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142400 - Hydraulic Elevators

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SECTION 14 24 00 - HYDRAULIC ELEVATORS

NOTES TO DESIGNERS (delete prior to publishing):

The following is not intended as a complete specification, but as a detailed template that the design team will use, while ensuring that the final specification complies with all applicable codes and regulations. The designers are responsible to ensure that the specifications comply with all applicable codes and regulations related to this section. Any changes proposed to this document needs to be reviewed and approved by UNH separate from the overall DD review by UNH so as to allow necessary review, while avoiding irreversible design decisions affecting broader design/construction issues.

In new construction and major renovations where practicable, UNH requires that all levels of a building be served by at least one-stretcher compliant elevator.

Architect shall design the elevator landings such that the hall call stations are located to the left of the hoistway door, where practicable, and 24" clear of all projecting obstructions including intersecting walls.

Architect and engineers shall incorporate the following elevator-related requirements into the work of other sections:

- *Fire-rated hoistway(s) and machine room(s)*
- *Machine rooms shall have finished walls, ceilings and floors (sealed concrete is not acceptable) prior to installation of any elevator equipment.*
- *Waterproof elevator pit with sump pit*
- *Elevator cab flooring*
- *Fire extinguisher in machine room*
- *Miscellaneous Metals:*
 - *Steel support angles for thresholds of each hoistway opening*
 - *Steel ladder for each elevator pit*
 - *Mechanically-fastened, flush, steel grating at sump pit, coordinate with pump requirements*
 - *Steel interfacing between guide rail brackets and building structure*
- *Year-round ventilation or cooling if/as required by ANSI A17.1 Elevator Code*
- *Hoistway ventilation (only if required by ANSI A17.1 Elevator Code) to include damper tied into fire alarm system to open on any smoke or heat detector activation in the building and designed to fail open upon power loss.*
- *Stancor Oil-Minder 110V UL-listed automatic sump pump(s); with control system in elevator machine room*
- *Electrical power feeder(s) as required for elevator controller(s) and equipment, with main line fused disconnect switch; step down transformers shall not be allowed in the elevator machine room*
- *Separate fused electrical service for car lights, in the machine room*
- *Separate dedicated circuit for sump pump(s) in the elevator pit*
- *Convenience outlets (GFI) and switched light fixtures in elevator pits and machine room.*
- *Smoke detectors, as required by Code, at elevator machine room, top and bottom of elevator shaft, and in all elevator lobbies; tied into fire alarm system and interlocked with elevator recall system*

- *Where building is served by a sprinkler system, provide:*
 - *Sprinkler coverage in control room and hoistway with separate branch lines for the top of each shaft, the bottom of each shaft, and each control room. All branch lines to include isolation valve with flow sensing and tamper switches.*
 - *Heat detectors (fixed temperature; below sprinkler temp rating) at elevator machine room and at top and bottom of elevator shaft tied in to fire alarm system*
 - *Shunt trip of all elevator power including battery lowering feature*
 - *Fire alarm connection and programming of flow and tamper switches at sprinkler branch lines serving elevator machine room, top of elevator shaft and bottom of elevator shaft*
- *Open conduit telecommunications system beginning with an open conduit and pulling bushing in the nearest telecommunications room and terminating with a junction box and cover adjacent to the elevator controller cabinet.*

PART 1 - GENERAL

1.01 SUMMARY

- A. The work in this Section consists of all plant, labor, materials, equipment and services necessary to complete the work of this Section, and without limiting the generality thereof includes:
 - 1. The installation of oil-hydraulic elevator(s), including transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation even though not specifically mentioned or indicated on the Drawings, but which are usually provided or are essential for proper operation.
 - 2. Furnish and maintain hoistway equipment, operating personnel and rigging to perform the work of this Section.
 - 3. All work shall be performed in a first class, safe and workmanlike manner.
 - 4. In all cases where a device or part of the equipment is referred to herein in the singular, it is intended that such reference shall apply to as many devices as required to complete the installation.
- B. The General and Supplementary Conditions of the Contract and Chapter 5, Division 01 requirements shall apply to the work under this Section.
- C. See Chapter 5, Division 01, Section 017700.1.1.B.1.i Closeout Procedures - Project Record Documents and equipment list requirements for all equipment provided in this section.

1.02 DEFINITIONS

- A. Definitions in ANSI A17.1 apply to work of this Section.
- B. Hydraulic Elevators: Elevators in which cars are hoisted either directly or indirectly by action of a hydraulic plunger and cylinder (jack); with other components of the Work, including fluid storage tank, pump, piping, valves, car enclosures, hoistway entrances, operation systems, signal equipment, guide rails, electrical wiring, buffers, and devices

for operations, safety, security, required performance at rated speed and capacity, and for a complete elevator installation.

- C. Defective: Operation or control system failures; performance below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; or other similar unusual, unexpected, or unsatisfactory condition(s) shall constitute defective elevator work.

1.03 DESIGN INTENT – ELEVATOR HOISTWAY AND PIT SIZE

- A. The hoistway and elevator pit dimensions (plan and vertical) shown on the contract drawings shall be considered maximum allowable. It is the intent of the design that these dimensions, particularly the plan dimensions, be reduced as much as possible based on the actual elevator installation. Therefore, the Elevator Contractor is required to configure the elevator installation to be as compact as possible. Once the minimum manageable hoistway and pit dimensions are established by the elevator contractor, the Architect will reconfigure the areas surrounding the elevator core and issue supplemental drawings and instructions. It is, therefore, imperative that the elevator layout drawings be submitted very early in the construction phase of the project such that the final elevator pit dimensions and location can be established well in advance of foundation construction.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for all materials proposed for use including, but not limited to, the following:
 - 1. All pump and hydraulic components including but not limited to tank, pumps, valves, oil lines, fittings, cylinders and pistons
 - 2. Controllers
 - 3. Signal and operating fixtures, operating panels and indicators
 - 4. Door equipment
 - 5. Door edge protection
 - 6. Cab components and finishes including material selection charts
 - 7. Hoistway door and frame details selection chart(s)
- B. Drawings: Submit drawings including, but not limited to, the following:
 - 1. Car, guiderails, buffers and other components in hoistway
 - 2. Maximum rail bracket spacing
 - 3. Maximum loads imposed on guide rails requiring load transfer to building structure
 - 4. Clearances and travel of car
 - 5. Clear inside hoistway and pit dimensions (see Paragraph 1.04 above)
 - 6. Location and sizes of access doors, hoistway entrances and frames
 - 7. Hoistway door and frame details

