	ability to verify operation of replaced board

Sub-task

24.03 Diagnoses logic problems.

Supporting Knowledge & Abilities

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	yes	yes	yes	yes	yes	NV	NV

24.03.01	knowledge of equipment operation and performance expectations for PLCs
24.03.02	knowledge of applications and types of logic systems
24.03.03	knowledge of process system requirements for PLC logic programs
24.03.04	knowledge of control circuits
24.03.05	knowledge of ladder logic
24.03.06	knowledge of PLC components and their operation and function
24.03.07	ability to prepare/obtain ladder diagrams for system
24.03.08	ability to run troubleshooting software and interpret findings
24.03.09	ability to interpret logic circuit and compare findings with system performance data
24.03.10	ability to force a bit

Sub-task

24.04 Reloads system memory. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	yes	NV	NV

24.04.01	knowledge of equipment operation and performance expectations for PLCs
24.04.02	knowledge of applications, types of systems, procedures and techniques for reloading system memory
24.04.03	knowledge of types of PLC's
24.04.04	knowledge of system capacity
24.04.05	ability to verify and select information for reload
24.04.06	ability to load commands
24.04.07	ability to verify that memory has been reloaded
24.04.08	ability to assess system operation

Sub-task

24.05 Backs up system memory. **Supporting Knowledge & Abilities**

NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK
yes	yes	yes	yes	ND	no	yes	yes	yes	yes	NV	NV

24.05.01	knowledge of equipment operation and performance expectations for PLCs
24.05.02	knowledge of system backup requirements
24.05.03	knowledge of equipment, procedures and techniques for backing up system
24.05.04	knowledge of memory archiving
24.05.05	ability to verify that memory has been backed up to tape/disk

APPENDICES

TOOLS AND EQUIPMENT

Hand Tools

Allen wrenches (Imperial/Metric)
ball peen hammer
Bristol wrenches
calipers
centre punch
chipping hammer
Crescent wrenches
crowbar
diagonal cutters
drill bits
easy outs
fixed vice
flaring tools
fuse puller
gauge blocks
gauge pointer puller
glass cutter
hack saw
hammer
hand files (assorted)
ignition wrenches
jack-knife
jewellers screwdrivers
knock out punches
level
locking pliers
magnet
measuring tape
micrometers (assorted)
mirrors
needle nose pliers
nut drivers (assorted)
open end wrenches
packing puller
pipe threader
pipe wrenches
plastic hammer
pliers (assorted sized)
punches
reamers
screw extractors
screw starters
screwdrivers
scriber
sockets (Imperial/Metric)
square
steel rule
strap wrenches
striker
tape measure
taps and dies set
torque wrench
tube benders
tube cutters
tweezers
vernier
vernier calipers
vice grips
water pump pliers
wire brushes
wire crimpers
wire cutters
wire strippers
wrenches

Power Tools

band saw
grinders
hammer drill
impact wrench
jig saw
pipe threader
portable electric drill
power actuated tools
pressure and vacuum pumps
reciprocating saw
sand-blaster
soldering iron
soldering torch

Test Equipment and Accessories

analog multimeter
barometer
bridges
capacitance simulators
current calibrator
current tracer
deadweight tester
decade resistance box
deflectional-type strain indicator
dew point tester
digital logic probe
digital multimeter
eddy current tachometer
electrostatic voltmeters
frequency counter
frequency generator
grounding mats
hand held configurators
hand held programmer
hand held pyrometer
huntron tracker
hydrometer
hypsometer
lab scales
laptop computer
laser inferometer
laser strength meter
light microscopes
logic clip
magmeter
manometer and standards
microwave leakage meter
millivoltmeter calibrator
modems
null balance strain indicator
optical pyrometer
oscilloscope
personal computer
pH simulator/buffers
plotters
pneumatic test stand
pointer pullers
portable sound level meter
potentiometer
power supplies
printers
radiation meters
regulators
RTD thermocouple calibrator
signal generators
signature analyzer
sling chrometer
software
stroboscope
strobotac
tachometer generator
temperature bath
test gas
test gauges (pressure vacuum)
thermal meter
thermometer
transistor checker
vacuum pumps
variator
wrist ground strap

Related Tools and Equipment

arc welder
chain fall
come along
drill press
extensions scaffolds
fixed vice
forklift
hoist basket
hydraulic press
lathe
lift/hoist equipment
metal ladders
metal lathe
oxy-acetylene welding equipment metal
scaffolds
mobile radio
overhead crane
portable cart
portable generator
portable power
prefabricated scaffold
scissor lift
slings
step ladders
wire labeler
wire rope
wooden/fibreglass ladders

