

Date of Authorization
BMEC Authorization
BMEC Application

September 29, 2005
05-11-315
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Authorization Report: Arencon - Shelf and Rack Storage System

1. Applicant

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2. Manufacturing Facilities

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3. Description

The Arencon shelf and rack storage system (the "shelf and rack storage system") is a self contained structural system within a building, having one or more elevated platforms or walkway levels for personnel access. The walkways and platforms may also support conveyors and other distribution equipment.

Shelf and rack storage systems are not considered to be mezzanines or interconnected floor spaces as defined by the Building Code, as amended or remade from time to time and are not subject to mezzanine or interconnected floor space rules.

4. Authorization Requested

The applicant sought authorization for the use of an innovative shelf and rack storage system designed for material handling, storage and distribution in warehouse facilities.

5. Assessment

Reports and assessments provided by the applicant show that if the shelf and rack system is used in accordance with the limitations and conditions stated in this authorization, it will provide the level of performance that would be achieved by conformance with the Building Code.

6. Authorization

The shelf and rack storage system is authorized for use within a building as a self contained structural system for material handling, storage and distribution, subject to the following terms and conditions:

A. SPECIFIC TERMS AND CONDITIONS:

1.1 This Authorization is valid only for Arencon.

Use and Occupancy

- 2.1 Except as where more restrictively provided for in 3.4. and 3.5. of this authorization, the shelf and rack storage system shall be used only for the storage, accessing, retrieval, packing and distribution of Class I, II, III and IV commodities as defined in NFPA 13-1999, and not for production, manufacturing, assembling / disassembling or ancillary administrative functions; where the shelf and storage system incorporates the storage of rubber tires, such storage shall conform to the requirements of Subsection 3.3.1. "Indoor Tire Storage" of the Ontario Fire Code, Ontario Regulation 338/97, as amended or remade from time to time (the "OFC"),
- 2.2 The shelf and rack storage system is not permitted in a High Hazard Industrial Occupancy (F1) as defined in Article 1.1.3.2. of the Building Code.
- 2.3 The shelf and rack storage system shall be accessible to employees only and shall be designated, signed and posted as a "NO SMOKING" area conforming to the OFC.

General

- 3.1 The structural components of the entire shelf and rack storage system, including posts, beams, decks, walkways, connections and their supports such as concrete slabs, separate foundations or similar, shall be of noncombustible construction, and be designed in accordance with Part 4 of the Building Code.
- 3.2 The design and general review of the rack and storage system shall be carried out by a Professional Engineer as defined in the *Professional Engineers Act* (Ontario). The Professional Engineer shall provide the Chief Building Official with a document certifying that the installation conforms with this Authorization. The construction drawings shall require the provision of an appropriate sign to indicate the maximum permissible design loads for each rack storage system and such sign shall be permanently fixed to the building interior and displayed in a prominent unobstructed viewing position.

- 3.3 Platform and walkway levels shall be of:
- (a) (i) solid construction consisting of steel plate or steel decking with a top substrate that forms a serviceable floor area, or
 - (ii) open construction consisting of steel grating or open steel floor planking.
 - (b) Deck and walkway levels in structure use for the storage of Group A, B, and C plastic, as defined in NFPA 13-1999, and rubber tires, shall be constructed of steel decking as required in (a) above.
- 3.4 The maximum height of the shelf and rack storage system from the floor supporting the shelf and rack system to the topmost portion of the shelf and rack system shall not exceed 18 m except that where the maximum height exceeds 18 m but does not exceed 24 m, the following provisions shall apply:
- (a) a fire alarm system shall be installed with:
 - (i) pull stations located at all exit doors including exit doors serving elevated decks and walkways; and
 - (ii) smoke detectors located, at the ceiling of all rooms and areas containing the shelf and rack system, within exit stair enclosures at the top, and at every third level of elevated deck or walkway; and
 - (b) the fire alarm system required by (a) above, shall be designed to notify the fire department upon activation; and
 - (c) the shelf and rack storage system shall be used only for the storage of Class I, II, III and IV commodities as defined in NFPA 13 -1999 as amended.
- 3.5 Where Class I, II, III and IV commodities and Group A, B, C, plastics and rubber tires as defined in NFPA 13-1999 are stored, the maximum height of the shelf and rack storage system from the floor supporting the shelf and rack system to the topmost portion of the shelf and rack system shall not exceed 7 m.
- 3.6 Lighting levels of walkways and platforms shall conform to the Building Code.
- 3.7 Emergency lighting on walkways, platforms, unenclosed egress stairs and exits providing means of egress, shall be provided to not less than the level and duration of illumination prescribed in Sentences 3.2.7.3.(2). and 3.2.7.4.(1). respectively of the Building Code.
- 3.8 Guards and toe boards shall be installed in accordance with the Building Code.

Fire Safety

- 4.1 An automatic sprinkler system shall be designed, constructed, installed and tested for the entire shelf and rack storage facility system including the top level and shall be in conformance with NFPA 13-1999 or the appropriate NFPA Standard for the most severe hazard to which the storage system is exposed. This shall include sprinkler protection under all platforms and walkways.

