CHAPTER 1[†]: GENERAL DESCRIPTION

1.0 GENERAL INFORMATION

This Final Safety Analysis Report (FSAR) for Holtec International's HI-STORM 100 System is a compilation of information and analyses to support a United States Nuclear Regulatory Commission (NRC) licensing review as a spent nuclear fuel (SNF) dry storage cask under requirements specified in 10CFR72 [1.0.1]. This FSAR describes the basis for NRC approval and issuance of a Certificate of Compliance (C of C) for storage under provisions of 10CFR72, Subpart L, for the HI-STORM 100 System to safely store spent nuclear fuel (SNF) at an Independent Spent Fuel Storage Installation (ISFSI). This report has been prepared in the format and content suggested in NRC Regulatory Guide 3.61 [1.0.2] and NUREG-1536 Standard Review Plan for Dry Cask Storage Systems [1.0.3] to facilitate the NRC review process.

The purpose of this chapter is to provide a general description of the design features and storage capabilities of the HI-STORM 100 System, drawings of the structures, systems, and components important to safety, and the qualifications of the certificate holder. This report is also suitable for incorporation into a site-specific Safety Analysis Report, which may be submitted by an applicant for a site-specific 10 CFR 72 license to store SNF at an ISFSI or a facility similar in objective and scope. Table 1.0.1 contains a listing of the terminology and notation used in this FSAR.

To aid NRC review, additional tables and references have been added to facilitate the location of information requested by NUREG-1536. Table 1.0.2 provides a matrix of the topics in NUREG-1536 and Regulatory Guide 3.61, the corresponding 10CFR72 requirements, and a reference to the applicable FSAR section that addresses each topic.

The HI-STORM 100 FSAR is in full compliance with the intent of all regulatory requirements listed in Section III of each chapter of NUREG-1536. However, an exhaustive review of the provisions in NUREG-1536, particularly Section IV (Acceptance Criteria) and Section V (Review Procedures) has identified certain deviations from a verbatim compliance to all guidance. A list of all such items, along with a discussion of their intent and Holtec International's approach for compliance with the underlying intent is presented in Table 1.0.3 herein. Table 1.0.3 also contains the justification for the alternative method for compliance adopted in this FSAR. The justification may be in the form of a supporting analysis, established industry practice, or other NRC guidance documents. Each chapter in this FSAR provides a clear statement with respect to the extent of compliance to the NUREG-1536 provisions. Chapter 1 is in full compliance with NUREG-1536; no exceptions are taken.

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† This chapter has been prepared in the format and section organization set forth in Regulatory Guide 3.61. However, the material content of this chapter also fulfills the requirements of NUREG-1536. Pagination and numbering of sections, figures, and tables are consistent with the convention set down in Chapter 1, Section 1.0, herein. Finally, all terms-of-art used in this chapter are consistent with the terminology of the glossary (Table 1.0.1) and component nomenclature of the Bill-of-Materials (Section 1.5).

The generic design basis and the corresponding safety analysis of the HI-STORM 100 System contained in this FSAR are intended to bound the SNF characteristics, design, conditions, and interfaces that exist in the vast majority of domestic power reactor sites and potential away-from-reactor storage sites in the contiguous United States. This FSAR also provides the basis for component fabrication and acceptance, and the requirements for safe operation and maintenance of the components, consistent with the design basis and safety analysis documented herein. In accordance with 10CFR72, Subpart K, site-specific implementation of the generically certified HI-STORM 100 System requires that the licensee perform a site-specific evaluation, as defined in 10CFR72.212. The HI-STORM 100 System FSAR identifies a limited number of conditions that are necessarily site-specific and are to be addressed in the licensee's 10CFR72.212 evaluation. These include:

- Siting of the ISFSI and design of the storage pad (including the embedment for anchored cask users) and security system. Site-specific demonstration of compliance with regulatory dose limits. Implementation of a site-specific ALARA program.

- An evaluation of site-specific hazards and design conditions that may exist at the ISFSI site or the transfer route between the plant's cask receiving bay and the ISFSI. These include, but are not limited to, explosion and fire hazards, flooding conditions, land slides, and lightning protection.

- Determination that the physical and nucleonic characteristics and the condition of the SNF assemblies to be dry stored meet the fuel acceptance requirements of the Certificate of Compliance.

- An evaluation of interface and design conditions that exist within the plant's fuel building in which canister fuel loading, canister closure, and canister transfer operations are to be conducted in accordance with the applicable 10CFR50 requirements and technical specifications for the plant.

- Detailed site-specific operating, maintenance, and inspection procedures prepared in accordance with the generic procedures and requirements provided in Chapters 8 and 9, and the technical specifications provided in the Certificate of Compliance.

- Performance of pre-operational testing.

- Implementation of a safeguards and accountability program in accordance with 10CFR73. Preparation of a physical security plan in accordance with 10CFR73.55.

- Review of the reactor emergency plan, quality assurance (QA) program, training program, and radiation protection program.

The generic safety analyses contained in the HI-STORM 100 FSAR may be used as input and for guidance by the licensee in performing a 10CFR72.212 evaluation.

Within this report, all figures, tables and references cited are identified by the double decimal system m.n.i, where m is the chapter number, n is the section number, and i is the sequential number. Thus, for example, Figure 1.2.3 is the third figure in Section 1.2 of Chapter 1.

Revisions to this document are made on a section level basis. Complete sections have been replaced if any material in the section changed. The specific changes are noted with revision bars in the right margin. Figures are revised individually. Drawings are controlled separately within the Holtec QA program and have individual revision numbers. Bills-of-Material (BOMs) are considered separate drawings and are not necessarily at the same revision level as the drawing(s) to which they apply. If a drawing or BOM was revised in support of the current FSAR revision, that drawing/BOM is included in Section 1.5 at its latest revision level. Drawings and BOMs appearing in this FSAR may be revised between formal updates to the FSAR. Therefore, the revisions of drawings/BOMs in Section 1.5 may not be current.

The HI-STORM 100 System has been expanded slightly to include options specific for Indian Point Unit 1. The affected components are the MPC enclosure vessel, MPC-32 and MPC-32F, HI-STORM 100S Version B and HI-TRAC 100D. Information pertaining to these changes is generally contained in supplements to each chapter identified by a Roman numeral "II" (i.e. Chapter 1 and Supplement 1.II). Certain sections of the main FSAR are also affected and are appropriately modified for continuity with the "II" supplements. Unless superseded or specifically modified by information in the "II" supplements, the information in the main FSAR chapters is applicable to the HI-STORM 100 System at Indian Point Unit 1.

Supplements identified by a Roman numeral "I" (i.e. Chapter 1 and Supplement 1.I) have been inserted in the FSAR as placeholders for future use.

1.0.1 Engineering Change Orders

The changes authorized by the Holtec ECOs (with corresponding 10CFR72.48 evaluations, if applicable) listed in the following table are reflected in Revision 6 of this FSAR.

LIST OF ECO'S AND APPLICABLE 10CFR72.48 EVALUATIONS

Affected Item	ECO Number	72.48 Evaluation or Screening Number
MPC-68/68F/68FF Basket	-	-
MPC-24/24E/24EF Basket	1022-72	828
MPC-32 Basket	1023-50	N/A
MPC Enclosure Vessel	1021-94	N/A
	1022-73	N/A
	1023-51	N/A

HI-STORM Overpack	1024-137	849
	1024-139	853
	1024-141	N/A
HI-TRAC 100 and 100D Transfer Cask	-	-
HI-TRAC 125 and 125D Transfer Cask	-	-
General FSAR Changes	5014-128	N/A
	5014-133	834
	5014-147	854
	5014-148	856
	5014-149	863
	N/A	857
	5014-151	N/A
	5014-152	N/A

Table 1.0.1

TERMINOLOGY AND NOTATION

ALARA is an acronym for As Low As Reasonably Achievable.

Boral is a generic term to denote an aluminum-boron carbide cermet manufactured in accordance with U.S. Patent No. 4027377. The individual material supplier may use another trade name to refer to the same product.

Boral™ means Boral manufactured by AAR Advanced Structures.

BWR is an acronym for boiling water reactor.

C.G. is an acronym for center of gravity.

Commercial Spent Fuel or CSF refers to nuclear fuel used to produce energy in a commercial nuclear power plant.

Confinement Boundary means the outline formed by the sealed, cylindrical enclosure of the Multi-Purpose Canister (MPC) shell welded to a solid baseplate, a lid welded around the top circumference of the shell wall, the port cover plates welded to the lid, and the closure ring welded to the lid and MPC shell providing the redundant sealing.

