

DIVISION 26 - ELECTRICAL

Section 26 00 00 Electrical General Requirements

- 1 Overhead Electrical Service:
 - 1.1 Refer to DC350, Part 1, Section 2, Division 26 and Section 33 71 00 - Electrical Utility Transmission and Distribution.
- 2 Underground Electrical Service:
 - 2.1 Refer to DC350, Part 1, Section 2, Division 26 and Section 33 71 00 - Electrical Utility Transmission and Distribution.
- 3 Security Door Supervision:
 - 3.1 Refer to DC350, Part 1, Section 2, Division 28 - Security System.
- 4 Lighting Control Equipment - Low Voltage:
 - 4.1 Refer to DC350, Part 1, Section 2, Division 26, Section 26 09 00 - Instrumentation and Control for Electrical Systems.
- 5 Fire Alarm System:
 - 5.1 Refer to DC350, Part 1, Section 2, Division 26 and Section 28 30 00 - Electronic Detection and Alarm or Section 26 24 00 Switchboards and Panels.
- 6 Electric Heat:
 - 6.1 Refer to DC350, Part 1, Section 2, Division 26 and Section 23 80 00 - Decentralized HVAC Equipment.
- 7 General:
 - 7.1 Provide all necessary equipment to interface fire alarm, security, telephone, computer, public address and interphone, television and multi-media systems.
 - 7.2 Indicate wiring diagrams and riser for each system including interfacing.
 - 7.3 Provide protective type guards for all of the following electrical related items:
 - 7.3.1 Gymnasium lighting fixtures of "all" types.
 - 7.3.2 Exterior wall mounted building (brackets) lighting fixtures.
 - 7.3.3 All interior gymnasium and exterior building speakers.
 - 7.3.4 All of the following devices installed in the gymnasium:
 - 7.3.4.1 Theatrical lights if applicable.
 - 7.3.4.2 Fire Alarm manual pull stations.
 - 7.3.4.3 Fire Alarm smoke detectors.
 - 7.3.4.4 Emergency lights, including battery packs and/or remote heads.
 - 7.3.4.5 Exit signs.
 - 7.3.4.6 Motion detectors.

- 7.3.4.7 All, or any other types of electrical devices that may protrude or extend beyond flush surfaces that could/might be subject to damage.
- 7.4 Main breakers on all new incoming switch boards shall be rated for 100% continuous load.
- 7.5 All outlets in gymnasium walls below 3048mm (10') A.F.F. are to be recessed 50mm (2") in the block utilizing 12.7mm (1/2") block increments.
- 7.6 Regardless of the system involved, all outlets shall have stainless steel cover plates, e.g. light switches, receptacles, voice/data structured cabling outlets, multi-media outlets, etc.
- 7.7 All system racks/cabinets are to be bolted to the floor.
- 7.8 Standard 483mm (19") racks shall be provided for structured cabling only. All other systems head ends shall be housed in stand alone cabinets c/w lockable doors. Provide ventilation as required.
- 7.9 Where a school is designated as an EMO site, provide an emergency power system c/w a manual transfer switch and an exterior male receptacle / connection point to accommodate a portable (NIC) generator.
- 7.10 Open Ceiling Concept:
- 7.10.1 General:
- 7.10.1.1 All exposed wiring is to be run in conduit or enclosed raceway.
- 7.10.1.2 Outlets in exterior walls will have to be piped back to accessible T-bar ceiling in corridors.
- 7.10.2 Lighting:
- 7.10.2.1 Use proper indirect fixtures manufactured for that purpose as opposed to upside down industrial fixtures, etc.
- 7.10.2.2 Relay panels are to be concealed above ceiling, yet accessible. Where this leads to a corridor location, ensure that this is not above cable tray - full access is required.
- 7.10.2.3 Ensure exposed portions of lighting branch circuits are aesthetically pleasing - no AC90.
- 7.10.2.4 Ensure ductwork is coordinated with lighting layout.
- 7.10.3 Power Distribution:
- 7.10.3.1 No exposed AC90.
- 7.10.3.2 Where boxes are not concealed, such as in an open ceiling concept, discs are to be fastened directly to the outside of the boxes after architectural painting is complete.
- 7.10.3.3 Cover plates for boxes containing branch circuits, are to have each branch circuit number neatly identified on the inside of the cover plate. Felt marker-pen may be used for this purpose.
- 7.10.4 Structured Cabling:
- 7.10.4.1 Conduit must be run in walls to provide for future changes. Provide bulkhead or other means to accommodate future wiring to reach accessible T-bar ceiling in corridors in a concealed manner.