- 4.2 Except where the platforms or walkways are of open construction, any openings for egress stairs shall be protected by non-combustible draft stops as specified in NFPA 13-1999 (minimum 450 mm below the floors above).
- 4.3 The automatic sprinkler system shall be electrically supervised to indicate a trouble signal on the building fire alarm system annunciator or where the building does not have a fire alarm system, to notify the person controlling the operation of the building for each of the following:
- (a) movement of a control valve handle;
 - (b) loss of excess water pressure required to prevent false alarms in a wet pipe system;
 - (c) loss of air pressure in a dry pipe system;
 - (d) loss of air pressure in a pressure tank;
 - (e) a significant change in water level in any water storage container used for fire fighting purposes;
 - (f) loss of electrical power to any automatically starting electrical fire pump; and,
 - (g) a temperature approaching the freezing point in any dry pipe valve enclosure or water storage container used for fire fighting purposes.
- 4.4 The automatic sprinkler system shall be designed to notify the fire department that a waterflow switch has been activated.
- 4.5 The notification to the person controlling the building and the fire department referred to in paragraphs 4.3 and 4.4 above, shall be provided by way of:
- (a) an independent central station conforming to NFPA 71-1998, "Standard for the Installation, Maintenance, and Use of Signalling Systems for Central Station Service", as amended;
 - (b) a proprietary control centre conforming to Chapter 4 of NFPA 72-1990, "Standard for the Installation, Maintenance, and Use of Protective Signalling Systems", as amended;
 - (c) a central station conforming to ULC/ORD-C693-1994, "Central Station Fire Protective Signalling Systems and Services"; or
 - (d) if the above mentioned facilities are not available in the municipality in which the shelf and rack storage system is to be built, an independent system is permitted to be used to transmit signals to the fire department.
- 4.6 A plain legible sign or signs, with contrasting letters and titled "NOTICE", shall be permanently mounted at or near the sprinkler control valve and shall describe:
- (a) the Commodity Class applicable and as referenced in paragraph 2.1, and
 - (b) the sprinkler design criteria used for each shelf and rack storage system.

- 4.7 A hose connection system shall be installed in accordance with Chapter 5-15.5 of NFPA 13 -1999.
- 4.8 Where an enclosed exit stair is required, the standpipe and hose system shall be located not more than 5 m from the enclosed exit and installed in accordance with the Building Code.
- 4.9 Every platform or walkway level of the shelf and rack storage system shall be provided with fire extinguishers, installed in accordance with the provisions of Part 6 of the OFC.
- 4.10. Regardless of the occupant load, the requirements of Section 2.8 “Emergency Planning” of the OFC shall apply.

Exits

- 5.1 Each walkway or platform level shall be provided with not less than two exit stair shafts that conform to all requirements for exits as stated in the Building Code except as follows:
 - (a) access to exit may be provided from an elevated platform level by means of open unenclosed stairs for shelf and rack storage systems comprising not more than four platform levels, the highest of which may not be more than 12 m above the main floor; and,
 - (b) any single platform or walkway may be served by a single unenclosed egress stair leading to the platform or walkway level immediately below provided the:
 - (i) platform or walkway does not exceed 200 m² in area;
 - (ii) travel distance on the platform or walkway to the level below, including the travel distance along the single unenclosed egress stair, does not exceed 25 m; and,
 - (iii) the platform or walkway below is provided with two separate egress stairs or exits.
- 5.2 The maximum travel distance on an elevated platform to the ground floor level, including the travel distance along unenclosed stairs, shall not exceed 45 m. The maximum travel distance on an elevated platform to an enclosed exit serving that platform shall not exceed 45 m.
- 5.3 The maximum travel distance from the bottom of an unenclosed stair to an exit along a main aisle on the ground floor level shall not exceed 45 m, *except* that if this travel distance exceeds 45 m:
 - (a) an egress system serving the shelf and rack storage shall be designed on the basis of a “time-based egress analysis” undertaken and sealed by a Professional Engineer or Architect as defined in the Building Code using the following criteria:
 - (i) occupant egress speed of 1 m/sec shall be used for horizontal egress routes within the shelf and rack storage,

- (ii) occupant egress speed of 0.6 m/sec shall be used for vertical egress routes within the shelf and rack storage, measured on the diagonal along the nosing of the stairs,
- (iii) occupant egress speed of 1.3 m/sec shall be used for horizontal egress routes along a main aisle (see paragraph A 5.6 below) on the ground floor level,
- (iv) each lift-gate shall be accorded an egress time of 10 seconds,
- (v) each 'at-level' conveyor cross-over shall be accorded a time of 5 seconds,
- (vi) a Safety Factor of 1.5 shall be used in calculating the Total Egress Time.