Confinement System means the Multi-Purpose Canister (MPC) which encloses and confines the spent nuclear fuel during storage.

Controlled Area means that area immediately surrounding an ISFSI for which the owner/user exercises authority over its use and within which operations are performed.

Cooling Time (or post-irradiation cooling time) for a spent fuel assembly is the time between reactor shutdown and the time the spent fuel assembly is loaded into the MPC.

DBE means Design Basis Earthquake.

DCSS is an acronym for Dry Cask Storage System.

Damaged Fuel Assembly is a fuel assembly with known or suspected cladding defects, as determined by review of records, greater than pinhole leaks or hairline cracks, empty fuel rod locations that are not replaced with dummy fuel rods, missing structural components such as grid spacers, whose structural integrity has been impaired such that geometric rearrangement of fuel or gross failure of the cladding is expected based on engineering evaluations, or those that cannot be handled by normal means. Fuel assemblies that cannot be handled by normal means due to fuel cladding damage are considered fuel debris.

Damaged Fuel Container (or Canister) means a specially designed enclosure for damaged fuel or fuel debris which permits gaseous and liquid media to escape while minimizing dispersal of gross particulates. The Damaged Fuel Container/Canister (DFC) features a lifting location which is suitable for remote handling of a loaded or unloaded DFC.

Design Heat Load is the computed heat rejection capacity of the HI-STORM system with a certified MPC loaded with CSF stored in *uniform storage* with the ambient at the normal temperature and the peak cladding temperature (PCT) at 400°C. The Design Heat Load is less than the thermal capacity of the system by a suitable margin that reflects the conservatism in the system thermal analysis.

Design Life is the minimum duration for which the component is engineered to perform its intended function set forth in this FSAR, if operated and maintained in accordance with this FSAR.

Design Report is a document prepared, reviewed and QA validated in accordance with the provisions of 10CFR72 Subpart G. The Design Report shall demonstrate compliance with the requirements set forth in the Design Specification. A Design Report is mandatory for systems, structures, and components designated as Important to Safety. The FSAR serves as the Design Report for the HI-STORM 100 System.

Design Specification is a document prepared in accordance with the quality assurance requirements of 10CFR72 Subpart G to provide a complete set of design criteria and functional requirements for a system, structure, or component, designated as Important to Safety, intended to be used in the operation, implementation, or decommissioning of the HI-STORM 100 System. The FSAR serves as the Design Specification for the HI-STORM 100 System.

Enclosure Vessel (or MPC Enclosure Vessel) means the pressure vessel defined by the cylindrical shell, baseplate, port cover plates, lid, closure ring, and associated welds that provides confinement for the helium gas contained within the MPC. The Enclosure Vessel (EV) and the fuel basket together constitute the multi-purpose canister.

Fracture Toughness is a property which is a measure of the ability of a material to limit crack propagation under a suddenly applied load.

FSAR is an acronym for Final Safety Analysis Report (10CFR72).

Fuel Basket means a honeycombed structural weldment with square openings which can accept a fuel assembly of the type for which it is designed.

Fuel Debris is ruptured fuel rods, severed rods, loose fuel pellets, containers or structures that are supporting these loose fuel assembly parts, or fuel assemblies with known or suspected defects which cannot be handled by normal means due to fuel cladding damage.

High Burnup Fuel, or HBF is a commercial spent fuel assembly with an average burnup greater than 45,000 MWD/MTU.

TERMINOLOGY AND NOTATION

HI-TRAC transfer cask or HI-TRAC means the transfer cask used to house the MPC during MPC fuel loading, unloading, drying, sealing, and on-site transfer operations to a HI-STORM storage overpack or HI-STAR storage/transportation overpack. The HI-TRAC shields the loaded MPC allowing loading operations to be performed while limiting radiation exposure to personnel. HI-TRAC is an acronym for **H**oltec **I**nternational **Tra**nsfer **C**ask. In this FSAR there are several HI-TRAC transfer casks, the 125-ton standard design HI-TRAC (HI-TRAC-125), the 125-ton dual-purpose lid design (HI-TRAC 125D), the 100-ton HI-TRAC (HI-TRAC-100), the 100-ton dual purpose lid design (HI-TRAC 100D), and the 75-ton dual purpose lid design for Indian Point 1 (HI-Trac 100D Version IP1). The 100-ton HI-TRAC is provided for use at sites with a maximum crane capacity of less than 125 tons. The term HI-TRAC is used as a generic term to refer to all HI-TRAC transfer cask designs, unless the discussion requires distinguishing among the designs. The HI-TRAC is equipped with a pair of lifting trunnions and the HI-TRAC 100 and HI-TRAC 125 designs also include pocket trunnions. The trunnions are used to lift and downend/upend the HI-TRAC with a loaded MPC.

HI-STORM overpack or storage overpack means the cask that receives and contains the sealed multi-purpose canisters containing spent nuclear fuel. It provides the gamma and neutron shielding, ventilation passages, missile protection, and protection against natural phenomena and accidents for the MPC. The term "overpack" as used in this FSAR refers to all overpack designs, including the standard design (HI-STORM 100) and two alternate designs (HI-STORM 100S and HI-STORM 100S Version B). The term "overpack" also applies to those overpacks designed for high seismic deployment (HI-STORM 100A or HI-STORM 100SA), unless otherwise clarified.

HI-STORM 100 System consists of any loaded MPC model placed within any design variant of the HI-STORM overpack.

Holtite*™* is the trade name for all present and future neutron shielding materials formulated under Holtec International's R&D program dedicated to developing shielding materials for application in dry storage and transport systems. The Holtite development program is an ongoing experimentation effort to identify neutron shielding materials with enhanced shielding and temperature tolerance characteristics. Holtite-A™ is the first and only shielding material qualified under the Holtite R&D program. As such, the terms Holtite and Holtite-A may be used interchangeably throughout this FSAR.

Holtite™-A is a trademarked Holtec International neutron shield material.

Important to Safety (ITS) means a function or condition required to store spent nuclear fuel safely; to prevent damage to spent nuclear fuel during handling and storage, and to provide reasonable assurance that spent nuclear fuel can be received, handled, packaged, stored, and retrieved without undue risk to the health and safety of the public.

Independent Spent Fuel Storage Installation (ISFSI) means a facility designed, constructed, and licensed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage in accordance with 10CFR72.

Intact Fuel Assembly is defined as a fuel assembly without known or suspected cladding defects greater than pinhole leaks and hairline cracks, and which can be handled by normal means. Fuel assemblies without fuel rods in fuel rod locations shall not be classified as Intact Fuel Assemblies unless dummy fuel rods are used to displace an amount of water greater than or equal to that displaced by the fuel rod(s).

License Life means the duration for which the system is authorized by virtue of its certification by the U.S. NRC.

Long-term Storage means the time beginning after on-site handling is complete and the loaded overpack is at rest in its designated storage location on the ISFSI pad and lasting up to the end of the licensed life of the HI-STORM 100 System (20 years).

Lowest Service Temperature (LST) is the minimum metal temperature of a part for the specified service condition.

Maximum Reactivity means the highest possible k-effective including bias, uncertainties, and calculational statistics evaluated for the worst-case combination of fuel basket manufacturing tolerances.

METAMIC® is a trade name for an aluminum/boron carbide composite neutron absorber material qualified for use in the MPCs.

METCON™ is a trade name for the HI-STORM overpack. The trademark is derived from the **met**al-**con**crete composition of the HI-STORM overpack.

MGDS is an acronym for Mined Geological Disposal System.

Minimum Enrichment is the minimum assembly average enrichment. Natural uranium blankets are not considered in determining minimum enrichment.

Moderate Burnup Fuel, or MBF is a commercial spent fuel assembly with an average burnup less than or equal to 45,000 MWD/MTU.

Multi-Purpose Canister (MPC) means the sealed canister consisting of a honeycombed fuel basket for spent nuclear fuel storage, contained in a cylindrical canister shell (the MPC Enclosure Vessel). There are different MPCs with different fuel basket geometries for storing PWR or BWR fuel, but all MPCs have identical exterior diameters. The MPC is the confinement boundary for storage conditions.

NDT is an acronym for Nil Ductility Transition Temperature, which is defined as the temperature at which the fracture stress in a material with a small flaw is equal to the yield stress in the same material if it had no flaws.

Neutron Absorber Material is a generic term used in this FSAR to indicate any neutron absorber material qualified for use in the HI-STORM 100 System MPCs.

Neutron Shielding means a material used to thermalize and capture neutrons emanating from the radioactive spent nuclear fuel.