7.10.5 Multimedia:

- 7.10.5.1 Ensure LCD projector ceiling installation and wiring is aesthetically pleasing. Provide a multimedia ceiling outlet similar to the multimedia wall outlet.

Section 26 05 00 Common Work Results

1 Outlet Boxes, Conduit Boxes & Fittings

- 1.1 Floor Boxes are prohibited.

Section 26 05 33 Raceways and Boxes for Electrical Systems

1 Stage:

- 1.1 Provide a flush installed 300mm x 300mm x 100mm (12" x 12" x 4") type "D" box in wall adjacent to panel c/w the following:
 - 1.1.1 2" empty EMT conduit between stage panel and same "D" box.
 - 1.1.2 2" chase nipple installed in middle of 325mm x 325mm (13" X 13") oversized metal cover plate to accommodate above conduit.

Section 26 08 00 Electrical Commissioning

- 1 See Part 1, Section 2, Division 26, 26 08 00 Electrical Commissioning.

Section 26 09 24 Instrumentation and Control for Electrical Systems

1 Lighting Control Equipment - Low Voltage

- 1.1 Switches:
 - 1.1.1 Common areas (corridors, washrooms, stairs, change rooms, etc.) are to be controlled by a bank of low voltage switches located in the administration area. These same switches are to be identified as to areas and/or rooms they "each" control and contain clear plastic protective "switch lids."
 - 1.1.2 Common area room types are to be controlled by separate switches, e.g. washrooms are to be controlled separately from corridors.
 - 1.1.3 All lights in gymnasium are to be controlled by keyed switches adjacent the main gym entrance, not by remote switches in the gym office.
 - 1.1.4 Key type low voltage switches regardless of locations installed, are to each incorporate LED type pilot light function.
 - 1.1.5 Rooms containing a teacher's desk are to have light switches located at the teacher's desk in addition to the regular location(s).
 - 1.1.6 Washrooms are to have additional local control from dual technology occupancy sensors.

1.2 Relay Panels:

- 1.2.1 Low voltage relay panels are to be located on walls immediately above finish T-Bar type ceilings in classrooms, directly above low voltage switches on latch side of door. Otherwise, relay panels are to be located in electrical rooms/closets.
- 1.2.2 Line voltage 347V, 20 amp, single or multi-pole light switch is to be installed in surface type box on wall adjacent to relay panel. Switch is to be wired in manner so as to interrupt 347 volt power source(s) or branch circuit(s) feeding respective relay panel. Local disconnecting means is provided to both, safely de-energize relay panel, and minimize “shut-down” time when performing maintenance procedures within same.
- 1.2.3 Factory installed neutral and bonding termination strips.

Section 26 09 61 Theatrical Lighting Controls

- 1 Provide a dimming system to accommodate dimming of the following incandescent fixtures:
 - 1.1 Gymnasium incandescent house lights.
 - 1.2 Stage lighting.
- 2 Dimming system shall include the following:
 - 2.1 Panel(s) as required c/w dimmers, circuit breakers, relays, terminal strip output, and cooling fan(s).
 - 2.2 Portable lighting control console c/w 24 channels, 2-scene preset memory, LCD menu screen and colour display with choice of English or French, programmable effects and manual, timed and recorded cross fades, 25' cable complete with XLR 5 pin connectors, power supply, and dust cover.
 - 2.3 Input receptacles for portable lighting control console c/w XLR 5 pin receptacle insert, and stainless steel cover plate. Provide appropriate cabling in conduit between the dimmer panel and the receptacle.
 - 2.4 Gymnasium Lighting - Provide a six channel control station with six manual dimmer switches and ON and OFF pushbuttons. Stations to be c/w protective, hinged, locking cover and located adjacent the keyed low voltage switches controlling the non-dimmed lighting.
 - 2.5 Zone control unit for scene selection. All initial scenes are to be programmed by the manufacturer's representative in coordination with the end user.
 - 2.6 Entrance pushbutton control c/w protective, hinged, locking cover at all gym/theatre entrances.

