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3.0 Technical Specifications

3.1 General

These specifications define the minimum requirements for the procurement of a Switch Production Tamper. This Switch Production Tamper is intended for use in the geographical area of Miami-Dade County, Florida with subtropical marine environmental conditions. It will be used by Miami Dade Transit Track and Guideway to perform Tamping tasks on the Miami Dade Transit Metrorail System.

3.1.1

The Switch Production Tamper must be capable of negotiating all MDT Track and structures, and stay within the dynamic envelope. Equipment must conform to all MDT restrictions regarding height, width, and weight. Specifications and drawings are provided.

3.1.2

The Switch Production Tamper shall be capable of performing work functions throughout the MDT System, without degradation of performance, for an unrestricted period of time.

3.1.3

The Switch Production Tamper Vehicle shall be of the latest type in production at the time of delivery. Production parts and components shall be new and not obsolete, nor near the end of their planned production life. All components shall be readily available as replacement parts for a minimum of ten (10) years from the Switch Production Tamper date of delivery.

3.1.4

The Switch Production Tamper Vehicle design, construction, and materials used shall ensure that it will function reliably and efficiently in sustained operations under harsh and extreme conditions typically found in adverse railway environments.

3.1.5

When engine drive shafts are used, the shafts shall have a separate protective element(s) to protect other equipment, should a drive shaft failure occur.

3.1.6

The vehicle shall have a diagnostic plan/system that conforms to Section 3.0. The diagnostic plan/system shall be located in a secured area of the cab.

3.1.7

The Switch Production Tamper Vehicle shall be free from defects such as incomplete welds, welds that cross weld, corrosion, loose or improper fasteners, any leaks or contamination, and any other defects that would impair or limit the operation or serviceability. All welds must comply with the applicable and established American Welding Society (AWS) standards.

3.1.8

The Switch Production Tamper Vehicle shall incorporate a design which allows ease of access, service, replacement, and adjustment by maintenance and operational personnel including filters, fluids, and other components.

3.1.9

The Switch Production Tamper Vehicle shall comply and conform to all Federal, State, and Local environmental, safety and health regulations in force, at the time of delivery. MIAMI DADE TRANSIT

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3.2 Material

3.2.1

All steel plates, shapes, bars, and sheets shall be of a quality that has good weld-ability, high impact resistance and meets IZOD impact toughness at low temperatures (0°F to 400°F). Steel items shall be of alloys and grades normally used for maintenance of way equipment and railway rolling stock. Design of structural members subject to normal working loads shall have a minimum design safety factor of 2 to 1. Structural members shall be designed to withstand impact stresses with a minimum safety factor of 3 to 1. It is generally recognized that this is only a minimum recommended guideline and greater design safety factors may be required as necessary.

3.2.2

All fasteners shall meet requirements of ASTM-A-325 as or alternate can be accepted but will have to be approved by MDT Engineering. Contractor shall use certified fasteners. Contractor shall be aware of the possibility of counterfeit fasteners available. All fasteners shall be plated or anodized to avoid corrosion or galvanic reaction to the mating surfaces.

3.2.2.1

All bolt applications shall have at least two (2) full threads protruding beyond the nut after the fastener has been torqued and no more than six (6) threads protruding beyond the nut.

3.2.2.2

All fastener certifications shall be maintained by the builder or made available to MDT as needed for inspection by MDT until all warranty/reliability periods have expired.

3.2.3

All non-ferrous metals shall be of alloys having strength and corrosion resistance suitable for the service and operating environment intended.

3.3 Brakes

3.3.1

The Switch Production Tamper Vehicle shall be equipped with fail-safe spring applied parking brakes on all wheels. The parking brake shall be capable of holding a fully loaded Switch Production Tamper Vehicle on a 6% grade. Service brakes shall be progressive in force application and capable of reducing the speed of the Switch Production Tamper Vehicle, at a rate equal to, or greater than 3 MPH per second at maximum travel speed on level track.

3.3.2

Single shoe or double shoe brake application shall not result in permanent bending of axles, support structure, or vehicle frame.

3.3.3

Brake shoes shall be of a composition type (Cobra or equivalent).

3.3.4

Air brake systems must utilize SAE J1402 Table A (formerly Type E), DOT #EMV-SS 106-74 Type A1 air brake hose with reusable fittings or other manufacturers system approved by MDT Engineering Dept. Brake systems must have independent pressure regulators, pressure gauges, and standard truck type reservoirs. The brake systems must be activated by standard truck type hand operated, control valves, and one (1) truck type quick release valve for each two (2) wheels. Reservoirs must conform to SAE J10-B specifications. Contractors shall also be able to provide reservoirs which meet ASME specifications for Certification when requested as an option. The reservoir shall be at least **22** gallons in capacity.

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3.3.6

Air brake systems must maintain operating pressure between 90 and 100 psi. An audible low pressure alarm shall be furnished and installed in the operator's cab, and shall be activated at 70 psi or less.

3.3.7

Main brake power shall be supplied by an in-line gear driven compressor. The compressor shall be capable of operation at normal engine speeds and shall be lubricated by the engine oil sump. The compressor must be mounted in such a manner as to limit vibration during normal operations.

3.3.8

To allow for emergency rescue of the Switch Production Tamper Vehicle, FM 3103 1/4 inch MPT male quick disconnect emergency rescue ports shall be provided at the front and rear of the Tamper to allow the release of the brakes for towing. Total failure of on-board electrical and engine systems shall have no affect on operation of the brake system during the emergency rescue mode. While in the emergency rescue mode, override and bypass components in the brake system will be isolated to avoid accidental or inadvertent venting of the charged brake system. Location of emergency rescue ports will be clearly identified on the Tamper.

3.4 Wheels, Axles, Bearings, Frame, and Suspension

3.4.1

Wheels and axles shall be in alignment and gauge, with the following allowable tolerances.