8. Detailed information regarding rough-in and other preparatory work by other trades related to the elevator installation(s)
9. Electrical characteristics and connection requirements
10. Expected heat dissipation of elevator equipment in control room space and machine space (BTU)

1.05 STANDARDS, CODES AND REGULATIONS

- A. Furnish all elevator equipment in accordance with most-stringent applicable provisions of the following Codes and/or Authorities, including revisions and changes in effect on date of these specifications:
 1. Latest version of the American National Standards Institute “Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks”, ANSI A17.1 (the ANSI Code).
 - a. Seismic Zone: Comply with code requirements for seismic risk zone as required by governing codes and authorities.
 2. Inspector’s Manual, ASME/ANSI A17.2.
 3. Elevator and Escalator Electrical Equipment, ASME/ANSI A17.5
 4. National Electrical Code, ANSI/NFPA 70, and other applicable codes and standards as described in Division 16 specifications.
 5. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.
 6. Life Safety Code, NFPA 101
 7. Requirements of any other Codes, Ordinances and Laws applicable with the governing jurisdiction.
 8. Architectural Barrier-Free Design Code for New Hampshire / ADA.

1.06 WARRANTY

- A. The Elevator Manufacturer and Elevator Contractor shall jointly provide a warranty agreeing to replace, repair, and restore defective (see definition above) materials and workmanship of elevator installation during the warranty period. The warranty period is twelve (12) months following Date of Substantial Completion and/or safety tests and certification of the elevators by State Inspectors, whichever occurs last.
- B. This warranty is not intended to supplant maintenance service and shall not be construed to require free service for periodic examination, lubrication, or adjustment due to normal use, beyond that included below; nor correction without charge for breakage, maladjustment, or other trouble arising from abuse, misuses, or any other causes beyond the control of the Elevator Manufacturer and Elevator Contractor.

1.07 MAINTENANCE AND CALL BACK SERVICE

- A. The Elevator Contractor shall furnish maintenance and call back service for a period of one (1) year following the Date of Substantial Completion or certification for operation by State authorities, whichever occurs last, at no additional cost to the Owner. Maintenance services shall be performed monthly. Call back service shall be performed upon request of the Owner. This shall consist of responding within one hour of notification during the normal working hours of the elevator trade and within two hours outside of regular working hours.
- B. Monthly maintenance shall include, but shall not be limited to, inspections, lubrication, cleaning, replacement of worn or defective components, and adjustment of equipment as required for safe and proper elevator performance and operation at rated speed and capacity. Only genuine standard parts produced by the manufacturer of the equipment concerned shall be used for replacement. The elevator contractor shall provide at least one hour per month per elevator of on-site maintenance.
- C. All work under the maintenance provision shall be performed by trained, competent personnel under the supervision and in the direct employ of the Elevator Manufacturer and/or Elevator Contractor.
- D. The maintenance service shall be performed solely by the Elevator Manufacturer and/or Elevator Contractor and shall not be assigned or transferred to any agent or subcontractor.
- E. Defects due to misuse, accidents, or negligence on the part of the Owner will not be considered covered under this maintenance/call back provision.

PART 2 - PRODUCTS**2.01 OPEN MARKET PRODUCTS**

- A. It is the intent of these specifications is that all products and materials used in the subject elevator installation be "open market", meaning:
 - 1. No special tools required.
 - 2. Equipment can be maintained by any elevator contractor.
 - 3. Parts can be sourced from multiple vendors.
 - 4. Parts are available off the shelf.

2.02 MANUFACTURER

- A. Hydraulic components shall be manufactured by Canton Elevator, Blain Hydraulics, American Crescent, Elevator Equipment Corporation, Minnesota Elevator, ThyssenKrupp Elevator or Otis.
- B. Controllers shall be manufactured by Motion Control Engineering, Inc., Elevator Controller Corporation or G.A.L. and shall have solid state motor starters.



- C. Elevator cab shall be manufactured by Roy Elevator Cabs and Entrances, Columbia Elevator Products, Snap Cab, or ThyssenKrupp.
- D. Door equipment shall be manufactured by G.A.L. Manufacturing Corporation.
- E. Full length door edge protection shall be IMS 100 3D Panachrome sensing beam by Adams Elevator or Pana 40 Plus by Janus.
- F. Signal Fixtures and Equipment shall be manufactured by PTL Equipment Mfg. Co., no exceptions.
- G. Textured Stainless Steel to be selected by the Owner and Architect from full selection of textures available through Rimex Metals Group, Ruggedized Metals Corp. or other source with a roughly equivalent range of textures.

2.03 ELEVATOR CONTRACTOR

- A. The Elevator Contractor shall have been regularly engaged in the installation of hydraulic elevators and shall be able to demonstrate at least three installations that have provided satisfactory operation for a period of at least two years.
- B. The Elevator Contractor shall be able to demonstrate that they have provided for a period of at least five years satisfactory maintenance service for hydraulic elevators, that they have maintained a complete elevator maintenance organization comprised of regularly employed, competent, trained elevator mechanics, and that they have maintained an adequate stock of parts for replacement and emergency purposes, all within fifty (50) miles of the site.