Section 26 24 00 Switchboards and Panel boards

- 1 Panelboards Breaker Type
 - 1.1 Stage:
 - 1.1.1 Install a 100A, 120/208V, 3Ø, 4W, 30 circuit panelboard reserved exclusively for supplying power to equipment for bands, etc. It shall be installed in an electrical

closet on the stage. This panel shall contain the following circuit breakers:

- 1.1.1.1 6 X 15A, 1P.
- 1.1.1.2 2 X 20A, 1P.
- 1.1.1.3 2 X 30A, 1P.
- 1.1.1.4 1 X 30A, 2P.
- 1.1.1.5 1 X 50A, 2P.

- 1.2 Unless otherwise noted, panelboards shall not be located in corridors, classrooms, or any other rooms where accessible to students or unauthorized personnel. Locate panelboards in locked rooms accessible to authorized personnel only.
- 1.3 Panelboards shall not be located in Janitor's rooms or any other room where water presents a danger.
- 1.4 Where panelboards are located in storage rooms, they shall be located near the entrance door so that stored materials do not render them inaccessible.

Section 26 27 00 Low Voltage Distribution Equipment

- 1 Finish cover plates for flush installed devices shall be stainless steel.
- 2 Switches (line voltage):
 - 2.1 Line voltage 347V, 20A, single or multi-pole light switch is to be installed in surface type box on wall adjacent to lighting relay panels. Switch(es) are to be wired in manner so as to interrupt 347V power source(s) or branch circuit(s) feeding respective relay panel. Local disconnecting means is provided to both, safely de-energized relay panel, and minimize "shut-down" time when performing maintenance procedures within same.
- 3 Receptacles:
 - 3.1 Classroom - Provide two (2) housekeeping receptacles on same separate branch circuit.
 - 3.2 Gymnasium - Provide duplex housekeeping receptacles at a minimum 10m spacing, maximum of three (3) receptacles per circuit.
 - 3.3 Exterior Entrances - Provide one exterior 15/20A, 120V T-slot duplex receptacle c/w lockable cover installed on adjacent wall. Feed from GFCI breaker.
 - 3.4 Staff Washrooms - Provide one 15A, 120V duplex receptacle adjacent to sink. Feed from GFCI breaker.
 - 3.5 Kiln (where applicable) - Provide "flush" installed device box c/w matching receptacle and angle plug of voltage(s), amps and poles as may be required. Cabtire between plug and "kiln" to be sized as required for the particular application.
 - 3.6 LCD Projectors - Provide 15A, 120V duplex receptacle. Receptacle is to be ceiling mounted so the plug side is vertical to allow for both LCD and speaker block transformer plug in, if required.
 - 3.7 Multi Purpose Room - Provide one 15/20A, 120V T-slot duplex receptacle.

- Coordinate location with end user.
- 3.8 Kitchen - Provide one 30, 120V receptacle for the bagel machine. Coordinate location with end user.
- 3.9 Stage:
- 3.9.1 Provide the following flush installed receptacles c/w matching stainless steel device plates, in wall directly below panel at approximately 450mm (18") A.F.F.:
- 3.9.1.1 2 X 15A, 120V.
- 3.9.1.2 1 X 20A, 120V.
- 3.9.1.3 1 X 30A, 120V.
- 3.9.1.4 1 X 30A, 120/208V, 1Ph, 3W.
- 3.9.1.5 1 X 50A, 120/208V, 1Ph, 3W.
- 3.9.2 Provide a minimum of four (4), duplex receptacles on the stage walls.
- 3.10 Main Communications Room:
- 3.10.1 The 2 duplex power outlets beside each dual data outlet are to be fed from a separate circuit (i.e. 1 circuit for each 2 duplex power outlets).
- 3.10.2 The 6-port bar for each rack is to be fed from a separate circuit (i.e. 1 circuit for each 6- port power bar).
- 3.10.3 Provide on-line, double conversion, solid state, UPS to feed branch circuit panel which in turn feeds all receptacles and power bars in main communications/server room and main communications office. UPS to be complete with surge suppression, power factor correction, rectifier, charger, inverter, batteries, internal bypass, and external wrap-around bypass. UPS shall operate during power outage for a minimum of 30 minutes.
- 3.11 Chemistry Labs:
- 3.11.1 Provide sufficient circuit capacity to accommodate 1 "electric Bunsen burner" per workstation.