Non-Fuel Hardware is defined as Burnable Poison Rod Assemblies (BPRAs), Thimble Plug Devices (TPDs), Control Rod Assemblies (CRAs), Axial Power Shaping Rods (APSRs), Wet Annular Burnable Absorbers (WABAs), Rod Cluster Control Assemblies (RCCAs), Neutron Source Assemblies (NSAs), water displacement guide tube plugs, orifice rod assemblies, and vibration suppressor inserts.

Planar-Average Initial Enrichment is the average of the distributed fuel rod initial enrichments within a given axial plane of the assembly lattice.

Plain Concrete is concrete that is unreinforced and is of density specified in this FSAR.

Post-Core Decay Time (PCDT) is synonymous with cooling time.

PWR is an acronym for pressurized water reactor.

Reactivity is used synonymously with effective neutron multiplication factor or k-effective.

Regionalized Fuel Loading is a term used to describe an optional fuel loading strategy used in lieu of uniform fuel loading. Regionalized fuel loading allows high heat emitting fuel assemblies to be stored in fuel storage locations in the center of the fuel basket provided lower heat emitting fuel assemblies are stored in the peripheral fuel storage locations. Users choosing regionalized fuel loading must also consider other restrictions in the CoC such as those for non-fuel hardware and damaged fuel containers. Regionalized fuel loading does not apply to the MPC-68F model.

SAR is an acronym for Safety Analysis Report (10CFR71).

Service Life means the duration for which the component is reasonably expected to perform its intended function, if operated and maintained in accordance with the provisions of this FSAR. Service Life may be much longer than the Design Life because of the conservatism inherent in the codes, standards, and procedures used to design, fabricate, operate, and maintain the component.

Short-term Operations means those normal operational evolutions necessary to support fuel loading or fuel unloading operations. These include, but are not limited to MPC cavity drying, helium backfill, MPC transfer, and onsite handling of a loaded HI-TRAC transfer cask.

Single Failure Proof means that the handling system is designed so that all directly loaded tension and compression members are engineered to satisfy the enhanced safety criteria of Paragraphs 5.1.6(1)(a) and (b) of NUREG-0612.

SNF is an acronym for spent nuclear fuel.

SSC is an acronym for Structures, Systems and Components.

STP is Standard Temperature and Pressure conditions.

Thermal Capacity of the HI-STORM system is defined as the amount of heat the storage system, containing an MPC loaded with CSF stored in *uniform storage,* will actually reject with the ambient environment at the normal temperature and the peak fuel cladding temperature (PCT) at 400°C.

Thermosiphon is the term used to describe the buoyancy-driven natural convection circulation of helium within the MPC fuel basket.

Uniform Fuel Loading is a fuel loading strategy where any authorized fuel assembly may be stored in any fuel storage location, subject to other restrictions in the CoC, such as those applicable to non-fuel hardware, and damaged fuel containers.

ZPA is an acronym for zero period acceleration.

ZR means any zirconium-based fuel cladding material authorized for use in a commercial nuclear power plant reactor. Any reference to Zircaloy fuel cladding in this FSAR applies to any zirconium-based fuel cladding material.

Table 1.0.2

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	Associated NUREG-1536 Review Criteria	Applicable 10CFR72 or 10CFR20 Requirement	HI-STORM FSAR
1. General Description			
1.1 Introduction	1.III.1 General Description & Operational Features	10CFR72.24(b)	1.1
1.2 General Description	1.III.1 General Description & Operational Features	10CFR72.24(b)	1.2
1.2.1 Cask Character-istics	1.III.1 General Description & Operational Features	10CFR72.24(b)	1.2.1
1.2.2 Operational Features	1.III.1 General Description & Operational Features	10CFR72.24(b)	1.2.2
1.2.3 Cask Contents	1.III.3 DCSS Contents	10CFR72.2(a)(1) 10CFR72.236(a)	1.2.3
1.3 Identification of Agents & Contractors	1.III.4 Qualification of the Applicant	10CFR72.24(j) 10CFR72.28(a)	1.3
1.4 Generic Cask Arrays	1.III.1 General Description & Operational Features	10CFR72.24(c)(3)	1.4
1.5 Supplemental Data	1.III.2 Drawings	10CFR72.24(c)(3)	1.5
NA	1.III.6 Consideration of Transport Requirements	10CFR72.230(b) 10CFR72.236(m)	1.1
NA	1.III.5 Quality Assurance	10CFR72.24(n)	1.3
2. Principal Design Criteria			
2.1 Spent Fuel To Be Stored	2.III.2.a Spent Fuel Specifications	10CFR72.2(a)(1) 10CFR72.236(a)	2.1
2.2 Design Criteria for Environmental Conditions and Natural Phenomena	2.III.2.b External Conditions, 2.III.3.b Structural, 2.III.3.c Thermal	10CFR72.122(b)	2.2
		10CFR72.122(c)	2.2.3.3, 2.2.3.10
		10CFR72.122(b)(1)	2.2
		10CFR72.122(b)(2)	2.2.3.11
		10CFR72.122(h)(1)	2.0
2.2.1 Tornado and Wind Loading	2.III.2.b External Conditions	10CFR72.122(b)(2)	2.2.3.5

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	Associated NUREG-1536 Review Criteria	Applicable 10CFR72 or 10CFR20 Requirement	HI-STORM FSAR
2.2.2 Water Level (Flood)	2.III.2.b External Conditions 2.III.3.b Structural	10CFR72.122(b)(2)	2.2.3.6
2.2.3 Seismic	2.III.3.b Structural	10CFR72.102(f) 10CFR72.122(b)(2)	2.2.3.7
2.2.4 Snow and Ice	2.III.2.b External Conditions 2.III.3.b Structural	10CFR72.122(b)	2.2.1.6
2.2.5 Combined Load	2.III.3.b Structural	10CFR72.24(d) 10CFR72.122(b)(2)(ii)	2.2.7
NA	2.III.1 Structures, Systems, and Components Important to Safety	10CFR72.122(a) 10CFR72.24(c)(3)	2.2.4
NA	2.III.2 Design Criteria for Safety Protection Systems	10CFR72.236(g) 10CFR72.24(c)(1) 10CFR72.24(c)(2) 10CFR72.24(c)(4) 10CFR72.120(a) 10CFR72.236(b)	2.0, 2.2
NA	2.III.3.c Thermal	10CFR72.128(a)(4)	2.3.2.2, 4.0
NA	2.III.3f Operating Procedures	10CFR72.24(f) 10CFR72.128(a)(5)	10.0, 8.0
		10CFR72.236(h)	8.0
		10CFR72.24(1)(2)	1.2.1, 1.2.2
		10CFR72.236(1)	2.3.2.1
		10CFR72.24(e) 10CFR72.104(b)	10.0, 8.0
	2.III.3.g Acceptance Tests & Maintenance	10CFR72.122(1) 10CFR72.236(g) 10CFR72.122(f) 10CFR72.128(a)(1)	9.0
2.3 Safety Protection Systems	--	--	2.3

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	**Associated NUREG-1536 Review Criteria**	**Applicable 10CFR72 or 10CFR20 Requirement**	**HI-STORM FSAR**
2.3.1 General	--	--	2.3
2.3.2 Protection by Multiple Confinement Barriers and Systems	2.III.3.b Structural	10CFR72.236(1)	2.3.2.1
	2.III.3.c Thermal	10CFR72.236(f)	2.3.2.2
	2.III.3.d Shielding/ Confinement/ Radiation Protection	10CFR72.126(a) 10CFR72.128(a)(2)	2.3.5.2
		10CFR72.128(a)(3)	2.3.2.1
		10CFR72.236(d)	2.3.2.1, 2.3.5.2
		10CFR72.236(e)	2.3.2.1
2.3.3 Protection by Equipment & Instrument Selection	2.III.3.d Shielding/ Confinement/ Radiation Protection	10CFR72.122(h)(4) 10CFR72.122(i) 10CFR72.128(a)(1)	2.3.5
2.3.4 Nuclear Criticality Safety	2.III.3.e Criticality	10CFR72.124(a) 10CFR72.236(c) 10CFR72.124(b)	2.3.4, 6.0
2.3.5 Radiological Protection	2.III.3.d Shielding/ Confinement/ Radiation Protection	10CFR72.24(d) 10CFR72.104(a) 10CFR72.236(d)	10.4.1
		10CFR72.24(d) 10CFR72.106(b) 10CFR72.236(d)	10.4.2
		10CFR72.24(m)	2.3.2.1
2.3.6 Fire and Explosion Protection	2.III.3.b Structural	10CFR72.122(c)	2.3.6, 2.2.3.10
2.4 Decommissioning Considerations	2.III.3.h Decommissioning	10CFR72.24(f) 10CFR72.130 10CFR72.236(h)	2.4
	14.III.1 Design	10CFR72.130	2.4
	14.III.2 Cask Decontamination	10CFR72.236(i)	2.4