2.04 GENERAL PARAMETERS

- A. Quantity and Elevator Designation: ***(EDIT AS NEEDED) One (1), designation E-1, E-2, etc.***
- B. Elevator Stop Designations: E-1 serves ***(ENTER FLOOR STOPS e.g. G, 1, 2, 2R, 3 and 4; E-2 serves)***
- C. Door Openings: All at front ***(EDIT THE FOLLOWING IF/AS NEEDED FOR REAR/SIDE DOOR OPENINGS), except 2R. Rear door to be diagonally opposite front door.***
- D. Travel: ***(ENTER TRAVEL DISTANCE) __'-__"***
- E. Capacity: ***(ENTER FOR EACH ELEVATOR; 3,500 LBS MINIMUM) E-1 – 3,500 lbs.***
- F. Speed: 125 feet per minute.
- G. Stopping Accuracy: ±1/4" under any loading condition or direction of travel
- H. Car inside Dimensions (clear between rails): ***(EDIT AS NEEDED) minimum __'-__" wide x __'-__" deep or as required to meet stretcher dimensions requirements of applicable codes, if/as applicable. Cab height to be 8'-0" with 7'-4¾" minimum ceiling height.***
- I. Entrances: ***(EDIT AS NEEDED) 3"-6" minimum width x 7'-0" high; stainless steel, single speed, side slide.***

- J. Hoistway Access: Drop key, all levels and hoistway access operation, in-car and at terminal floors.
- K. Signals: Illuminated car and hall buttons; alarm bell.
- L. Position Indicators: In car and at all landing entrances with chimes and car direction lanterns.
- M. Registration Lights: Car and Corridor Pushbuttons.
- N. Independent Service: Key switch by elevator contractor; cylinder provided and keyed by Owner.
- O. Access Control:
 - 1. Keyed Lockout: ***(EDIT AS NEEDED; REQUIRED AT LANDINGS SERVING ONLY MEP SPACE) In-car for Level 4***; all necessary programming and key switches by elevator contractor; cylinder(s) provided and keyed by Owner.
 - 2. Card Access: ***(DELETE IF NOT APPLICABLE; OTHERWISE, EDIT AS REQUIRED FOR PROJECT CONDITIONS)*** Coordinate with separate security contractor for installation of a card reader in-car and associated communications cable back to the elevator machine room. At Landing ____, provide 2-position keyed lock-out switch that, when on, limits in-car call registration to all levels/landings (except ____ and ____) to only those authorized through the card access system. All necessary programming and key switch by elevator contractor; card reader by separate security contractor; Key switch by elevator contractor; cylinder provided and keyed by Owner.

2.05 DESCRIPTION OF EQUIPMENT

- A. Car Top Inspection Station: Yes.
- B. Emergency Car Lighting: Yes.
- C. Emergency Operation: Fireman's Service – Phase I and II, with Barrel-Key FE 01.
- D. Two-Way Communication, one touch auto dial, built-in; EMS brand preferred
- E. Sills: Extruded Aluminum.
- F. Isolation: Yes.
- G. Guide Rails: T-type steel
- H. Rail Backing: Comply with seismic code requirements.
- I. Casing: Yes.
- J. Cylinder: Yes, with PVC protection.
- K. Plunger: Yes.
- L. Wiring Diagrams: Provide with O&M Manuals.
- M. Mechanical Drawings and Cuts: Provide with submittals; include with O&M manuals.

- N. Documentation: Provide three (3) complete bound sets of O&M Documentation for all materials and products incorporated into the elevator construction. Refer to Chapter 5, Division 01, Section 011000, if applicable, for more information.
- O. Electrical:
 - 1. Main Power Supply: **(EDIT AS REQUIRED) 480V or 208V** (+/- 5% of normal), 3-phase, with dedicated equipment grounding conductor.
 - 2. Car Lighting: 277V, single-phase.
 - 3. Battery backup for controlled descent to lowest level of egress in event of power loss; with relay(s) as needed to allow interruption by shunt trip when initiated by heat detector activation.
 - 4. Battery backup for the car lights.
 - 5. Key switches for in-cab light and fan.

2.06 ELEVATOR MACHINERY

- A. Type of Equipment:
 - 1. The elevator shall be the “plunger electric” type with direct acting plunger, pumping unit, storage tank and magnetic control valves. The pumping machine associated control equipment shall be located in machine rooms.
 - 2. The pump shall deliver the oil directly to the cylinder at the necessary pressure and in sufficient quantity to lift the fully loaded elevator at the specified speed. The tank shall act as a storage tank only and the oil shall be pumped into the cylinder on the up trip and shall be returned into the tank on the down trip.
- B. Elevator Cylinder and Plungers:
 - 1. The elevator cylinder shall be constructed of steel piping of sufficient thickness suitable for working pressure of 400 pounds per square inch. Cylinders of multiple section construction shall be thoroughly and substantially connected by means of external couplings. The bottom of the cylinder shall be closed and the top provided with a self-adjusting packing that does not require external adjustments, so arranged as to prevent leakage. The cylinder shall be prepared and coated with a butyl type adhesive at a uniform minimum thickness of 10 mils, and covered with an overcoat sheath of virgin, high molecular weight polyethylene, free of contamination from foreign substances, to a uniform thickness of minimum 40 mils. The bottom of the cylinder shall be sealed with an end cap. The end cap must be monolithic with the extruded coating, either by continuous extrusion or plastic welding, and holiday tested. The bottom end cap shall be a high molecular weight polyethylene cap, welded to the bottom pipe section, and protected during shipping by a cushioned, metallic oversheath.
 - 2. The plunger shall be constructed of selected steel tubing of proper diameter, machined true and smooth with a fine polished finish. The plunger sections shall be securely joined by means of internal couplings. Stop rings shall be welded to the bottom of the plungers to prevent the plungers from leaving the cylinders. The plungers shall be secured to the car frame by means of a platen plate. The platen plate shall be isolated from the car frame by means of a thick rubber pad.

C. Well for Cylinder:

1. The well for the cylinder shall be sunk into the ground by the Elevator Installing Firm. Excavation work is unclassified, and shall be made through whatever materials encountered, without extra payment. All parties are advised that excavation may require substantial drilling through rocks and boulders. Well shall be cased and sealed to prevent water from entering inner casing and pit.

