

# **Specification for New Electrochemical Machine for Rifling – ECM 2**

Spec. # 01-22-3424

Manufacturing Engineering Work Group  
Watervliet Arsenal  
Watervliet, New York 12189  
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Department of the Army  
TACOM

## New Electrochemical Machine for Rifling –ECM 2

### Table of Contents

#### Contents

1.	Scope.....	1
2.	Applicable Standards and Publications.....	1
3.	General Requirements.....	1
4.	Machine Installation and Startup .....	16
5.	Machine Specification Requirements .....	19
6.	Requirements for Demonstration of Conformance.....	299
7.	Quality Assurance Provisions .....	311
8.	General Requirements and Information.....	<b>Error! Bookmark not defined.</b>
9.	Attachment A - Acceptable Lubricants, Hydraulic Fluids, Oils, and Coolants.....	344
10.	Attachment B – Class I Ozone Depleting Substances .....	356
11.	Attachment C – Electrical Survey.....	367
12.	Attachment D – Environmental Protections Requirements .....	378
13.	Attachment E – Drawings.....	455

## **1. Scope:**

**1.1. Abbreviated Description:** The equipment covered by this specification shall be an industry standard production duty Computer Numerical Control (CNC) controlled two axis machine capable of electrochemically cutting internal splines on long tubular workpieces. The machine shall have the capability to cut straight grooves and constant/progressive twist left or right-hand splines. The machine shall be complete with all supporting components necessary to conduct electrochemical machining on the tube surface. The actual cutting head is not part of this scope of work.

**2. Applicable Standards and Publications:** All work performed, and procedures followed in association with this project shall meet or exceed all applicable and current Watervliet Arsenal (WVA), Occupational Safety and Health Administration (OSHA), local, state, and federal government codes and laws relative to fire, safety, environmental, and electrical issues. These standards include, but are not limited to, ANSI, NFPA, NEC, ISO, and ASME. The quality of all work performed and material provided shall meet or exceed the most recent revision of applicable industry standards and engineering practices for this type of equipment and its intended function. In all instances material, quality, and workmanship shall meet or exceed OEM specifications.

**3. General Requirements:** All requirements are mandatory from the standpoint of intended function. Wherever a specific requirement would force an offeror to depart from his standard practice or configuration, the Arsenal will accept, for evaluation, alternative offers for achieving the intended function. Any such alternative offers must be accompanied by sufficient technical information to allow the evaluator to reach a definite conclusion that the alternative is equal to or better than that specified. The equipment specified in this document shall be a standard product of the manufacturer and shall require either no design changes, or if required, minor design changes to meet the requirements of this specification. Therefore, ownership of the design shall remain with the manufacturer. Equipment incorporating new or unproven technology is subject to rejection at the discretion of the Contracting Officer.

**3.1. Design and Engineering:** The equipment specified in this document shall be designed and engineered in accordance with the most current version of each standard, recognized by the Association for Manufacturing Technology.

**3.2. Materials and Components:** Materials and components incorporated in the construction of the equipment specified herein shall be new, free from defects, and conform to the specifications and standards included within this specification.

**3.3. Construction:** All parts of the equipment specified in this document shall be new, unused, and constructed to be capable of withstanding all forces encountered during operations to the equipment's maximum factor of safety rated capacity. The structure and assembly of the machine and its components shall be sufficiently rigid that workpiece finish and accuracy are not impaired by machine vibrations.

**3.3.1. Alignment Retention:** Non-integral machine components, heads and ways, which are separately assembled and whose alignments determine the squareness and parallelism of machine geometry shall utilize a positive means for retaining alignments and regaining them in the event of unintentional dislocation.

**3.3.2. Slideway Design and Construction:** All precision ways which guide and bear the rated design loads shall adhere to the hardness criteria shown in the following examples of acceptable way systems. Please state in your proposal details of the way system being offered if applicable. Hardness tests other than Rockwell C shall be subject to approval by the designated POC.

- A. Integral cast iron ways shall be hardened from RC 50 to RC 54 to a depth of 0.100 inches or more.
- B. Hardened and ground steel ways for mating with Turcite, Rulon, or other such low friction forgiving materials shall be hardened within the range of RC 55 to RC 62. Actual hardness within this range shall not vary more than 5 RC points.
- C. Hardened and ground steel ways for use with anti-friction roller bearings shall be to a hardness of RC 62 to RC 65 to a depth of 0.125 inches or more.

Slideway systems other than the ones referred to above may be offered provided that their design is consistent with all specified performance characteristics of the machine. All slideway systems having less than a 60-degree incline to the horizontal shall be protected by way covers unless it can be substantiated that covers will interfere with the functions of the machine.

**3.3.3. Replaceable Ways:** If the machine being offered is portrayed as having replaceable ways, the assembly of the way bars to the machine frame shall be such that finished ground ways are fastened to a precision ground or scraped surface to permit field replacement without additional grinding.

**3.3.4. Way Wipers:** All way systems shall be equipped with wipers designed to prevent intrusion of foreign material. Wipers shall be adjustable to compensate for wear. Wipers shall be easily removable and replaceable.

**3.3.5. Shims and Spacers:** Shims that do not appear on engineering drawings shall not be incorporated in the machine. Spacers that do appear on engineering drawings are permissible.

**3.3.6. Castings and Forgings:** All castings and forgings shall be free of defects, scale, and mismatching. Weldments, if used, shall be braced, ribbed and gusseted to obtain strength equal to or better than the strength of castings, and shall be properly stressed relieved.

**3.4. Workmanship:** Workmanship throughout the construction and assembly equipment specified herein shall be free from irregularities or defects that could adversely affect performance or durability.

**3.5. Maintainability:** All equipment components offered that are subject to wear, distortion or failure and all parts which require periodic adjustment shall be accessible for replacement or

adjustment. Instructions for the maintenance and adjustment of these parts shall be clear, concise and definitive.

**3.6. Interchangeability:** All parts offered that bear the same part number shall be interchangeable.

**3.7. Applicable Power Source:** The power source to which the machine will be connected to furnishes a nominal 480 volts, 3 phase, 60 Hz AC. However, the machine shall be tolerant enough of line fluctuations to operate normally at source voltages ranging from 432 to 504 volts.

**3.7.1. Electrical Safety Devices:** The machine and its equipment shall be protected by circuit breakers which comply with NEMA standards for thermal magnetic types and shall have a minimum interrupting capacity of 25,000 RMS symmetrical amperes for 480 volt, 3-phase system. Breaker terminals shall be UL listed as suitable for the type of conductors provided. Plug in circuit breakers or current limiting fuses are not acceptable.

**3.7.2. Conversion Equipment:** If DC or reduced voltage AC is required to meet any specified requirement, the necessary conversion or transformation equipment shall be provided by the contractor. All transformers must meet efficiency levels specified in CFR Title 10 Chapter II Part 431 (also known as DOE 2016 Efficiency Levels). Equipment which requires a high-quality constant power source shall have proper isolation and/or power conditioning equipment for the power service designated in this description. All electrical equipment shall have a power factor (ratio of real power to apparent power) of no less than 80%, as read at the equipment main disconnect. Equipment with a power factor of less than 80% shall be fitted with suitable power factor correction capacitance, sized on the basis of the equipment's inductive AC load.

**3.7.3. Operator Control Voltage:** All electrical controls meant for use by the operator of the machine shall carry 120 volts AC maximum.

**3.7.4. Utility Outlet:** The machine shall be provided with a 120 VAC, 20 amp, single phase, industrial rated, GFI, covered dual receptacle externally mounted onto the operator control panel.

**3.7.5. Cabinet Enclosure for Electronic Equipment:** All separate electrical hardware/circuitry are to be housed in a NEMA 12 rated enclosure/cabinet. Should forced ventilation be necessary to maintain the interior of the enclosure at a temperature to ensure good product reliability, filtered air shall be forced into the cabinet to maintain an over pressure condition in the cabinet. Cabinet shall not inhibit operator access to the controls and/or adjustments.

**3.7.6. Interconnecting Wiring:** All control functions shall be pre-wired by the contractor at their manufacturing facility. This includes wiring from the CNC/PLC to the interface and from the interface to the machine tool. If any disassembly of the machine tool and associated control wiring is necessary for shipment from the contractor's plant, the contractor shall rewire the system at the Arsenal unless a clearly labeled plug and socket system is employed. The Arsenal will not perform detailed control wiring. All wiring shall comply with accepted Joint Industry

Code (JIC), National Machine Tool Builders Association (NMTBA), and National Fire Protection Association (NFPA) Standards.

**3.8. Motors:** All motors provided shall be of the type and horsepower rating to meet the specified requirements based on all applicable engineering practices and standards. All motors shall be rated for continuous duty. Motors shall not operate in an overload condition during normal operation of the equipment and shall be equipped with thermal overload protection. Motor starters and controls shall operate at 24 VDC. Motor starters shall provide drop out protection (no auto-reset). This means that in the event of power loss, the equipment shall be re-energized only by deliberate action of the operator or maintenance personnel. Manual or mechanical motor starters are not acceptable. All motors shall be housed in enclosures of the appropriate NEMA type for class and severity of service. All AC unidirectional motor housing shall bear a directional arrow to indicate proper rotation direction when correctly wired. All AC motors rated at 25 horsepower or greater shall be equipped with a “soft start” device which provides for reduced voltage starting. All polyphase AC motors rated at one horsepower or greater shall be tested per IEEE Standard 112-Method B and must meet premium efficiency requirements per NEMA MG 1-2006 Table 12-12 or IEC 60034-30:2008. All motors are to be permanently lubricated and sealed.

**3.8.1. Motor Identification Plates:** Each motor shall bear an identification plate containing the identity of the manufacturer, model number, serial number, input voltage, amperage, horsepower, phase, frequency, duty cycle, and frame size or mounting identification. No identification plate shall be painted.

**3.9. Safety and Environmental Requirements:** The contractor shall review the environmental requirements documented in Attachment D of this document and comply as required.

**3.9.1. Protection of Machine Operator:** Protection of the machine operator and other personnel shall be accomplished in accordance with all pertinent Arsenal, State, Federal, and local regulations, OSHA and NEC in particular.

**3.9.2. Protection of the Machine:** The machine shall be designed and equipped in accordance with all applicable standards to prevent self-damage in the event of component malfunctions, power failures, expended consumables, incorrect consumables, and operator errors.

**3.9.3. Noise Levels:** Noise levels at a distance not exceeding one meter from the nearest point on the machine shall, under no circumstances, exceed a maximum of 85 dBA when measured by a calibrated sound level meter set for "A" weighting and slow response. Any shields, baffles, enclosures or other devices required to bring the machine into conformance with this noise level requirement shall be provided by the contractor. Any such devices shall not interfere with the operation of the machine and shall be designed to preserve the visibility needed for safe operation and ease of maintenance.

**3.9.4. Ozone Depleting Substances:** Section 326 of Public Law 102-484 precludes the Department of Defense (DoD) from awarding any contract that directly or indirectly requires the use of a Class I ozone depleting substance within the Government specification or standards set forth in the contract. Attachment B is a list of the restricted Class I CFCs and Halons. All shall be replaced by new functionally equivalent substances or systems that are approved for use by the Environmental Protection Agency (EPA) and have an "Ozone Depletion Potential" (ODP) rating of zero. ODP is defined as the relative capacity of a substance, per unit weight, for destroying the earth's stratospheric ozone layer, in comparison with CFC 11, CFC 12 and CFC 114, each having been assigned an ODP of 1.00.

**NOTE:** Offerors are responsible to obtain and adhere to the most current list of prohibited substances as of the date of the submission of bids or proposals.

**3.9.5. Asbestos and Mercury Free Certification:** All materials utilized in the system shall be certified as asbestos and mercury free unless substitute materials do not exist. This certification shall be provided prior to machine delivery **IAW CDRL A001.**

**3.9.6. Material Safety Data Sheets:** The offeror shall provide Watervliet Arsenal with all material safety data sheets at the time of proposal submission **IAW CDRL A014.**

**3.9.7. Lead Free and Chromium Free Paint Certification:** All paints and primers applied to the system shall be certified as lead free and chromium free. Lead based paint is paint that contains more than six one hundredths of one percent (0.06%) lead by weight. This certification shall be provided prior to machine delivery **IAW CDRL A002.**

**3.9.8. PCB Free Certification:** To the extent that the machine is charged with lubricant or hydraulic fluids at the contractor's plant for preliminary acceptance inspection, these fluids shall not contain Polychlorinated Biphenyl's (PCBs). The machine and its equipment shall be certified as PCB free and certification shall be provided prior to machine delivery **IAW CDRL A003.**

**3.9.9. Lockout/Tagout Procedures:** The manufacturer shall provide the control of hazardous energy (lockout/tagout) per OSHA 29 CFR 1910.147. This information shall be incorporated into the maintenance manual. Contractor shall ensure their employees are trained so they know, understand, and follow the applicable provisions of the hazardous energy control procedures. The control of hazardous energy sources includes but is not limited to electrical, pneumatic, hydraulic, chemical, mechanical, UV, electromagnetic and thermal energy.