- a) Gauge: 1/8 inch Maximum Tolerance (56-1/8 inches - 56-3/8 inches).
- b) Tram: \pm 1/8 inch Maximum Tolerance.
- c) Diagonal Measurement:
 - 1) \pm 3/16 inch Maximum tolerance for wheel bases up to 9 feet.
 - 2) \pm 1/8 inch Maximum tolerance for wheel bases more than 9 feet.

MDT's standard track gauge for tangent track is 56 1/4".

3.4.2

Wheel nominal gauge shall be 56-1/4 inches. **MDT's standard track gauge for tangent track is 56 1/4".**

3.4.3

No excessive vibration, wobble, or eccentric action shall occur at any speed for which the machine is intended. Suspension shall provide for damage free operation under maximum foreseeable operating stresses. The entire machine shall withstand a free drop of 6 inches to a non-resilient surface without impairing normal travel or operating functions. Derail guards shall be incorporated near each wheel to cover inboard and outboard rail area, so that in the event of derailment, the machine will not leave the rails. The derail guards shall be designed so as to prohibit any part of the Tamper to touch the contact rail at any time. The machine shall push or tow easily when not working.

3.4.4

The Tamper Vehicle shall be designed for safe operation on track meeting minimum standard for FRA Class 3 track.

3.4.5

Wheels shall be 28 inches minimum diameter, not-to-exceed 30 inches diameter, machined from non-porous steel castings at AAR Specification M-107-77, Class B. Wheels must be of multi-wear type. Wheel tread shall be AAR G-4-76, Tapered. Other wheel types, so long as the Tamper can travel safely on the MDT system may be approved by the MDT Engineering Dept.

3.4.6

Wheels shall be pressed on to the axles in accordance with Section G AAR, Wheel and Axles Manual, and 11th Edition or other manufacturer wheel installation system approved by MDT Engineering Dept.

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3.4.7

Axles shall be of solid design and continuous in length from wheel-to-wheel, mounted in standard railway type truck assemblies with roller bearings of AAR Grade C or better. Axles shall be cold stamped with at least 1/4" markings. Truck or Agricultural type axles shall not be allowed. Other manufacturer's axle designs may substitute so long as the Tamper can travel safely on the MDT system and the design is approved by MDT Engineering Dept.

3.4.8

Axles shall utilize double-row, roller type axle bearings. Where pillow block bearings are used, they shall be self-aligning, double-row, non-expansion, roller type axle bearings, and shall have cast steel or ductile iron housings and their location shall be fixed to avoid movement.

3.4.9

Bearings selected for use shall have a radial load capacity of 20,000 hours, B-10 life at 50 RPM to exceed static wheel load of the machine.

3.4.10

All axle bearings shall be designed for 250,000 miles service life and shall be of sealed maintenance free design.

3.4.11

The Tamper Vehicle wheel-to-wheel impedance of each wheel axle assembly shall be less than 0.01 ohm when measured from tire tread to tire tread over the frequency range of DC to 10 kilohertz.

3.4.12

Frames shall be equipped with jacking pads located in such a manner as to distribute the dead load equally during jacking operations.

3.4.13

The Tamper Vehicle shall be provided with a means of lifting it with a crane hook without damage to and equipment. Lifting points and balance points must be clearly marked and labeled.

3.4.14

Appurtenances and payloads shall be distributed along the Tamper Vehicle such that the load on each wheel falls within the range of 20% to 30% of the total dead and live load.

3.4.15

The design of members, and the assembly thereof, shall withstand all stresses imposed by continuous dead and live loads, without bending more than 1/8 inch in a span of 12 feet.

3.4.16

A torque arm of adequate design and size for the imposed loads shall be installed on each axle.

3.5 Insulation

3.5.1

The Tamper Vehicle shall not be insulated. The Tamper shall not be converted from an insulated design by bonding around insulating parts. If shunt bonding is used, its design must be approved by MDT. The Switch Production Tamper Vehicle must provide for a positive indication of track occupancy to MDT's Signal System under any condition of loading.

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3.6 Engine and Power Train

3.6.1

All engines offered, whether standard or optional equipment shall start within 2/3 of cranking systems time rating.

3.6.2

Engine shall incorporate high water temperature and low oil pressure shut down systems where applicable. It shall provide ample power, with exhaust compliant with all EPA's "TIER 3" requirements regarding air pollution, for all equipment functions under the following conditions:

- a) ALTITUDE: 0 feet to 450 feet above sea level
- b) AMBIENT TEMPERATURE: 20° F to 100° F
- c) ATMOSPHERE: Heavy Dust to 1 inch of Rain per Hour
- d) GRADE OF TRACK: 4%
- e) CURVATURE (work mode): 19°, 4 inch Super-elevation

3.6.3

The engine of the Tamper Vehicle shall have adequate horsepower to operate when subjected to the conditions of Section 3.6.2, while operating the compressor listed in Section 3.3.7, at 110 psi.

3.6.4

The engine of the Tamper Vehicle shall be water cooled, diesel fueled, four (4) cycle in operation, turbo charged, and of proven design.

3.6.5

The air filter for the engine shall be of adequate size recommended by the engine manufacturer and be equipped with a highly visible air filter restriction indicator. The air filter shall be positioned to be readily accessible and shall operate with unrestricted fresh, outside air.

3.6.6

Supplied engine shall be mounted in an enclosed, sound insulated housing.

3.7 Fuel Tank

3.7.1

Capacity of fuel tank shall provide for continuous operation of the machine for a period of no-less-than 16 hours of operation at 50% of the rated output.

3.7.2

Filler opening shall have a minimum diameter of 1-1/2 inches, and a removable strainer.

3.7.3

The filler opening shall be located so as to make it impossible for a fuel can or nozzle to contact electrically energized parts. Tanks shall be located to eliminate fire hazard from spill, overflow, or drain of fuel.