D. Pumping Unit:

1. The pumping unit shall be of integral design and an electric motor, a pump, a control valve assembly, a storage tank, a main-line strainer, necessary piping connections and controller, all compactly designed and mounted on a structural steel bedplate as a single self-contained unit. Provide submersible pump up to 30hp. Over 30hp, the motor and pump assembly shall be mounted on a rubber isolated inner base with removable drip pan and the tank and controller shall be supported above on a structural steel frame.
2. Pumps: Shall be a positive displacement screw type to give smooth operation and shall be designed and manufactured specifically for elevator service.
3. Motors: Shall be of alternating current, polyphase, squirrel cage induction type and shall be of a design especially adapted to plunger elevator requirements. Motors shall be premium efficiency.
4. Control Valve Assembly: Shall be of compact design suitable for operation under the required pressures. It shall contain a metered bypass valve, a check valve, a relief valve, a manual lowering valve, metered lowering and leveling valves and pilot valves. An isolated seal and coupling device, designed to reduce the transmission of vibrations and noise to the elevator car, shall be provided. Operation of the manual lowering valve shall permit the car to be lowered at slow speed, in the event the power fails.
5. Storage Tanks: Oil reservoirs shall be constructed of welded steel sheets, and shall be provided with a cover, a protected vent opening, a filtering screen mounted over the suction inlet and a drain connection. An initial supply of oil sufficient for proper operation of the elevator shall be provided. Tanks shall have a capacity equal to the volume of oil required to lift the elevators to the top terminal plus a reserve of not less than ten (10) gallons.
 - a. The tank shall be provided with a marked gauge to meter the hydraulic fluid level. The permissible minimum hydraulic fluid shall be clearly indicated.
 - b. A data plate shall be affixed to the tank indicating the characteristics of the hydraulic fluid used, installation date, and name of installing firm, name of manufacturer, piston diameter, and manufacturer's designed head pressure.
 - c. Provide tank heater to maintain temperature of oil at minimum of 100 degrees.
6. Sound Reducing Enclosure: The lower area of the power unit where the motor and pump are installed shall be enclosed with removable sheet steel panels lined with sound deadening material to reduce airborne noises; not required where submersible units are provided.

7. Muffler: A blow-out muffler, designed to minimize the transmission of fluid pulsation, shall be furnished and installed in the pipeline between the pumping unit and the cylinder head.
 8. Sound Isolation Couplings: A minimum of two shall be installed in the oil line between the pump and jack.
 9. Rubber Isolation: A rubber isolation mat shall be provided for underneath the reservoir, motor and pump frame.
- E. Hoistway Components:
1. Hoistway Operating Devices:
 - a. Stop Switch in Pit: A stop switch shall be provided in the elevator pit(s) and shall conform to the specified code. The pit stop switch, when in the off or "stop" position, shall eliminate, along with other operations, car leveling.
 - b. Terminal stopping switches.
 - c. Car positioning unit.
 - d. Hoistway access switches.
 2. Guide Rails:
 - a. Guide rails shall be planed steel, securely fastened to the building structure with steel brackets by means of bolts and forged steel rail clips. Rails shall conform in all respects with the elevator codes, and shall be located so that the entire car assembly shall be in true balance with the guide rails.
 - b. Guide rails shall be supported by brackets at each floor. Where fastenings are over 12 feet apart, rails shall be reinforced with 9-inch channel backing, or approved equal, to ensure the rigidity required for elevator capacity, platform size and method of loading.
 - c. All joints shall be located so as not to interfere with supporting rail clips and brackets. Shims used to secure rail alignment shall be designed so that they remain in position, even though the fastening bolts may be loosened.
 - d. Guide rails shall extend to within three inches of the underside of the hoistway ceiling with a maximum deviation 1/8-inch from plumb in all directions. Provide a minimum of 3/4-inch clearance between bottom of rails and top of pit channels.
 - e. Guide rail anchorages in pit shall not be made in a manner that will reduce the effectiveness of the pit waterproofing, if applied.
 - f. Guide rails shall be free of any signs of rust or abrasion, and shall be filed to remove all rough edges prior to final inspection. All guide rail joints shall be filed to assure perfectly matching surfaces.
 - g. For attaching of guide rails in concrete or brick, where steel framing is not available, install approved inserts. Installation by Contractor.
 - h. Rail brackets and fishplates shall be installed in accordance with applicable seismic requirements.
 3. Roller Guides: Roller guides shall be mounted on the top and bottom of the car frame and shall be held in contact with the guide rails. Each roller shall be adjustable and set to provide equal pressure on all rollers.

4. **Buffers:** Adequate spring buffers shall be provided on the pit channels. Buffers shall be blocked up as required to protect the cylinder head and packing gland in the event the car should pass the bottom final limit switch setting. Strike plates shall be mounted on the underside of the car frame. Each spring buffer shall be provided with a marking plate showing its load rating and stroke, and the number of springs. Where the springs are removable, each spring shall be identified and the assembly marking plates shall indicate this identification. Markings shall be made in a permanent and legible manner.
 5. **Rupture Valve:** A rupture valve shall be installed in the oil line, located in the pit, between the cylinder and control valves.
 6. **Isolation Valve and Drain:** If elevator machine room is not immediately adjacent to the elevator shaft, provide an isolation valve on the oil line in the elevator pit and a normally capped drain valve between the isolation valve and the cylinder.
 7. **Fascia:** Galvanized sheet steel shall be provided at the front <and rear> of the hoistway as required to meet maximum horizontal loading zone clearances.
- F. **Piping:**
1. Piping shall be furnished and installed between the pumping unit and the cylinder head complete with necessary fittings. A gate valve shall be provided in the line to facilitate maintaining and adjusting the elevator.
 2. All hydraulic piping related to the elevator machinery shall be installed so that rigid contact between the piping and other building systems is avoided. Piping supports shall include Neoprene Isolators (1/4 inch static deflection) and Neoprene Filler Sleeves shall be used where piping penetrates walls.
 3. All in-ground cylinders shall be encased in PVC.
 4. Include wrap-around plastic pipe identification, clearly visible within each space piping is located.
- G. **Wiring:** The Elevator Installing Firm shall furnish and install complete, all necessary insulated wiring to connect all parts of the equipment. All wire and traveling cables shall have a flame retarding and moisture resisting outer covering and shall be run in metal conduit, metallic tubing, wire ducts or raceways. Traveling cables shall be flexible and suitably suspended so that there is no strain on individual conductors. All electrical material and work shall, at minimum, comply with the latest enforcing electrical codes. All electrical penetrations through fire-rated walls shall utilize non-combustible sleeves and be appropriately sealed.
- H. **Controller:**
1. The elevator controller shall have solid state motor starters and shall utilize a non-proprietary microprocessor based logic system that can be easily serviced by any and all recognized service companies with parts easily accessible on the aftermarket and shall comply with ANSI/ASME 17.1 safety code for elevators. The system shall provide comprehensive means to access the computer memory for elevator diagnostic purposes, and shall have permanent indicators to indicate important elevator statuses as an integral part of the controller. Systems that require hookup of external devices for troubleshooting shall have the device provided to the Owner as part of the installation. Laptop interface shall be provided

for purposes of adjustments and troubleshooting. Failure of any single magnetically operated switch, contactor, or relay to release in the intended manner or the occurrence of a single accidental ground or short circuit shall not permit the car to start or run if any hoistway door or gate interlock is unlocked or if any hoistway door or car door or gate contact is not in the made position. Furthermore, while on car top inspection or hoistway access operation, failure of any single magnetically operated switch, contactor or relay to release in the intended manner or the occurrence of a single accidental ground shall not permit the car to move even with the hoistway door locks and the car door contacts in the closed or made position.