**3.10. Identification Plate:** A corrosion resistant metal plate shall be securely attached to the machine in a location visible to the operator's workstation. This plate shall bear, as a minimum, the information called for below, with space at the bottom of the plate for the addition of one line of information to be applied by the Government.

- A. Manufacturer's name
- B. Model
- C. WV# (Please contact the POC to receive this number)

- D. Manufacturer's Serial Number
- E. Power Input (voltage, phase, frequency, and full load amps)
- F. Government Contract Number
- G. Date of Manufacture

**3.11. Data Plates:** All instruction, data, and identification plates and labels attached to this equipment and its controls shall be manufactured of corrosion and oil resistant metal or plastic material. All wording shall be in the English language using plain, bold face lettering. Lettering shall be permanent and have a contrasting background.

**3.12. Utility Connections:** Equipment supplied to the Watervliet Arsenal shall have a single point shut off for each utility supplied to the system. This will be referred to as the “point of first connection.” Electric utilities shall have only one point of first connection, including sub systems. Each point of first connection shall be clearly labeled on the system and shown in the safety Lockout/Tagout portion of the documentation package. These points shall be located on a stationary component and positioned so that they will not create a hazard to personnel during normal operation of the system. The point of first connection shall be accessible from the shop floor without the use of ladders, steps, or stools. Access cannot be hampered by operation of the system. Specific to electrical connections, all Arc-Flash protocols per NEC codes shall be implemented.

**3.13. Utility Connection Labor and Requirements:** WVA will provide a utility connection between point of first connection on the equipment, and the facility. Only one connection per utility type (air, water, electrical, etc.) will be provided. All other work shall be provided by the Contractor.

**3.13.1. Electrical:** The WVA power source that the specified equipment will be connected to will be a nominal 480 VAC, 3 phase, 60 Hz AC voltage. However, the machine shall be able to operate normally at source voltages ranging from 432 to 504 volts. The WVA power source does not include sub-panels, filters, surge protection, or any peripheral equipment necessary to make the equipment functional. All electric requirements shall be routed to a single point of connection, including sub systems or 120V connections.

**NOTE:** Offeror is to state required power/electrical requirements for offered machine. See Attachment C and include in the proposal.

**3.13.2. Pneumatics/Air:** If air is required for any machine operation or function, the machine shall be fully equipped with all required components, fully installed to the point of connection of WVA shop air. Shop air at the Arsenal is 85 PSI with above normal moisture and contaminant levels. If higher or lower pressure is required at the machine or a different air flow rate is needed, the machine shall be fully equipped to modify the supply pressure and volume. The machine shall also be equipped to remove the above normal moisture and contaminant levels. Normal moisture is defined as that moisture produced when air at a relative humidity of 75% has been compressed to 85 PSI. The equipment’s nominal and maximum compressed air usage rates in CFM shall be provided to the POC.



**3.13.2.1. Air Booster Unit:** If the equipment offered requires more than 85 psi at the volume for operation of the equipment, then an air booster unit shall be provided with the machine. If operation of the equipment requires an accumulator tank, it shall be provided with the booster. Please state in your proposal what the machine requirements shall be and if a booster and tank will be required. Installation shall be provided by the contractor. If the use of an air booster is not possible and an air compressor is required, the contractor must state this in their proposal and provide justification detailing CFM, psi, application, and duration of air usage. Power requirements of the air booster or compressor shall be provided to the POC.

**3.13.2.2. Air Dryers/Filtration:** If the offeror determines that on machine air dryers are required to maintain moisture levels, the air dryers shall have a regenerative type desiccant or refrigerated compressed air dryer capable of drying air down to 35°F pressure dew point, minimum, from air entering the equipment at 110°F. The air dryer shall supply air at the required standard cubic feet per minute (SCFM) of the equipment. The unit shall purge condensate automatically. In the case of a refrigerated air dryer, the refrigerant used shall not be a Class I ozone depleting substance. The air dryer shall be connected and piped to the equipment by the contractor. All air dryer designs are to be supplied by manufacturers participating in the CAGI Refrigerated Dryer Performance Verification Program and have been tested and rated in accordance with CAGI ADF 100. Power for the refrigerated air dryer unit shall be 110 volts and shall be wired and powered through the machine electrical system.

**NOTE:** Common industrial air dryers that are used at the Watervliet Arsenal include the ZEKS HSE and Ingersoll Rand D31NC models.

**3.14. Lubrication:** The machine shall be equipped to provide lubrication to every moving part where lubrication is essential to prevent damage. Slideways shall be lubricated by an automatically cycled distribution system such as that manufactured by Trabon or approved equivalent. Gearboxes and transmission cases shall be lubricated by the wet sump splash method. Spindle bearings shall be lubricated by recirculating pressure spray systems. Automatic lubrication systems shall be equipped to be fail safe to the maximum extent possible. All sensors and devices used to detect the presence or absence of lubrication shall be accessible for test or replacement without major disassembly. Manual lubrication methods are permissible for lubrication points not practically served by automatic systems. For non-recirculating automatic systems, such as slideway lubrication, the reservoirs shall be sized to provide lubrication reserve equivalent to 80 operating hours and shall be located at floor level. For recirculating automatic systems, cleanable or replaceable filtration devices shall be provided. Wet sump type systems shall be equipped with a means to confirm proper oil level. Sight gauges shall be of the external standing tube type rather than the flush mounted porthole type. Standing tube sight gages shall be protected against accidental breakage.

**3.14.1. Lubrication Plate:** A lubrication plate shall be permanently fastened to the machine and shall clearly indicate the type and viscosity of lubricant and the service interval for all automatic and manual lubrication reservoirs and fittings. The plate shall include a simple diagram which depicts the physical location of all lubrication points on the machine structure.

**3.14.2. Lubricants, Hydraulic Fluids, Oils and Coolants:** Watervliet Arsenal has established a standardized list of lubricants, hydraulic fluids, oils and coolants. The contractor shall choose the required lubricants, hydraulic fluids, oils and coolants from Attachment A, enclosed, or where there is a designated equivalent. If a substitute is required, the contractor shall provide at the time of machine delivery, a justification which shall include the manufacturer, type and specification number as well as the reason for the substitution. A list of all fluids required to operate the machine shall be provided to the Arsenal 30 days prior to delivery IAW CDRL A007.

**3.14.3. Control of Cutting Fluids:** If the machine is equipped with a coolant system, the contractor shall ensure that the machine is designed and equipped to prevent coolant from escaping the confines of the machine and leaking to the floor when producing workpieces of a size within the machine's normal working range. If the coolant reservoir is part of the foundation, the coolant shall be contained in a leak proof metallic or nonmetallic liner.

**3.15. Hydraulic System:** Hydraulic systems provided shall be sized and powered for the intended application and shall conform to industry standards. The system shall incorporate cleanable or replaceable filtration devices to insure fluid cleanliness. Reservoirs shall be equipped with easily visible gauges to indicate fluid level. If duty cycle of the system under maximum usage will cause the hydraulic fluid to exceed 120°F in temperature, a suitable heat exchanger shall be provided to maintain fluid temperature at or below this level. The system shall be protected against overpressure as well as under pressure. System pressure in any hydraulic device shall be as low as is practical for the intended application but shall not exceed 3000 PSI in any case unless approved under special justifiable circumstances. In any system which utilizes hydraulics to produce thrust or direct linear motion, anti-surge devices or circuits shall be incorporated to ensure uniformity of motion under varying loads. These devices or circuits shall be adjustable. All reservoirs shall be easily accessible for cleaning and flushing and shall be located at floor level.

**3.16. Painting:** All exterior machine surfaces shall be painted except where bright metal is required for machine function or to otherwise adhere to the requirements of this specification. Paint shall be chromium-free and lead-free. Quality and manner of application shall afford protection throughout the normal life of the machine. Paint shall be "semi-gloss", and selected by the Government, from a list of standard colors supplied by the offeror with their proposal. This selection shall be made after contract award. Danger areas shall be painted red and caution areas shall be painted yellow in accordance with OSHA Standard 1910.144. Appropriate warning signs, tags or emblems shall be affixed to respective areas of the machine in accordance with OSHA Standard 1910.145.

**3.17. Machine Hold Down and Leveling:** The machine base shall be provided with a mounting hole quantity and location for positive hold down when operating at full rated capacity. In addition, for each hole in the machine base, the contractor shall provide a set of recommended hold down and leveling hardware. If grouting is required, it shall be provided by the contractor.

**NOTE:** All hold down and leveling hardware shall be delivered 30 days prior to the scheduled delivery of the machine.

**3.18. Gears:** All gears used in the machine and its components shall meet or exceed the standards recommended by the American Gear Manufacturers Association for the type and severity of service required.

**3.19. Handwheels:** Where power feed and rapid traverse of a machine component is provided or specified, associated handwheels or cranks, shall not rotate when power feed or rapid traverse is engaged.

**3.20. Technical Data:** All data shall be in the English language and shall be furnished in accordance with the quantities, formats and delivery dates below. All data shall be packaged and delivered separately from the machine itself marked to the attention of the Technical POC. The contractor shall provide full documentation in the form of “as built” drawings and manuals. Drawings shall not be generic or sub-assembly prints. A “hardcopy” refers to a reproducible printed, paper copy. An “electronic copy” refers to a document saved on CD. All AutoCAD drawings shall be provided in AutoCAD version 2014 or later, shall be of one-to-one scale, shall be dimensioned in English units, and shall not utilize the color yellow. “On-line” technical data shall not be acceptable as the sole means of providing technical data for any of the systems provided. The Government contract number and the Watervliet WV# shall be printed in a conspicuous place on the covers of every manual, on each drawing/schematic, and on all disks/CDs provided.

**3.20.1. Foundation Drawings, Standard or Special:** Shall be complete in all construction detail to permit pricing and construction by a general contractor and shall be furnished as soon as possible after contract award and no later than 30 days after award. All drawings shall be dimensioned in English units and text shall be in the English language. One reproducible hardcopy and one electronic copy on CD in AutoCAD .dwg or .dxf format shall be provided. AutoCAD drawings shall not utilize yellow or any other colors that cannot be made readily visible when plotted out in color. When drawings are finalized the contractor shall certify the accuracy of the drawings by providing a stamped and signed hard copy of the drawings to the Watervliet Contracting Office **IAW CDRL A004**. If a special foundation (see note) is required and the vendor/contractor refuses to provide the detailed drawings required then this shall be grounds for disqualification from further consideration in the machine tool procurement.

- A.** At least one drawing shall depict an over-lay top view of the machine foundation outline, machine general arrangement drawing (including all ancillary equipment) and the anchor bolt hole pattern.
- B.** The foundation drawing(s) shall be provided as 100% complete and constructible. Provide all necessary information for bid and award of the foundation work by others. This information shall include, but is not limited to, complete foundation dimensions, rebar locations, rebar size, rebar pattern, concrete PSI requirements, and load bearing specs, etc. The submitted drawings and specifications are suggested to be stamped by a Professional Engineer registered to practice in the State of New York.