Protective Clothing and Devices

apron
cap lamps
coveralls
ear muffs
ear plugs
eye wash bottle
face shield
fire extinguishers
first aid kit
gamma survey meter
Geiger counter
gloves
hard hat
mask
personal dosimeter
personal monitor (gas)
respirators
radiometer
rubber boots
rubber suits
safety boots
safety glasses
safety harnesses
safety laps
safety lines
self contained breathing apparatus
splash goggles
suit winter clothing
supplied air hood

GLOSSARY

accuracy	degree of conformity of an indicated value to a recognized accepted standard value, or ideal value.
actuator	a controlled hardware device used to implement change in a process.
adapter	a device used to make electrical or mechanical connections between items not originally intended for use together.
amplifier	a device that enables an input signal to control power from a source independent of the signal and thus be capable of delivering an output that bears some relationship to, and is generally greater than, the input signal.
analog	a physical variable which remains similar to another variable insofar as the proportional relationships are the same over some specified range; for example, a temperature may be represented by a voltage which is its analogue.
analog to digital	a device, or subsystem, that changes a proportional signal that is converted to a discrete signal.
ASME	American Society of Mechanical Engineers.
basis weight	the weight in pounds of 500 sheets of standard size paper; certain sized for a given class of paper are accepted as standard.
bellows	a mechanical element of generally cylindrical shape with cylindrical walls containing deep convolutions.
bus	a group of wires or conductors, considered as a single entity, which interconnects part of a system in a computer, signal paths might include the address bus, the data bus, etc.

calibrate	to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter or other device, or the correct value for each setting of a control knob.
cascade control	a type of controller set-up in which the output of one controller acts as the set point or controlling signal of another controller.
control mode	a specific type of control action such as proportional, integral or derivative.
control variable	one of the input variables of a control system, such as, motor torque or the opening of a valve, which can be varied directly by the operator to maximize some measure of performance of the system.
converter (A/D, ADC)	real-world data (as from transducers) to a form compatible with binary (digital) processing.
deadweight tester	an instrument used as a standard for calibrating pressure gauges in which known hydraulic pressures are generated by means of freely balanced (dead) weights loaded on a calibrated piston.
dew point	the temperature at which water vapour begins to condense.
direct digital control	a method of control in which all control outputs are generated by the computer directly, with no other intelligence between the central computer and the process being controlled.
distributed control	a system of dividing plant or process control into several areas of responsibility, each managed by its own controller (processor), with the whole interconnected to form a single entity usually by communication buses of various kinds.
feed forward	an industry standard process control program, in which mathematically predicted errors are corrected before they occur.
flowmeter	a device which measures the rate of flow or quantity of a moving fluid in an open or closed conduit – usually consists of both a primary and a secondary device.

frequency	the number of cycles completed by a periodic quantity on a unit time.
flume	a device that measures large flow rates in open channels.
input/output (I/O)	all equipment and activity that transfers information into or out of a computer.
instrumentation	a collection of instruments or their application for the purpose of observation, measurement or control.
integral action	a control action in which the rate of change of the correcting force is proportional to the deviation.
interface	the place at which two systems, or a major system and a minor system (such as a computer and a peripheral), meet and interact with each other.
microcomputer	a microprocessor combined with input/output interface devices some type of external memory and the other elements required to form a working computer system.
microprocessor	a single silicon chip on which the arithmetic and logic functions of a computer are placed.
modem	a device that converts signals in one form to another form compatible with another kind of equipment - a device that changes digital data into a form suitable for transmission over telephone lines and vice versa.
modulation	the process, or result of the process, whereby some characteristic of one wave is varied in accordance with some characteristic of another wave.
module	an assembly of interconnected components which constitutes an identifiable device, instrument or piece of equipment - can be removed, tested as a unit and replaced with a spare.

multiplexing	transmitting multiple signals on a single channel by selecting one signal at a time and this providing a conversion from a parallel to serial.
Pascal's principle	the law that a confined fluid transmits externally applied pressure uniformly in all directions, without change in magnitude.
port	a signal input (access) or output (egress) point.
power supply	a device that produces one or more DC voltages for the operation of electronic circuitry and input/output devices.
process	physical or chemical change of matter or conversion of energy, such as, change in pressure, temperature, speed, electrical potential, etc.
program	a list of instructions that a computer will execute to perform a certain task.
Programmable Logic Controller (PLC)	a control device, normally used in industrial control applications that employs the hardware architecture of a computer and a relay ladder diagram language.
proportional band	the range of values of the controlled variable that will cause a controller to operate over its full range.
pyrometer	any of a broad class of temperature measuring devices in any temperature range - includes radiation pyrometers, thermocouples, resistance pyrometers and thermistors.
range	the region between the limits within which a quantity is measured, received or transmitted; expressed by stating the lower and upper range values.
rate action	a control action in which the speed at which a correction is made depends on how fast the system error is increasing - also known as derivative action and derivative compensation.