2. Dedicated permanent status indicators shall be provided on the controller to indicate the following: When the safety circuit is open, when the door locks are open, when the elevator is operating at high speed, when the elevator is on independent service, when the elevator is on fireman's service, when the elevator out of service timer has elapsed or when the motor limit timer or valve limit timer has elapsed. In addition, provide means of displaying other special or error conditions that are protected by the microprocessor.
3. All available options or parameters shall be field programmable, without need for knowledge of any programming languages. Programmable options and parameters shall be stored in a nonvolatile memory. As a minimum, there shall be a 32 character alphanumeric display to be used for programming and diagnostics. Programmable parameters and options shall include and not be limited to the following:
 - a. Number of stops/opening served (each car).
 - b. Selective Collective/Double Hall Button.
 - c. Fire Floors (Main, Alternates).
 - d. Single Automatic Pushbutton.
 - e. Floor Encoding (Absolute PI).
 - f. Digital PI's/single wire PI's.
 - g. Programmable door times.
 - h. Programmable Motor Limit Timer.
 - i. External Car Shutdown Input (e.g. Rescuvator).
 - j. External Low Oil Sensor Input.
 - k. External Viscosity Control Input.
 - l. Parking Floors.
4. Each elevator shall have its own computer and dispatching algorithm. Should one of the computers lose power or become inoperative in any way, the other computer shall be capable of accepting and answering hall calls. When both computers are in operation, only one of them shall assume the role of dispatching the hall calls to both elevators. Communication between the controller computers shall be accomplished through a high speed serial link using a single twisted shielded pair of wires.
5. On power up the controllers shall move the car to the closest floor to identify the position of the elevator.
6. The controllers shall have a real-time clock/calendar with battery backup.

7. The controllers shall have a serial port for communication with any data or computer terminal such as CRT terminal, modem, etc.
 8. Overload relays shall be of the manual reset type of suitable size for the motor furnished.
 9. A main line switch shall be provided on the controllers to avoid the possibility of pump churning.
 10. The controllers shall be equipped with hinged panels, lift-off panels will not be accepted.
- I. Car Stall Protective Circuit: In the event the car should stall while ascending as the result of a relay or control failure, valve failure, low oil in the system, etc., a special circuit shall be provided which shall automatically return the car to the bottom landing and perform a normal door operation, after which the elevator shall be completely shut down except for the door operation. Service will be restored by recycling the main line disconnect switch.
- J. Motor Limit Timer: A motor limit timer function shall be provided which, in the event of the pump motor being energized longer than a predetermined time, shall cause the car to descent to the lowest landing, open the doors automatically and then reclose them. The car calls shall then be canceled and the car taken out of service automatically. Operation may be restored by cycling of the power disconnect switch.
- K. Valve Limit Timer: A valve limit timer shall be provided which shall automatically cut off current to the valve solenoids if they have been energized longer than a predetermined time. The car calls shall then be canceled and the car taken out of service automatically. Operation may be restored by the cycling of the power disconnect switch.

2.07 OPERATION AND CONTROL

- A. Collective Automatic Push Button Operation:
1. Control of the elevator(s) shall be automatic in operation by means of push buttons in the elevator car(s) marked for each of the landing levels served and button boxes located immediately adjacent to the elevator door frame at each landing, wherein all stops registered by the momentary pressing of landing or car buttons shall be maintained until the car answers the call. Each landing station shall contain push buttons that “light up” when pressed to indicate that a call has been registered, which will bring the car to that particular landing (see Car and Hall Stations). A time delay, non-interference feature shall be incorporated in the control mechanism to allow ample time for opening and closing of the car and hoistway doors before it is again placed in motion.
 2. The car operating panel(s) shall contain a key operated stop switch to interrupt the power supply to the valves and pump motor, independently of the regular operating devices. The opening of the stop switch shall not cancel the registered calls or the leveling operation while the elevator is in the landing zone and, after the stop switch is closed the car shall continue to answer its various calls. The car panel(s) shall also contain key operated light, fan, and door hold switches.
 3. Hall or car call registration and lamp acknowledgment shall be by means of a single wire per call besides the power busses. Systems that register the call with one

wire and light the call acknowledgment lamp with a separate wire are not acceptable.

4. Elevator Car and Hall Stations:
 - a. All the signal systems described herein will be manufactured by PTL Equipment Company, Inc.
 - b. All faceplates shall be flush mounted stainless steel with #4 satin finish and shall be 0.135 thick.
 - c. All engraved numbers and letters on the faceplate for floor buttons shall be 5/8" high.
 - d. All other buttons and switches shall be identified with engraved lettering approximately 5/16" high.
 - e. All symbols shall comply with ANSI Handicap Code A117.1, latest edition, Rule 210.B.
 - f. Buttons shall be of the mushroom type bottoming out on the plate. Buttons shall be stainless steel with a maximum protrusion from the cover surface of 3/16".
 - g. All floor buttons and switch assemblies requiring visual acknowledging light shall be 1/4-inch diameter clear Lexan Jewel replaceable insert type.
 - h. Hall push buttons shall have direction arrows and Lexan inserts.
 - i. Contact switch assembly shall be the Square D Class 9001 Type K contact.
 - j. At keyed stop, light, fan, and door hold key switches, provide and install Best mortise electric switch locks with removable cores.
 - k. Provide one (1) control key and three (3) change keys for construction phase of project. Control key and change keys to be turned over to UNH Hardware Services at completion of project.
 - l. At Independent Operation and any required floor lock-out key switches, provide and install necessary key switches and install ASSA Series 6000 high security cylinders, which shall be provided and keyed by the Owner.
 - m. Hall stations must be provided with an appropriately sized box for the shaft construction to ensure that the faceplate can be installed tight to the finished wall surface.
5. Operating Procedures:
 - a. The operation of the elevator(s) shall be from a single riser of pushbutton boxes at each landing, with "UP" and "DOWN" pushbuttons at all intermediate landings, and a single pushbutton at each terminal landing.
 - b. If the hoistway door interlock and the car door contact circuits have been activated, the car shall start automatically upon activation of one or more pushbuttons within the car or at a landing. The car shall stop at any landing reached for which a car call or a hall call in the direction of travel has been registered. The car shall not respond to hall calls registered in the opposite direction of travel unless it is the last call reached in the direction ahead of the car. The car shall make stops in the natural order in which calls are reached, irrespective of the sequence of which the calls have been