Typical floor thickness at Watervliet is 8 inches to 10 inches. A special foundation is one which exceeds thickness, load bearing capability and vibration isolation of Watervliet Arsenal's

standard monolithic concrete flooring of 1,000 pounds per square foot (psf) load rating and/or one which requires a specific thickness, uniquely shaped excavations for coolant housings, chip conveyors, electrical circuits and conductors, etc. The soil (substrate) for a foundation is assumed to be medium dense gravel or medium dense gravel /sand with a minimum bearing capacity of 4,000 psf. Although 4,000 psf is the assumed minimum bearing capacity, there may be variations depending on the exact location of the machine. The contractor shall contact the POC to ensure that the minimum psf and other requirements are accurate. If the contractor states no foundation is required and does not ensure the minimum psf in the area and the machine causes damage to floor and requires a foundation after initial installation is attempted, the contractor shall be responsible for all costs associated with floor repair, relocation of the machine, and reinstallation of the machine. Should the contractor disturb the soil below the yet to be constructed concrete foundation then the contractor shall compact the disturbed soil to achieve at least 2,000 psf bearing capacity. See instructions in section 8.5. Drawings shall be provided **IAW CDRL A004.**

**3.20.2. Machine and Equipment Floor Plan:** Machine and equipment floor plan AutoCAD drawings shall contain information that indicates the type, magnitude, and connection points of all plant utilities required to operate the machine. The plan view AutoCAD drawing shall depict the machine, foundations, feet/anchor locations, anchor requirements, grounding, all ancillary equipment, and all necessary clearance requirements for normal use and maintenance. This data shall be furnished with offeror's proposal **IAW CDRL A005. (One hardcopy and one AutoCAD electronic copy).**

**3.20.3. Catalog of Standard Tooling and Accessories:** If applicable, catalog shall be furnished at time of machine delivery. For offers of foreign built machine tools (i.e., machines built outside the United States, its possessions or Canada), the catalog shall set forth U.S. domestic sources of supply. **(Two hardcopies).**

**3.20.4. Non-Standard (Special) Tooling and Accessories:** To the extent that this specification requires the development of unique tooling and accessories not generally available commercially, a set of drawings and specifications to permit manufacture of such tooling and accessories shall be furnished at the time of machine delivery **IAW CDRL A016. (One hardcopy and one electronic copy).**

**3.20.5. Installation Instructions and Drawings:** Instructions outlining the requirements for installation of the equipment shall include a drawing containing the certified dimensioned locations of all equipment mounting/anchor holes from an agreed upon facility datum. These documents are to be furnished 60 days prior to scheduled delivery **IAW CDRL A006. (One hardcopy and one AutoCAD electronic copy).**

**3.20.6. Lubrication Diagram and Instructions:** To be delivered to the technical POC at time of machine delivery **IAW CDRL A007. (One hardcopy and one AutoCAD electronic copy).**

**3.20.7. Operating Instructions:** These instructions shall be provided in separate manuals from other technical data provided. To be delivered upon machine delivery **IAW CDRL A008. (Three hardcopies and one electronic copy).**

**3.20.8. Maintenance and Troubleshooting Instructions:** To be supplied for all machine and control systems. These instructions shall include the machine's mechanical assembly and wiring drawings. To be delivered at time of machine delivery **IAW CDRL A009. (Two hard copies and two electronic copies).**

**3.20.9. Electronic and Hydraulic Schematics:** To be considered acceptable, these schematics shall clearly portray all "as built" electrical and hydraulic ties to their respective main systems. To be delivered at time of machine delivery. Wiring diagrams used to do the initial power hookup shall be included and furnished no later than 90 days after award **IAW CDRL A010. (One hardcopy and one electronic copy).**

**NOTE:** If, during installation and testing, the actual electrical and hydraulic systems are configured differently than depicted on the schematics, receipt of the revised "as built" schematics shall be a condition of final acceptance.

**3.20.10. Repair Parts Catalog:** This catalog shall encompass every replaceable part in the machine and shall include identification and original equipment manufacturer's part numbers and ordering data. Items which can normally be purchased locally may be so indicated provided they are sufficiently described. The repair parts catalog shall include illustrations which clearly locate parts within larger subassemblies. To be delivered at time of machine delivery **IAW CDRL A011. (Two hardcopies and one electronic copy).**

**3.20.11. Program Manuals:** Where a CNC machine is specified, programming manuals shall be supplied. These manuals shall include a clear summary of the control functions actually implemented and usable on the system specified. To be delivered at time of machine delivery **IAW CDRL A012. (One hardcopy and one electronic copy).**

**3.20.12. Software Documentation:** The offeror shall provide documentation of all system software and ladder logic developed to control and interface the control/drives with the machine tool. To be delivered 30 days after delivery of the machine **IAW CDRL A013. (One hardcopy and one electronic copy).** One copy of the system memory backup (S-Ram) shall be provided on a USB Type-A flash drive at startup of machine.

**3.21. Training Required:** The contractor shall be responsible for providing training of WVA personnel. The type and extent of training shall depend upon whether the machine specified is equipped with numerical control. All instructions and materials, oral or written, shall be in English. "On-Site" means "At Watervliet Arsenal" and "Off-Site" means "a location within the U.S. away from Watervliet Arsenal as determined and arranged for by the contractor." If specialized formal "off-site" training is available, specify on offer, availability and price as an option. The quality of the training shall be such that at the conclusion of the specified training time, each individual within their assigned category shall be capable of repairing or operating the machine to its productive capacity. Training shall be in accordance with the applicable areas of the schedule below. Training attendance, duration and execution shall be officially documented and submitted at the time of final acceptance by the manufacturer's trainer.

Type of training	Number of persons	When required	Training location
Machine operation	4	During or after machine performance testing	On site
Mechanical maintenance	2	During startup	On site
Hydraulic maintenance (if applicable)	2	During startup	On site
Electrical maintenance	2	During startup	On site
Electronics (CNC) maintenance	2	During Installation	On site
Spindle/Axes Drives (if applicable)	2	During Installation	On site
Programming training	2	During Installation	On site

**NOTE:** For all types of training, the associated technical data (see section 3.20) shall be on hand at the time of instruction and its use and interpretation shall be covered during the training.

**3.22. Repair/Replacement Parts and Service:** The offeror shall provide parts and service for the contracted equipment within 72 hours of notification of a problem. The offeror shall agree, as part of the contract, to store complete ordering data to include specifications, engineering drawings and other information for the contracted machine tools/parts. This data shall be stored within the U.S. or Canada and in detail to permit successful acquisition of the parts and associated repair service. The offeror shall supply a list of recommended spare machine parts as an option with the offer. Watervliet Arsenal recognizes that it may be difficult to fulfill this requirement for major machine components. If the requirement cannot be adhered to, the offeror shall notify Watervliet Arsenal's POC within two business days and shall provide a delivery schedule to be approved by Watervliet Arsenal's POC.

**3.23. Special Tools:** If any element of machine operation or maintenance requires the use of specially designed tools, these tools shall be provided with the machine and shall become the property of the Government.

**3.24. Site Conditions:** The machine covered by this specification shall be installed in a general machine shop space and there will be no environmental conditioning. Temperatures will range from 65°F to 95°F and relative humidity will range from 20% or less to 95%. On any given day, the temperature in the machine shop may change as much as 4°F per hour. These are the conditions under which the machine is expected to perform as specified, and the contractor shall be responsible for supplying what is required to meet the specified performance. The only permissible exception is positioning accuracy for numerically controlled machines. For this performance factor, allowances may be made for the effects of temperature fluctuation.

**3.25. Heat Exchange Equipment:** Heat exchange equipment shall be provided with the machine wherever it is needed to keep operating temperatures within design or specified limits. Any heat exchange equipment using water as the heat exchange medium shall be fully recirculating and shall not require the continuing input and discharge of Arsenal water supply. Wastewater systems of any type are not acceptable. Furthermore, it is the Arsenal's preference to avoid heat exchange equipment making use of the refrigeration cycle, and refrigeration systems of any kind are not acceptable unless design or specified temperature limits cannot be achieved without them. If a refrigeration system is absolutely necessary, the contractor shall ensure that it operates properly using a refrigerant having an ozone depletion potential of zero. The contractor shall be responsible for identifying and providing such a refrigerant and its material safety data sheet **IAW CDRL A014**.

**3.26. Elapsed Time Meter:** The machine shall be fitted with a meter to measure operating time of the spindle drive. The time totalizing meter shall be of the non-resetting type and shall have a range of 0 to 99,999 hours in increments of one hour; one-hour being the least significant digit. Upon reaching the maximum accumulative hours the meter readout shall automatically revert to zero and continue to totalize time. The meter shall be designed to prevent the entrance of dust and moisture and shall be mounted to withstand shock and vibration generated by the equipment. The meter shall be located as to be readily visible but not subject to abuse relative to the operating environment of the equipment. Time meters resident in the numerical control unit are unacceptable.

**3.27. Enclosures:** All new controller hardware shall be provided with new electrical enclosures. Enclosures located in explosive, high dust, paint or heavy industrial manufacturing environments shall be NEMA 4X rated. All other locations shall be NEMA-12 rated. In addition, if required, given shop environmental conditions as detailed in section 3.24, new control system enclosures for electronic circuitry shall be air conditioned and air filtered to maintain constant temperature, to reduce humidity and to prevent contamination of control boards and other critical system components. Air conditioning units shall not utilize Ozone Depleting substances. New enclosures shall be painted with a color as close to the painted color of the original machine tools as possible.

**3.28. Piping:** All pipe work performed by the contractor shall be to the specifications below:

- A.** All equipment piping shall be identified per ANSI/ASME A13.1 or equivalent.
- B.** Brazing filler metal shall conform to AWS A5.8/A5.8M, Type BAg-5 with AWS Type 3 flux, except Type BCuP-5 or BCuP-6 may be used for brazing copper-to-copper joints.
- C.** Welding work for new piping systems shall be in conformance with ASME B31.9. The welding work includes brazing procedures, brazers, brazing operators, and nondestructive examination personnel, maintenance of welding records, and examination methods for welds.
- D.** Pipe hangers, inserts and supports shall conform to MSS SP-58, MSS SP-69, and ASME B31.1, except as specified or indicated otherwise. Piping shall be adequately supported to eliminate sag and weak points and allowance for thermal expansion must be considered on long pipe runs.

- E. All piping, tubing and fittings shall be in strict accordance with manufacturer's requirements and recommendations to include industry standards and applicable codes (ANSI B16 and B31.3).
- F. Process piping shall be ASTM 312, 304 stainless steel, seamless.
- G. For pressures up to 150 psi, SCH 80, pipe shall be used where threaded connections are made. For pressures between 150 and 2000 psi, SCH 160 pipe shall be used where threaded connections are made.
- H. Joints in piping systems shall be listed as complying with ASME B31.3 to include the use of welded fittings. Gaskets and sealants shall also be listed as complying with ASME B31.3.
- I. Prior to acceptance and initial operation, all piping shall be inspected, and pressure and leak tested in accordance with ASME B31, Code for Pressure Piping, and Section 705 of the IFGC.

**3.29. Machine Control:** If a control system is supplied with the machine, it shall be of the CNC type and the requirements specified in sections 3.30.1 through 3.30.10 shall apply.

**3.29.1. Applicable Electronics Standards:** The CNC system shall adhere to the most current applicable revisions of the standards of the Electronics Industries Association (EIA).

**3.29.2. Input/Output Requirements:** The CNC shall be equipped with at least the following:

- A. A visual display having sufficient resolution to provide easily readable text of at least 80-columns and 20-rows. A color display shall be provided to provide contrast between different data types. If a monochrome display is required, it shall be subject to approval by the POC and an alternate means (inverse video, for example) shall be provided.
- B. An alpha-numeric keyboard for on-site program editing, operator input, MDI and other necessary communication. This keyboard shall be an open-key, tactile feedback type. The alpha characters shall be arranged in "QWERTY" format.
- C. A USB Type-A flash drive and USB Type-A port on the controller shall be provided. The drive shall provide formatted data capacity of at least 8 gigabytes and shall be the means of uploading to the CNC the system executive (operating system and machine-specific data) as well as part program files.
- D. The CNC offered in accordance with this specification shall have included in its design both the capability and cabinet space to permit the future installation of a remote data interface so that the control may be placed online to a remote host computer. Offerors must certify that the offered control could subsequently be equipped with any of the common interfaces covered by EIA RS-422.

**3.29.3. Control/Machine Interface:** It is required that the control/machine interface be of the solid-state type. Electromagnetic relays are not permissible.

**3.29.4. Operator's Console:** The CNC console shall house everything necessary for communicating with the control and operating the machine. This shall include at least the visual display, keyboard and USB Type-A drive specified in section 3.30.2, "A" through "C". An emergency stop button shall also be located on the console. The console shall be



machine-mounted or pendant-mounted. A floor-mounted console is unacceptable. A fixed-height machine-mounted console shall place the visual display at 66-72 inches above foot level at the operator's station. A pendant-mounted console shall be adjustable to place the visual display within this same height range.

**3.29.5. User Software Interface:** The control's operating system shall include a software interface providing a user-friendly environment within which operating, programming and maintenance personnel can interact with the control. "User-friendly" means that the interface shall employ on-screen menus or equivalent techniques to guide the user through the process of accessing control functions and entering or modifying data. Write access to system level data such as axis calibration tables shall be protected by user-selectable passwords.