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	Associated NUREG-1536 Review Criteria	Applicable 10CFR72 or 10CFR20 Requirement	HI-STORM FSAR
	14.III.3 Financial Assurance & Record Keeping	10CFR72.30	(1)
	14.III.4 License Termination	10CFR72.54	(1)
3. Structural Evaluation			
3.1 Structural Design	3.III.1 SSC Important to Safety	10CFR72.24(c)(3) 10CFR72.24(c)(4)	3.1
	3.III.6 Concrete Structures	10CFR72.24(c)	3.1
3.2 Weights and Centers of Gravity	3.V.1.b.2 Structural Design Features	--	3.2
3.3 Mechanical Properties of Materials	3.V.1.c Structural Materials 3.V.2.c Structural Materials	10CFR72.24(c)(3)	3.3
NA	3.III.2 Radiation Shielding, Confinement, and Subcriticality	10CFR72.24(d) 10CFR72.124(a) 10CFR72.236(c) 10CFR72.236(d) 10CFR72.236(l)	3.4.4.3 3.4.7.3 3.4.10
NA	3.III.3 Ready Retrieval	10CFR72.122(f) 10CFR72.122(h) 10CFR72.122(l)	3.4.4.3
NA	3.III.4 Design-Basis Earthquake	10CFR72.24(c) 10CFR72.102(f)	3.4.7
NA	3.III.5 20 Year Minimum Design Length	10CFR72.24(c) 10CFR72.236(g)	3.4.11 3.4.12
3.4 General Standards for Casks	--	--	3.4
3.4.1 Chemical and Galvanic Reactions	3.V.1.b.2 Structural Design Features	--	3.4.1
3.4.2 Positive Closure	--	--	3.4.2
3.4.3 Lifting Devices	3.V.1.ii(4)(a) Trunnions --	--	3.4.3

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	**Associated NUREG-1536 Review Criteria**	**Applicable 10CFR72 or 10CFR20 Requirement**	**HI-STORM FSAR**
3.4.4 Heat	3.V.1.d Structural Analysis	10CFR72.24(d) 10CFR72.122(b)	3.4.4
3.4.5 Cold	3.V.1.d Structural Analysis	10CFR72.24(d) 10CFR72.122(b)	3.4.5
3.5 Fuel Rods	--	10CFR72.122(h)(1)	3.5
4. Thermal Evaluation			
4.1 Discussion	4.III Regulatory Requirements	10CFR72.24(c)(3) 10CFR72.128(a)(4) 10CFR72.236(f) 10CFR72.236(h)	4.1
4.2 Summary of Thermal Properties of Materials	4.V.4.b Material Properties	--	4.2
4.3 Specifications for Components	4.IV Acceptance Criteria ISG-11, Revision 3	10CFR72.122(h)(1)	4.3
4.4 Thermal Evaluation for Normal Conditions of Storage	4.IV Acceptance Criteria ISG-11, Revision 3	10CFR72.24(d) 10CFR72.236(g)	4.4, 4.5
NA	4.IV Acceptance Criteria	10CFR72.24(d) 10CFR72.122(c)	11.1, 11.2
4.5 Supplemental Data	4.V.6 Supplemental Info.	--	--
5. Shielding Evaluation			
5.1 Discussion and Results	--	10CFR72.104(a) 10CFR72.106(b)	5.1
5.2 Source Specification	5.V.2 Radiation Source Definition	--	5.2
5.2.1 Gamma Source	5.V.2.a Gamma Source	--	5.2.1, 5.2.3

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	Associated NUREG-1536 Review Criteria	Applicable 10CFR72 or 10CFR20 Requirement	HI-STORM FSAR
5.2.2 Neutron Source	5.V.2.b Neutron Source	--	5.2.2, 5.2.3
5.3 Model Specification	5.V.3 Shielding Model Specification	--	5.3
5.3.1 Description of the Radial and Axial Shielding Configura-tions	5.V.3.a Configuration of the Shielding and Source	10CFR72.24(c)(3)	5.3.1
5.3.2 Shield Regional Densities	5.V.3.b Material Properties	10CFR72.24(c)(3)	5.3.2
5.4 Shielding Evaluation	5.V.4 Shielding Analysis	10CFR72.24(d) 10CFR72.104(a) 10CFR72.106(b) 10CFR72.128(a)(2) 10CFR72.236(d)	5.4
5.5 Supplemental Data	5.V.5 Supplemental Info.	--	Appendices 5.A, 5.B, and 5.C
6. Criticality Evaluation			
6.1 Discussion and Results	--	--	6.1
6.2 Spent Fuel Loading	6.V.2 Fuel Specification	--	6.1, 6.2
6.3 Model Specifications	6.V.3 Model Specification	--	6.3
6.3.1 Description of Calcula-tional Model	6.V.3.a Configuration	-- 10CFR72.124(b) 10CFR72.24(c)(3)	6.3.1

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	**Associated NUREG-1536 Review Criteria**	**Applicable 10CFR72 or 10CFR20 Requirement**	**HI-STORM FSAR**
6.3.2 Cask Regional Densities	6.V.3.b Material Properties	10CFR72.24(c)(3) 10CFR72.124(b) 10CFR72.236(g)	6.3.2
6.4 Criticality Calculations	6.V.4 Criticality Analysis	10CFR72.124	6.4
6.4.1 Calculational or Experimental Method	6.V.4.a Computer Programs and 6.V.4.b Multiplication Factor	10CFR72.124	6.4.1
6.4.2 Fuel Loading or Other Contents Loading Optimization	6.V.3.a Configuration	--	6.4.2, 6.3.3
6.4.3 Criticality Results	6.IV Acceptance Criteria	10CFR72.24(d) 10CFR72.124 10CFR72.236(c)	6.1, 6.2, 6.3.1, 6.3.2
6.5 Critical Benchmark Experiments	6.V.4.c Benchmark Comparisons	--	6.5, Appendix 6.A, 6.4.3
6.6 Supplemental Data	6.V.5 Supplemental Info.	--	Appendices 6.B,6.C, and 6.D
	7. Confinement		
7.1 Confinement Boundary	7.III.1 Description of Structures, Systems and Components Important to Safety ISG-18	10CFR72.24(c)(3) 10CFR72.24(1)	7.0, 7.1
7.1.1 Confinement Vessel	7.III.2 Protection of Spent Fuel Cladding	10CFR72.122(h)(l)	7.1, 7.1.1
7.1.2 Confinement Penetrations	--	--	7.1.2
7.1.3 Seals and Welds	--	--	7.1.3

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	**Associated NUREG-1536 Review Criteria**	**Applicable 10CFR72 or 10CFR20 Requirement**	**HI-STORM FSAR**
7.1.4 Closure	7.III.3 Redundant Sealing	10CFR72.236(e)	7.1.1, 7.1.4
7.2 Requirements for Normal Conditions of Storage	7.III.7 Evaluation of Confinement System ISG-18	10CFR72.24(d) 10CFR72.236(1)	7.1
7.2.1 Release of Radioactive Material	7.III.6 Release of Nuclides to the Environment	10CFR72.24(1)(1)	7. 1
	7.III.4 Monitoring of Confinement System	10CFR72.122(h)(4) 10CFR72.128(a)(l)	7.1.4
	7.III.5 Instrumentation	10CFR72.24(l) 10CFR72.122(i)	7.1.4
	7.III.8 Annual Dose ISG-18	10CFR72.104(a)	7.1
7.2.2 Pressurization of Confinement Vessel	--	--	7.1
7.3 Confinement Requirements for Hypothetical Accident Conditions	7.III.7 Evaluation of Confinement System ISG-18	10CFR72.24(d) 10CFR72.122(b) 10CFR72.236(l)	7.1
7.3.1 Fission Gas Products	--	--	7.1
7.3.2 Release of Contents	ISG-18	--	7.1
NA	--	10CFR72.106(b)	7.1
7.4 Supplemental Data	7.V Supplemental Info.	--	--
	8. Operating Procedures		
8.1 Procedures for Loading the Cask	8.III.1 Develop Operating Procedures	10CFR72.40(a)(5)	8.1 to 8.5
	8.III.2 Operational Restrictions for ALARA	10CFR72.24(e) 10CFR72.104(b)	8.1.5
	8.III.3 Radioactive Effluent Control	10CFR72.24(1)(2)	8.1.5, 8.5.2