remote	a device allowing the set point to be altered by a signal from a physical location away from the controller – necessary for cascade operation.
reset action	floating action in which the final control element is moved at a speed proportional to the extent of proportional-position action.
resistance decade box	an assembly of precision resistors whose individual values vary in submultiples and multiples of 10 - by approximately setting a 10-position selector switch for each section, the decade box can be set to any desired value within its range.
retrofit	a modification of equipment to incorporate changes made in later production of similar equipment - derived from retroactive refit.
self-operated controller	a controller in which all energy to operate the final controlling element is derived from the controlled system.
sensing element	the element directly responsive to the value of the measured variable.
servomechanism	an automatic feedback control device in which the controlled variable is the mechanical position or any of its time derivatives, such as, velocity and acceleration.
servomotor	the electric, hydraulic or other type of motor that services as the final control element in a servomechanism.
signal	physical variables, one or more parameters of which carry information about another variable (which the signal represents).
steady state	a characteristic of a condition, such as, a value, rate, periodicity or amplitude, exhibiting only negligible change over an arbitrary long period of time.
strain gauge	a device which uses the change of electrical resistance of a wire under strain to measure pressure.
telemetering	transmitting the readings of instruments to a remote location by means of wires, radio waves or other means.

temperature bath	a relatively large volume of a homogeneous substance held at constant temperature, so that an object placed in thermal contact with it is maintained at the same temperature.
terminal	a peripheral device used by the operator to communicate with the computer.
thermocouple	a device consisting basically of two dissimilar conductors joined together at their ends such that the device can be used to measure the temperature of one of the junctions when the other is held at a fixed, known temperature.
transducer	an element or device which received information in the form of one quantity and converts it to information in the form of the same or another quantity.
transmitter	a transducer which responds to a measured variable by means of a sensing element, and converts it to a standardized transmission signal which is a function only of the measured variable.
tuning	adjustment of controller parameters to suit a particular process.
volt-ohm-milliammeter (VOM)	a test instrument having a number of different ranges for measuring voltage, current and resistance.
weir	an obstruction placed in an open channel.

BLOCKS AND TASKS WEIGHTING

BLOCK A OCCUPATIONAL SKILLS

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	National Average
%	12	12	4	5	ND	10	8	15	3	6	NV	NV	8%

Task 1 Demonstrates safe work practices and personal protection.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	20	30	35	25	ND	16	14	25	15	20	NV	NV	22%

Task 2 Utilizes drawings, codes, standards and government regulations.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	25	25	25	25	ND	19	33	25	30	22	NV	NV	25%

Task 3 Utilizes tools and measuring equipment.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	30	30	25	25	ND	31	30	25	35	22	NV	NV	28%

Task 4 Demonstrates common work practices and procedures.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	25	15	15	25	ND	34	23	25	20	36	NV	NV	24%

BLOCK B NEW INSTALLATIONS AND EFFICIENT OPERATION

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	National Average
%	12	10	14	14	ND	12	6	10	13	6	NV	NV	11%

Task 5 Maximizes operating efficiency of process control system.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	55	65	75	56	ND	69	70	50	55	60	NV	NV	62%

Task 6 Facilitates new installations.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	45	35	25	44	ND	31	30	50	45	40	NV	NV	38%

BLOCK C FIELD MOUNTED EQUIPMENT

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	National Average
%	10	15	14	16	ND	21	15	10	23	12	NV	NV	15%

Task 7 Maintains field mounted pressure equipment.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	27	25	25	25	ND	26	23	25	20	25	NV	NV	25%

Task 8 Maintains field mounted flow equipment.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	23	25	25	25	ND	27	27	25	40	25	NV	NV	27%

Task 9 Maintains field mounted level equipment.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	23	25	25	25	ND	26	23	25	20	30	NV	NV	25%

Task 10 Maintains field mounted temperature devices.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	27	25	25	25	ND	21	27	25	20	20	NV	NV	24%

BLOCK D INSTRUMENTATION AND CALIBRATION

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	National Average
%	18	20	25	20	ND	21	25	25	18	30	NV	NV	22%

Task 11 Maintains analyzers.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	20	10	20	16	ND	23	16	10	40	25	NV	NV	20%