**3.29.6. Control Functions and Capacities:** The CNC shall include at least the following functional capabilities and capacities whether standard or optional:

- A. Two-axis linear and circular interpolation. For machines of three or more axis, the plane of interpolation shall be switchable via program code.
- B. The ability to program, execute and display in both inch and metric modes. Inch/metric switching shall be possible by MDI as well as from a part program. All displayable numeric information shall reflect the selected format.
- C. Selectable absolute or incremental programming.
- D. Automatic maintenance of the commanded feed rate when slide velocity is a vector resulting from two or more axis of motion.
- E. Full floating point support for display and programming.
- F. System resolution of 0.0001 inch (English) and 0.001 mm (metric). Visual display format and command increments shall also exhibit this resolution.
- G. Dry run mode, which is the ability to execute a programmed tool path at an accelerated rate under non-cutting conditions.
- H. The ability to program a dwell of adjustable duration.
- I. Program and data editing at the machine. However, editing capability shall be protected by a user-selectable password.
- J. Zero shift (i.e., the capability to establish a program origin point which differs from the machine's home position anywhere along each axis).
- K. Provision for disabling the operator's ability to override programmed speeds at the machine.
- L. Data format for positioning and contouring shall be in accordance with the most recent revision of EIA Standard RS-274.
- M. A minimum of 4 GB of RAM shall be provided for the control system.

**3.29.7. Diagnostics Capabilities:** The CNC shall be equipped with diagnostic capabilities covering the control itself, the interface and the machine tool. As a minimum, diagnostic capability shall include the display of a message or other meaningful indicator to identify any fault which causes the machine to be inoperable. This includes electrical/electronic faults and any mechanical faults which result in operation of a safety interlock.

**3.29.8. Crash Protection:** The machine and control shall be equipped with means to sense and react to abnormal power draw at the spindle. Abnormal power draw shall be a variable

assignable by the programmer on a tool-by-tool basis. A bi-level system employing two variables per tool is preferred, the first level being a warning threshold which shall display a warning and initiate feedhold upon completion of the current machining pass and the second level being an absolute threshold which shall initiate immediate feedhold. If the bi-level system is not available, a system employing at least the absolute thresholds is mandatory.

**3.29.9. Temperature Control:** The control shall be equipped with means to maintain electronic circuitry and devices at temperatures well within operating limits. The temperature control system shall also provide stability such that temperatures are maintained within 10°F of shop ambient temperature. Ambient temperature in the shop will range from a low of 65°F to a high of 95°F. It is preferred that temperature control be achieved without the use of refrigeration. In the event that a refrigeration system is absolutely essential, it shall operate normally using a refrigerant having an ozone depletion potential of zero.

The machine enclosure shall be equipped with means to maintain internal cavity of the enclosure at temperatures well within operating limits. The temperature control system shall also provide stability such that temperatures are maintained within +/-10°F of 75°F.

**3.29.10. Power Supply Conditioning:** The AC feed to the control's DC power supply shall incorporate transient suppression. The suppression network shall have a transient response time not greater than 6 nanoseconds and a peak ampacity of 20,000 or more.

#### **4. Machine Installation and Startup:**

##### **4.1. Work Performed by Watervliet Arsenal:**

**4.1.1. Site Designation:** Upon receipt of the required installation and foundation drawings (see section 3.20), Watervliet Arsenal will designate an installation site and outline a general machine location on the shop floor. Watervliet Arsenal will not perform any floor work or other work related to the machine except for ensuring the area where the machine will be installed is cleared.

**4.1.2. Utilities:** Once the machine is installed, positioned and rough leveled by the contractor or their designated rigging crew, Watervliet personnel will run utilities to a single point of first connection for electrical and a single point of first connection for compressed air. Watervliet must be provided with sufficient time to accomplish these connections. Sufficient time may be up to three working days depending on Watervliet personnel availability. However, if the installation instructions supplied by the contractor are incomplete or insufficiently detailed, installation work will stop and the contractor shall be required to dispatch a service engineer. Installation shall resume upon their arrival and continue under their guidance.

**NOTE:** If installation instructions, electrical and hydraulic schematics are not delivered at or before the times specified (see section 3.20), the Government reserves the right to forestall delivery and/or final acceptance testing of the machine by an amount of time equal to the delay in receipt of instructions, drawings or schematics.

**4.2. Work Performed by the Contractor:** This project is classified as a “turn-key” system with the contractor being responsible for all costs and work associated with the installation unless otherwise stated. The contractor shall be solely responsible for all costs associated with skidding and shipment, rigging, and installation at WVA. Contractor personnel shall adhere to the WVA requirements to utilize OSHA approved PPE including non-tinted safety glasses with side shields, safety shoes, and to refrain from wearing loose clothing (i.e. “hoodies”) and jewelry while in the manufacturing shop areas. The contractor shall ensure they bring all equipment/material necessary for the installation of the machine. The contractor shall remove from WVA and dispose of all wastes (other than hazardous wastes) generated from uncrating, unpacking, and installing the machine at a permitted off-post disposal facility, in accordance with Attachment D of this specification and the document “WATERVLIET ARSENAL INFORMATION FOR CONTRACTORS” which is available on the Watervliet Arsenal website (<https://wva.army.mil>). All labor for the installation of material and equipment furnished under this Contract shall be done by experienced personnel. All workmanship shall be up to commercial standards and in compliance with the specific requirements of the Scope, Drawings and Specifications. If any of the contractor’s services do not conform to the contract requirements, the Government may require the contractor to perform the services again in conformity with the contract requirements at no additional cost. The contractor shall be responsible for the professional quality, technical accuracy, and the coordination of all construction and other services furnished under this contract. Contractor shall, without additional compensation, correct or revise any errors or deficiencies in its construction and other services.

**4.2.1. Site Preparation:** Once an installation site is identified by Watervliet personnel and if required, a foundation is constructed, the contractor or their designated third party shall layout the machine. Please note that much of the Watervliet Arsenal’s shop floor is covered with 2.5” thick wood block. The contractor is responsible for the removal of wood block flooring and existing concrete preparation. Contractor shall also be responsible for securing wood block flooring and install any leveling pads necessary for installation. This shall include providing and placing metal blocks to act as a spacer where the floor was removed to prevent the machine from sitting on the concrete below the wood block flooring.

**4.2.2. Site Visit:** A site visit to the Watervliet Arsenal is highly encouraged. The purpose of the visit is to observe the process of how the machine is currently used at the Arsenal, enabling the machine to be constructed with the process in mind. It shall also allow the contractor to see the location of the machine and determine how to rig it into place.

**4.2.3. Rigging:** Contractor personnel shall arrange for rigging services to off load the machine and contractor personnel shall be on site at Watervliet when the machine arrives and is off loaded to supervise the placement of the machine on the installation site by the rigging service. Outside rigging services should be advised that only certified grade 8 chains are permitted to be used at the Arsenal and that all rigging slings must be tagged and certified for the weights being lifted. Only propane powered forklifts are permitted and forklifts must also be equipped with a roll cage. Operators of forklifts shall have and be able to produce valid forklift licenses. The contractor shall ensure they bring all equipment/material necessary for the rigging of the machine. If necessary, the Watervliet Arsenal can provide the contractor with information for local rigging companies. Any crane truck or lifting equipment used for the installation works

shall be inspected and certified as required by applicable regulations. Ensure full compliance with OSHA (CFR 1926) regulations as applicable as well as any other applicable local and Federal Code.

**4.2.4. Installation:** Once the machine is positioned and rough leveled by the contractor, the contractor, through his own service personnel, shall be fully responsible for the startup and testing of the machine, conduct any acceptance tests specified and perform the required onsite training. The contractor shall provide competent English speaking service personnel to install the machine, rough and finish level the machine, startup, and conduct the acceptance tests. The contractor and the service personnel shall remain until the machine activation and testing have been successfully completed. Under no circumstances should the contractor plan on gratuitous Arsenal assistance for diagnosis, troubleshooting or repair of the equipment during activation and testing. If the contractor chooses to request Arsenal assistance in lieu of providing their own resources, the request will be reviewed by the Technical POC who shall reserve the right to impose a charge for the assistance. Approvals, even on a charge basis, should not be taken for granted since there is no guarantee that appropriate Arsenal personnel will be readily available. In such cases, the Arsenal will not be held responsible for delays in acceptance of the equipment resulting from non-availability of Arsenal personnel or Arsenal furnished equipment. If the contractor requests Watervliet Arsenal to ship miscellaneous material via UPS, FedEx or by other similar carrier, then the contractor shall provide their carrier account number for this purpose.

**NOTE:** Under normal circumstances the contractor will be allowed to work if it is desired during normal workdays. Contractor work outside Watervliet's normal workdays cannot be guaranteed. Watervliet is on a condensed work schedule. Normal work hours/days for this schedule are four 9-hour workdays, Monday through Thursday with Friday off one week and four 9-hour days (Monday through Thursday), one 8-hour day (Friday) the following week. Contractor work on the Friday off and weekends cannot be guaranteed. Contractors classified as foreign nationals may further restrict work hours and days available.

**4.3. Project Safety:** Throughout the duration of the project, all contractors must maintain a safe working environment for both the contractors and WVA personnel. This shall include, but not limited to, sections 4.3.1 and 4.3.2.

**4.3.1. Safety Fencing:** If applicable, the contractor shall provide temporary safety fencing around the work area within five (5) business days of work beginning at the Arsenal. The contractor shall maintain the safety fencing for the duration of the contract work and remove the safety fencing within five (5) business days of Government acceptance of the completed work. The type of safety fencing used (barrier, mesh and pole, etc.) shall be subject to approval by the POC. Signage shall be posted notifying all personnel that no foot traffic is allowed.

**4.3.2. Safety Systems:** Protect the integrity of all installed safety systems or personnel safety devices. Obtain prior approval from the Contracting Officer if entrance into systems serving safety devices is required. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish contract requirements, provide alternative means of

protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

**4.4. Denial of Entry:** The equipment purchased in this specification shall be installed on a secure military base. As such, all visitors to the base shall be subject to denial of entry. This applies to riggers, technicians, trainers, company employees, and anyone else who would need to come on site. If this person is not a citizen of the United States of America (foreign national), they will be denied access without obtaining prior approval. If a foreign national must be sent to work on this equipment, a request shall be made to the POC at least 30 days in advance.

## **5. Machine Specification Requirements:**

**5.1 Machine Tool Description:** The machine tool covered by this specification shall be an industrial standard CNC controlled two axis machine capable of cutting internal splines on long tubular sections with an electrochemical process. The spline cutting process requires low voltage at high current at the tool to initiate a chemical reaction between the workpiece and the tooling. The gap between the workpiece and tooling must have a flow of electrolyte. The electrolyte is an aqueous salt mixture consisting of either sodium chloride or sodium nitrate and deionized water. The machine, ways, ancillary equipment and plumbing must be protected from contact of/or resistant to saltwater. The cutting head will require accurate axial and rotational positioning, transmission of low voltage at high current and electrolyte. A cylindrical copper bus bar shall be used to translate and rotate the cutting head via a rotary union. The busbar shall be sized to fit within the internal diameter of the workpiece, insulated to prevent contact with the machine, and workpiece and long enough to meet the travel requirements specified in section 5.2.1. Delivery of the electrolyte shall be through the center of the busbar.

### **5.2 Required Characteristics:**

#### **5.2.1 Machine Capacity:**

Specification	Value
a. Workpiece length maximum	40 feet
b. The maximum tool process depth (with tool supports)	40 feet
c. Rated tool process diameter	5 in
d. Workpiece outside diameter (minimum)	8 inches
e. Workpiece outside diameter (maximum)	14 inches
f. Maximum workpiece weight (with workpiece supports)	5 tons
g. Tool feed rate (minimum)	0.1 in/min
h. Tool feed rate (maximum)	75 in/min
i. Tool traverse rate (maximum)	150 in/min

**5.3 Machine Enclosure:** The region of the machine outside the work zone will be enclosed to prevent electrolyte vapor or spray from settling on those components. Access doors are to be provided for routine maintenance. The doors or covers shall be removable for major repair without disassembly of any wiring or plumbing. The part shall be loaded onto the machine with

use of an overhead crane and design provisions must accommodate load. The enclosure shall have safety interlocks to prevent personnel from contacting the workpiece and/or tooling during automatic operation.

#### **5.4 Alignment and Accuracy Characteristics:**

<b>5.4.1 Drive Spindle Runout</b>	.0003 inches TIR
<b>5.4.2 Carriage Misalignment with Longitudinal Bedways</b>	
(A) Vertical	.0006 inches Per Foot
(B) Horizontal	.0006 inches Per Foot
<b>5.4.3 Misalignment of Carriage and Spindle Centerlines</b>	.002 inches Per 6 Feet
	NTE .004 inches
<b>5.4.4 Drive Spindle Centerline Misalignment with</b>	
5.4.4.1 Longitudinal Bedways	.0006 inches Per Foot
5.4.4.2 Flatness and Parallelism of Bedways	.0004 inches Per Foot
5.4.4.3 Cylindrical Busbar rest centerline	.0015 inches
5.4.4.4 Steady Rest centerline	.0015 inches
5.4.4.5 Alignment and accuracy is required over the carriage travel distance.	
<b>5.4.5 Leveling of slideways:</b>	
5.4.5.1 Longitudinal	.001 inches/39 inches
5.4.5.2 Transversal	.0015 inches/39 inches
5.4.5.3 Straightness of Bed	.002 inches
5.4.5.4 Finish on All Ways	16 Microinches

**5.5 Positioning Accuracy and Repeatability:** The machine shall be operated under CNC control and laser tested for positioning accuracy. Positioning accuracy shall be tested at intervals specified by Watervliet machine inspectors. Before correction, directional readings will be supplied along with the corrected. The following tolerances shall apply:

5.5.1 Carriage Longitudinal Positioning	+.0003 inches in any 12 inches
5.5.2 Max. Carriage Longitudinal Positioning	.003 inches
5.5.3 Carriage Positioning Repeatability	+/- .0003 inches
5.5.4 Drive Spindle Positioning	±7.5 ARC seconds
5.5.5 Drive Spindle Repeatability	±3 ARC Seconds
5.5.6 Drive Spindle Resolution	.001 Deg.

