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An American National Standard

Standard Guide for Layout of Ice Arena[1]

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1. Scope

1.1 This guide for the layout of the ice rink/arenas includes guidelines for developing an artificial indoor ice rink/arena. This guide describes systematic procedures and criteria for the development of the arena's appurtenant facilities. A description of several appurtenant facilities utilized in ice rink/arenas is included within the guide as examples of those that should be considered.

1.2 This guide addresses only those phases of a project related to the selection design, specification, and installation procedures. Every arena is unique in material, architecture, and engineering, and therefore will require technical review. This guide is not meant to provide an architectural prototype, but is a guide to set forth measures for the development of safer ice arena venues.

1.3 This guide shall only be used by architects, designers, registered engineers, construction contractors, owners/operators, and appropriate inspectors who are involved in the design and construction of new ice arena venues.

1.4 This guide is pertinent to the support facilities of a multi-use ice arena.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *IESNA Standard:*[2]

IESNA (RP-6-01) Sports and Recreational Area Lighting

3. Terminology

3.1 *Definitions:*

3.1.1 *arena*—term applied to a building or other structure containing an ice-skating rink.

3.1.2 *design*—term which means the conceptual detail and final configuration of the spaces within and around the ice rink/arena.

3.1.3 *ice hockey playing facility*—playing surface consisting of a horizontal ice surface surrounded by a vertical enclosure used for the sport of ice hockey and skating; also called a rink.

3.1.4 *ice skating rink*—skating surface consisting of a horizontal ice surface used for the recreational sport of ice skating, and may also be used for ice sports if it meets their requirements.

3.1.5 *installation*—term which means the fabrication, placement, and assembly of all the materials, machinery, and equipment to be encompassed in the arena.

3.1.6 *layout*—term applied to the planning, designing, and engineering of an ice rink/arena.

3.1.7 *selection*—term meaning the process of identifying, evaluating, and choosing the parameters of the ice rink/arena.

3.1.8 *specification*—term which means the process of describing, identifying and outlining the materials, methods and means by which the arena will be constructed.

4. Equipment

4.1 *Fixed Equipment*—An ice arena has fixed equipment for which installation specifications are provided. The manufacturers should provide operating manuals to the owner/operator for all fixed equipment.

4.1.1 *Lighting*—Off-ice lighting devices subject to abuse should have fixtures that are unbreakable.

4.1.2 *Grandstands/Fixed Bleachers*—All grandstands or bleachers should meet Consumer Product Safety Commission for bleacher guidelines.

4.1.3 *Mechanical Equipment*—All mechanical equipment should be identified and tagged with labels conforming to all regulatory requirements, such as OSHA, ICC, NFPA, and other applicable agencies.

4.1.4 *Ice Resurfacing Equipment*—All ice rink/arenas should have one or more ice resurfacers, ice edgers, as well as spare resurfacing blades, shovels, squeegees, scrapers, and

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[2] Available from Illuminating Engineering Society of North America (IESNA), 120 Wall Street, Floor 17 New York, NY 10005, http://www.iesna.org.

tools to enable the operator to maintain the ice properly. The placement of this equipment should be located in the ice resurfacing machine storage area to prohibit or prevent public or player access.

5. Building Environment

5.1 The following guideline should be considered in the design and selection of ice rink/arena dehumidification equipment.

5.1.1 Building temperature is typically maintained at 45 to 65°F (7 to 18°C). The lower the building temperature, the higher the relative humidity can be and the higher the building temperature, the lower the relative humidity should be.

5.1.2 *Air Temperature over Ice (3 ft – 1.52 m)*—35 to 45°F (7 to 18°C).

5.1.3 *Relative Humidity*—35 to 45 % maintained during entire operating season.

5.1.4 *Relative Dew Point*—32 to 37°F (0 to 3°C).

5.2 *Ice Surface Temperature*—Refrigeration equipment shall be able to maintain an ice surface temperature between 18 and 26°F (–8 to –2°C) with 1 to 2 in. (2.54 to 5.08 cm) of ice thickness.

6. Handicapped Accessibility

6.1 The user of this guide (the designer/engineer, installer, and the arena equipment manufacturers) shall conform to all A.D.A. regulatory requirements.