Task 12 Maintains speed measuring devices.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	7	10	10	11	ND	6	11	10	5	5	NV	NV	8%

Task 13 Maintains weight and density measuring devices.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	10	10	15	13	ND	11	15	10	10	15	NV	NV	12%

Task 14 Maintains vibration measurement devices.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	7	10	10	11	ND	4	13	10	5	5	NV	NV	8%

Task 15 Maintains consistency measuring devices.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	8	10	0	8	ND	12	9	10	5	10	NV	NV	8%

Task 16 Maintains final control elements.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	30	25	35	28	ND	28	23	25	25	30	NV	NV	28%

Task 17 Maintains calibration, reference, comparison standards and test equipment.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	18	25	10	13	ND	16	13	25	10	10	NV	NV	16%

BLOCK E SIGNAL TRANSMISSION

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	National Average
%	8	10	9	10	ND	6	8	10	10	10	NV	NV	9%

Task 18 Maintains signal transmission systems.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	40	50	50	53	ND	50	60	25	40	30	NV	NV	44%

Task 19 Maintains transducers (signal conditioners) (current/pressure, pressure/current, current/voltage, voltage/current, current/current, current/digital, frequency/voltage).

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	60	50	50	47	ND	50	40	75	60	70	NV	NV	56%

BLOCK F PANEL MOUNTED EQUIPMENT

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	National Average
%	12	5	5	8	ND	5	4	5	8	6	NV	NV	6%

Task 20 Maintains operator interface (panel mounted) equipment.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	100	100	100	100	ND	100	100	100	100	100	NV	NV	100%

BLOCK G HYDRAULICS AND PNEUMATICS

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	National Average
%	8	10	9	8	ND	6	12	10	10	13	NV	NV	10%

Task 21 Maintains hydraulic systems.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	35	35	50	28	ND	4	60	25	30	1	NV	NV	30%

Task 22 Maintains pneumatic systems.

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	
%	65	65	50	72	ND	96	40	75	70	99	NV	NV	70%

BLOCK H DISTRIBUTED CONTROL AND PLC'S

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	18%
%	20	18	20	19	ND	19	22	15	15	17	NV	NV	

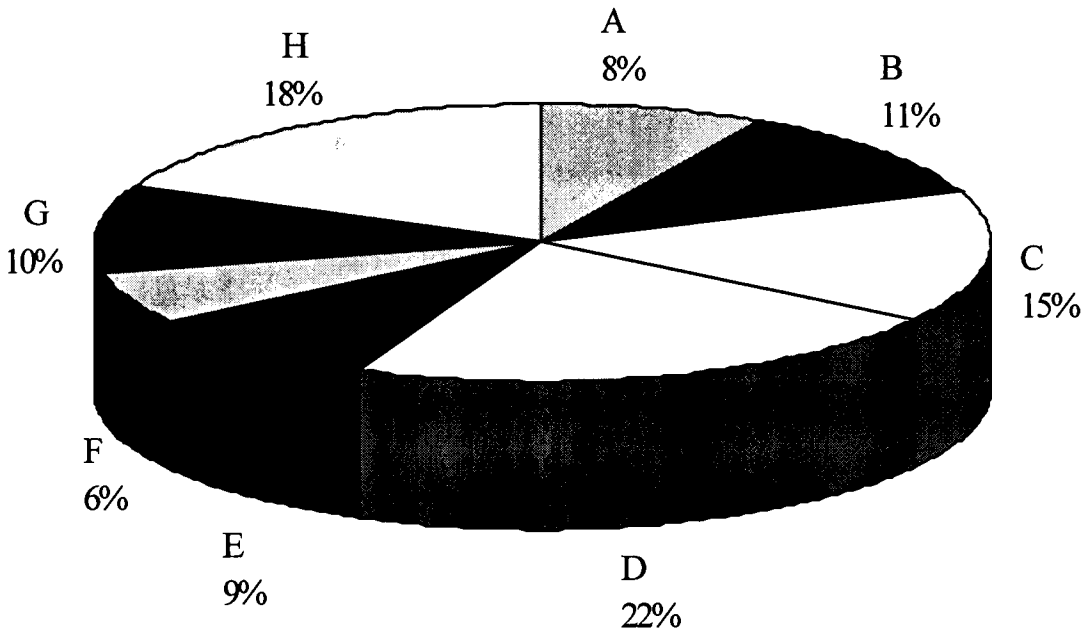
Task 23 Maintains distributed control systems (DCS).