5.5.7 HEIDENHAIN or equivalent linear and angular encoders shall be used for positioning and rotational accuracy. Scales shall be positioned in a manner to protect the scale and read head from containments particularly saltwater electrolyte. Placement under the way is permissible.

#### **5.6 Axis:**

##### **5.6.1 Rotational Axis Characteristics:**

5.6.1.1 Drive spindle shall allow for passage of electrolyte plumbing.

**5.6.1.2** The rotational axis shall be capable of synchronizing rotational motion with axial feed of the Longitudinal Z axis.

**5.6.2 Longitudinal Z-axis Characteristics:**

**5.6.2.1** Supports shall be provided to prevent copper bar from deflecting 0.001 inches per foot.

**5.6.2.2** Linear feed shall be driven with a ball screw or rack and pinion.

**5.6.2.2.1** In the event of a rack system, a helical rack heat treated with ground teeth shall be used.

**5.6.3 Axis Seals:** All mechanical & electrical components that constitute axis drive(s) including but not limited to slides, rails, motors, shall be protected from contact with the working fluid, either direct contact, spray, vapor, or other contaminants.

**5.7 Environmental Control:** The internal cavity of the enclosure shall be temperature controlled to 65-85°F.

**5.8 Center Busbar:** The cylindrical busbar acts as an electrical conductor, electrolyte conduit and positioner of the tooling.

**5.8.1** The ECM rifling tooling head will require 9-24 volts at a maximum of 10,000 amps. The busbar shall be sized to have a maximum temperature rise of 85°F at full load.

**5.8.2** Flow through electrolyte is at a nominal 40 GPM at 150 to 300 PSI at 70-80°F. The busbar shall not have an outside diameter less than 4.5 inches with an internal diameter of 2 inches.

**5.8.2.1** The cylindrical busbar material shall be made from C11000 copper. Alternate materials will be considered however the material must have an electrical conductivity equal to C11000.

**5.8.3** Segmented sections can be used to achieve the travel length specified in section 5.2.1. The connections between the busbar shall be watertight and permit electrical conduction with a loss of no less than 0.01 ohms.

**5.8.3.1** Staubli connectors similar to Double Plug DS74-F AG in Appendix E is permissible to connect the busbar sections.

**5.8.4** The busbar shall translate the length of the workpiece and rotate per the specifications in section 5.2.1.

**5.8.5** The busbar shall terminate at the tooling end with a connection per the drawing in attachment E.

**5.8.6 Cylindrical busbar insulation:** The insulation shall prevent electrical contact between the busbar and workpiece.

**5.8.6.1** Material selection shall have sufficient wear resistance to prevent galling or damage to the insulation.

**5.8.6.2** The diameter of the insulation shall be sufficient to provide electrical insulation and fit within the internal diameter of the workpiece with no less than 0.005 inch clearance.

## **5.9 Steady Rests:**

**5.9.1** Steady rests shall be used to support the workpiece. The rest shall be designed to permit top loading of the workpiece. The steady rest shall have at least three roller bearing jaws adjustable for the capacity specified. The jaws shall be manually adjusted by screws and be capable of being locked in the set position. The rest shall be capable to support a workpiece diameter size of 6 inches to 20 inches. The rests shall not be fixed in a single position. The rests shall be capable of moving to any axial position along the workpiece support/fixed partition of the machine.

**5.9.1.1** Steady rests shall be electrical isolated from the workpiece.

**5.9.2** The copper bus bar shall be supported with an electrically insulated rest to prevent deflection. Rests should be capable of moving with the carriage to provide continuous support and allow for full carriage travel and bar rotation.

## **5.10 Additional Characteristics:**

**5.10.1** Program adjustable machine “home” positions.

**5.10.2** Cable and hose management to allow for one 2 inches hose to connect to the carriage and travel the lengths specified in section 5.2.1.

**5.10.3** The cutting head electrolyte exit port will use a chemical resistant hose with a minimum diameter of 2 inches not to exceed 3 inches.

**5.10.4** A driven hose reel assembly shall spool the hose and allow for full positive and negative travel of the cutting head.

**5.10.5** The reel shall be of sufficient size to hold a minimum 2-inch diameter chemical resistant hose with sufficient length to permit full travel of the cutting head.

**5.10.6** The reel rotation shall be synchronized with the feed rate of the cutting head. Spring actuated hose reels are not permitted.

**5.10.7** The hose length shall permit the full travel of the cutting head. The hose shall



terminate at a rotary union located on the cutting head. The rotary union shall be resistant to saltwater.

### **5.11 Alignment:**

**5.11.1** The machine shall have a system, device or method to align the workpiece to the tooling. A center line laser with a minimum of 2 targets to align the workpiece to the center line of the machine is permissible. A machine center on each end of the workpiece is permissible just as long as it does not interfere with the operation of the tooling.

**5.11.2** The unit shall be installed on a mounting fixture which shall be connected to the end of the cylindrical busbar so that the laser unit can be introduced into the bore of the workpiece for measurements before and after the process. The following measurements shall be made available: barrel bore diameter and circularity in continuous mode or in step mode, and helical pitch and spline depth.

- Laser wavelength 670nm, power 1 mW having 15 mm depth measuring range.
- 1 Bluetooth transmitter and receiver units
- 1 Battery power supply for the laser and the Bluetooth transmitter
- Bluetooth receiver mount installed on the machine frame in proximity to the end of the workpiece.
- Software and hardware to collect measurement results to be displayed on machine console.

### **5.12 Pumping skid:**

**5.12.1** Electrolyte flow to the cutting head shall be pressure regulated to within +/- 2 PSI, over a working range of 50 ~ 300 PSI. Note: The pressure sensing point shall be downstream of the filter and shall utilize a high-quality pressure sensor that is isolated from the electrolyte with a diaphragm. The sensor should exhibit no more than 1% drift/year, the sensor should be shock resistant, and mounted in an area that is vibration free. The sensor should be accurate to within +/- 2 %, and repeatable to within +/- 1%

**5.12.2** The expected electrolyte flow through the cutting head is 40 GPM, with a minimum expected flow of approximately 10 GPM. The working range is 50 ~ 300 PSI with a flow rate of up to 90 GPM.

**5.12.3** A multi-stage centrifugal pump that can produce 50 ~ 300 PSI. The flow must be smooth and not pulsate. Depending on minimum flow requirements of the pump, an appropriately sized bypass line may need to be installed to assure minimum pump flow requirements are met.

**5.12.4** The electrolyte shall be drawn from the clean reservoir, filtered to 10 micron or better, and delivered to the cutting head. This filter shall consist of two high quality wedgewire filter designs that can be automatically back flushed. This filter provides clean process electrolyte to the cutting zone. Pressure sensors on either side of the filter canister shall be used to measure the pressure differential across the filter. Note: Feedback from the “control” pressure

sensor is allowed. The control system will continually monitor the filter backpressure and provide a signal to back flush. The machine control will then automatically back flush the filter when a window exists in the machining cycle (such as during tool length measurement). Note: A single differential pressure sensor across the filter is NOT allowed.

**5.12.5** Coolant temperature control system to maintain bulk electrolyte temperature within +/- 5 degrees of 60 degrees F from a maximum process output of 90F. Coolant temperature shall be adjustable to on a range of 60-75F.

### **5.13 Electrical Connections:**

The electrochemical process requires the workpiece to be connected to the positive terminal of the rectifier and for the tool to be connected to the negative terminal of the rectifier.

**5.13.1** The workpiece electrical connections shall:

**5.13.1.1** Have a minimum of 4 connections. The connections shall encompass the full diameter of the workpiece. A drawing of the workpiece is available upon request.

**5.13.1.2** The spacing of the workpiece connections shall be spaced 72" from center to center and 36" from the start of the workpiece.

**5.13.1.3** The anode/workpiece connection shall be of a clamping style to permit the loading and unloading of the workpiece. The clamp shall provide sufficient force to ensure a uniform electrical conduction around the surface.

**5.13.1.3.1** The clamp shall not deform the workpiece in any manner including surface defects and structural diameter changes.

**5.13.1.3.2** Split clam shell with hydraulic or electromechanical connections are permitted.

**5.13.1.3.3** Operation of the clamps shall be controlled through the HMI and at the clamp location. Indication of a closed condition under a certain clamping load or electrical resistance shall be provided to the operator either through the HMI or indicator light on the anode connection.

**5.13.1.3.4** Operation of the anode clamp shall also be activated or deactivated in manual mode at the connection and the HMI.

**5.13.1.3.5** Operation of the process in automatic mode or the rectifiers shall not be permitted if the clamps are open.

**5.13.1.3.6** The operator shall have the ability to enable or disable a workpiece clamp to allow for short length workpieces. In this case the operator shall be able to position the steady rests to support the shorter length tube and enable only the electrical

connections needed for the size of the workpiece.

**5.13.2** The tool electrical connection: The tool shall connect to the negative terminal of the rectifier. The tool will rotate and travel per the requirements specified in section 5.2.1. The electrical connections shall permit greater than 360 degrees rotation. Cable connection to the carriage and the rectifier is permitted only if the cables are sized to conduct the full load of the rectifier without damage to the cable insulation.

#### **5.14 Filtration:**

**5.14.1** Machined debris must be removed from the system in a manner that is cost effective and minimizes operator oversight. It is desirable to have a system that would require emptying no more than every 40 hours of runtime based on CNC/PLC run time specified in 3.27.

**5.14.2** The material resembles grinding swarf and does have some “fine” particles that will not easily fall out of solution. Key attributes include a minimum of operator time required to perform task, minimum of machine downtime to perform cleaning functions, minimum volume of entrained fluid, and method of debris removal from system. – do we want to specify key components.

**5.14.3** Flocculation – The post machined debris can be flocked and removed with a clarifier and/or centrifuge. Emulsion flocculants are not permissible and shall not be used in the system. Suez Inc. AD1502 flocculent or equivalent is recommended should flocculation be required. This type of flocculent shall be injected neat at a rate range (0.1 - 1.0 ml/L) or similar prior to the clarifier but after machining.

**5.14.4** Consultation with the US Army DEVCOM AC technical POC is encouraged.

**5.14.5** The intended function of the ECM system is to reuse the electrolyte throughout the machining process. The system shall remove the post machined debris from the electrolyte through mechanical means in a manner to immediately return the electrolyte to the storage tank for reuse. Storage of a single volume of electrolyte for the entire duration of the machining process is not permitted.

**5.14.5.1** Permitted methods of mechanical removal are not limited to setting via clarifier and solid liquid separation per decanter centrifuge using a high-speed and continual rotational process.

**5.14.6** Filtration system shall permit the flow of the process electrolyte per section 5.12.

**5.14.7** Filtration system shall have the ability to bypass the tool for extended cleaning of the electrolyte.

#### **5.15 Plumbing:**

**5.15.1** Plumbing materials, fittings and joining methods must be compatible with the requirements of section 5.12.

**5.15.2** The plumbing system must have the ability to remove the electrolyte from the tooling, cylindrical busbar and hose to permit the removal of the tooling and workpiece without the loss of electrolyte. Air purge is permitted.

**5.15.3** Operation of the directional valves shall be automatic to permit actuation at the HMI. The operator shall have the ability to select the electrolyte flow direction, bypass of the tooling, flow through the tooling, and purge the system without leaving the HMI.

## **5.16 Rectifiers:**

**5.16.1** The rectifier shall be designed to operate from 60 Hz, 480VAC 3 phase electrical power. The rectifier shall also provide all power at required voltages necessary for proper operation of the machine, with appropriately sized circuit protection.

**5.16.2** The rectifier shall be designed for continuous operation at full rated power.

**5.16.3** The rectifier shall have a power factor correction to within 90% of unity over entire operating range.

**5.16.4** The DC power output of the rectifier shall be regulated to the tolerances specified provided the incoming voltage is maintained within 480VAC +/- 15%.