(b) the Total Egress Time shall be calculated using the following formula;

$$\text{Total Egress Time} = (H_p + V_p/0.6 + H_m/1.3 + 10N_{lg} + 5N_{lc}) \cdot 1.5 \text{ (in seconds)}$$

where:

- H_p = Horizontal travel distance on the shelf and rack storage (m)
- V_p = Vertical travel distance on the shelf and rack storage (m)
- H_m = Horizontal travel distance on the main floor (m)
- N_{lg} = Number of lift gates in the means of egress
- N_{lc} = Number of 'at-level' cross overs in the means of egress

- (c) the Total Egress Time from any point in the shelf and rack storage system shall be a maximum of 4 minutes,
- (d) a fire alarm system complying with Subsection 3.2.4. of the Building Code shall be installed in the building and there shall be smoke detectors under all solid decking and walkways,
- (e) in addition to required pull stations, the shelf and rack storage system design shall provide for clearly identified and easily accessible pull stations at egress stairs, conveyor cross-overs or lift-gates located along egress paths, and
- (f) the occupant load on each level of the shelf and rack storage system shall not exceed ten (10) persons per egress stair.

5.4 Dead end travel distance to a point of choice of direction of horizontal travel to an egress facility from an elevated platform or walkway shall not exceed 9 m where the platform or walkway is required to be provided with at least 2 egress facilities.

5.5 Aisles serving the shelf and rack storage system shall have clear-aisle widths of not less than 760 mm (30 in). This clearance is for access to exits and shall not be used for conveyors, trolleys, tracks or any other similar mode of product transportation within the aisle or walkway.

- 5.6 Where exits are provided to comply with Sentence 3.4.2.5.(2) of the Building Code, main aisles serving the shelf and rack storage system on the ground floor (leading from egress stairs directly to an exit) shall be clearly demarcated and have a minimum unobstructed, clear-aisle width of 2.4 m.
- 5.7 Where lift-gates are incorporated along egress routes in the shelf and rack storage system design:
- (a) a maximum of two lift-gates may be within a single egress route,
 - (b) each lift-gate shall be equipped with a “positive lock” when open,
 - (c) when a lift-gate is open, it shall be designed to automatically stop the conveyor belt that it serves, and
 - (d) the Fire Safety Plan, as required by 4.10. of this Authorization, shall mark the lift gates such that they are readily identifiable as part of the egress route.
- 5.8 Where ‘at-level’ conveyor cross-overs are incorporated along egress routes in the shelf and rack storage system design:
- (a) a maximum of two ‘at-level’ conveyor cross-overs may be within a single egress route,
 - (b) handrails spaced not more than 1 m apart and parallel to the direction of egress shall be provided on both sides of the ‘at-level’ cross-over,
 - (c) flat, metal inserts shall be placed between each roller over the required egress width at each ‘at-level’ conveyor cross-over to provide a walking surface. At least two, minimum 100 mm wide inserts shall be arranged symmetrically between the handrails serving the ‘at-level’ cross-over and all inserts shall be sized to support loads required in Part 4 of the Building Code,
 - (d) a clearly identified and easily accessible switch that will stop the conveyor shall be located at each ‘at-level’ cross-over, and
 - (e) stairs approaching ‘at-level’ conveyor cross-overs shall be marked in accordance with the Fire Safety Plan, as required by 4.10 of this Authorization, such that they are readily identifiable as part of the egress route.

B. GENERAL CONDITIONS

1. The use of the shelf and rack storage system must comply with the *Building Code Act, 1992* as amended or re-enacted from time to time (BCA) and, except as specifically authorized herein, with the Building Code.
2. A copy of this Authorization shall be included with an application for a building permit and shall be posted and maintained on the site of the construction with the building permit.

3. The Applicant named in Section 1 hereof shall promptly notify the BMEC of:
 - (a) the failure of the Applicant, or of the material, system or building design that is the subject matter of this authorization, to comply with any of the terms and conditions set out in Section A. above; or
 - (b) the occurrence of any of the events described in Sections B. 4. (a) and (b) (ii) below.
4. The BMEC may amend or revoke this Authorization where it determines that:
 - (a) any change has been made to:
 - (i) the material, system or building design that is the subject matter of this Authorization;
 - (ii) the address of the applicant specified in Section 1 of this authorization; or,
 - (iii) the ownership of the Applicant specified in Section 1 or of the companies specified in Section A 1.1 of this authorization.
 - (b) the use of the material, system or building design authorized herein;
 - (i) does not comply with the BCA or any relevant legislation as they may be amended or re-enacted from time to time; or
 - (ii) provides an unsatisfactory level of performance, in situ.
 - (c) the Applicant, or the material, system or building design that is the subject matter of this Authorization, has failed to comply with any of the terms and conditions set out in Section A. above; or
 - (d) any Building Code provision relevant to this authorization has been amended or remade.
5. Where the BMEC receives additional information concerning the material, system or building design authorized herein, the BMEC may review this Authorization and the BMEC may after the review amend or revoke this Authorization as in the opinion of the BMEC may be necessary.

Dated at Toronto this 29 day of September 2005.

BUILDING MATERIALS EVALUATION COMMISSION

Edward Link, Vice-Chair