3.7.4

The tank shall be located on the Tamper Vehicle, in a position that will provide protection against rupture due to collision or derailment.

3.7.5

The tank shall incorporate a top loading port with vented cap, a sight gauge for fuel levels, a remote fuel gauge (cab-console); and a 3/4 inch drain valve with a pipe plug.

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3.8 Drive System

3.8.1

The drive system shall be a hydrostatic drive system. Each of the four axles shall be hydrostatically driven by heavy duty hydraulic motors and axle driven gear boxes for maximum traction. For towing purposes, a manual mechanism shall be provided to permit easy disengagement of the drive system. MDT Engineering approved axle/axle design may be accepted.

3.8.2

A rescue Towing Procedure Placard shall be installed in a highly visible location in the operator's cab.

3.9 Exhaust System

3.9.1

The exhaust system shall be located so that it will cause no adverse temperature rise in any other part of the equipment and so that a minimum of heat and exhaust gas can reach the operator. The exhaust system shall utilize a purifier design in the exhaust and muffler.

3.9.2

Machines equipped with an enclosed cab or cab top shall have the exhaust discharge above the top of the cab roof or a safe distance from the cab.

3.9.3

An exhaust muffler, located as close as possible to the engine shall be provided. Noise level shall be limited to 85 dba, when measured at a distance of 50 feet from the operating unit.

3.9.4

Stainless steel shall be used for all exhaust components. Not more than 36 inches of flexible metal exhaust pipe may be used, where necessary to reduce transmission or vibration. All exhaust piping shall be properly braced to eliminate shocks at all junctions, and at the interfaces between the manifold and muffler. Vibration dampeners may be used if necessary. The system shall provide for expansion, contraction, vibration, and stress produced by operation of the machine. The system shall comply with all EPA's "TIER 3" requirements regarding air pollution.

3.9.5

When utilizing exhaust tubing in the vertical position, the end shall be bent or a rain cap incorporated to eliminate moisture entry into the exhaust system.

3.10 Hydraulic System

3.10.1

The hydraulic system shall conform to the recommendation of the National Fluid Power Association (NFPA), American National Standards Institute (ANSI), and the International Standards Organization (ISO).

3.10.2

Upon completion of manufacture and before any operation, all parts of the system shall be cleaned and free from contaminants. Threads, holes, cuts, flares and machining must be deburred and cleaned.

3.10.3

Contractors must pre-filter all oil through a ten (10) micron or finer filtering system.

3.10.4

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All reservoirs shall be designed and constructed to prevent entry of foreign matter, including water, and sized to protect the hydraulic system against excessive heat or thermal conditions. High pressure and flow Hydrostatic drive system shall incorporate a failsafe safety circuit that will shut down the tamper to prevent oil loss in the event of component or hose failure. Reservoir shall be of 180-gallons size or larger, and shall include:

- a) Hydraulic shut off valves shall be incorporated.
- b) Baffles to separate intake and return lines to facilitate the separation of air and foreign matter from the hydraulic fluid, separate pump inlet from the settling portion of the tank, and shall direct flow toward tank walls for maximum heat dissipation.
- c) Access panels large enough for complete cleaning, inspection, maintenance, and servicing of sump filters with an accessible means to empty the reservoir in the event the fluid is to be retained.
- d) An air inlet breather which is of sufficient capacity to maintain approximately atmospheric pressure at maximum demands on the hydraulic system and to assure vacuum at pump inlet(s) shall not exceed 60% of pump manufacturers' recommendations. Air breather system shall be equipped with a 25 micron or finer filter, either cartridge or spin-on type.
- e) A thermometer, in plain view, protected from damage, as near the intake line as possible, at the add point fluid level.
- f) A static fluid level gauge to show fill and add points protected from damage.
- g) A non-integral reservoir (not part of the frame) shall be utilized. This reservoir shall be mounted in accordance with the section relating to the fuel tank (Section 3.7).
- h) Both the intake and return tubes shall be located below the minimum working fluid level so as not to cause cavitation or aeration.
- i) System shall include a low level and high level temperature audio and visual alarm incorporated into the reservoir.

3.10.5

Fluid temperature in the reservoirs shall not exceed 180° F at the reservoir outlet(s) while operating in a 100° F ambient.

3.10.6

Where failure of the power plant or pump can immobilize components, in a position which would prevent moving of the Tamper Vehicle, a battery operated emergency pump, Fenner Fluid Pump, Model KMD 8, 5,000 psi, 300 amp or approved equal, shall be provided in the circuit to allow normalization of all equipment components, i.e. clamp frame, work heads, for movement of the Tamper Vehicle to a proper location.

3.10.7 Fluid Filtration

3.10.7.1

The total pressure line and/or return line flow shall pass through filters rated at 20 microns or finer and minimum beta 10 rating of 10 per ANSI Std. B93-31-1973, equipped with a condition indicator. Filtration shall not be less than recommended by manufacturers of the hydraulic system components.

3.10.7.2

A magnetic particle attraction feature shall be provided in the pump intake line and/or in the filters and/or in the reservoir.

3.10.8 Fluid Conductors

3.10.8.1

Maximum use of rigid tubing is preferred. Tubing will be equipped with 370 fittings for interfacing with flexible hose used when needed. Fluid conductors utilized in circuits operating at or less than 3,000 psi must use high pressure hose; SAE 100 R2 Type A Plus, HI Impulse type with the following qualification requirements are suggestions:

- a) Constructed with a corrosion resistant, 2-wire braid reinforcement;

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- b) Have a bursting pressure safety factor of 4:1;
- c) Tested to 300,000 impulse cycles at 250° F; and
- d) Have an operating temperature range of 30° F to + 250° F.