7. Documentation

7.1 Documentation of the specifications, designs, installation, blueprints, records, permits, catalogs, and manuals from the arena's professional consultants, suppliers, manufacturers, and inspectors of the venue equipment systems should be provided to the owner/operator.

8. Selection

8.1 Many factors, including climate, can influence the selection of ice rink systems and other components. Consideration must be given to such factors in the selection, specification, design, installation, and maintenance of the ice rink/arena systems.

9. Specifications

9.1 The ice arena systems and other components should be thoroughly specified by the purchaser. In the construction specifications, elements such as refrigeration, dehumidification, ventilation, and illumination should also be included.

10. Design

10.1 The ice rink system and other interior and exterior components should be thoroughly designed by an experienced, registered professional engineer or architect.

11. Spaces

11.1 The ice arena may include space for the ice rink, mechanical room, entry arena, participant changing areas, spectator, and administrative areas. An example of such spaces that could be included are in 11.2 and 11.3.

11.2 *Ice Rink Area*—This area should be large enough so that building walls or bleacher systems do not contact the dasher board system. Building utility lines should not be installed under the ice surface area. A drain should be installed at the ice resurfacer entrance outside of the ice surface.

11.3 *Ice Resurfacer Storage Area*—This area should be designed requiring the least amount of turning for the ice resurfacer. Turning of the ice resurfacer reduces tire life and damages floors. The ceiling height should provide enough clearance to operate the snow tank of ice resurfacer being used in the "raised" snow dump position. Turning radius of machines should be considered. A snow dump pit should be constructed with a minimum of 125 ft^3 volume per ice sheet. The pit should be able to melt 125 ft^3 of snow per hour per ice sheet. All garage doors to this area should be a minimum 9 by 9 ft wide (2.74 by 2.74 m). Also, this area should be constructed to be used as a repair garage and meet the appropriate building codes. This area should provide adequate ventilation of exhaust, refrigerant, or other emissions. This room should be heated and have adequate floor drains. Entry area should be designed to allow only a minimum number of employees to provide services.

11.4 Snow melt pit should be designed to use the waste heat from the refrigeration system and be located in the ice resurfacer room.

11.5 A separate hot water heating system not used for showers should be included in the design to allow the operator of the ice resurfacer to meet the manufacturer's recommended hot water temperature needed for ice making.

11.6 Water treatment for ice making water should not contain more than 150 ppm of all total dissolved solids in the water content and no more than five total grains of hardness. Higher test numbers may require water treatment for ice making water. Water treatment for the refrigeration/cooling system must be considered regardless of water quality.

11.7 *Seating Area*—Seating should be designed to accommodate the average expected attendance for the majority of the events conducted in the arena. Bleachers should not be accessible to skaters.

11.7.1 *Height and Location*—Bleacher height, location, and protection shall meet the regulations of the Consumer Product Safety Commission (CPSC) and bleacher industry standards.

11.7.2 *Spectator Area Heating*—Heaters should be installed so as to not adversely affect the ice surface. Thermostats or timers should be installed to prevent continuous running and should not be accessible to the general public.

11.7.3 *Flooring Surface*—The type of floor surfacing in the seating area should reflect patron, player, and employee use.

11.8 *Dehumidification and Heating, Ventilation and Air Conditioning (HVAC) System:*

11.8.1 A typical NHL size ice surface (200 by 85 feet or 60.95 by 25.9 m) will require 33 lb and 100 lb of moisture to be removed each hour. The desiccant type systems should be designed to allow for dehumidified fresh air to be introduced to

the building at proper humidity levels. There are other types of dehumidification systems available which do not use natural gas in the dehumidification process and may be designed to allow for dehumidified fresh air.

11.8.2 Indoor Air Quality (IAQ) should meet local and state codes in regards to CO_2 (carbon monoxide) and NO_2 (nitrogen dioxide, also known as oxides of nitrogen (NO_x). Generally, indoor air quality monitoring devices and controls should be designed into the dehumidification or HVAC system, or both.

11.8.3 HVAC should be considered for the entire facility with the ability to control each zone of the facility from a central location.

11.8.4 Air currents from the dehumidification and HVAC systems must not affect ice quality and should be designed to have the capacity to be directed onto the floor for non-ice activities

11.9 *Lights, Sound, and Electrical System*—Lighting and sound systems for rinks should be controlled from the office or a control room and not the resurfacer room. A minimum of electrical equipment should be located near the ice resurfacer room since it is a wet environment and water may be splashed in this area.