Section 26 28 00 Low Voltage Circuit Protective Devices

- 1 Disconnect Switches - Fused and Non-Fused Up To 1000 Volts
- 1.1 Unless otherwise noted, disconnect switches are not to be accessible to students and shall be installed in locked rooms which are only accessible to staff.
- 1.2 Provide local unfused disconnect(s) for moveable basketball backboards.

Section 26 43 00 Transient Voltage Surge Suppression (TVSS)

- 1 Provide TVSS in the main switchboard only.

Section 26 50 00 Lighting Equipment

- 1 Unless otherwise noted, provide a 3500K colour temperature c/w highest CRI for all LED fixtures.
- 2 Cove lighting is permitted in corridors.
- 3 All lighting in entrance vestibules is to be of the unswitched, night light type.
- 4 Unless noted otherwise, “Paint after fabrication” is not a requirement for light fixtures on school projects.
- 5 Valance lighting under cupboards installed above counters is not a requirement for school projects.
- 6 Recessed, fixtures are to be installed in “dry-wall” type ceilings as per the following:
 - 6.1 Washrooms.
 - 6.2 Changing rooms.
 - 6.3 Corridors.
- 7 Classrooms:
 - 7.1 Provide, recessed, direct / indirect fixtures complete with low voltage dimming. Rows of fixtures are to be installed parallel to the exterior (window) wall. Configure the lighting controls such that the light fixtures illuminating the path to the teacher’s desk and the fixtures adjacent to the whiteboard are switched from a single low voltage switch located at the latch side of the classroom entry door from the corridor and a second switch adjacent to the teacher’s desk. The remainder of the classroom fixtures are to be switched from a third switch located adjacent to the teacher’s desk. Locate a single, separate sliding dimmer us to control the output levels for all fixtures adjacent to the low voltage switches at the teacher’s desk. Vacancy sensors are to be incorporated as part of the classroom lighting control system; these sensors are to turn off the classroom lighting when no motion has been detected for 20 minutes.
- 8 Offices:
 - 8.1 Provide recessed direct / indirect fixtures complete with low voltage dimming. Provide a single, separate sliding dimmer for all fixtures adjacent to the low voltage switch.
- 9 Library:
 - 9.1 Provide fixtures c/w multi-level switching or dimming.
 - 9.2 For bookshelf illumination, provide direct/indirect light fixtures.

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10 Gymnasium:

- 10.1 Where white paint is applied, it shall be baked polyester powder enamel with 90% minimum reflectivity applied after fabrication using an electrostatic process.
- 10.2 Provide damage protection from sports balls, protection to be sloped where required to prevent sports equipment becoming trapped on the fixture.
- 10.3 Lighting:
 - 10.3.1 Gymnasiums shall incorporate totally indirect fixtures as follows:
 - 10.3.1.1 Ensure ceiling height permits manufacturer's recommended spacing between fixture and ceiling while maintaining minimum required mounting height to the floor.
 - 10.3.2 Exception to the Gymnasium Lighting requirements above:
 - 10.3.2.1 Gymnasiums serving students up to and including grade six shall incorporate direct lighting fixtures as follows:
 - 10.3.2.2 Fixtures are to be in excess of 10000 lumen, 3500K, minimum 85 CRI fixtures.
 - 10.3.2.3 Provide multilevel switching.
 - 10.3.2.4 Dimming may be used for the house lighting requirement.
 - 10.3.2.5 Specification grade (as opposed to commodity grade or "off the shelf").
 - 10.3.2.6 Lenses shall be pattern 12 low brightness UV stabilized, 100% virgin acrylic lenses A minimum thickness of 0.125" shall be used regardless of manufacturers pattern 12 designation.
 - 10.3.2.7 Fixtures are to be mounted on structure.
 - 10.3.2.8 Provide full wire guard.
 - 10.3.2.9 CSA approved.
- 10.4 Gymnasiums shall incorporate totally indirect fixtures as follows: House Lighting:
 - 10.4.1 Provide house lighting on dimmers.
- 10.5 Each unit is to be c/w a "wire guard" provided by fixture manufacturer.
- 10.6 Coordinate with other disciplines in order to achieve maximum ceiling reflectance with even ceiling distributed illumination, minus "any" ceiling "hot spots," as per IES recommendations.
- 10.7 Each light fixture is to incorporate steel "safety cables" installed as per the following:
 - 10.7.1 Between main ceiling structure and fixture/ballast housing.
 - 10.7.2 Between fixture/driver housing and optical assembly.
- 10.8 Lighting fixtures installed in ceilings containing open steel type joist construction are to be pendant type, stem hung (from hooks) as per the following:
 - 10.8.1 Stem hung from "eye" type hooks unless specifically indicated otherwise.
 - 10.8.2 To be suspended from "overhead" structure utilizing rigid galvanized steel conduit stem sized per fixture manufacturer's recommendation c/w accompanying hook. Individual stem length(s) are to be as required for their particular location(s).