3.10.8.2

All fluid conductors utilized in circuits operating over 3,000 psi should use extra high pressure hose; SAE 100 R12 plus type when utilizing hose sized up to 1 inch, which have the following qualification requirements are suggestions:

- a) Constructed with 4-spiral plies of steel reinforcement;
- b) Have a bursting pressure safety factor of 4:1;
- c) Tested to 1,000,000 impulse cycles at 250° F;
- d) Have an operating temperature range of - 50° F to + 212° F; and
- e) Use with permanent, crimp type fittings, for added reliability.

3.10.8.3

Maximum use of rigid tubing is preferred. Tubing will be equipped with 37 degree fittings for interfacing with flexible hose used where needed. All fluid circuits and hydrostatic drive systems operating at pressures exceeding 3,000 psi shall use ultra-high pressure, heavy duty, HI Impulse tubing and hoses. SAE 100 R13 type hoses 1 inch diameter and larger shall meet the following requirements:

- a) Constructed with 6-spiral plies of steel reinforcement;
- b) Have a bursting pressure safety factor of 4:1;
- d) Have an operating temperature range of - 40° F to +212° F; and
- e) Use with permanent, crimp type fittings, for added reliability.

3.10.8.4

Pump supply hoses must meet the requirement of SAE 100R4, with reusable fittings.

3.10.8.5

Hose shall not be:

- a) Flexed to less than their rated minimum bend radius;
- b) Installed or routed to expose them to temperatures above or below their rated operating temperature ranges;
- c) Subjected to any twisting, pulling, kinking, crushing, or abrasion;
- d) Routed in a manner which would expose the hose to damage under normal conditions.

3.10.8.6

Hoses shall be installed, routed, and isolated where possible for proper support through clamping and/or brackets to avoid all of the above conditions, especially abrasion. If necessary, hoses subjected to excessive abrasion should be wrapped or protected with an abrasion resistant wrapping or sleeve.

3.10.8.7

Tubing and piping shall be mounted to minimize vibration. Tubing shall have only gentle bends to change direction or compensate for thermal expansion. Bend radii shall not be less than three (3) times the ID.

3.10.8.8

Pipe threads are not recommended but not prohibited. If they are used, they must be NPTF dry seal type.

3.10.8.9

Whenever practical, valves shall be manifold mounted.

3.10.8.10

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Galvanized or brass tubes, pipes, or fittings shall not be used.

3.11 Electrical System

3.11.1

Electrical Systems shall conform to the regulations of the American National Standards Institution (ANSI) and the International Standards Organization (ISO) where applicable.

3.11.2

Upon completion of manufacture and before any operation shall begin, all parts shall be clean and free from scale, rust, water, and/or any contamination. All materials and workmanship must be of good quality for the intended use.

3.11.3

Sequence of operation and electrical, physical, and schematic drawings showing the exact circuit(s) in use on the machine and large enough to be easily followed during trouble-shooting shall be furnished. Subsequent changes shall be covered by new drawings furnished to MDT.

3.11.4

Whenever practical, components shall be interchangeable.

3.11.5

Cables shall be routed to prevent exposure and mounted to prevent damage. Use of Cable trays are not mandatory but should be used where possible.

3.11.6

DC Systems, when grounded must have a negative ground.

3.11.7

Battery charging alternators must have a rated capacity to handle equipment and accessories with a 50% reserve.

3.11.8

The DC Electrical System shall be 24 Volts.

3.11.9

Circuit breakers shall be utilized for overload protection as required. All wiring with potential difference of 50 Volts or more must be separated by a clearance of 12 inches.

3.11.10

The battery box shall be constructed entirely of stainless steel material and shall incorporate adequate drain holes and provide proper ventilation when lead acid batteries are used. The battery shall be provided with a disconnect key switch and shall have a cover with provisions for locking the battery box with a large railroad type padlock.

3.11.11

The Tamper Vehicle shall be equipped with two (2) 8D batteries.

3.11.12

The Electrical System shall provide a Voltage Reducer, New Mar Model 48-12-35 I, or MDT approved equal, isolated DC-DC converter to power the 12 VDC Radio Communication Systems.

3.11.13

Standard, industrial grade, readily available components shall be used.

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3.11.14

Cabinets shall be of steel construction. Clearance between walls and bare "live" parts shall not be less than 1-1/2 inches, unless affected interior surfaces utilize insulating plastic or fiber sheeting, where a potential in excess of 50 Volts exists. Cabinets must be weatherproof.

3.11.15

Panels must be readily removable and parts easily accessible.

3.11.16

Adequate lighting shall be provided in cabinets.

3.11.17

Pipes other than electrical conduit shall not enter cabinets.

3.11.18

Interior metal surface walls must be painted with electrical insulating paint or covered with other approved electrical insulating material.

3.11.19

Nominal voltages used must be plainly shown on outside of cabinet.

3.11.20

All parts and groups of parts shall be identified by function and clear, simple, exact reference to service diagram and parts list. Integral units such as circuit board, should be considered as one part, if intended to be replaced as a unit. Complete parts identification shall be shown where practical, in order to minimize errors and time consuming reference to drawings or lists.

3.11.21

Wires must be equipped with good quality ring lug or pin terminals and identified with permanent numbered markers or color coded when and where practical. Terminal posts must be plainly marked. Once used, a number or color code must not be reused for a different circuit. All wires must be neatly dressed and clamped. The marking system must be well thought out and consistent throughout the machine by the manufacturer.

3.11.22

Housing containing heat producing elements must be properly ventilated.

3.12 Pneumatic System

3.12.1

System must contain an air pressure gauge in easy view of operator.

3.12.2

Standard air brake hose SAE-J1402 Table A1 will be the only hose used anywhere in the system. Use of push-on barb type fittings are banned, except for control circuits where space is critical, and where working pressure and abrasion is not severe and braking is not involved.

3.12.3

System must contain an Air Compressor Discharge Line constructed of heat resistant, Teflon, flexible tubing utilizing an outer layer of stainless steel wire braid.