registered, if the call is registered sufficiently in advance of the arrival of the car at that particular landing to permit a stop to be made.

6. Firefighters Service: The elevator(s) shall be equipped with Phase I, Emergency Recall Operation and Phase II, Emergency In-Car Operation. The Firefighters Service shall comply with Fireman's Service-Phase I and II, with Barrel-Key FE 0.
 - a. Designated level shall be determined by the Durham Fire Department and NH State Fire Marshal's Office.
 - b. Alternate designated level shall be determined by the Durham Fire Department and NH State Fire Marshal's Office.
7. Dispatching Procedures (Applicable to Duplex Operation Only):
 - a. One car shall be parked at a predetermined main lobby landing and the other car shall remain at the last landing served or, optionally, be moved to a predetermined landing. Both cars shall, if idle, have their doors closed. The car at the main landing shall be considered the "parked" car and the other shall be considered the "free" car. Should both cars complete their calls at the main landing, the car which arrives first shall be considered the "parked" car. An idle "free" car shall respond to any landing call registered either above or below the floor at which it is located. When the "free" car is responding to car and/or landing calls, the "parked" car shall automatically respond to any up call or down call registered below an up-traveling "free" car, or to any up call or down call registered above a down-traveling "free" car. In addition, continuous hall call demand for longer than a programmable time shall also release the "parked" car. If the "parked" car leaves the main landing for any reason, it shall become and assume the duties of a "free" car, and the first idle "free" car shall proceed to the main landing to become the "parked" car.
8. Independent Service: The elevator car operating panel(s) shall be provided with a key switch to remove them from the "Automatic" operation where the elevator(s) shall operate in response to car calls only "in an independent mode of operation". Independent operation key switch shall be provided by the elevator installer. ASSA high security cylinder shall be provided and keyed by Owner for installation by the elevator installer.
9. Lock-Outs: If specified, the elevator car operating panel(s) and/or hall stations shall be provided with a momentary contact key switch(es), card reader(s) and/or biometric reader(s) to control access to a particular landing level(s) and/or ability to call the car. The key switch(es) and reader(s) are to be wired such that turning the key in the key switch or an authorized card swipe or biometric reading allows the particular call button on the car operating panel or hall station to register. Otherwise under normal conditions, the key-controlled call button(s) shall not be allowed to register. Attic and mechanical rooms with elevator access shall all have keyed lock-outs.

B. Signals:

1. Car and Hall Buttons: When a call is registered by pressing a button, it shall illuminate to indicate that a call has been registered. The button shall remain lit until the elevator answers the call.

2. Alarm Bell: An alarm bell shall be provided in the hoistway, connected to the alarm bell button in the car.
 3. Make all provisions to comply with State and Federal Disability Acts and codes referred to herein.
- C. Two-Way Leveling: The car shall be equipped with a two-way leveling to automatically bring the car sill level with the landing sill, with a minimum one-quarter (1/4) inch tolerance above or below the floor, regardless of load. The two-way leveling system feature shall be automatic and independent of the operating device.
- D. Automatic Terminal Stops: Normal and Final Switches shall be provided at the terminal floors to bring the car to a stop independent of their regular operating device.

2.08 CARS

A. Car Frames:

1. Car frames shall conform to the requirements of the Code and shall be constructed of steel plates and structural shapes securely riveted, bolted, or welded together. No cast iron shall be permitted. The entire assembly shall be of rugged construction, and amply braced to withstand unequal loading. Car frame members shall be such as to relieve the car enclosure of all strains. Car frames shall be balanced front to back and side to side. Provide weights and frames to achieve the required true balance. Weights and frames used for balancing shall be properly located.
2. Bolts which pass through the flanges of structural beams or channels shall be furnished with beveled washers at all points of contact with slope of the flange.

B. Car Platform: The car platform shall consist of steel frame, steel stringers, and a substantial wood floor (minimum of a double layer of 3/4" plywood subfloor, fire-retardant treated). Car thresholds shall be of extruded aluminum, with the necessary grooves for the car doors. The underside of the wooden platforms shall be covered with sheet steel not less than 27 gauge thickness. The platforms and car sills shall be arranged to accept finish flooring (by others) of thickness and composition specified elsewhere.

C. Car Enclosures: The car enclosure shall be constructed of the following construction and design. The car enclosures shall be UL certified, in compliance with the latest version of A17.1.

1. The car canopies shall be of best-grade cold-rolled furniture steel, 14 ga. minimum. The canopies shall be of one-piece construction and reinforced to form a working platform to withstand a minimum weight of two workmen.
2. The entrance columns shall be square. A fascia shall be provided above the return panels from top of car entrance to ceiling. Entrance columns, return panels and fascia shall be minimum 14 ga. satin stainless steel.
3. Floor to be unfinished plywood construction. Finish provided in Division 9.
4. **(EDIT FOR SATIN STAINLESS STEEL CAB WALLS, IF APPLICABLE)** The walls of the cab shall be constructed of minimum 16 ga. commercial-quality cold rolled steel adequately reinforced. Panels shall be formed to provide light-proof joints and securely fastened to the platform with bolts, a minimum 1'-0" on center.