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	63%
%	75	50	50	62	ND	76	50	60	65	80	NV	NV	

Task 24 Maintains programmable logic controllers (PLC).

	NF	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YK	37%
%	25	50	50	38	ND	24	50	40	35	20	NV	NV	

PIE CHART*
Industrial Instrument Mechanic



TITLES OF BLOCKS

Block A	Occupational Skills	Block E	Signal Transmission
Block B	New Installations and Efficient Operation	Block F	Panel Mounted Equipment
Block C	Field Mounted Equipment	Block G	Hydraulics and Pneumatics
Block D	Instrumentation and Calibration	Block H	Distributed Control and PLC's

* The average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. Interprovincial examinations typically have from one hundred up to one hundred and fifty multiple choice questions on each examination.

BLOCKS	TASKS	SUB-TASKS
A Occupational Skills	1. Demonstrates safe work practices and personal protection.	1.01 Complies with safety regulations and safe work practices.
		1.02 Determines safety lock out and tagging procedures.
		1.03 Installs safety shields and guards.
	2. Utilizes drawings, codes, standards and government regulations.	2.01 Interprets blueprints, schematics and drawings.
		2.02 Interprets codes, trade standards and government regulations.
	3. Utilizes tools and measuring equipment.	3.01 Operates hand tools.
		3.02 Operates portable power tools.
		3.03 Operates stationary power tools.
		3.04 Operates measuring equipment.
	4. Demonstrates common work practices and procedures.	4.01 Installs tubing and pipes.
		4.02 Performs hook-ups and terminates wiring.
		4.03 Applies fasteners and adhesives.
		4.04 Performs welding, cutting and brazing operations with gas welding equipment. *
		4.05 Performs welding operations using standard arc welding equipment. *
		4.06 Fabricates and mounts brackets.
		4.07 Installs valves and fittings.
		4.08 Inspects removable components for wear or malfunction.
B New Installations and Efficient Operation	5. Maximizes operating efficiency of process control system.	5.01 Reviews maintenance and operations report.
		5.02 Evaluates operation of panel mounted equipment.
		5.03 Investigates "out of spec", unusual reading and responses (low/high flows, temperatures, pressures, panel alarms, operator concerns).
		5.04 Tunes process control systems (feedback loops, feed-forward, cascade, ratio, batch, on-off).
		5.05 Inspects field mounted equipment.
		5.06 Develops preventative and predictive maintenance programs.
		5.07 Develops standard operating procedures (SOPs).
		5.08 Performs operational checks of process control systems.
	6. Facilitates new installations.	6.01 Advises on system requirements.
		6.02 Verifies process drawings and documentation.
		6.03 Verifies new equipment against specifications on data sheets.
		6.04 Fabricates brackets and mounts.
		6.05 Fabricates field enclosures. *
		6.06 Fabricates panels. *
		6.07 Coordinates equipment and field enclosure installations.
		6.08 Performs operational check outs of new equipment.
		6.09 Verifies equipment installations and calibrations.
		6.10 Coordinates changeovers to new systems from old.
		6.11 Configures process control systems.
		6.12 Installs auxiliary equipment.

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INDUSTRIAL INSTRUMENT MECHANIC (2000)