11.10 *Rest Rooms:*

11.10.1 Rest rooms shall meet current local codes for male and female water closet numbers.

11.10.2 Public rest rooms shall be separate from player locker rooms.

11.10.3 Player/skater locker rooms should have non-slip protective flooring, vandal proof wall coverings, automatic flush toilets/urinals, and vandal proof partitions.

11.11 *Skate Changing Area*—Skate changing areas should be provided as part of the waiting area or general public area and have non-slip protective flooring.

11.12 *Locker Rooms*—An ice rink/arena should have at least five team rooms per ice sheet. Each team room should be at least 250 ft^2 and have two showerheads per adjacent shower room and meet current codes. Continuous benches should be placed around the room. These benches should be supported by angled brackets if mounted on the wall, which will help minimize the time needed for the maintenance staff during the cleaning of the room. Hooks or shelves should be provided at a safe height above the benches. These locker rooms should have a non-slip protective flooring.

11.13 *Food Service Area*—Concession or restaurants, or both, should meet local health department codes. A vending machine area should be considered as to not interfere with patron circulation.

11.14 *Skate Rental Area:*

11.14.1 This room should be 300 to 500 ft^2 depending on the amount of skates. This room needs large counters to hand out and receive rental skates. A well-ventilated room is needed to promote drying of the rental skates. This room should have protective non-slip flooring and may include odor removal equipment.

11.14.2 Skate sharpening space of 60 ft^2 should be included in the skate rental room. Additional ventilation should be provided in conjunction with skate sharpening dust removal equipment and protective non-slip flooring.

11.15 *Official's Room*—The official's room should be separate from the player locker rooms and if possible located in a place away from player and or spectator areas. This room should be 100 ft^2 minimum and have a restroom/shower area and meet local codes and should have protective non-slip flooring.

11.16 *Manager/Administrative Offices*—These offices should be 400 to 2000 ft^2 depending on programming and the use of the ice rink/arena. A secure money counting arena should be considered.

11.17 *Cashier/Ticket Box Office*—This office should be 100 ft^2 minimum and have adequate space for computer ticketing equipment. The flow of patrons during busy sessions or events should be considered while designing this space and may be adjacent to the manager/administrative offices and retail space or included with the skate rental room.

11.18 *Conference Room*—This room should be a minimum of 400 ft^2 to be used by user groups and for employee training.

11.19 *Janitorial Room*—Janitorial/custodial room closets and cabinets space need to be located near the locker rooms, rest rooms, concession, and conference areas.

11.20 *Employee Break Room*—This area should be 100 ft^2 minimum and is needed for employee communications and a place for breaks and lunch away from public

11.21 *Party Room*—This room should consist of at least 400 ft^2 with non-slip protective flooring and be located adjacent to the ice surface without stairway access.

11.22 *Storage Space*—Adequate storage space should be considered into the design phase for maintenance, concession, pro shop, and rental for user groups.

11.23 *Parking Lots:*

11.23.1 An ice arena is a special use buildings and may not fall under regular parking space guidelines. During the design phase, refer to local codes regarding parking spaces.

11.23.2 Approximately 80 parking spots per ice sheet should be considered as a guideline. The ice arena should include exterior spaces for traffic, vehicle, and pedestrian circulation, parking, service, and emergency vehicle access. The area outside the ice arena should be designed by a registered landscape architect.

11.24 *Entry and Exit Areas*—Access to all doorways and walkways to the ice rink/arena should be designed to protect patrons or employees from falling snow or ice falling from roof structures.

12. Energy Management

12.1 The ice rink/arena structure shall meet minimum insulation U values and R ratings. Insulation U values normally required in a rink facility arena are 12 in. (30.48 cm) for roofs and walls. The R ratings for the insulation materials are not consistent in places of assembly and can differ as much as 70 %, requiring more insulation to attain the U value. The following examples of physical factors must be considered:

12.1.1 *Roof*—A coating or insulation should be sufficient enough to reduce the heat load over the ice surface.

12.1.2 *Low Emissivity Ceiling*—This system should be considered to provide added energy savings and should be installed only over the ice surface.