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	Associated NUREG-1536 Review Criteria	Applicable 10CFR72 or 10CFR20 Requirement	HI-STORM FSAR
	8.III.4 Written Procedures	10CFR72.212(b)(9)	8.0
	8.III.5 Establish Written Procedures and Tests	10CFR72.234(f)	8.0 Introduction
	8.III.6 Wet or Dry Loading and Unloading Compatibility	10CFR72.236(h)	8.0 Introduction
	8.III.7 Cask Design to Facilitate Decon	10CFR72.236(i)	8.1, 8.3
8.2 Procedures for Unloading the Cask	8.III.1 Develop Operating Procedures	10CFR72.40(a)(5)	8.3
	8.III.2 Operational Restrictions for ALARA	10CFR72.24(e) 10CFR72.104(b)	8.3
	8.III.3 Radioactive Effluent Control	10CFR72.24(1)(2)	8.3.3
	8.III.4 Written Procedures	10CFR72.212(b)(9)	8.0
	8.III.5 Establish Written Procedures and Tests	10CFR72.234(f)	8.0
	8.III.6 Wet or Dry Loading and Unloading Compatibility	10CFR72.236(h)	8.0
	8.III.8 Ready Retrieval	10CFR72.122(1)	8.3
8.3 Preparation of the Cask	--	--	8.3.2
8.4 Supplemental Data	--	--	Tables 8.1.1 to 8.1.10
NA	8.III.9 Design to Minimize Radwaste	10CFR72.24(f) 10CFR72.128(a)(5)	8.1, 8.3
	8.III.10 SSCs Permit Inspection, Maintenance, and Testing	10CFR72.122(f)	Table 8.1.6
9. Acceptance Criteria and Maintenance Program			
9.1 Acceptance Criteria	9.III.1.a Preoperational Testing & Initial Operations	10CFR72.24(p)	8.1, 9.1

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	Associated NUREG-1536 Review Criteria	Applicable 10CFR72 or 10CFR20 Requirement	HI-STORM FSAR
	9.III.1.c SSCs Tested and Maintained to Appropriate Quality Standards	10CFR72.24(c) 10CFR72.122(a)	9.1
	9.III.1.d Test Program	10CFR72.162	9.1
	9.III.1.e Appropriate Tests	10CFR72.236(l)	9.1
	9.III.1.f Inspection for Cracks, Pinholes, Voids and Defects	10CFR72.236(j)	9.1
	9.III.1.g Provisions that Permit Commission Tests	10CFR72.232(b)	9.1(2)
9.2 Maintenance Program	9.III.1.bMaintenance	10CFR72.236(g)	9.2
	9.III.1.cSSCs Tested and Maintained to Appropriate Quality Standards	10CFR72.122(f) 10CFR72.128(a)(1)	9.2
	9.III.1.hRecords of Maintenance	10CFR72.212(b)(8)	9.2
NA	9.III.2 Resolution of Issues Concerning Adequacy of Reliability	10CFR72.24(i)	(3)
	9.III.1.d Submit Pre-Op Test Results to NRC	10CFR72.82(e)	(4)
	9.III.1.i Casks Conspicuously and Durably Marked	10CFR72.236(k)	9.1.7, 9.1.1.(12)
	9.III.3 Cask Identification		
10. Radiation Protection			
10.1 Ensuring that Occupational Exposures are as Low as Reasonably Achievable (ALARA)	10.III.4 ALARA	10CFR20.1101 10CFR72.24(e) 10CFR72.104(b) 10CFR72.126(a)	10.1
10.2 Radiation Protection Design Features	10.V.1.b Design Features	10CFR72.126(a)(6)	10.2

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	Associated NUREG-1536 Review Criteria	Applicable 10CFR72 or 10CFR20 Requirement	HI-STORM FSAR
10.3 Estimated Onsite Collective Dose Assessment	10.III.2 Occupational Exposures	10CFR20.1201 10CFR20.1207 10CFR20.1208 10CFR20.1301	10.3
N/A	10.III.3 Public Exposure	10CFR72.104 10CFR72.106	10.4
	10.III.1 Effluents and Direct Radiation	10CFR72.104	
11. Accident Analyses			
11.1 Off-Normal Operations	11.III.2 Meet Dose Limits for Anticipated Events	10CFR72.24(d) 10CFR72.104(a) 10CFR72.236(d)	11.1
	11.III.4 Maintain Subcritical Condition	10CFR72.124(a) 10CFR72.236(c)	11.1
	11.III.7 Instrumentation and Control for Off-Normal Condition	10CFR72.122(i)	11.1
11.2 Accidents	11.III.1 SSCs Important to Safety Designed for Accidents	10CFR72.24(d)(2) 10CFR72.122b(2) 10CFR72.122b(3) 10CFR72.122(d) 10CFR72.122(g)	11.2
	11.III.5 Maintain Confinement for Accident	10CFR72.236(1)	11.2
	11.III.4 Maintain Subcritical Condition	10CFR72.124(a) 10CFR72.236(c)	11.2, 6.0
	11.III.3 Meet Dose Limits for Accidents	10CFR72.24(d)(2) 10CFR72.24(m) 10CFR72.106(b)	11.2, 5.1.2, 7.3

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	**Associated NUREG-1536 Review Criteria**	**Applicable 10CFR72 or 10CFR20 Requirement**	**HI-STORM FSAR**
	11.III.6 Retrieval	10CFR72.122(l)	8.3
	11.III.7 Instrumentation and Control for Accident Conditions	10CFR72.122(i)	(5)
NA	11.III.8 Confinement Monitoring	10CFR72.122h(4)	7.1.4
12. Operating Controls and Limits			
12.1 Proposed Operating Controls and Limits	--	10CFR72.44(c)	12.0
	12.III.1.e Administrative Controls	10CFR72.44(c)(5)	12.0
12.2 Development of Operating Controls and Limits	12.III.1 General Requirement for Technical Specifications	10CFR72.24(g) 10CFR72.26 10CFR72.44(c) 10CFR72 Subpart E 10CFR72 Subpart F	12.0
12.2.1 Functional and Operating Limits, Monitoring Instruments, and Limiting Control Settings	12.III.1.a Functional/ Operating Units, Monitoring Instruments and Limiting Controls	10CFR72.44(c)(1)	Appendix 12.A
12.2.2 Limiting Conditions for Operation	12.III.1.b Limiting Controls	10CFR72.44(c)(2)	Appendix 12.A
	12.III.2.a Type of Spent Fuel	10CFR72.236(a)	Appendix 12.A
	12.III.2.b Enrichment		
	12.III.2.c Burnup		
	12.III.2.d Minimum Acceptance Cooling Time		
	12.III.2.f Maximum Spent Fuel Loading Limit		
	12.III.2g Weights and Dimensions		
	12.III.2.h Condition of Spent Fuel		
	12.III.2e Maximum Heat Dissipation	10CFR72.236(a)	Appendix 12.A

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Regulatory Guide 3.61 Section and Content	Associated NUREG-1536 Review Criteria	Applicable 10CFR72 or 10CFR20 Requirement	HI-STORM FSAR
	12.III.2.i Inerting Atmosphere Requirements	10CFR72.236(a)	Appendix 12.A
12.2.3 Surveillance Specifications	12.III.1.c Surveillance Requirements	10CFR72.44(c)(3)	Chapter 12
12.2.4 Design Features	12.III.1.d Design Features	10CFR72.44(c)(4)	Chapter 12
12.2.4 Suggested Format for Operating Controls and Limits	--	--	Appendix 12.A
NA	12.III.2 SCC Design Bases and Criteria	10CFR72.236(b)	2.0
NA	12.III.2 Criticality Control	10CFR72.236(c)	2.3.4, 6.0
NA	12.III.2 Shielding and Confinement	10CFR20 10CFR72.236(d)	2.3.5, 7.0, 5.0, 10.0
NA	12.III.2 Redundant Sealing	10CFR72.236(e)	7.1, 2.3.2
NA	12.III.2 Passive Heat Removal	10CFR72.236(f)	2.3.2.2, 4.0
NA	12.III.2 20 Year Storage and Maintenance	10CFR72.236(g)	1.2.1.5, 9.0, 3.4.10, 3.4.11
NA	12.III.2 Decontamination	10CFR72.236(i)	8.0, 10.1
NA	12.III.2 Wet or Dry Loading	10CFR72.236(h)	8.0
NA	12.III.2 Confinement Effectiveness	10CFR72.236(j)	9.0
NA	12.III.2 Evaluation for Confinement	10CFR72.236(l)	7.1, 7.2, 9.0
13. Quality Assurance			
13.1 Quality Assurance	13.III Regulatory Requirements	10CFR72.24(n) 10CFR72.140(d)	13.0
	13.IV Acceptance Criteria	10CFR72, Subpart G	

Table 1.0.2 (continued)

HI-STORM 100 SYSTEM FSAR REGULATORY COMPLIANCE
CROSS REFERENCE MATRIX

Notes:

(1) The stated requirement is the responsibility of the licensee (i.e., utility) as part of the ISFSI pad and is therefore not addressed in this application.