BLOCKS	TASKS	SUB-TASKS
Field Mounted Equipment	7. Maintains field mounted pressure equipment.	7.01 Installs pressure gauges (pressure, vacuum and differential pressure).
		7.02 Installs electronic pressure transmitters (pressure and vacuum).
		7.03 Installs pneumatic pressure transmitters (pressure and vacuum).
		7.04 Installs pressure regulators.
		7.05 Installs pressure switches (pressure, vacuum and differential pressure).
		7.06 Calibrates pressure gauges (pressure, vacuum and differential pressure).
		7.07 Calibrates electronic pressure transmitters (pressure and vacuum).
		7.08 Calibrates pneumatic pressure transmitters (pressure and vacuum).
		7.09 Calibrates pressure switches (pressure, vacuum and differential pressure).
		7.10 Test pressure regulators.
		7.11 Replaces pressure gauge components (pressure, vacuum and differential pressure). *
		7.12 Replaces electronic pressure transmitter components (pressure and vacuum).
		7.13 Replaces pneumatic pressure transmitter components (pressure and vacuum).
		7.14 Replaces pressure switch components (pressure, vacuum and differential pressure).
		7.15 Replaces components on pressure regulators.
	8. Maintains field mounted flow equipment.	8.01 Installs primary flow elements (annubars, orifice plates, venturi tubes, flow nozzles, flumes and weirs).
		8.02 evaluates primary flow element condition.
		8.03 Installs mechanical solid flowmeters.
		8.04 Installs electronic solid flowmeters.
		8.05 Installs nuclear solid flowmeters.
		8.06 Installs mechanical fluid flowmeters.
		8.07 Installs electronic fluid flowmeters.
		8.08 Installs magnetic fluid flowmeters.
		8.09 Installs mass flowmeters.
		8.10 Installs vortex shedding meters.
		8.11 Installs turbine flowmeters.
		8.12 Installs flow switches.
		8.13 Calibrates mechanical solid flowmeters.
		8.14 Calibrates electronic solid flow meters.
		8.15 Calibrates nuclear solid flowmeters.
		8.16 Calibrates mechanical fluid flowmeters.
		8.17 Calibrates electronic fluid flowmeters.
		8.18 Calibrates magnetic fluid flowmeters.
		8.19 Calibrates mass flowmeters.
		8.20 Calibrates turbine flowmeters.
		8.21 Calibrates flow switches.
		8.22 Replaces components on mechanical solid flowmeters.
		8.23 Replaces components on electronic solid flowmeters.
		8.24 Replaces components on nuclear solid flowmeters.
		8.25 Replaces components on mechanical fluid flowmeters.
		8.26 Replaces components on electronic fluid flowmeters.
		8.27 Replaces components on magnetic fluid flowmeters.
		8.28 Replaces components on mass flowmeters.
		8.29 Replaces components on turbine flowmeters.
		8.30 Replaces components on flow switches.
	9. Maintains field mounted level equipment.	9.01 Installs sight glasses.
		9.02 Installs mechanical level indicators.
		9.03 Installs nuclear level measuring devices.
		9.04 Installs pneumatic level measuring devices.
		9.05 Installs electronic level measuring devices.
		9.06 Installs level switches.
		9.07 Replaces mechanical level measuring device components.
		9.08 Replaces nuclear level measuring device components.
		9.09 Replaces pneumatic level measuring device components.
		9.10 Replaces level switch components.
		9.11 Replaces electronic measuring device components.
	10. Maintains field mounted temperature devices.	10.01 Installs mechanical temperature measuring devices (bimetallic thermometers).
		10.02 Installs primary temperature element (thermistors, thermocouples, RTD's and pyrometers).
		10.03 Evaluates primary temperature element condition.
		10.04 Installs filled thermal systems.
		10.05 Installs temperature switches.
		10.06 Calibrates mechanical temperature measuring systems.
		10.07 Calibrates filled thermal systems.
		10.08 Calibrates temperature switches.
		10.09 Replaces components on mechanical temperature measuring systems.
		10.10 Replaces components on filled thermal systems.
		10.11Replaces temperature switch components.

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INDUSTRIAL INSTRUMENT MECHANIC (2000)