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3.12.4

System must contain an Engine Air Compressor Intake supply commonly connected to the Engine Air Inlet System.

3.12.5

The air reservoir shall be equipped with a Bendix automatic dump valve, Model V-2 or equivalent, to exhaust accumulated moisture. The dump valve shall blow down periodically during operation. The reservoir shall also be equipped with an easily operated manual drain valve.

3.12.6

Desiccant type electric air-dryers, Model CR Brake Master T244 Turbo 2000, or approved equivalent, shall be installed as needed to ensure the delivery of moisture-free air.

3.13 Cabin

3.13.1

The Switch Production Tamper shall have a fully enclosed operator's cab. The cab shall provide seating space for the operator, a database work station and two (2) passengers. All work functions shall be easily viewed from the operator's position. The cab shall be weather tight. The glazing material shall be 1/4 inch laminated safety glass. Cab side windows shall be divided into two (2) halves. The rear half shall be fixed. The windshield wiper shall be of the 2-speed type with controls within easy reach of the operator. The windshield wiper shall be able to clear the glass satisfactorily and provide optimum visibility. The cab shall contain a fire extinguisher. Tinted windows are optional.

3.13.2

Access to the cab from track level shall be via a rear cross platform with steps to each side leading to a rear entrance door. All hand railing, steps and running boards must comply with AREMA standards.

3.13.2

When rechargeable wet type batteries are located inside the body or cab, the top of battery shall be vented to outside air.

3.13.4

The cab shall be heated, air-conditioned, and ventilated. A hydraulically driven, Visionaire, self-contained environmental control unit, or approved equivalent, shall be used. Fluid power for the unit shall be provided by main power unit. Fresh air intakes shall assure a minimum of three (3) changes of air volume per hour. Interior temperatures shall be thermostatically controlled through operator adjustment, such that at maximum heating conditions, a temperature of 68° F can be sustained and at maximum cooling conditions, a temperature of 85° F can be sustained.

3.13.5

Each seat shall be constructed of durable non-toxic materials. The operator seat position shall be equipped with a cushioned seat and back, employing natural or man-made leather, over a 3-inch low smoke foam cushion. The operator seat position shall be adjustable to accommodate operators ranging in height from 5 feet 2 inches to 6 feet 4 inches. The operator seat shall be capable of 180° rotation, and be capable of being secured in the front or rear facing position by means of a latch. The seat shall be placed in the cab to allow an as unrestricted view as possible. A suggested seat type is Isringhausen model 86499-10000.

3.13.6

All switches, valves, levers, controls, and adjustments used to start, stop, or operate the machine shall be clearly labeled with weather and wear resistant plates permanently affixed to the machine or component. Controls used in continuous operation of the machine shall be within easy reach of the operator and shall not interfere with his view of the work.

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3.13.7 The engine must not start with controls in travel position.

3.13.8

A red emergency shut-down control shall be quickly accessible to the operator. The shutdown control must stop the engine and apply brakes at a reduced pressure to prevent locking of wheels. An emergency shut-down shall be installed in all operating stations and at each outside corner of the vehicle.

3.13.9

The operator's seat shall contain the readily accessible controls to allow operation when the seat is latched in the forward position. These contained controls shall include:

- a) Service Braking;
- b) Engine Throttle Control;
- c) Gear Selection.

3.13.10

Main cab shall be equipped with an Intercom System to communicate with the spotters on left and right side near the work heads and clamp frame shall include four headsets. This should be a hands free wireless system.

3.13.11

The operator's console shall contain all other instruments and controls necessary to operate the forward and reverse motion of the vehicle in a safe manner. Controls for exterior lights, windshield wipers, and horns shall be readily accessible to the operator. All exterior switches shall be all-weather proof. The controls can be on the operator computer screen or standalone gauges shall and shall consist of:

- a) Switches:
 - 1) Windshield Wiper – Front
 - 2) Windshield Wiper – Rear
 - 3) Defroster Fan – Front
 - 4) Defroster Fan – Rear
 - 5) Headlights - Front/Rear
 - 6) Interior Lights - On/Off
 - 7) Exterior Work Lights - Front/Rear
 - 8) Battery Switch
- b) Gauges: (All Gauges shall be the back lighted type and shall read in USA Standard).
 - 1) Oil Pressure Engine
 - 2) Water Temperature
 - 3) Volts
 - 4) System voltage - Battery
 - 5) Air Pressure – Main
 - 6) Fuel Level
 - 7) Speedometer – MPH
- c) Controls:
 - 1) Throttle
 - 2) Air Brakes
 - 3) Forward / Reverse
 - 4) Gear Select
 - 5) Electric or Air Horn must be able to be heard at the front & rear of the machine.
 - 6) Electric Horn or Air horn
 - 7) Parking Brake
 - 8) Engine Kill - Mushroom Button

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d) Indicators:

- 1) Murphy Power View or
- 2) Audible/Visible Low Air Alarm

e) Console (Shall also have soft exterior lighting.)

f) Circuit Breakers (Required)

g) Key Switches - Ignition

3.14 Tamper Capabilities / Performance

3.14.1

The Switch Production Tamper shall be required to satisfactorily tamp the switch area in switch mode and be capable of high speed tamping (15 ties per minute minimum), and shall meet the following performance criteria:

- a) Workable Curve: Tamp / Lift / Line on 300' radius, 19°.
- b) Computer Plotting: Minimum curve of 250' radius 23°.
- c) Negotiable Curve: 23° radius.
- d) Max Super-Elevation: 4".
- e) Max Raise: 4".
- f) Workable Grade: 4%.

3.14.2

Shall have semi-automatic and fully automatic operations.

3.14.3

Shall be equipped with an operator controlled, push-button, and electric over hydraulic operated tamping tool spacing adjustment system, allowing the operator to quickly adjust the tool spacing, to compensate for irregular tie spacing, and compensate for slewed ties.