5. Except at stainless steel, all interior and exterior steel surfaces shall be bonderized or given an approved rust preventative process before the finish is applied.
6. Finish: Except at stainless steel, all steel on cars shall be thoroughly cleaned, followed by a baked-on primer coat and sprayed-on two-coat baked enamel finish. All exposed surfaces of the furniture steel work shall receive applications of mineral filler with each coat application and shall be baked, sanded, and rubbed smooth between coats. Colors of all painted finishes shall be custom color as selected by the Owner.
7. Necessary cutouts shall be provided in the car for operating fixtures, signal fixtures, etc., as specified elsewhere.
8. Particular care must be taken in boxing and crating cabs to avoid damage in transit, as cabs and accessories must be in perfect condition at the time of final inspection after installation.
9. The finish wall panels shall be constructed of wood core, fire retardant, faced and edged on four sides with **(SELECT ONE) plastic laminate / textured stainless steel; pattern selected from commercially available / satin stainless steel**. Panels shall be removable.
10. The ceiling shall be suspended from the car canopy and shall consist of polished No. 8 stainless steel panels and framing elements in a 2-foot square grid. Framing members shall be so designed to prevent panels from becoming dislodged during normal operation and to allow easy removal of panels for service purposes.
11. Lighting shall be from LED (minimum 3500 Kelvin) downlights recess mounted in the car ceiling, quantity and lumen output as required for uniform 15 footcandle illumination.
12. The cabs shall be provided with emergency exit covers located in the canopy. The emergency exit covers shall be kept in the closed position when not in use by a manually operated self-locking latch or bolt without the use of keys or tools. The locking devices shall be accessible only from the car top. The covers shall be equipped with hinges and a handle, mounted and only openable from the top of the car. The car top emergency exit covers shall be equipped with a manually reset electrical device that will prevent the movement of the elevator if the cover is not fully closed and latched.
13. Ventilation shall consist of a two-speed fan exhaust fan located in the car ceiling.
14. The Elevator Contractor shall furnish and install a suitable communications cabinet in the car and shall furnish and install the necessary communication wires from the cabinet to a junction box, furnished and installed by the electrician, on the controllers. The communication system shall be of the vandal-resistant, hands-free phone equipped with push button automatic dial system, mounted in the operating panel of each car.
15. Provide an emergency light mounted above the car operating panels as required by code.
16. Handrail shall be provided on all non-access walls. It shall be made of flat solid stainless steel bar 1/4" (6 mm) x 2" (51 mm), satin No. 4 finish, with radiused end returns.

17. Stainless steel pad buttons and removable protective pads shall be provided for the elevator cabs.

2.09 DOORS AND ENTRANCES

- A. Comply with NFPA Standard No. 80 for construction and installation of hoistway entrances. Door units shall bear a UL label of approval as a “1½-hour Fire Door.” Where required by NFPA 80, provide separate UL labels of approval on hardware, sills, closers, and other accessory items of hoistway entrances.
- B. Hollow Steel Elevator Hoistway Entrances:
 1. Furnish and install entrance units with frames, sill struts, hanger supports and cover, fascia, dust covers and toe guards as described below.
 2. Frames: The frames shall be made from minimum 14 ga. satin stainless steel and shall comprise head and jamb sections with integral casing of trim and bolted to form one-piece unit frames. Frames shall contain suitable materials for effective sound deadening and bear UL Labels. All frames shall be securely fastened to sills and hanger supports and shall be returned on the hoistway side to present a neat appearance.
- C. Doors:
 1. Car doors shall be horizontal sliding type construction not less than one inch thick.
 2. Face car doors with minimum 16 ga. **(SELECT ONE) textured / satin** stainless steel. Doors shall contain suitable materials for sound deadening.
 3. Car doors shall be designed and reinforced for power operation.
 4. Car door leaves shall be hung on two-point suspension sheave-type hangers similar to those specified for hoistway doors. Doors shall be reinforced for separate hangers or built to include integral hangers.
 5. Car doors to be reinforced and provided with keyways as required for door operating mechanisms and to meet applicable codes.
 6. Bottom of doors shall be provided with removable laminated guides that run in the sill slots with minimum clearance and metal fire stops.
 7. Provide a “Drop Key” access on all landing doors. Drop keys to be stored at the site adjacent to the main line disconnect switches.
 8. Sills: The sills shall be of extruded aluminum. Finish with non-skid surface. Grooves for the door guides shall be machined with minimum clearance. The sills shall be supported on steel anchors securely fastened to the floor construction. The underside of the landing sills shall be thoroughly grouted the full width of the door opening.
 9. Fascia Plates and Toe Guards: Minimum 14 ga. steel fascia plates and toe guards shall be installed on all hoistway walls with door opening in order to provide proper running clearances. Toe guards shall be installed on the lowest landing sill extending down below the lowest travel of the elevator and on the top landing

header gradually beveled toward and fastened to the hoistway wall. Fascia plates shall extend from the headers to the underside of the landing sills at each floor. The fascia plates shall be reinforced as to prevent against deflections and secured to prevent contact with the elevator and/or the elevator equipment.

10. Hanger Supports and Dust Cover Plates: Hanger supports shall be 3/16 inch thick formed sections securely bolted to the struts. Cover plates shall be made of minimum 14 ga. steel extending the full travel of the doors and shall be made in removable sections for the purpose of servicing the hangers and other equipment from within the elevator car.
11. Struts and Closer Angles: Structural steel angles shall be furnished of sufficient size to accommodate the door closures. Angles shall be continuous and securely bolted to the sills and building beams above. Strut angles shall be provided with rubber stops. The stops shall be adjusted to allow the landing doors to fully open but prevent the hanger roller from leaving the tracks.
12. Sight Guards: Sight guards shall be furnished, finished to match the landing doors.