BLOCKS	TASKS	SUB-TASKS
D Instrumentation and Calibration	11. Maintains Analyzers.	11.01 Installs process gas analyzers (thermomagnetic, thermoconductive, infrared, ultraviolet and temperature sensor type).
		11.02 Installs sample conditioning system.
		11.03 Installs liquid chemical analyzers.
		11.04 Installs turbidity analyzers.
		11.05 Installs radioactive analyzers.
		11.06 Installs pH meters.
		11.07 Installs thermal or magnetic field analyzers.
		11.08 Installs electromagnetic radiation instrument.
		11.09 Installs energy analyzers.
		11.10 Installs air quality analyzers.
		11.11 Installs stack emission analyzers.
		11.12 Installs fluid samplers.
		11.13 Installs gas samplers.
		11.14 Installs on-line moisture analyzers.
		11.15 Calibrates process gas analyzers (thermomagnetic, thermoconductive, infrared, sensor type).
		11.16 Calibrates liquid chemical analyzers.
		11.17 Calibrates turbidity analyzers.
		11.18 Calibrates radioactive analyzers.
		11.19 Calibrates pH meters.
		11.20 Calibrates thermal or magnetic field analyzers.
		11.21 Calibrates electromagnetic radiation instrument.
		11.22 Calibrates energy analyzers (chemical, thermal, mechanical).
		11.23 Calibrates air quality analyzers.
		11.24 Calibrates stack emission analyzers.
		11.25 Calibrates on-line moisture analyzers.
		11.26 Replaces process gas analyzer components (thermomagnetic, thermoconductive, infrared, sensor type).
		11.27 Replaces sample conditioning system components.
		11.28 Replaces liquid chemical analyzer components.
		11.29 Replaces turbidity analyzer components.
		11.30 Replaces radioactive analyzer components.
		11.31 Replaces pH meter components.
		11.32 Replaces thermal or magnetic field analyzer components (thermistors, coils).
		11.33 Replaces electromagnetic radiation instrument components (light sensitive diodes and FET's).
		11.34 Replaces energy instrument analyzer components (chemical, thermal, mechanical).
		11.35 Replaces air quality analyzer components.
		11.36 Replaces stack emission analyzer components.
		11.37 Replaces fluid sampler components.
		11.38 Replaces gas sampler components.
	12. Maintains speed measuring devices.	12.01 Installs mechanical devices for measuring speed.
		12.02 Installs optical devices for measuring speed.
		12.03 Installs electrical devices for measuring speed.
		12.04 Calibrates mechanical devices for measuring speed.
		12.05 Calibrates optical devices for measuring speed.
		12.06 Calibrates electrical devices for measuring speed.
		12.07 Replaces components on mechanical devices for measuring speed.
		12.08 Replaces components on optical devices for measuring speed.
		12.09 Replaces components on electrical devices for measuring speed.
	13. Maintains weight and density measuring devices.	13.01 Installs mechanical weight measurement devices (non-continuous).
		13.02 Installs hydraulic weight measurement devices.
		13.03 Installs electronic weight measurement devices.
		13.04 Installs nuclear density measuring devices.
		13.05 Installs mechanical density measuring devices.
		13.06 Installs electronic density measuring devices.
		13.07 Calibrates nuclear density measuring devices.
		13.08 Calibrates mechanical density measuring devices.
		13.09 Calibrates electronic density measuring devices.
		13.10 Calibrates mechanical weight mensurement devices.
		13.11 Calibrates hydraulic weight measurement devices.
		13.12 Calibrates electronic weight measurement devices.
		13.13 Replaces mechanical weight mensurement device components.
		13.14 Replaces hydraulic weight measurement device components.
		13.15 Replaces electronic weight measurement device components.
		13.16 Replaces components on nuclear density measuring devices.
		13.17 Replaces components on mechanical density measuring devices.
		13.18 Replaces components on electronic density measuring devices.

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INDUSTRIAL INSTRUMENT MECHANIC (2000)

BLOCKS | **TASKS** | **SUB-TASKS**

TASKS	SUB-TASKS
14. Maintains vibration measurement devices.	14.01 Installs probes.
	14.02 Installs amplifiers.
	14.03 Installs proximeters.
	14.04 Calibrates amplifiers.
	14.05 Calibrates proximeters.
	14.06 Replaces vibration measurement device components.
15. Maintains consistency measuring devices.	15.01 Installs mechanical consistency measuring devices.
	15.02 Installs optical consistency measuring devices.
	15.03 Installs rotary and blade type consistency measuring devices.
	15.04 Calibrates mechanical consistency measuring devices.
	15.05 Calibrates optical consistency measuring devices.
	15.06 Calibrates rotary and blade type consistency measuring devices.
	15.07 Replaces components on mechanical consistency measuring devices.
	15.08 Replaces components on optical consistency measuring devices.
	15.09 Replaces components on rotary and blade type consistency measuring devices.
16. Maintains final control elements.	16.01 Installs variable speed and variable frequency drives.
	16.02 Installs electric actuators.
	16.03 Installs power controllers. *
	16.04 Installs pneumatic drives.
	16.05 Installs pneumatic cylinders.
	16.06 Installs hydraulic cylinders.
	16.07 Installs mechanical control valves, actuators and positioners (ball, veeball, plug, butterfly).
	16.08 Calibrates variable speed and variable frequency drives.
	16.09 Calibrates electric actuators.
	16.10 Calibrates power controllers. *
	16.11 Calibrates pneumatic drives.
	16.12 Calibrates control valves, actuators and positioners (ball, veeball, plug, butterfly).
	16.13 Replaces components on variable speed and variable frequency drives. *
	16.14 Replaces components on electric actuators.
	16.15 Replaces components on pneumatic drives.
	16.16 Replaces components on pneumatic cylinders.
	16.17 Replaces components on hydraulic cylinders.
	16.18 Replaces components on mechanical control valves, actuators and positioners (ball, veeball, plug, butterfly).
17. Maintains calibration, reference, comparison standards and test equipment.	17.01 Verifies calibration of temperature baths and controls.
	17.02 Verifies calibration of electrical/electronic potentiometer.
	17.03 Replaces components on electrical potentiometers.
	17.04 Replaces components on manometers.
	17.05 Replaces components on deadweight testers.
	17.06 Verifies calibration of bridge test sets.
	17.07 Replaces components on bridge test sets.
	17.08 Verifies calibration of resistance, voltage and current reference devices.
	17.09 Replaces components on resistance, voltage and current reference devices.
	17.10 Verifies calibration of analyzer test equipment.
	17.11 Replaces components on analyzer test equipment.
	17.12 Verifies calibration of digital test equipment.
	17.13 Replaces components on digital test equipment.
	17.14 Verifies calibration of pneumatic test equipment.
	17.15 Replaces components on pneumatic test equipment.
E Signal Transmission	
18. Maintains signal transmission systems.	18.01 Blows down impulse lines.
	18.02 Fabricates impulse and signal lines (pipe and tube)
	18.03 Installs impulse and signal lines (pipe and tube).
	18.04 Installs heat tracing on impulse lines.
	18.05 Installs insulation on impulse lines. *
	18.06 Replaces damaged impulse lines (pipe, tube and fittings).
	18.07 "Runs" signal wiring.
	18.08 Terminates signal wiring.
	18.09 Splices signal wiring.
	18.10 Fabricates conduit (flexible and rigid).
	18.11 Replaces damaged conduit and fittings (flexible and rigid).