(2) It is assumed that approval of the FSAR by the NRC is the basis for the Commission's acceptance of the tests defined in Chapter 9.

(3) Not applicable to HI-STORM 100 System. The functional adequacy of all important to safety components is demonstrated by analyses.

(4) The stated requirement is the responsibility of licensee (i.e., utility) as part of the ISFSI and is therefore not addressed in this application.

(5) The stated requirement is not applicable to the HI-STORM 100 System. No monitoring is required for accident conditions.

"—" There is no corresponding NUREG-1536 criteria, no applicable 10CFR72 or 10CFR20 regulatory requirement, or the item is not addressed in the FSAR.

"NA" There is no Regulatory Guide 3.61 section that corresponds to the NUREG-1536, 10CFR72, or 10CFR20 requirement being addressed.

Table 1.0.3

HI-STORM 100 SYSTEM FSAR CLARIFICATIONS AND EXCEPTIONS TO NUREG-1536

NUREG-1536 Requirement	Alternate Method to Meet NUREG-1536 Intent	Justification
2.V.2.(b)(1) "The NRC accepts as the maximum and minimum "normal" temperatures the highest and lowest ambient temperatures recorded in each year, averaged over the years of record."	Exception: Section 2.2.1.4 for environmental temperatures utilizes an upper bounding value of 80°F on the annual average ambient temperatures for the United States.	The 80°F temperature set forth in Table 2.2.2 is greater than the annual average ambient temperature at any location in the continental United States. Inasmuch as the primary effect of the environmental temperature is on the computed fuel cladding temperature to establish long-term fuel cladding integrity, the annual average ambient temperature for each ISFSI site should be below 80°F. The large thermal inertia of the HI-STORM 100 System ensures that the daily fluctuations in temperatures do not affect the temperatures of the system. Additionally, the 80°F ambient temperature is combined with insolation in accordance with 10CFR71.71 averaged over 24 hours.
2.V.2.(b)(3)(f) "10CFR Part 72 identifies several other natural phenomena events (including seiche, tsunami, and hurricane) that should be addressed for spent fuel storage."	Clarification: A site-specific safety analysis of the effects of seiche, tsunami, and hurricane on the HI-STORM 100 System must be performed prior to use if these events are applicable to the site.	In accordance with NUREG-1536, 2.V.(b)(3)(f), if seiche, tsunami, and hurricane are not addressed in the SAR and they prove to be applicable to the site, a safety analysis is required prior to approval for use of the DCSS under either a site specific, or general license.

Table 1.0.3 (continued)

HI-STORM 100 SYSTEM FSAR CLARIFICATIONS AND EXCEPTIONS TO NUREG-1536

NUREG-1536 Requirement	Alternate Method to Meet NUREG-1536 Intent	Justification
3.V.1.d.i.(2)(a), page 3-11, "Drops with the axis generally vertical should be analyzed for both the conditions of a flush impact and an initial impact at a corner of the cask..."	Clarification: As stated in NUREG-1536, 3.V.(d), page 3-11, "Generally, applicants establish the design basis in terms of the maximum height to which the cask is lifted outside the spent fuel building, or the maximum deceleration that the cask could experience in a drop." The maximum deceleration for a corner drop is specified as 45g's for the HI-STORM overpack. No carry height limit is specified for the corner drop.	In Chapter 3, the MPC and HI-STORM overpack are evaluated under a 45g radial loading. A 45g axial loading on the MPC is bounded by the analysis presented in the HI-STAR FSAR, Docket 72-1008, under a 60g loading, and is not repeated in this FSAR. In Chapter 3, the HI-STORM overpack is evaluated under a 45g axial loading. Therefore, the HI-STORM overpack and MPC are qualified for a 45g loading as a result of a corner drop. Depending on the design of the lifting device, the type of rigging used, the administrative vertical carry height limit, and the stiffness of the impacted surface, site-specific analyses may be required to demonstrate that the deceleration limit of 45g's is not exceeded.
3.V.2.b.i.(1), Page 3-19, Para. 1, "All concrete used in storage cask system ISFSIs, and subject to NRC review, should be reinforced..." 3.V.2.b.i.(2)(b), Page 3-20, Para. 1, "The NRC accepts the use of ACI 349 for the design, material selection and specification, and construction of all reinforced concrete structures that are not addressed within the scope of ACI 359". 3.V.2.c.i, Page 3-22, Para. 3, "Materials and material properties used for the design and construction of reinforced concrete structures important to safety but not within the scope	Exception: The HI-STORM overpack concrete is not reinforced. However, ACI 349 [1.0.4] is used as guidance for the material selection and specification, and placement of the plain concrete. Appendix 1.D provides the relevant sections of ACI 349 applicable to the plain concrete in the overpack, including clarifications on implementation of this code. ACI 318-95 [1.0.5] is used for the calculation of the compressive strength of the plain concrete.	Concrete is provided in the HI-STORM overpack primarily for the purpose of radiation shielding during normal operations. During lifting and handling operations and under certain accident conditions, the compressive strength of the concrete (which is not impaired by the absence of reinforcement) is utilized. However, since the structural reliance under loadings which produce section flexure and tension is entirely on the steel structure of the overpack, reinforcement in the concrete will serve no useful purpose. To ensure the quality of the shielding concrete, all relevant provisions of ACI 349 are imposed as clarified in Appendix 1.D. The temperature limits for normal conditions are per Paragraph A.4.3 of Appendix A to ACI 349 and temperature limits for

HI-STORM 100 SYSTEM FSAR CLARIFICATIONS AND EXCEPTIONS TO NUREG-1536

NUREG-1536 Requirement	Alternate Method to Meet NUREG-1536 Intent	Justification
of ACI 359 should comply with the requirements of ACI 349".		off-normal and accident conditions are per Paragraph A.4.2 of Appendix A to ACI 349. Finally, the Fort St. Vrain ISFSI (Docket No. 72-9) also utilized plain concrete for shielding purposes, which is important to safety.
3.V.3.b.i.(2), Page 3-29, Para. 1, "The NRC accepts the use of ANSI/ANS-57.9 (together with the codes and standards cited therein) as the basic reference for ISFSI structures important to safety that are not designed in accordance with Section III of the ASME B&PV Code."	<u>Clarification:</u> The HI-STORM overpack steel structure is designed in accordance with the ASME B&PV Code, Section III, Subsection NF, Class 3. Any exceptions to the Code are listed in Table 2.2.15.	The overpack structure is a steel weldment consisting of "plate and shell type" members. As such, it is appropriate to design the structure to Section III, Class 3 of Subsection NF. The very same approach has been used in the structural evaluation of the "intermediate shells" in the HI-STAR 100 overpack (Docket Number 72-1008) previously reviewed and approved by the USNRC.
4.IV.5, Page 4-2 "for each fuel type proposed for storage, the DCSS should ensure a very low probability (e.g., 0.5 percent per fuel rod) of cladding breach during long-term storage." 4.IV.1, Page 4-3, Para. 1 "the staff should verify that cladding temperatures for each fuel type proposed for storage will be below the expected damage thresholds for normal conditions of storage." 4.IV.1, Page 4-3, Para. 2 "fuel cladding limits for each fuel type should be defined in the SAR with thermal restrictions in the DCSS technical specifications." 4.V.1, Page 4-3, Para. 4 "the applicant should	<u>Clarification:</u> As described in Section 4.3, all fuel array types authorized for storage are assigned a single peak fuel cladding temperature limit.	As described in Section 4.3, all fuel array types authorized for storage have been evaluated for the peak normal fuel cladding temperature limit of 400°C.