3.14.4

Tamper Control Area Network (CAN) systems shall be modular design that allows use of common components replacing analog circuit boards. The tamper shall be equipped with a touch screen that will allow the machine to be calibrated with one or more integrated touch screens. All modules shall be capable of withstanding vibration, shock and extreme operating temperature ranges.

3.15 Track Lifting and Lining Unit

3.15.1

The Switch Production Tamper shall be equipped with a heavy duty, combination track lifting and lining clamp that provides complete switch and standard track production work.

3.15.2

The clamp shall be capable of standard track production work, as well as a rail head base hook system for switch work.

3.15.3

The clamp system shall be completely adjustable laterally and longitudinally, as well as rail hook depth, from the operator's cab, and be capable of lifting and lining at every point in a switch.

3.15.4

The clamp system shall have hydraulic operated safety locks for securing work heads in the travel mode and a safety circuit to ensure locks are open to prevent damage to locks when stowing clamp frame for travel.

3.15.5

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The Switch Production Tamper shall be equipped (as an option) with an integrated auxiliary turnout lifting system. This system shall be hydraulically operated, telescopic, auxiliary lifting clamp installed on each side of the machine. The lifting system shall be set up by using the controls in the operator cab or via remote control. During tamping lifting the auxiliary system shall be controlled automatically by the machine's electronic surfacing and cross-leveling system.

3.16 Track Surfacing and Alignment

3.16.1

Surfacing and lining systems shall be fully automatic and allow complete, accurate work on tangent track in curves and spirals, and switches, turnouts and cross-overs.

3.16.2

The reference points (front, center and rear) shall be within the length of the machine's main frame.

3.16.3

Surfacing and lining shall be accomplished by a wire reference system or MDT Engineering approved equal.

3.16.3.1

Track surfacing shall use a single wire stretched over each rail and mounted on feeler rods or infrared light system may be used.

3.16.3.2

Track alignment shall use a single wire stretched under the machine in the center of the track or infrared light system may be used..

3.17 Geometry Measuring / Correction System

3.17.1

System shall have a self-contained, automatic surfacing and alignment control system.

3.17.1.1

System shall allow the operator to correct track surface, cross-level, and alignment deviations. The system shall utilize a self-calculated "model" as a basis for track geometry corrections, and features fully automatic capability, as well as allowing the machine operator to perform design lining and surfacing as may be required by existing track conditions.

3.17.1.2

Contractor shall supply "Microsoft® Office" software package for off-board analysis of the measured track geometry data which allows it to be solved to the original track design by an engineer in the office.

3.17.2

System shall allow operator to create "what-if" scenarios and compute an infinite number of manual solutions using various user-defined track geometry tolerances.

3.17.3

System shall allow operator to define track points which cannot be disturbed, and system shall compute the "best-fit" solution incorporating this input.

3.17.4

System shall contain a performance monitor that keeps record of the following parameters:

- a) Travel time and distance;

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- b) Work time and distance;
- c) Measure time and distance;
- d) Delay time;
- e) Start and stop times;
- f) Total ties tamped;
- g) Average ties tamped/ min;
- h) Average production rate/ hr.

3.18 Tamping Units

3.18.1

Tamping Units shall be a 16-tool tamping system with four 4-tool, non-synchronous tamping heads. Each head shall be equipped with two tamping arms (tool holders), and each tamping arm holds two tamping tools.

3.18.2

Tamping Units shall be hydraulically driven, and each tamping unit shall be laterally adjustable to allow complete switch tamping.

3.18.3

Each of the four Tamping Unit halves shall have the capability to be raised and lowered individually when switch tamping or in unison for production tamping. Each unit shall be raised and lowered vertically not at an angle.

3.18.4

Tamping Unit depth control shall be easily adjusted from the work cab to allow proper ballast compaction under varying track conduction.

3.18.5

The Tamping Unit shall be equipped with an automatic lubrication system.

3.18.6

The Tamping Unit shall have hydraulic operated safety locks for securing work heads in the travel mode and a safety circuit to ensure locks are open to prevent damage to locks when stowing tamping units.

3.19 Decking

3.19.1

Decking material shall be steel diamond plate.

3.19.2

Deck plates shall be welded together where serviceability access is not required. Where serviceability access is required, plates shall be bolted for easy removing.

3.20.1

Provisions shall be made within the cabin for mounting, by the Contractor, a transit vehicle AAR Radio with separate speaker, separate microphone and an exterior antenna. The Contractor shall furnish a source of 12 VDC power as described in Section 3.11.12, through a circuit breaker rated at 3 AMPS for the control circuit and 40 AMPS for the transmitter.

3.20.2

The Radio shall be of the "clean cab" design and meet all AAR Standards.

3.20.3

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The Radio will be provided by MDT.

3.21 Towing

3.21.1

One (1) Tow Eye of 1 3/16 inches in diameter shall be provided at each end of the Tamper Vehicle.

3.21.2

The Tow Eye shall be 14 inches \pm 2 inches, from the top of rail to centerline of Tow Eye as measured with new wheels.

3.21.3

One (1) Tow Bar of a strength equal to 150% of the Draw Bar force required by the maximum load coupled to the Switch Production Tamper of minimum six (6) foot length shall be provided and stowed in an accessible area of the vehicle.

3.21.4

For Towing purposes, a manual mechanism shall be provided to permit easy disengagement of the drive system to prevent damage to the drive system during towing operations. A metal etched placard shall be installed inside the cab with step by step towing procedures. Or the machine can have an air cylinder shifting the gearbox into neutral for towing operations. Gear box default should be neutral.