- 10.8.3 Stem to be threaded into a female hanger hook containing a safety screw c/w 5/8" wire and 3/8" jaw openings and capable of supporting not less than a 75 lb. (34.0 kg) weight.
- 10.8.4 Stem is to include a #715 open loop hook, (3)- conductor cabtire type cable and be c/w a 20 Amp twist-lock plug, to suit voltage.
- 10.8.5 Cabtire type cables are to be of adequate lengths as may be required to accommodate differing or contrasting stem lengths.
- 10.8.6 Matching twist-lock receptacle is to be supplied and installed in a separate cast type "FSD" box secured directly to overhead metal "Q" deck and be c/w a matching steel type "FS" one hole receptacle plate.
- 10.8.7 Hanger hook is to be adequately secured to overhead metal Q-Decking or structure via an approved type of steel "eye" capable of supporting not less than a "minimum" of 75 lb. (34.0 kg) weight.
- 10.8.8 Fixture stem is not to be secured directly to box containing its power source, but rather installed to ceiling adjacent to, or off to one side of same. From deck, to hook, to ballast, to fixture body.
- 10.8.9 Fixtures may also be chain hung.
- 10.8.10 Where completely indirect units are used, they may be mounted direct to the 4 inch octagon box and incorporate a minimum 30 degree swivel aligner. The swivel aligner is not to be utilized for bonding purposes.

11 Stage Lighting:

- 11.1 All equipment is to be specification grade.
- 11.2 Provide dimmable LED lighting fixtures for house lighting.
- 11.3 The theatrical lighting system shall consist of three light pipes: one light pipe located front of house, one light pipe located down stage behind the Proscenium arch curtain, and one light pipe located upstage in front of the cycloramic curtain. Fixtures are to be mounted on industry standard size light pipes, 2"OD (1 1/2"ID).
 - 11.3.1 Front of house light pipe:
 - 11.3.1.1 Locate and mount the FOH light pipe to ensure the ellipsoidal theatrical fixtures mounted on this pipe can illuminate the cycloramic curtain to a height of 2M through the proscenium arch. If the FOH light pipe is mounted in a gymnasium, coordinate its location and mounting arrangement with the gym equipment.
 - 11.3.1.2 Provide 6 Focusable 15/35 degree ellipsoidal dimmable theatrical lights - zoom variable focus units, 120V, RGBW, 3000K, 150W LED source with DMX control, mounting yoke, C- Clamp, 1m power cable, safety cable, and L5-20P plug.
 - 11.3.1.3 Provide 2 Focusable 30/50 degree ellipsoidal dimmable theatrical lights - zoom variable focus units, 120V, RGBW, 3000K, 150W LED source with DMX control, mounting yoke, C-clamp, 1m power cable, safety cable, and L5-20P plug.
 - 11.3.1.4 Ensure sufficient spare capacity is provided to permit future installation of

an additional 2 fixtures.

11.3.1.5 Safety cages are to be provided for front of house (FOH) lights mounted in gymnasium. Recommendations/examples are available from the theatrical fixture manufacturers.

11.3.2 Down Stage light pipe:

11.3.2.1 Provide 2 Focusable 30/50 degree ellipsoidal dimmable theatrical lights - zoom variable focus units, 120V, RGBW, 3000K, 150W LED source with DMX control, mounting yoke, C-clamp, 1m power cable, safety cable, and L5-20P plug.