12.1.3 *Ceiling Height*—Ceiling height should not be below 1620 ft (4.876 m) over the playing area in the ice rink/arena. Height of ceilings in off ice areas such as locker rooms should be considered in an effort to minimize vandalism and damage.

12.1.4 *Building Orientation*—The compass points for sun and wind direction should be considered and stipulated in the design process. Glass with southern or Western exposure should be installed in a way as to not affect the ice surface quality or player's vision. Windows in ice rink should have UV protection and shading.

12.2 *Illumination:*

12.2.1 *Lights*—The type of luminaries/fixtures should be stipulated in the guide. To ensure safe visibility, the level of illumination at the ice surface should be of evenly distributed intensity to comply with federal, state, and local codes. It is recommended that the guidelines published by the Illuminating Engineering Society of North America be used to determine the appropriate illumination level. IESNA (RP-6-01) recommends the following illumination guidelines for indoor hockey facilities. The following values given are horizontal illuminance in foot candles (fc).

12.2.1.1 Large facilities seating over 10 000 spectators with televised coverage of events, defer to the sanctioning organization such as NHL or NCAA to obtain lighting criteria for television;

12.2.1.2 Competition play with 5000 to 10 000 spectators-125 fc;

12.2.1.3 Competition play with 5000 spectators-100 fc;

12.2.1.4 Competition play with some spectators-75 fc; and

12.2.1.5 Competition or recreational play only, with no provision for spectators-50 fc; light fixtures in danger of being struck should have protective coverings to prevent breakage.

13. Building Configuration

13.1 The fire capacity of the building, classification of use, and intensity of patron use should be considered in the design process.

13.2 *Physical Dimensions*—The length, width, and ice rink/arena configuration should be considered in relationship to the site location on the property.

13.3 *Columns and Beams*—The clear span should have no obstacles and their placement should not become obstructive to players, patrons, or spectators.

13.4 *Construction Materials*—The durability, strength, wind shear, and fire resistance of materials should be stipulated on all construction plans and specifications in accordance with state and local building codes.

13.5 *Windows, Size, and Location*—Thermal sound modulating glazing should be considered in the design process.

13.6 *Doors, Size, and Location*—The type and use of doors should be considered in the design process.

14. Combustible Material Storage

14.1 Gasoline, propane, or natural gas may be used in the facility, and storage systems for these materials should be included into facility design and stipulated by state and local codes.

14.2 Resurfacer operators should be trained to handle all types of combustible materials used in the facility in accordance with OSHA requirements.

14.3 Fire retardant and fire resistant storage areas should be considered in the design process.

14.4 Fire sprinkler systems should have adequate water pressure as required by local fire safety codes.

APPENDIX

(Nonmandatory Information)

X1. SOURCES OF INFORMATION

X1.1 Sources of Information

X1.1.1 There are a number of publications, both print and electronic, along with programs and organizations that can provide helpful information with regard to the provision of ice surfaces and systems to ensure the enjoyment of the user and the promotion of positive play. The list in Table X1.1 provides sources and references that can be contacted for further information regarding this guide.

TABLE X1.1 Sources

American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org
ASTM Guide F1703-04, Guide for Ice Hockey Playing Facilities[A]
Hockey Canada, Father David Bauer Arena, 2424 University Drive, NW Calgary, Alberta, T2N 3Y9
International Ice Hockey Federation, Todistrasse 23m CH-8002 Zurich, Switzerland
ISI (Ice Skating Institute) 17120 Dallas Parkway, Dallas TX 75248, www.skateisi.org
National Collegiate Athletic Association, 6201 College Blvd., Overland Park, KS 66211
National Federation of State High School Association, NW Plaza Cir., Box 20626, Kansas City, MO 64195
National Hockey League, 1251 Ave. of the Americas, 47th Fl., New York, NY 10019
ORFA (Ontario Recreation Facilities Association Inc.), 1185 Eglinton Ave. East, Suite 402, New York, Ontario, Canada M3C 3C6, www.ORFA.com
STAR (Serving The American Rinks) 1775 Bob Johnson Drive, Colorado Springs, CO 80906 719-538-1150, www.starrinks.com
USA Hockey Inc., 1775 Bob Johnson Dr., Colorado Springs, CO 80906

[A] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.