3.22 Exterior Lights

3.22.1

The vehicle shall be equipped with the following Exterior Lights:

3.22.1.1

Four (4) – 3 inch Minimum Red Marker Lights, LED Type (2 front, 2 rear)

3.22.1.2

Four (4) – Xenon headlight 24VDC X4524-0-BB or equivalent (2 Front, 2 Rear), or LED, or JW Speaker LED light.

3.22.2

The operation of these lights shall be as follows, and automatically switchable as the vehicle direction is selected:

CAB-END LEADING FORWARD REVERSE

RED Marker Light OFF ON

60 watt 24 VDC Quart ON OFF

3.22.3

Work lights shall be provided to illuminate the rail clamp and tamping unit area. All lights shall be cab controlled and circuit breaker protected. Work lights shall be Xenon X4524-0-WF, LED, or JW Speaker LED lights are acceptable.

3.22.4

Railroad lighting package shall include front and rear double locomotive Xenon high intensity US Reflector Work lamp Model X-4500, JW Speaker LED lights or MDT approved equal.

3.23 Travel Speed

3.23.1

Each axle of the Switch Production Tamper Vehicle shall be driven and permit operation at maximum torque speed, in both directions of travel. The power plant shall permit operation under full design load at speeds of not less than 25

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mph, on level tangent track, but shall be governed to prohibit operation above 30 mph under minimum load conditions. The accuracy of speed regulation shall be within the following ranges:

SPEED LOAD ACCURACY

< 1 mph Up to 5 mph Full ± 0.5 mph

> 5 mph Up to 35 mph Minimum Load ± 2.0 mph

Maximum Load ± 0.5 mph

3.24 Clearance

3.24.1

Clearance of fixed system points: The Switch Production Tamper Vehicle and appurtenances must successfully operate and negotiate under all operating and loading conditions within the constraints of the physical structures of the MDT System. The following drawings exhibit the guide-way constraints:

- a) MDT Compendium of Design Vehicle Dynamic Outline Diagram – Horizontal Tangent & Curved Track, Double Track
- b) MDT Compendium of Design Vehicle Dynamic Outline Diagram – Horizontal Tangent & Curved Track, Single Track
- c) MDT Compendium of Design Vehicle Dynamic Outline Diagram – Minimal composite Vehicle Dynamic Envelope
- d) MDT Compendium of Design Criteria Clearance Drawings/Specs attached in documents section of requisition.
- e) MDT Dynamic Outline Drawings/Specs #'s are VDP-001, VDP-002 and VDP-003.

NOTE: All applicable drawings /Specs are attached for reference

Section 9.1.

3.24.2

Components which may encroach upon track, signal, crossing, or other structures on, or within the MDT System must have a positive mechanical lock to secure these components into a safe position for travel.

3.24.3

No component shall be less than 3 inches above the plane extending from the ball of one (1) rail to the ball of the other rail. Clearance to the cover board shall be maintained within the above constraints.

3.24.4

All components which may present a hazard to operator, assistant or bystanders shall be protected with a shield or safety device.

3.24.5

Handrails or grab irons shall be installed wherever it is intended that personnel board the Switch Production Tamper Vehicle. The lowest step used for boarding the machine shall not be more than 12 inches above the top of the running rail, when measured with fully worn wheels. Any area more than 3 feet above the top of the running rail (where persons are expected to walk or pass) shall be protected by rigid tubular handrails. The handrails shall be no less than 1-1/4 inches O.D. diameter, 42 inches high, with a secondary rail 24 inches high. A 3 inch kick board shall be provided to prevent entry into potentially hazardous areas. All floor walking areas shall be of diamond plate, or MDT approved non-skid material.

3.25 Paint

3.25.1

Contractor shall use paints which meet OSHA regulations and standards, and do not have any known history of biological hazards due to long term exposure. Passive respirators and eye protection shall be the only safety or health equipment necessary to protect workers making repairs.

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3.25.2

Contractor shall also utilize proper surface preparation, including the use of epoxy or urethane type rust inhibiting primer and finish coats, to provide a glossy, high quality, durable, and fade resistant finish.

3.25.3

Exposed parts of the machine shall be painted (Work Equipment Yellow), Urethane or Yellow Suncryl HS 327 product with Valspar single stage acrylic enamel; except as follows:

- a) Diesel Fuel Tank: GREEN
- b) Hydraulic Reservoir: BLUE
- c) Coolant Tank: GRAY
- d) Wheels and Handrails: BLACK
- e) Lifting Lugs: BLACK
- f) Safety Locks: RED
- g) Jacking Points or Pads: BLACK
- h) Engine and Other Parts: Manufacturer's Option

3.25.4

The name of fluid and the words "CHECK DAILY" shall be stenciled on each tank in 1 inch letters. Total machine weight with all tanks filled shall be plainly marked on both sides of the machine in 1-1/2 inch letters: "

3.25.5

All equipment shall be protected by finishes suitable to the environment. Moving parts shall be self-lubricated or shall contain provisions for full application of all lubricants.

3.25.6

Exteriors exposed to the elements shall be finished by a minimum three (3) coat process. The base coat shall contain a rust inhibitor phosphatized coating and be thoroughly bonded to base metals.

3.26 Labeling

3.26.1

Switch Production Tamper Vehicle shall have identification labels on sides and rear of unit indicating "ST2015" in 8 inch letters.

3.26.2

All applicable safety decals shall be attached.

3.26.3

Pneumatic and hydraulic component location chart. All valves shall have metal ID tag or manufacture approved long lasting tags that will reference the location chart and all prints.

3.26.4

Switch Production Tamper Vehicle shall have reflective safety tape applied on the front, rear and sides of the vehicle.

3.27 Noise Exposure

3.27.1

Noise shall not exceed permissible exposure for operators, assistants, and workmen for a continuous eight-hour work day. Noise sources and machine cab shall be treated to bring about total compliance of the following conditions:

- a) Less than 90 dBA at 20 feet from the power plant housing; and
- b) Less than 85 dBA at 50 feet from the centerline of the track; or

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3.28 Repair Parts and Service

3.28.1

Equipment shall be delivered with a full complement of all recommended spare parts necessary to ensure successful start-up and total operational capability for a minimum of one (1) year.