HI-STORM 100 SYSTEM FSAR CLARIFICATIONS AND EXCEPTIONS TO NUREG-1536

NUREG-1536 Requirement	Alternate Method to Meet NUREG-1536 Intent	Justification
verify that these cladding temperature limits are appropriate for all fuel types proposed for storage, and that the fuel cladding temperatures will remain below the limit for facility operations (e.g., fuel transfer) and the worst-case credible accident."		
4.V.4.a, Page 4-6, Para. 6 "the basket wall temperature of the hottest assembly can then be used to determine the peak rod temperature of the hottest assembly using the Wooten-Epstein correlation."	Clarification: As discussed in Subsection 4.4.2, conservative maximum fuel temperatures are obtained directly from the cask thermal analysis. The peak fuel cladding temperatures are then used to determine the corresponding peak basket wall temperatures using a finite-element based update of Wooten-Epstein (described in Subsection 4.4.1.1.2)	The finite-element based thermal conductivity is greater than a Wooten-Epstein based value. This larger thermal conductivity minimizes the fuel-to-basket temperature difference. Since the basket temperature is less than the fuel temperature, minimizing the temperature difference conservatively maximizes the basket wall temperature.
4.V.4.b, Page 4-7, Para. 2 "high burnup effects should also be considered in determining the fuel region effective thermal conductivity."	Exception: All calculations of fuel assembly effective thermal conductivities, described in Subsection 4.4.1.1.2, use nominal fuel design dimensions, neglecting wall thinning associated with high burnup.	Within Subsection 4.4.1.1.2, the calculated effective thermal conductivities based on nominal design fuel dimensions are compared with available literature values and are demonstrated to be conservative by a substantial margin.
4.V.4.c, Page 4-7, Para. 5 "a heat balance on the surface of the cask should be given and the results presented."	Clarification: No additional heat balance is performed or provided.	The FLUENT computational fluid dynamics program used to perform evaluations of the HI-STORM Overpack and HI-TRAC transfer cask, which uses a

HI-STORM 100 SYSTEM FSAR CLARIFICATIONS AND EXCEPTIONS TO NUREG-1536

NUREG-1536 Requirement	Alternate Method to Meet NUREG-1536 Intent	Justification
		discretized numerical solution algorithm, enforces an energy balance on all discretized volumes throughout the computational domain. This solution method, therefore, ensures a heat balance at the surface of the cask.
4.V.5.a, Page 4-8, Para. 2 "the SAR should include input and output file listings for the thermal evaluations."	Exception: No input or output file listings are provided in Chapter 4.	A complete set of computer program input and output files would be in excess of three hundred pages. All computer files are considered proprietary because they provide details of the design and analysis methods. In order to minimize the amount of proprietary information in the FSAR, computer files are provided in the proprietary calculation packages.
4.V.5.c, Page 4-10, Para. 3 "free volume calculations should account for thermal expansion of the cask internal components and the fuel when subjected to accident temperatures.	Exception: All free volume calculations use nominal confinement boundary dimensions, but the volume occupied by the fuel assemblies is calculated using maximum weights and minimum densities.	Calculating the volume occupied by the fuel assemblies using maximum weights and minimum densities conservatively overpredicts the volume occupied by the fuel and correspondingly underpredicts the remaining free volume.

HI-STORM 100 SYSTEM FSAR CLARIFICATIONS AND EXCEPTIONS TO NUREG-1536

NUREG-1536 Requirement	Alternate Method to Meet NUREG-1536 Intent	Justification
7.V.4 "Confinement Analysis. Review the applicant's confinement analysis and the resulting annual dose at the controlled area boundary."	Exception: No confinement analysis is performed and no effluent dose at the controlled area boundary is calculated.	The MPC uses redundant closures to assure that there is no release of radioactive materials under all credible conditions. Analyses presented in Chapters 3 and 11 demonstrate that the confinement boundary does not degrade under all normal, off-normal, and accident conditions. Multiple inspection methods are used to verify the integrity of the confinement boundary (e.g.,non-destructive examinations and pressure testing). Pursuant to ISG-18, the Holtec MPC is constructed in a manner that supports leakage from the confinement boundary being non-credible. Therefore, no confinement analysis is required.
9.V.1.a, Page 9-4, Para. 4 "Acceptance criteria should be defined in accordance with NB/NC-5330, "Ultrasonic Acceptance Standards"."	Clarification: Section 9.1.1.1 and the Design Drawings specify that the ASME Code, Section III, Subsection NB, Article NB-5332 will be used for the acceptance criteria for the volumetric examination of the MPC lid-to-shell weld.	In accordance with the first line on page 9-4, the NRC endorses the use of "...appropriate acceptance criteria as defined by either the ASME code, or an alternative approach..." The ASME Code, Section III, Subsection NB, Paragraph NB-5332 is appropriate acceptance criteria for pre-service examination.

Table 1.0.3 (continued)

HI-STORM 100 SYSTEM FSAR CLARIFICATIONS AND EXCEPTIONS TO NUREG-1536

NUREG-1536 Requirement	Alternate Method to Meet NUREG-1536 Intent	Justification
9.V.1.d, Para. 1 "Tests of the effectiveness of both the gamma and neutron shielding may be required if, for example, the cask contains a poured lead shield or a special neutron absorbing material."	Exception: Subsection 9.1.5 describes the control of special processes, such as neutron shield material installation, to be performed in lieu of scanning or probing with neutron sources.	The dimensional compliance of all shielding cavities is verified by inspection to design drawing requirements prior to shield installation. The Holtite-A shield material is installed in accordance with written, approved, and qualified special process procedures. The composition of the Holtite-A is confirmed by inspection and tests prior to first use. Following the first loading for the HI-TRAC transfer cask and each HI-STORM overpack, a shield effectiveness test is performed in accordance with written approved procedures, as specified in Section 9.1.
13.III, " the application must include, at a minimum, a description that satisfies the requirements of 10 CFR Part 72, Subpart G, 'Quality Assurance'..."	Exception: Section 13.0 incorporates the NRC-approved Holtec International Quality Assurance Program Manual by reference rather than describing the Holtec QA program in detail.	The NRC has approved Revision 13 of the Holtec Quality Assurance Program Manual under 10 CFR 71 (NRC QA Program Approval for Radioactive Material Packages No. 0784, Rev. 3). Pursuant to 10 CFR 72.140(d), Holtec will apply this QA program to all important-to-safety dry storage cask activities. Incorporating the Holtec QA Program Manual by reference eliminates duplicate documentation.

1.1 INTRODUCTION

HI-STORM 100 (acronym for Holtec International Storage and Transfer Operation Reinforced Module) is a spent nuclear fuel storage system designed to be in full compliance with the requirements of 10CFR72. The annex "100" is a model number designation which denotes a system weighing over 100 tons. The HI-STORM 100 System consists of a sealed metallic canister, herein abbreviated as the "MPC", contained within an overpack. Its design features are intended to simplify and reduce on-site SNF loading, handling, and monitoring operations, and to provide for radiological protection and maintenance of structural and thermal safety margins.

The HI-STORM 100S and HI-STORM 100S Version B overpack designs are variants of the HI-STORM 100 overpack design and have their own drawings in Section 1.5. The "S" suffix indicates an enhanced overpack design, as described later in this section. "Version B" indicates an enhanced HI-STORM 100S overpack design. The HI-STORM 100S and 100S Version B accept the same MPCs and fuel types as the HI-STORM 100 overpack and the basic structural, shielding, and thermal-hydraulic characteristics remain unchanged. Hereafter in this FSAR reference to HI-STORM 100 System or the HI-STORM overpack is construed to apply to the HI-STORM 100, the HI-STORM 100S, and the HI-STORM 100S Version B. Where necessary, the text distinguishes among the three overpack designs. See Figures 1.1.1A and 1.1.3A for pictorial views of the HI-STORM 100S overpack design. See Figures 1.1.1B and 1.1.3B for pictorial views of the HI-STORM 100S Version B design.

The HI-STORM 100A overpack is a variant of two of the three HI-STORM 100 System overpack designs and is specially outfitted with an extended baseplate and gussets to enable the overpack to be anchored to the ISFSI pad in high seismic applications. In the following, the modified structure of the HI-STORM 100A, in each of four quadrants, is denoted as a "sector lug." The HI-STORM 100A anchor design is applicable to the HI-STORM 100S overpack design, in which case the assembly would be named HI-STORM 100SA. The HI-STORM 100A anchor design is not applicable to the HI-STORM 100S Version B overpack design. Therefore, the HI-STORM 100S Version B overpack cannot be deployed in the anchored configuration at this time. Hereafter in the text, discussion of HI-STORM 100A applies to both the standard (HI-STORM 100A) and HI-STORM 100SA overpacks, unless otherwise clarified.