D. Door Operators:

1. Doors on the car and at each hoistway landing shall be operated quietly and smoothly by an electric operator, which shall open and close the car doors and hoistway doors simultaneously.
2. The car doors shall be provided with a non-contact infrared curtain protection system with 3D sensing beam, which shall cause the doors to reopen upon the detection of a person or object in or near the entrance of the elevator. The detector shall extend the full length of and not project beyond the leading edge of the car doors. The infrared curtain, when interrupted, shall reverse any active door closing operation and/or hold the doors in the open position, permitting the doors to reclose a programmable period of time after the interruption has ceased. Pressing of car operating floor button, or "Door Close" button, shall cancel the door timing interval and cause the doors to close provided the infrared curtain is not interrupted. Door nudging is not acceptable
3. A door restrictor shall be installed on the car doors to prevent the opening of the car doors from within the elevator unless the elevator is in the landing zone.
4. Each hoistway door shall be equipped with a positive electromechanical interlock and auxiliary door closing device so that the elevator can be operated only after the interlock circuit is established. The interlock operations shall comply with the specified codes.
5. An electric contact for the car door shall be provided which shall prevent the elevator movement away from the landing unless the door is in the closed position as defined in the specified codes.
6. The door shall open automatically only after the elevator comes to a complete level stop, and close automatically either after the expiration of a time interval or the moment a car button call is registered. Only the door shall open for the landing being served. A "Door Open" button, in the car station, shall cause the doors to stop and reopen upon activation of that button. The activation of a landing or car

- station button, at the landing where the elevator is located shall cause the doors to stop and reopen.
7. Door protection timers shall be provided for both the open and close directions which will help protect the door motor and which will help prevent the car from getting stuck at a landing. The door open protection timer shall cease attempting to open the door after a predetermined time in the event that the doors are prevented from reaching the open position. The door close protection timer will reopen the doors for a short time in the event that the door closing attempt fails to make up the door locks after a predetermined time.
 8. A minimum of three different door standing open times shall be provided. A car call time value shall predominate when a car call only is canceled. A hall call time value shall predominate whenever a hall call is canceled. In the event of a door reopen from the safety edge, photo eye, or door open button, a separate short door time value shall predominate. The timing value for these timers must be field adjustable.
- E. Door Hangers and Tracks: Furnish and install, for each hoistway sliding door sheave type, two point suspension hangers and tracks complete. Hanger brackets shall be integral with the door or applied. Sheaves and rollers shall be of steel and shall include ball bearings properly sealed to retain grease lubrication. Hangers shall be equipped with adjustable ball bearing rollers to take the upthrust of the doors. Tracks shall be drawn steel shapes, smooth surface, and arranged to hold lubrication. Suitable means shall be used to transmit motion from one door panel to the other.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Inspect hoistway, hoistway openings, pit, and elevator equipment room. Verify all critical dimensions, and examine supporting structure and the conditions under which the work is to be performed. Report, in writing to the Contractor with copies to the Owner and Architect, any conditions that might adversely affect the installation or ultimate operation of the elevator. Do not proceed with elevator installation until unsatisfactory conditions have been corrected.
- B. The Elevator Installing Firm shall be responsible for making field measurements of the machine rooms, hoistway, and openings for entrances before submitting drawings. After approval of shop drawings, the Elevator Installing Firm shall be responsible for the installation of equipment without field changes.
- C. Installation of elevator plant shall be complete in all respects and in a first-class manner, in accordance with the approved shop drawings, and the requirements of the laws, rules, regulations, codes, and industry standards specified herein.
- D. Elevator work shall be complete in all respects, with all components properly adjusted, and with all operating mechanisms and controls in proper working order.
- E. Comply with manufacturer's instructions and recommendations for all installation work.

- F. Provide welded connections for installation of elevator work unless bolted connections are required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welders.
- G. Coordinate elevator work with work of other trades. Properly time and sequence the work to avoid construction delays.
- H. Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts, designed to effectively prevent transmission of vibrations to structure, and thereby eliminate sources of structure-borne noise from the elevator system(s).
- I. Lubricate operating parts of systems as recommended by the respective manufacturer.
- J. Coordinate installation of hoistway entrances with car entrances. Where possible, delay final adjustment of sills and doors until car is operable. Reduce clearances to minimum, safe, workable dimension at each landing.
- K. Set sills accurately aligned with finished floor at all landings.

3.02 EXCAVATION

- A. A hole shall be excavated by the Elevator Installing Firm to accommodate the plunger and cylinder, and the bid shall be based on the possibility of encountering solid rock, boulders, sand and water. If such obstructions are encountered, no additional compensation will be provided.
- B. All bidders shall visit the building/site prior to bidding, to examine existing conditions.

3.03 WIRING

- A. Furnish and install as work of this Section all wiring necessary to connect operating buttons, switches and signals in the hoistway and all electrical equipment on the car to the elevator control panel. The wiring shall be installed in a neat and orderly manner, and shall be installed in conduit, electrical metallic tubing or metal wireways, excluding traveling cables, except that "liquid-tight" flexible conduit may be used for short runs.
- B. Traveling cables shall be of the best grade for service and shall be so installed to provide a proper size loop to the car. The traveling cables shall have a fire resistant outer braid. Protection against wear shall be provided on any structural surface where the traveling cables come in contact during the movement of the elevator.
- C. Three complete sets of wiring diagrams containing any field corrections, if necessary, shall be provided to the Owner as part of a complete Operations and Maintenance manual submission upon completion of the installation of elevator equipment.

3.04 CLEANING AND PAINTING

- A. Clean elevators promptly after installation in accordance with manufacturer/installer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

- C. All exposed metal, furnished under these specifications, unless otherwise specified shall be properly painted, after being installed, by the Elevator Contractor. Painting shall include but not be limited to the machine room floor, the pit floor, unused sections of rails, rail brackets, pit channels, fascia and dust covers shall be cleaned and painted before the improvements are accepted by the Owner.

3.05 FIELD QUALITY CONTROL

- A. Upon nominal completion of elevator installation, and before permitting use of the elevator (either temporary or permanent), perform formal acceptance tests as required and recommended by governing codes and authorities. All operational tests are to be performed under full load.
- B. The Owner reserves the right to hire a third party elevator consultant to inspect the installation and observe all required testing.
- C. Notify Contractor, Owner, and Architect of any scheduled formal inspection of the elevator installation. Provide 48-hour minimum advance notification.

3.06 PROTECTION

- A. The Contractor shall be responsible for protection of the elevator installation after installation. Protection shall include suitable coverings, barriers, devices, signs, or other methods or procedures to protect elevator work from damage or deterioration. Protective measures shall be maintained throughout the remainder of the construction period. For items that cannot be refinished in the field, return them to the shop for repair and complete refinishing or replace with new. All work shall be left clean and free of blemishes upon the Date of Substantial Completion.
- B. See requirements in Part 1 of this Section regarding temporary use of the elevator.

END OF SECTION 14 2400