3.28.2

Additionally, the Contractor shall provide a comprehensive list of spare components inclusive of current prices. A separate list of parts necessary for routine maintenance and recommended on-hand quantities shall also be submitted. The list may be based on historical failure data, or industry standard reliability failure predictions, and available mean time between failure (MTBF) reliability data.

3.29 Manuals and Documentation

3.29.1

The Contractor shall provide ten (5) sets of Operation and Maintenance Manuals, and parts manuals and (5) memory sticks or CD's. If Training videos are available the manufacture will provide 2 copies on memory sticks or CD's.

3.29.2

Manuals shall contain 8-1/2 inch x 11 inch pages. The binders shall not exceed 3 inches overall thickness. Punched holes shall be on 3/4 inch centers. Folding pages will be permitted (11 inch x 17 inch, "Z" folded) where the information to be conveyed cannot be presented clearly on single pages. Manuals for 8-1/2 inch x 11 inch pages may be divided into Book 1, Book 2, etc., if the required material cannot be accommodated within the maximum binder thickness. Table of Contents shall be provided in each book.

3.29.3

All sections shall be sub-divided, to the extent required by the subject Matter, per the Manufacture design.

3.29.4

All parts shall be identified and cataloged within each individual system.

3.29.5

The Material Safety Data Sheets (MSDS) for all materials shall be supplied.

3.29.6 Technical Manuals:

3.29.6.1

Technical manuals shall contain a complete list of the major OEM part numbers for all consumable replacement items including replacement filters and drive belts, and other high wear items. OEM reliability data and documentation for manufacturers' recommended scheduled maintenance requirements for all major components, assemblies and subassemblies will be provided as an integral part of the technical manuals. The Machine Manufacture should provide a reasonable amount of information so that the machine can be maintained properly

3.30 N/A

4.0 Inspection and Acceptance Testing

4.1 Initial Preparation and Servicing

4.1.1

The machine shall be delivered completely lubricated and serviced with all equipment installed for immediate operation, except for fuel. Water cooled engines are to be protected from freeze up by a 50/50 solution of ethylene

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glycol base anti-freeze (rust inhibitive type) unless otherwise specified, and the radiator marked or tagged to show the manufacturer and type of coolant used and actual protection afforded.

4.2 Equipment Delivery Acceptance Testing

4.2.1

Upon equipment delivery, the Contractor shall perform acceptance testing at MDT. Acceptance test plans shall be submitted by the Contractor ten (10) working days prior to performing the test and approved by MDT, prior to testing. As a minimum acceptance tests shall include:

- a) System Clearance Checks (within the MDT System);
- b) Full-functions performance testing including track alignment, high speed tamping, lifting and plotting;
- c) Tow Capacity Verification;
- d) Braking Capability Verification;
- e) Hydraulic System Performance Check;
- f) Engine Check;
- g) Vehicle Lighting Test;
- h) Heating & Cooling Test;
- i) Noise Level Measurements.

4.2.2

A Contractor's Representative shall place equipment in service and instruct MDT's operators, mechanics/technicians, and supervisors at a location, to be specified by MDT (not necessarily at the machine delivery point).

5.0 Safety Requirements

6.0 Reliability and Warranty

7.0 Training

7.1

Training with Required Submittals:

The Contractor is responsible for providing training at MDT's facility for up to 20 people: for 6 weeks 3 weeks for operators & 3 week for mechanics.MDT will provide the training room.

7.1.1

Training in the maintenance and operation of the contracted item(s).

7.1.2

Training materials sufficient to support continued in-house MDT training.

7.1.3

Updated training and training materials when, in the scope of the Contract, changes or modifications are made that affect the operation or maintenance of the unit(s) contracted for.

7.1.4

Scope of work: Training for the Switch Production Tamper will require a minimum of six (6) weeks at forty (40) hours per week shifts to be designated by MDT with no premium rates. 3 weeks operators & 3 weeks mechanics

7.1.5

All training, as described below, shall take place by the Contractor prior to acceptance of equipment or materials by MDT. The number of MDT employees to be trained will be specified on a contract-by-contract basis. However, the

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minimum number shall be twenty (20) for operation training and twenty (20) for operations and maintenance of equipment or materials by MDT. Those persons shall be identified by MDT.

7.1.5.1

Operations training: will be tailored specifically to MDT Equipment and track, and designed to teach the day to day operations of all equipment. The training will be sufficient to bring personnel to a level of operating proficiency such that routine Contractor support is not needed.

7.1.5.2

Maintenance training: will be subdivided into two major levels:

- a) System Level Maintenance Training covering:
 - 1) Theory of operation of the system and its major components
 - 2) System configuration
 - 3) Preventative maintenance, consisting of written procedures and schedules for the periodic maintenance of all equipment

- b) Shop Level Maintenance Training covering:
 - 1) Detailed theory of operation to module, board, and /or device level;
 - 2) Component level troubleshooting and component replacement;
 - 3) Testing and alignment procedures of repaired units.

7.1.7

Number of Copies of the training manual: The Contractor shall deliver final copies to MDT as follows:

- a) A set of complete student materials for each participant enrolled in training classes.

7.1.8

All instruction will be presented in accordance with approved training materials.

- a) All operator training will be coordinated through MDT Training Department.
- b) All maintenance training will be coordinated through MDT Training Department.
- c) All courses will be attended and monitored by MDT Training Department.
- d) Operator training & maintenance shall be performed between 7:00 AM to 3:00 PM.
- e) Training shall cover safe operation of all systems.
- f) All training shall be performed at the location specified by MDT Training Department.
- g) The Trainer must have a minimum of five (5) years of experience on the specified equipment.