**5.16.5** Rectifier current shall be rated at 10,000 amps between 9 ~ 24 volts.

**5.16.6** Rectifier voltage shall be part program configurable and controllable and have a maximum system response time interval less than 20 ms.

**5.16.7** Current control limits shall be part program configurable and controllable and have a maximum system response time interval less than 20 ms.

**5.16.8** Current control limits shall regulate the maximum current output of the rectifier from 50 – 10000 amps in one amp increments. Accuracy & repeatability shall be better than 0.2 amps or 1% of setting, whichever is greater, over entire range.

**5.16.9** All items read from the part program on a single line must be implemented simultaneously (within ladder scan and transfer rate), including rectifier control items.

**5.16.10** Rectifier shall be air-cooled.

**5.16.11** Rectifier shall have short circuit protection.

**5.16.12** Rectifier output ripple shall be no more than 1% RMS of maximum rated output voltage.

**5.16.13** Rectifier shall be constructed to conform to NEMA 12 standards.

**5.16.14** A two-alarm over temperature indicator and automatic shutdown of rectifier and ECM equipment shall be provided. The first alarm will provide a warning on the operator control panel. The second alarm will shut down the rectifier (and machine) before permanent damage occurs.

**5.16.15** Should there be a rectifier failure for whatever reason, the rectifier shall initiate a “feed hold” with notification of fault to operator. Operation of rectifier shall be prevented until fault is corrected.

**5.16.16** The machine control logic shall be thorough to prevent rectifier operation if voltage & current limits are not provided and inaccurate parameters are encountered. The machine display shall indicate missing parameters and prevent operation.

**5.16.17** The machine shall incorporate a safety circuit to prevent rectifier operation when the operator has access to the work zone. If the circuit should fail, the rectifier shall be rendered inoperable until the circuit is repaired. The circuit fail mode shall be “normally open” or “door open”, thereby preventing rectifier and machine operation.

**5.16.18** For process control, the rectifier shall be made inoperable if the electrolyte is not at the minimum specified pressure level and/or flow rate.

**5.16.19** All electrical connections to the cylindrical busbar must permit rotation and linear translation of the cutting head. This can be achieved through the use of stranded cabling, stranded braided connections and/or rotary unions sized to the voltage and current requirements of the process.

**5.16.20** Electrical conductors from the rectifier to the cylindrical busbar shall be covered to prevent personal contact. The guarding shall permit access for maintenance and visual inspection.

**5.16.21** Rectifiers shall be sized to provide 0-24 volts at a minimum of one (1) amp to a maximum of 10000 amps.

**5.16.21.1** Multiple smaller units can be ganged in parallel to achieve current requirements at the specified voltage. For example: five (5) 0-24 volt 2000 amp rectifier modules can be connected in parallel to meet the total requirement of 10000amps. Current requirement can be exceeded to meet even number multiples of rectifier units. The government will consider a reduction in total current requirements to meet even number units in parallel.

**5.16.21.2** Multiple units shall operate in a master/slave configuration. One controller shall be used to operate all units.

**5.16.22** The rectifier controller shall be compatible with the control logic and/or

communication bus of the machine controller. A separate stand-alone control system is not permissible. The machine operator must be able to program or set the values of the rectifier and start/stop the rectifier, through the HMI and through the part program.

**5.16.23** Special attention is required to ensure the machine base, ancillary equipment, guarding, steady rests, and busbar supports are electrically insulated from the rectifier and electrical busbar system. Specific to electrical connections, all Arc-Flash protocols per NEC codes shall be implemented.

### **5.17 Electrolyte Handling:**

**5.17.1** The cutting process requires an aqueous saltwater solution as the working fluid. The electrolyte provides electrical conductivity and the mass transport of ions to the electrodes results in the transmission of current. The condition of the electrolyte will ensure the consistency of the ECM operation. Electrolyte is recirculated through the process via a closed loop. The ECM system must have a storage tank, filtration method to remove post ECM solids, ability to monitor and control in real-time the electrolyte temperature, conductivity and pH. Requirements of each area are provided in more detail below.

#### **5.17.2 Electrolyte Storage:**

**5.17.2.1** Electrolyte storage must have a minimum of 1000 gallons in a closed top tank.

**5.17.2.1.1** The tank top shall be removable to permit inspection and cleaning of the internal surface.

**5.17.2.2** The tank shall be fabricated from a 316 stainless steel.

**5.17.2.3** The tank level shall be monitored and displayed at the operator control panel and at the tank.

**5.17.2.4** The tank material shall be compatible with saltwater solutions of 20%.

**5.17.2.5** The tank shall have a secondary containment sufficient to hold 110% of the tank contents. This can be achieved with a trough around the machine sufficient in size to hold 110% of the system capacity.

**5.17.2.6** Makeup electrolyte and pH control shall be stored in additional tanks with spill containment.

#### **5.17.3 Electrolyte Status:**

**5.17.3.1** The system shall have the ability to monitor the pH and conductivity of the electrolyte. The data shall be displayed on the HMI.

**5.17.3.2** The system shall provide a warning to the operator if the level exceeds 10% of the process set point.

**5.17.3.3** The system shall have the ability to control the pH and conductivity in real-time. This requirement can be achieved through the injection of concentrated saltwater, and pH buffering solutions. The pH shall be controlled to the range of 8-10 and the conductivity shall be controlled to a range of 130-145 millisiemens.

**5.17.3.4** The operating conditions of the system shall be operated in automatic and manual modes and displayed on the operator console.

**5.17.3.5** The electrolyte shall be free of contaminants such as, but not limited to: oils, coolant, debris, etc.

## **6. Requirements for Demonstration of Conformance:**

**6.1 Certification, Drawing and Test Required:** The contractor shall demonstrate the machine's conformance to all requirements elsewhere specified in sections 3, 4, and 5 of this specification. The contractor shall also, as a minimum, provide the following certification and perform the following specific tests:

**6.1.1 Certification of Completeness:** The contractor shall provide written certification that the machine is complete, including all specified systems, accessories, markings, safety devices, geometric and accuracy requirements. The certifications shall be provided to the Technical POC 14 days prior to the scheduled preliminary testing IAW CDRL A014.

**6.1.2 Test of Conformance to Specified Characteristics:** The machine shall be dry cycled at least 30 minutes, during which time the machine shall be tested for conformance to specified performance characteristics, including but not limited to, feeds, speeds and manual as well as automatic operations.

**6.1.3 Test of Conformance to Specified Alignments and Accuracies:** The machine shall be tested for conformance to the alignments and accuracies listed below. The contractor shall supply all materials and labor needed to demonstrate conformance. 3 (three) Bi-directional laser tests shall be in accordance with ISO 230-2. A certified factory inspection report shall be provided to the Arsenal 14 days prior to the scheduled preliminary testing. As part of the final acceptance testing, the contractor shall, on all applicable axes perform laser positioning and repeatability testing and develop and enter into the control optimal bi-directional axes compensation values. Also, the contractor shall provide the laser equipment and labor for this testing for preliminary and final acceptance testing. For future reference a hardcopy and electronic copy of the final compensation values/tables for each axis shall be provided as part of the final technical documentation provided with the machine.

**6.1.4 Test of Conformance to Specified Horsepower Characteristics:** At the discretion of the WVA POC, the machine shall be tested for power and rigidity. The vendor shall

provide a proposed test part of their choosing for this test. The test shall pull full load spindle horsepower for a minimum of three minutes. The machine capability and machine rigidity will be evaluated.

**6.1.5 Test of Conformance to Specified Performance:** The machine shall be tested for the performance characteristics specified in Section 5 by successfully completing the following performance and accuracy tests without interruption due to machine or control malfunction. A preliminary dry cycling period not in excess of sixty minutes may precede the testing. In a sequence to be selected by the contractor, the following functions shall be demonstrated.

**6.1.6 Pre-Acceptance System Test:** A demonstration of all machine functions shall be performed at the vendor facility. The demonstration shall confirm the use of corrosion resistant materials for all surfaces that will come in contact with the electrolyte.

**6.1.6.1** The vendor shall demonstrate the pumping skid will achieve the requirements of Section 5.12.

**6.1.6.2** The vendor shall demonstrate the rectifiers can achieve the voltage and current specified in Section 5.

**6.1.6.3** The vendor shall demonstrate the laser alignment ability to align the workpiece to the centerline of the machine.

**6.1.6.4** The vendor shall demonstrate the workpiece electrical clamp and show the electrical resistance of each workpiece connection.

**6.1.6.5** The vendor shall demonstrate the z-axis shall traverse the full-length of travel inside the workpiece.

**6.1.7 Final System Test:** A demonstration of all machine functions shall be conducted after installation at the end user facility.

## **6.2 Provision of Materials/Equipment for Preliminary/Final Acceptance Testing:**

**6.2.1 Workpieces:** All workpieces to be tested as required in section 6 shall be provided by the Watervliet Arsenal.

**6.2.2 Tooling:** All tools (perishable, non-perishable, & special) required to perform the tests specified in Section 6 shall be furnished by the contractor and shall become the property of the Arsenal.

**6.2.3 Hydraulic Fluids and Lubricants:** All fluids and lubricants necessary to perform all required tests shall be furnished by the contractor during preliminary acceptance testing and final acceptance testing. A list of acceptable fluids and lubricants is located in Attachment A. If the equipment needs to use a fluid or lubricant not listed in Attachment A, a justification shall be



provided.

**6.2.3.1** Pressure testing and flow of electrolyte handling equipment may use city water in place of electrolyte.

**6.2.4 Testing and Measuring Equipment:** All testing and measuring equipment, including fixtures, required to perform all the required tests and measurements shall be furnished by the contractor and shall be calibrated to standards traceable to the National Institute of Standards and Technology (NIST).

NOTE: The only thing that shall be provided to the contractor to enable the machine to perform both preliminary and final acceptance inspections are workpieces. Everything else shall be provided by the contractor.

## **7. Quality Assurance Provisions:**

**7.1. Responsibility for Inspection:** The contractor shall be responsible for performing all certifications and tests required in Section 6 and shall provide materials, supplies and equipment specified.

**7.2. Preliminary Acceptance Inspection:** Preliminary acceptance inspection shall occur at the contractor's facility prior to machine shipment to WVA and shall consist of the certifications and tests specified in Section 6. However prior to officially scheduling the preliminary acceptance inspection, the contractor shall perform preliminary machine geometry alignments and laser accuracy tests. When these tests are completed successfully, the contractor shall provide no less than 14 calendar day's notice to the Contracting Officer that the machine is ready for the preliminary acceptance inspection. This notification shall also include for review the test results of all preliminary tests performed. If test results are acceptable, the Arsenal representatives will schedule a factory acceptance and the contractor shall await the arrival of the Arsenal representatives before starting the official acceptance.

### **7.3. Arsenal Participation in Preliminary and Final Acceptance Inspection:**

**7.3.1. Examination for Completeness:** The contractor shall furnish the Arsenal's representatives with a certification of completeness. The Arsenal's representatives will reserve the right to examine the machine to ascertain the presence of all specified features, equipment, markings and safety devices.

**7.3.2. Examination of Performance Characteristics:** During the test of conformance to specified performance characteristics, the Arsenal's representatives will observe the machine and its equipment for proper operation.

**7.3.3. Examination of Power and Rigidity:** During the test of conformance to specified power and rigidity (see Section 6) the Arsenal's representatives will observe the machine for rigidity of construction and achievement of full power for the specified time period, and reserve the right to examine the workpiece after the test.

**7.3.4. Examination of Alignments and Accuracies:** During the test of conformance to specified alignments and accuracies the Arsenal's representatives will observe the performance of the test and reserve the right to review the results obtained.

**7.3.5. Examination of Performance Testing:** During the test of conformance to specified performance on workpieces, the Arsenal's representatives will observe the operation of the machine and its equipment and reserve the right to inspect the workpiece for conformance to drawing requirements after completion of the test.

**7.3.6. Supplementary Tests and Examinations:** The Arsenal's representatives reserve the right to ask for demonstrations of any specified features or machine characteristics not demonstrated during the tests conducted in accordance with Section 6.

**7.4. Re-Inspection Provisions:** If, during the course of preliminary acceptance inspection, deficiencies are discovered which cannot be satisfactorily corrected during this visit, preliminary acceptance will be withheld, and the contractor will be required to take corrective actions. In such cases, the Arsenal's Technical POC reserves the right to dispatch Arsenal representatives to observe a re-inspection and to charge the contractor's account for the travel and per diem costs of such re-inspections.

**NOTE:** It is still the responsibility of the offeror to correct any deficiencies that may not have been noted or over looked at the preliminary inspection.