11.3.2.2 Provide 4 10" Fresnel dimmable theatrical lights, 120V, RGBW, 3000K, 100W LED source with DMX control, 4-way barn door, mounting yoke, C-clamp, 1m power cable, safety cable and L5-20P plug.

11.3.2.3 Ensure sufficient spare capacity is provided to permit future installation of an additional 2 fixtures.

11.3.3 Cycloramic light pipe:

11.3.3.1 Provide 4 Cyclorama dimmable floodlights, 120V, RGBW, 3000K, 100W LED source with DMX control, 1m power cable, safety cables, and L5-20P plug.

11.3.3.2 Ensure sufficient spare capacity is provided to permit future installation of an additional 2 fixtures.

11.3.4 In addition to the light pipes; the theatrical lighting system shall also include two separate locations for portable theatrical lighting equipment to be connected: one downstage adjacent to the proscenium opening and the second upstage behind the cycloramic curtain. Provide a DMX outlet and 2 L5-20P plugs at each location.

11.3.5 Provide pipe mounted DMX receptacles on the individual light pipes.

11.3.6 Provide L5-20R receptacles for all theatrical stage lights. Provide pipe mounted plug-in boxes as required c/w flush mounted receptacles and associated lamicaid identification.

12 Cafeteria:

12.1 Unless otherwise noted, track/theatrical lighting are not to be used in the cafeteria.

13 Site Lighting:

13.1 Mount lighting fixtures on side of the building where possible.

13.2 Flood lights are not to be used on the front of the building.

13.2.1 All lights fixtures installed on building exterior are to be c/w protective guards.

13.3 Fixture selections are to minimize glare and light trespass on adjacent sites.

13.4 Provide free-standing light standards as required. Poles may be steel or aluminum.

Where steel is used, it is to be galvanized and painted after fabrication with a polyester powder coat. Confirm pole height with the Minister's Representative.

13.5 Provide the following average, maintained illumination levels:

- 13.5.1 Landscaped areas: (1) footcandle, extending 20' away from the bldg.
- 13.5.2 Parking lots: (1) footcandle.
- 13.5.3 Sidewalks: (1) footcandle.
- 13.5.4 Driveways/Roadways (1) footcandle.
- 13.5.5 Bus loops: (1) footcandle.
- 13.6 Lighting uniformity (minimum levels, max/min ratios, etc.) are to meet or exceed IES recommended practice. This notwithstanding, due consideration is to be given to avoiding "over-illumination".
- 13.7 Utilizing rental lights from the power utility is permitted. Include for all costs until the end of the 1 year warranty period.

Section 26 52 00 Emergency Lighting

- 1 In addition to emergency lighting required by Provincial and National Building Codes, provide emergency lighting for the following:
 - 1.1 Kitchens and areas with cooking appliances.
 - 1.2 Interior changing rooms.
 - 1.3 Washrooms.
 - 1.4 Electrical rooms.
 - 1.5 Mechanical rooms.
 - 1.6 Boiler rooms.
 - 1.7 Stairwells (including non-exit stairs).
 - 1.8 All other areas as required by applicable codes.
- 2 Emergency lighting units are not to be installed on gymnasium walls behind basketball nets.
- 3 In lieu of stand alone units, a central inverter system shall also be permitted with the following minimum features.
 - 3.1 Warranty: Electronics - 3 years, Batteries - 10 years.
 - 3.2 Maintenance Bypass Switch.
 - 3.3 Metering / Data Acquisition.
 - 3.4 Remote Annunciator.
 - 3.5 Provision for monitoring similar to security and fire alarm systems.
 - 3.6 Sprinkler Guard.
- 4 Small electrical closets, where the door(s) is used to obtain the code required 1m clearance in front of the panelboard(s), need not contain emergency lighting.

Section 26 53 00 Exit Signs

- 1 Exit signs shall be specification grade, vandal resistant, LED type complete with DC backup. Faceplate to be fastened with appropriate tamper proof screws. Metal portions of body to be white, painted after fabrication with a polyester powder coat. CSA C860 certified.

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- 2 Exit signs are to be wall mounted as much as possible.
- 3 Where ceiling mount cannot be avoided, provide rigid support to the T-bar ceiling or building structure.
- 4 In addition to exit signage required by the Provincial and National Building Codes provide an exit sign at the exit from the stage area.

END