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BLOCKS	TASKS	SUB-TASKS										
		18.12 Installs signal conditioning devices (surge suppressors, multiplexors).	18.13 Installs intrinsic signal conditioner.	18.14 Performs operation check of signal transmission system.								
	19. Maintains transducers (signal conditioners) (current/pressure, pressure/current, current/voltage, voltage/current, current/current, current/digital frequency/voltage).	19.01 Installs transducers.	19.02 Calibrates transducers.	19.03 Replaces components on transducers.								
F Panel Mounted Equipment	20. Maintains operator interface (panel mounted) equipment.	20.01 Installs pneumatic indicators, recorders, controllers and associated components (auto/manual transfer stations).	20.02 Installs electronic indicators, recorders, controllers and associated components (auto/manual transfer stations).	20.03 Installs alarm/shutdown systems.	20.04 Installs annunciators.	20.05 Installs communication equipment.	20.06Installs data management storage equipment.	20.07 Installs printers.	20.08 Installs operator stations.	20.09 Calibrates pneumatic indicators, recorders, controllers and associated components (auto/manual transfer stations).	20.10 Calibrates electronic indicators, recorders, controllers and associated components (auto/manual transfer stations).	20.11 Calibrates alarm/shutdown panels.
		20.12 Calibrates annunciators.	20.13 Calibrates communication panels.	20.14 Performs operational checks of data management storage equipment.	20.15 Replaces components on pneumatic indicators, recorders, controllers and associated components (auto/manual transfer stations).	20.16 Replaces components on electronic indicators, recorders, controllers and associated components (auto/manual transfer stations).	20.17 Replaces components on alarm/shutdown panels.	20.18 Replaces components on annunciators.	20.19 Replaces components on communication panels.	20.20 Replaces components on data management storage equipment.	20.21 Replaces components on printers.	20.22 Replaces components on operator stations.
G Hydraulics and Pneumatics	21. Maintains hydraulic systems.	21.01 Visually assesses hydraulic fluid condition.	21.02 Replaces hydraulic fluids.	21.03 Replaces hydraulic filters.	21.04 Installs hydraulic pumps. *	21.05 Replaces components on hydraulic pumps. *	21.06 Installs hydraulic control systems and valves.	21.07 Sets-up hydraulic control systems.	21.08 Replaces components on hydraulic control systems.	21.09 Installs hydraulic lines.	21.10 Bleeds air from hydraulic lines.	
	22. Maintains pneumatic systems.	22.01 Installs instrument air dryers.	22.02 Tests the efficiency of instrument air dryers.	22.03 Replaces components on instrument air dryers.	22.04 Installs pneumatic conditioning components (filter assemblies, volume boosters, pneumatic relays).	22.05 Replaces components on pneumatic conditioning components (filter assemblies, volume boosters, pneumatic relays).						
H Distributed Control and PLC's	23. Maintains distributed control systems (DCS)	23.01 Diagnoses hardware problems.	23.02 Replaces DCS boards.	23.03 Diagnoses software problems.	23.04 Reloads system memory.	23.05 Configures control loops.	23.06 Backs up system memory.					

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INDUSTRIAL INSTRUMENT MECHANIC (2000)

BLOCKS	TASKS	SUB-TASKS				
	24. Maintains programmable logic controllers (PLC).	24.01 Diagnoses hardware problems.	24.02 Replaces PLC boards.	24.03 Diagnoses logic problems.	24.04 Reloads system memory.	24.05 Backs up system memory.

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