**7.5. Post Preliminary Inspection Procedures:** The Arsenal's representatives will not grant authority to ship the machine following factory acceptance inspections, even in cases where there have been no apparent instances of non-conformance. Authority to ship will be granted only by the Contracting Officer. In cases where it is determined that the machine and its equipment conform to specification, the Contracting Officer will grant shipping authority within (10) working days of completion of the preliminary acceptance inspection. In cases where deficiencies requiring correction are discovered, the Contracting Officer will furnish a formal listing of required corrective actions within 15 working days of completion of the preliminary acceptance inspection. Also, in such cases, the provisions of section 7.4 shall apply.

**7.6. Final Acceptance Inspection:** Final inspection and acceptance of the machine shall be after installation at the Arsenal, also referred to as onsite final acceptance. At this time the machine shall again be subjected to, and required to pass, the test procedures specified in Section 6. The redundancy ensures deficiencies didn't occur during shipping and final installation/commissioning of the machine.

**7.7. Warranty:** Upon final acceptance of the machine, a Standard Commercial Warranty shall commence for two years, to include as a minimum, parts and labor for the duration of the warranty, at no cost to the Government. The two-year period shall commence from the date of notification by the Contracting Officer of the final acceptance of the machine. Final acceptance is defined as the act of an authorized representative of the Government, by which the Government assumes ownership of existing supplies/equipment and/or approves specific services rendered, as partial or complete performance of the contract (i.e. testing, training, and

delivery of all required technical documentation and ancillary equipment and supplies/parts included in the original contract).

**7.8. Preservation and Packaging:** The contractor shall utilize standard commercial methods of preservation and packaging appropriate for machine tools and acceptable to commercial carriers. As a minimum, all areas susceptible to damage from exposure to the elements shall be preserved and packed to prevent damage. The machine and equipment shall be blocked, braced and skidded to prevent damage during transport and to facilitate handling, loading and unloading. The contractor shall be responsible for ensuring that the machine and equipment are delivered to Watervliet Arsenal in operational condition and shall retain this responsibility until the machine and equipment are off loaded at Watervliet Arsenal and installed.

**NOTE:** If any special lifting devices are required by the contractor to facilitate handling, such devices shall be shipped with the machine.

## **8. General Requirements and Information:**

**8.1.** The period of performance of the contract shall commence upon award of the contract.

**8.1.1.** Completion of the tasks for section 5.0 shall be completed no later than 70 weeks after award of the contract.

**8.1.2.** Training shall be completed no later than 30 days from completion machine installation.

**8.1.3.** Monthly Status reviews and meetings (via phone or electronically) will be completed on by the Contracting Officer Representative (COR).

### **8.2. Contract Officer Representative:**

TBD  
U.S. Army CCDC-AC  
RDAR-WSB-L  
Benét Laboratories  
1 Buffington St.  
Watervliet, NY 12189-4000  
Phone: 518-266-xxx

### **8.3. Technical POC:**

Christopher Humiston  
U.S. Army DEVCOM-AC  
RDAR-WSB-PB  
Benét Laboratories  
1 Buffington St.  
Watervliet, NY 12189-4000  
Phone: 518-266-3938

Fax: 518-266-3951  
[christopher.j.humiston2.civ@army.mil](mailto:christopher.j.humiston2.civ@army.mil)

#### **8.4. Shipping Provisions:**

Deliverables shall be sent to the following POCs:

##### **8.4.1. Non-Explosive Shipments:**

Attn: Christopher Humiston  
US ARMY – DEVCOM-AC  
RDAR-WSB-PB  
1 Buffington St.  
Watervliet Arsenal, NY 12019  
518-266-3938  
[christopher.j.humiston2.civ@army.mil](mailto:christopher.j.humiston2.civ@army.mil)

#### **8.5. Location:**

Principal place of performance is at contractor's site for machine manufacturing. Installation to be at the Watervliet Arsenal located at 1 Buffington St Watervliet, NY 12189.

**8.6. Procurement of More Than One Machine:** In this specification requirements and terminology are oriented toward the purchase of a single machine tool. However, in many cases, two or more identical machine tools will be procured in accord with this specification. In such cases, the term "the machine" means "each machine." Depending on current circumstances, the Arsenal may wish to exercise an option to purchase more than one machine with the expectation of capitalizing on the economy of scale, specifically a reduction in cost and delivery for a second machine.

### **9. Attachment A - Acceptable Lubricants, Hydraulic Fluids, Oils, and Coolants**

<b>Type</b>	<b>Manufacturer</b>
Coolant, Water Soluble Oil	Van Straten #826-C
Coolant, Water Soluble, "No Dye" Concentrate Must Be Clear	Andersol "C"
Cutting Fluid Sulfur and Chlorine Additive 285°F min. Flash Point. 18-22 Centistokes at 100°F Viscosity (Gun Drilling)	MIL-C-46149 Grade 4 *
Cutting Fluid Sulfur and Chlorine Additive 30°F Pour Point, 285°F min. Flash Point 40-44 Centistokes at 100°F Viscosity (Honing)	MIL-C-46149 Grade 5 *
Cutting Fluid Sulfurized Fatty And Mineral Oils. Federal Test Method Std. No. 791	WVTPD 1051 *
Cutting Oil Sulfurized Fatty Mineral	VV-C-850 Type II Grade D

Cutting Oil, Non-Staining, Mineral Oil Base 400°F Flash Point	Mobilmet Omicron
Cutting Oil (Broach Oil)	Product Sol # 336
Cutting Oil (Rifler)	Fuchs Ecocut 336 X
Cutting Oil (Guided Bore)	Benz Patraulic 32
Cutting Oil (Guided Bore)	Monroe Cut NC DP-1 EXP
Grease (Medium Grade)	Almaplex 1275
Grease, Automotive and Artillery	MIL-G-10924-C *
Grease	MOLYKOTE BR-2 PLUS
Hydraulic Fluid, Petroleum Base	MIL-H46001-D *
Lubricant Center Saver	Cimcool
Lubricating Oil, General Purpose, Corrosion & Salt Spray Resistant 39.8-55 Centistokes at 130°F	MIL-L-3150 *
Lubricating Oil, Light Spindle, Velocite #10 (Sunvis #911)	MIL-L-46014 *
Oil, Hydraulic, Light	Socony Mobil DTE-24
Oil, Gear	Mobil #636
Oil, Hydraulic	DTE #26
Oil, Magnetic Particle Insp.	DD-F-87935 (NORPAR 13)
Oil, Hydro Treated Paraffinic Mineral Oil	Pillsbury Circlene FG #21
Oil, Reciprocating	Taco 10/40
Oil, Fatty (Lard Oil)	MIL-F-46148 *
Additive Oil, Extreme Pressure	Lubrizol #5345

\* Approved industry/commercial equivalents will be acceptable substitutes

#### **10. Attachment B – Class I Ozone Depleting Substances:**

- CFC 11: Trichlorofluoromethane (CFCL<sub>3</sub>)
- CFC 12: Dichlorodifluoromethane (CF<sub>2</sub>CL<sub>2</sub>)
- CFC 13: Chlorotrifluoromethane (CF<sub>3</sub>CL)
- CFC 111: Pentachlorofluoroethane (C<sub>2</sub>FCL<sub>5</sub>)
- CFC 112: Tetrachlorodifluoroethane (C<sub>2</sub>F<sub>2</sub>CL<sub>4</sub>)
- CFC 113: Trichlorotrifluoroethane (C<sub>2</sub>F<sub>3</sub>CL<sub>3</sub>)
- CFC 114: Dichlorotetrafluoroethane (C<sub>2</sub>F<sub>4</sub>CL<sub>2</sub>)
- CC 115: Monochloropentafluoroethane (C<sub>2</sub>F<sub>5</sub>CL)
- CFC 211: Heptachlorofluoropropane (C<sub>3</sub>FCL<sub>7</sub>)
- CFC 212: Hexachlorodifluoropropane (C<sub>3</sub>F<sub>2</sub>CL<sub>6</sub>)
- CFC 213: Pentachlorotrifluoropropane (C<sub>3</sub>F<sub>3</sub>CL<sub>5</sub>)
- CFC 214: Tetrachlorotetrafluoropropane (C<sub>3</sub>F<sub>4</sub>CL<sub>4</sub>)
- CFC 215: Trichloropentafluoropropane (C<sub>3</sub>F<sub>5</sub>CL<sub>3</sub>)
- CFC 216: Dichlorohexafluoropropane (C<sub>3</sub>F<sub>6</sub>CL<sub>2</sub>)
- CFC 217: Monochloroheptafluoropropane (C<sub>3</sub>F<sub>7</sub>CL)
- Halon 1011: Bromochloromethane (CH<sub>2</sub>BRCL)
- Halon 1202: Dibromodifluoromethane (CBR<sub>2</sub>F<sub>2</sub>)
- Halon 1211: Bromochlorodifluoromethane (CF<sub>2</sub>CLBR)
- Halon 1301: Bromotrifluoromethane (CF<sub>3</sub>BR)
- Halon 2402: Dibromotetrafluoroethane (C<sub>2</sub>F<sub>4</sub>BR<sub>2</sub>)
- Carbon Tetrachloride: Tetrachloromethane (CCL<sub>4</sub>)
- Menthyl Chloroform: 1,1,1-Trichloroethane (C<sub>2</sub>H<sub>3</sub>CL<sub>3</sub>)

## **11. Attachment C – Electrical Survey:**

The Watervliet Arsenal requests that all offerors provide the following machine information along with their proposal (please complete as much as possible):

1. Full Load Amps (FLA) @ 480 V
2. Start-up (surge) current
3. Average Power requirement (75%)
4. Standby power load at idle (if applicable)
5. Power Factor Information (efficiency)
6. Wiring schematics
7. Size and number of the largest motor(s)
8. Number of motors
9. Type of motor
  - a. Synchronous
  - b. Induction
10. Equipment Manufacturer contact information:
  - a. Point of contact for equipment electrical power requirements
    - i. Telephone Number
    - ii. Email address
11. Sub-components Manufacture Recommendations for Installation
  - a. Electrical Manual
  - b. Manufacture's Point of contact
    - i. Telephone Number
    - ii. Email address

**12. Attachment D – Environmental Protections Requirements:**

**1. Compliance with Environmental Laws and Regulations:** Contractor shall comply with all applicable federal, state, and local environmental laws, statutes, regulations, executive orders, permits, Army regulations (with supplements), as well as Major Subordinate Command (MSC) and installation regulation, policy, Host Tenant Agreement, Interagency Service Support Agreement, or Status-of-Forces Agreement. Contractor shall immediately report any conflicts between applicable federal, state, local environmental laws, statutes, executive orders, and provisions of Army Regulation 200-1, and any specifications within this contract to the Contracting Officer Representative (COR).

**2. Compliance with Green Procurement Requirements:** Contractor shall follow Federal EPA Comprehensive Procurement guidelines ([www.epa.gov/cpg](http://www.epa.gov/cpg)) and Army Contracting Command Quick Guide (<https://acc.aep.army.mil/accapps/ACCMAP/Documents/Quick-Guide-for-Sustainable-Procurement.docx>) for acquisition of building materials and products and select materials that have a long life cycle; the least toxic materials; recyclable materials; materials that are resource-efficient; materials with the maximum recycled content; materials harvested on a sustained yield basis; and products causing the least pollution during their manufacture, use, and reuse.

**3. Compliance with License and Certification Requirements:** Contractor shall obtain all license and certification required by Federal, State, and Local environmental laws and regulations necessary to adhere to the specifications of this contract. The Contractor shall submit all plans, notifications, reports, submittal documents, and fees required by Federal, State, and Local environmental laws and regulations to the appropriate Federal, State, and Local authority and/or agency as necessary to adhere to the specification of this contract. All required licenses and certifications required by Federal, State, and Local environmental laws and/or regulations shall be considered a contract deliverable upon award.

**4. Notification of Federal and State Regulators:** Contractor shall immediately notify the Designated Government Representative (DGR) and COR of the arrival on site of any Federal, State, and/or DoD environmental regulator or enforcement agent and/or the receipt of any correspondence from a Federal or State environmental agency.

**5. Inspections of Work Sites:** Contractor shall submit to potential Federal, State, Army and installation work site environmental regulatory inspections and/or investigations into noncompliance, and fully cooperate with such inspections/investigations by providing the appropriate records and documentation. Environmental regulatory agencies are authorized by law to inspect any work site for environmental compliance with regulatory requirements. If an inspection is conducted, it will not stop or disrupt ongoing contract activities. The inspection will only require the work site environmental officer, or supervisor/manager to answer questions and/or escort the inspector to specific work site areas with the potential to affect environmental quality.

**6. Reporting Noncompliance:** Contractor shall immediately report any nonconformance and/or noncompliance with applicable Federal, State or Local environmental laws, Army and installation environmental regulations or policies to the COR and DGR.



**7. Verification of National Environmental Policy Act Documents:** Contractor shall obtain from the COR or DGR, a copy of AMC's National Environmental Policy Act Policy and 32 CFR 651 which addresses actions to be taken by contractor. These documents include but is not limited to the analysis-associated decision document of an Environmental Impact Statement and Record of Decision; Environmental Assessment and Finding of No Significant Impact or Notice to Proceed; or Record of Environmental Consideration on the proposed contract actions prior to commencement of such actions.

**8. Conformance with Environmental Management System:** Contractor shall take the necessary actions to identify, monitor, and control those contract operations and activities that pose risk of contamination, or can negatively impact the natural and/or human environment.

**9. Assignment of Environmental Compliance Designee (ECD):** Contractor shall appoint an ECD for all contract work periods exceeding 180 consecutive days. Contractor shall appoint a primary and alternate ECD for each production, shop or work area that uses and/or stores hazardous materials and/or generates hazardous wastes. Contractor ECDs shall monitor implementation of all environmental regulatory requirements, report all environmental noncompliance to the work site supervisor, correct all environmental noncompliance, and verify implementation of directed actions to correct identified environmental noncompliance. Contractor shall have at least one ECD on duty at all times at each shop or work area. Contractor shall require all personnel designated as ECDs to complete the initial ECD training through the installation or Major Subordinate Command (MSC) environmental compliance point of contact within 15 days of the start of contract performance. Contractor personnel appointed as ECDs may perform other duties provided they do not prevent the performance of ECD duties. Contractors may request a waiver of this requirement through the COR and DGR, if using and/or storing very small quantities of hazardous materials.

**10. Competency Training for Contractor Personnel:** Contractor shall not allow personnel to perform any activities and/or tasks on AMC installations without proper and adequate qualifications or job competency training. In the event of any identified noncompliance, the Contractor shall, if requested, provide proof of contract personnel training or qualification (individual name, training/qualification type, training/qualification certificate, and date of training/qualification) to perform those contract activities associated with the identified noncompliance.

**11. Generation of Solid Waste:** Contractor shall remove from the installation and dispose of all solid waste generated, which cannot be recycled to an approved and permitted off-post disposal facility.

**11.1.** Contractor shall make every effort to divert construction, demolition debris, and all other solid waste to comply with the Army Integrated Solid Waste Management Policy.

**11.2.** The Contractor shall establish a program to promote cost-effective waste reduction in all operations and facilities covered by the contract. This includes collection, separation, and processing products or other materials recovered from solid waste streams for use in the form of raw materials.

**11.3.** The Contractor shall make maximum effort to reduce and prevent waste.

**12. Segregation of Hazardous Waste:**

- A. All hazardous waste generated on this contract must be segregated and kept physically separate from any other waste items and materials. All wastes must be properly containerized and labeled. Waste containers are to be supplied by the Contractor and must be designed for the waste type being disposed of according to all Federal, State and Local laws. In the event the waste classification is unknown prior to containerization, the container must be marked “under analysis, treat as hazardous waste”. All waste must be properly sampled and characterized at the Contractors expense, with copies of all analytical results submitted to the Environmental Department within 24 hours of receipt. Any waste characterized as Hazardous Waste must be properly labeled and will stored at the WVA RCRA Storage Area.
- B. All waste items must be so marked, that they are readily identified to this contract throughout the process. In addition, the contractor must ensure that there is a clear audit trail for all items until final treatment/disposal is accomplished.
- C. The Contractor is responsible for proper disposal of all excess samples, they shall be added to the corresponding waste container.

**12.1. Treatment of Hazardous Waste on Government Facility:**

- A. Treatment of hazardous waste (including solidification) on Government facilities is not permitted. Treatment is defined as any process which meets the definition of treatment as set forth in applicable local, state, and Federal (including 40 CFR 260.10) laws and regulations.
- B. The contractor shall not drain and/or flush PCB items at Government installations. Draining will be allowed only to prevent leaking and to meet DOT regulations.
- C. Treatment, disposal, or release of gas (other than inert) to the atmosphere on Government premises is not permitted by this contract. The contractor may perform gas extraction for other than inert gas cylinders at the pickup location using self-contained apparatus. This apparatus shall emit no gas into the atmosphere and purge the entire cylinder contents into a closed receiver for transport to a recycling or disposal site.

**12.2. Waste Disposal Requirements and Documentation:**

- A. The Contractor is responsible for the proper disposal of any Hazardous Waste generated during the project, in accordance with all applicable Federal, State, and Army regulations. Disposal shall only be through licensed/permitted Treatment Storage and Disposal Facilities (TSDF), utilizing properly permitted waste transporters. Waste profiles will be provided to the WVA Environmental Office for review prior to the removal of any waste. All Hazardous Waste Manifests MUST be signed only by a representative of the WVA Environmental Office. The Contractor may NOT sign hazardous waste manifests on behalf of the Generator. Non-RCRA regulated (Non-Hazardous) waste will be properly disposed of by the Contractor, at the Contractor’s expense. The contractor shall, without additional expense to the Government, be responsible for paying all fees, preparing or obtaining any necessary

licenses, permits, notifications, waste profiles, or reports, which result from a contractor's transportation, recycling, or disposal decision of such wastes.

- B. The Contractor shall pay any and all fees, surcharges, fines or civil penalties resulting from errant or illegal waste profiling, packaging, labeling, documentation, transport or disposal of any waste from the project. The Contractor shall contact the Environmental Department immediately upon learning of any of the above.
- C. All references to manifests in this provision relate to the "appropriate shipping paper" as required. The Contractor shall obtain and prepare all manifests, required for acceptance of waste into a Qualified Facility, and any other shipping documents. The contractor shall provide the COR with a copy of the completed form(s), for review by the appropriate Government official **at least five (5) business days prior to removal**. Prior to removal from the site, completed copies of all manifests shall be furnished to the Environmental Office. Disposal receipts, weight slips and/or recycling receipts shall be submitted to the Environmental Office within 24 hours of receipt by Contractor. Each manifest, as well as all other documentation required herein, shall be clearly and distinctly marked with the generator and the contract and task order number, as applicable. Emergency response information and twenty-four hour emergency phone numbers shall be listed on the manifest as well. If blocks are not provided, this information shall be placed in the upper, right-hand corner of each document.
- D. The contractor shall notify the Environmental Department at least **five (5) business days** BEFORE attempting analysis or pickups of any waste for disposal.
- E. The Government reserves the right to take appropriate action, such as the pursuit of monetary consideration and/or annotation of negative past performance if the contractor fails to meet the above applicable notification of waste removal from the pick-up location.
- F. Contractor may not ship waste outside of the United States to circumvent Environmental Protection Agency (EPA) land disposal restrictions.

**13. Use of Hazardous Materials:** Contractor shall assign all hazardous materials management responsibilities to the appointed ECD. Contractor shall contact the DGR or COR to obtain technical assistance from Environmental Office for assisting the ECD with achieving and maintaining compliance with hazardous material storage, issue, use, and disposal requirements. Contractor shall submit to the COR and/or DGR a hazardous material inventory. The hazardous material inventory will be submitted 30 days prior to commencement of work for contracts that exceed 180 consecutive days. The inventory list will contain the hazardous material type and maximum quantities of materials anticipated to be stored on-site. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. The Contractor shall maintain copies of Safety Data Sheets for all hazardous materials used and stored on-site during performance of the contract. Contractor shall not supply or deliver any hazardous materials or chemicals to an installation that are listed on EPA toxic chemical list without prior written approval from DGR and/or COR.

**14. Prevention of Storm Water Pollution:** The Contractor shall perform, track, participate, implement, and comply with storm water pollution prevention minimum control measures, protocols, and best management practices (BMP) and ensure that water quality standards are not violated in accordance with all regulations and policies as applicable to the Pollutant Discharge Elimination System general permit requirements. Applicable permits include:

- 1) The Multi-Sector General Permit for Storm Water Discharges Associated with Industrial Activities (MSGP); and,
- 2) All Construction Activity Storm Water permits minimum control measures include, but not limited to:

- Public Education and Outreach on Storm Water Impacts
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Run-off Control
- Post Construction Storm Water Management in New Development and Redevelopment
- Pollution Prevention/Good Housekeeping for Municipal Operations Contractors will

comply with the MSGP permit when the activity is identified as a permitted industrial activity. BMPs include, but are not limited to:

- Practicing spill prevention and good housekeeping.
- Installing and managing erosion and sediment control.
- Contractors will obtain permit coverage for construction activities disturbing over one

acre of land (total acreage is cumulative across all portions of the project). BMPs include, but are not limited to:

- Preparing and implementing a site-specific Storm Water Pollution Prevention Plan (SWPPP) as outlined in the permit and prior to any soil disturbance.
- Installing and managing erosion and sediment control.
- Make available, upon request, permit associated documentation.
- Practicing spill prevention and good housekeeping.
- Schedule inspections and provide corrective actions for noted deficiencies.

**15. Storm Water Management Low Impact Design/Development (LID):** The Contractor shall perform, track, participate, implement, and comply with Section 438 of the Energy Independence and Security Act; Executive Order 13514; and the DOA memorandum (2010) for full implementation of low impact design/development (LID) techniques to restore predevelopment hydrology to the maximum extent technically feasible for both new and renovation construction projects regardless of size. In support of LID, Contractors will adhere to installation landscape codes and the guidance found in the Installation Design Guide concerning Low Impact Design/Development for storm water management. The following LID practices include, but are not limited to:

- Restoring predevelopment hydrology to the maximum extent technically feasible
- Promoting natural removal of pollutants such as nutrients, oil and grease, and sediments from storm water
- Managing rainfall at the point where it falls
- Meeting the requirements of the MS4 permit
- Important Note: Utilization of permanent retention/detention ponds is prohibited without authorization from the Installation Planning Division.

**16. Use of Pesticides:** N/A

**17. Protection of Work Site Resources:** Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any work, the Contractor shall

identify any land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms. The Contractor shall provide effective protection for land and vegetative resources at all times. Prior to site clearing and grubbing, the Contractor shall coordinate harvesting of saleable timber with the DGR and/or COR. Contractor shall notify the DGR and/or COR if any trees are required to be disposed or removed. The Contractor is not authorized to remove or dispose of any tree greater than 6 inches in diameter unless permission has been granted in writing by the DGR or COR.

**18. Prevention of Spills:** Contractor shall adopt the installation's Spill Prevention Control and Countermeasures Plan (SPCC) if transporting, processing, storing, or in any way managing hazardous waste, hazardous material, petroleum-oils-lubricants, or other restricted items. In case of a spill, the person in control of the spill site or their designated representative shall take appropriate action to protect workers and bystanders; contain the spill (if it can be done safely); secure the spill site; restrict ignition sources; and immediately contact the installation Fire and Emergency Services (Fire Department).

**19. Protection of Sensitive Areas:** Contractor shall comply with all installation designated sensitive and/or off-limit area restrictions. Sensitive areas are generally demarked indicating what activities (e.g., driving, digging, foot traffic) are prohibited. The Contractor shall also adhere to the following installation sensitive areas requirements:

**19.1. Cultural Resources Sites:** Do not excavate, remove, damage, or otherwise deface any archeological resource located on public lands.

**20. Corrective Action for Noncompliance:** Contractor shall when given a verbal and/or written notice of environmental noncompliance or nonconformance by the COR, take immediate corrective action. Failure or refusal to comply promptly may be grounds for the Contracting Officer to invoke the appropriate contractual remedies. This may cause all or part of the work to be stopped immediately until satisfactory corrective action has been taken.

**21. Noise:** Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives will not be permitted without written permission from the Contracting Officer, and then only during the designated times. Pile-driving operations shall be coordinated through the DGR and COR.

**22. Mercury:** Mercury is prohibited, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed. Immediately report to the DGR and COR instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction

of the Contracting Officer. Cleanup of a mercury spill shall not be recycled and shall be managed as a hazardous waste for disposal.

**23. Universal Waste / e-Waste Management:** Universal waste and e-wastes including but not limited to some mercury containing building products such florescent lamps, mercury vapor lamps, high pressure sodium lamps, CRTs, batteries, aerosol paint containers, electrical equipment containing PCBs, and consumed electronic devices, shall be managed in accordance with applicable environmental law and installation instructions.

**24. Pollution Prevention / Hazardous Waste Minimization:** Minimize the use of hazardous materials and the generation of hazardous waste. Consult with the Environmental Office for suggestions and to obtain a copy of the installation's pollution prevention/hazardous waste minimization plan for supporting waste minimization goals.

**13. Attachment E – Drawings:**

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