The HI-STORM 100 System is designed to accommodate a wide variety of spent nuclear fuel assemblies in a single basic overpack design by utilizing different MPCs. The external diameters of all MPCs are identical to allow the use of a single overpack. Each of the MPCs has different internals (baskets) to accommodate distinct fuel characteristics. Each MPC is identified by the maximum quantity of fuel assemblies it is capable of receiving. The MPC-24, MPC-24E, and MPC-24EF contain a maximum of 24 PWR fuel assemblies; the MPC-32 and MPC-32F contain a maximum of 32 PWR fuel assemblies; and the MPC-68, MPC-68F, and MPC-68FF contain a maximum of 68 BWR fuel assemblies.

The HI-STORM overpack is constructed from a combination of steel and concrete, both of which are materials with long, proven histories of usage in nuclear applications. The HI-STORM overpack incorporates and combines many desirable features of previously-approved concrete and metal module designs. In essence, the HI-STORM overpack is a hybrid of metal and concrete systems, with the design objective of emulating the best features and dispensing with the drawbacks of both. The HI-STORM overpack is best referred to as a METCON™ (metal/concrete composite) system.

Figures 1.1.1, 1.1.1A, and 1.1.1B show the HI-STORM 100 System with two of its major constituents, the MPC and the storage overpack, in a cut-away view. The MPC, shown partially withdrawn from the storage overpack, is an integrally welded pressure vessel designed to meet the stress limits of the ASME Boiler and Pressure Vessel Code, Section III, Subsection NB [1.1.1]. The MPC defines the confinement boundary for the stored spent nuclear fuel assemblies with respect to 10CFR72 requirements and attendant review considerations. The HI-STORM storage overpack provides mechanical protection, cooling, and radiological shielding for the contained MPC.

In essence, the HI-STORM 100 System is the storage-only counterpart of the HI-STAR 100 System (Docket Numbers 72-1008 (Ref. [1.1.2]) and 71-9261 (Ref. [1.1.3])). Both HI-STORM and HI-STAR are engineered to house identical MPCs. Since the MPC is designed to meet the requirements of both 10CFR71 and 10CFR72 for transportation and storage, respectively, the HI-STORM 100 System allows rapid decommissioning of the ISFSI by simply transferring the loaded MPC's directly into HI-STAR 100 overpacks for off-site transport. This alleviates the additional fuel handling steps required by storage-only casks to unload the cask and repackage the fuel into a suitable transportation cask.

In contrast to the HI-STAR 100 overpack, which provides a containment boundary for the SNF during transport, the HI-STORM storage overpack does not constitute a containment or confinement enclosure. The HI-STORM overpack is equipped with large penetrations near its lower and upper extremities to permit natural circulation of air to provide for the passive cooling of the MPC and the contained radioactive material. The HI-STORM overpack is engineered to be an effective barrier against the radiation emitted by the stored materials, and an efficiently configured metal/concrete composite to attenuate the loads transmitted to the MPC during a natural phenomena or hypothetical accident event. Other auxiliary functions of the HI-STORM 100 overpack include isolation of the SNF from abnormal environmental or man-made events, such as impact of a tornado borne missile. As the subsequent chapters of this FSAR demonstrate, the HI-STORM overpack is engineered with large margins of safety with respect to cooling, shielding, and mechanical/structural functions.

The HI-STORM 100 System is autonomous inasmuch as it provides SNF and radioactive material confinement, radiation shielding, criticality control and passive heat removal independent of any other facility, structures, or components. The surveillance and maintenance required by the plant's staff is minimized by the HI-STORM 100 System since it is completely passive and is composed of materials with long proven histories in the nuclear industry. The HI-STORM 100 System can be used either singly or as the basic storage module in an ISFSI. The site for an ISFSI can be located either at a reactor or away from a reactor.

The information presented in this report is intended to demonstrate the acceptability of the HI-STORM 100 System for use under the general license provisions of Subpart K by meeting the criteria set forth in 10CFR72.236.

The modularity of the HI-STORM 100 System accrues several advantages. Different MPCs, identical in external diameter, manufacturing requirements, and handling features, but different in their SNF arrangement details, are designed to fit a common overpack design. Even though the different MPCs have fundamentally identical design and manufacturing attributes, qualification of HI-STORM 100 requires consideration of the variations in the characteristics of the MPCs. In most cases, however, it is possible to identify the most limiting MPC geometry and the specific loading condition for the safety evaluation, and the detailed analyses are then carried out for that bounding condition. In those cases where this is not possible, multiple parallel analyses are performed.

The HI-STORM overpack is not engineered for transport and, therefore, will not be submitted for 10CFR Part 71 certification. HI-STORM 100, however, is designed to possess certain key elements of flexibility.

For example:

- The HI-STORM overpack is stored at the ISFSI pad in a vertical orientation, which helps minimize the size of the ISFSI and leads to an effective natural convection cooling flow around the MPC.

- The HI-STORM overpack can be loaded with a loaded MPC using the HI-TRAC transfer cask inside the 10CFR50 [1.1.4] facility, prepared for storage, transferred to the ISFSI, and stored in a vertical configuration, or directly loaded using the HI-TRAC transfer cask at or nearby the ISFSI storage pad.

The version of the HI-STORM overpack equipped with sector lugs to anchor it to the ISFSI pad is labeled HI-STORM 100A, shown in Figure 1.1.4. Figure 1.1.5 shows the sector lugs and anchors used to fasten the overpack to the pad in closer view. Details on HI-STORM 100A are presented in the drawing and BOM contained in Section 1.5. Users may employ a double nut arrangement as an option. The HI-STORM 100A overpack will be deployed at those ISFSI sites where the postulated seismic event (defined by the three orthogonal ZPAs) exceeds the maximum limit permitted for free-standing installation. The design of the ISFSI pad and the embedment are necessarily site-specific and the responsibility of the ISFSI owner. These designs shall be in accordance with the requirements specified in Appendix 2.A. The jurisdictional boundary between the anchored cask design and the embedment design is defined in Table 2.0.5. Additional description of the HI-STORM 100A configuration is provided in Subsection 1.2.1.2.1. The anchored design is applicable to the HI-STORM 100 and the HI-STORM 100S overpack designs only.

The MPC is a multi-purpose SNF storage device both with respect to the type of fuel assemblies and its versatility of use. The MPC is engineered as a cylindrical prismatic structure with square cross section storage cavities. The number of storage locations depends on the type of fuel. Regardless of the storage cell count, the construction of the MPC is fundamentally the same; it is built as a honeycomb of cellular elements positioned within a circumscribing cylindrical canister shell. The manner of cell-to-cell weld-up and cell-to-canister shell interface employed in the MPC imparts extremely high structural stiffness to the assemblage, which is an important attribute for mechanical accident events. Figure 1.1.2 shows an elevation cross section of an MPC.

The MPC enclosure vessel is identical in external diameter to those presented in References [1.1.2] and [1.1.3]. However, certain fuel basket models may not be certified for storage or transportation in the HI-STAR 100 System. The Part 71 and 72 CoCs for HI-STAR 100 should be consulted for the MPC models that are certified for that system. Referencing these documents, as applicable, avoids repetition of information on the MPCs which is comprehensively set forth in the above-mentioned Holtec International documents docketed with the NRC. However, sufficient information and drawings are presented in this report to maintain clarity of exposition of technical data.

The HI-STORM storage overpack is designed to provide the necessary neutron and gamma shielding to comply with the provisions of 10CFR72 for dry storage of SNF at an ISFSI. Cross sectional views of the HI-STORM storage overpacks are presented in Figures 1.1.3, 1.1.3A, and 1.1.3B. A HI-TRAC transfer cask is required for loading of the MPC and movement of the loaded MPC from the cask loading area of a nuclear plant spent fuel pool to the storage overpack. The HI-TRAC is engineered to be emplaced with an empty MPC into the cask loading area of nuclear plant spent fuel pools for fuel loading (or unloading). The HI-TRAC/MPC assembly is designed to preclude intrusion of pool water into the narrow annular space between the HI-TRAC and the MPC while the assembly is submerged in the pool water. The HI-TRAC transfer cask also allows dry loading (or unloading) of SNF into the MPC.

To summarize, the HI-STORM 100 System has been engineered to:

- minimize handling of the SNF;
- provide shielding and physical protection for the MPC;
- permit rapid and unencumbered decommissioning of the ISFSI;
- require minimal ongoing surveillance and maintenance by plant staff;
- minimize dose to operators during loading and handling;
- allow transfer of the loaded MPC to a HI-STAR overpack for transportation.

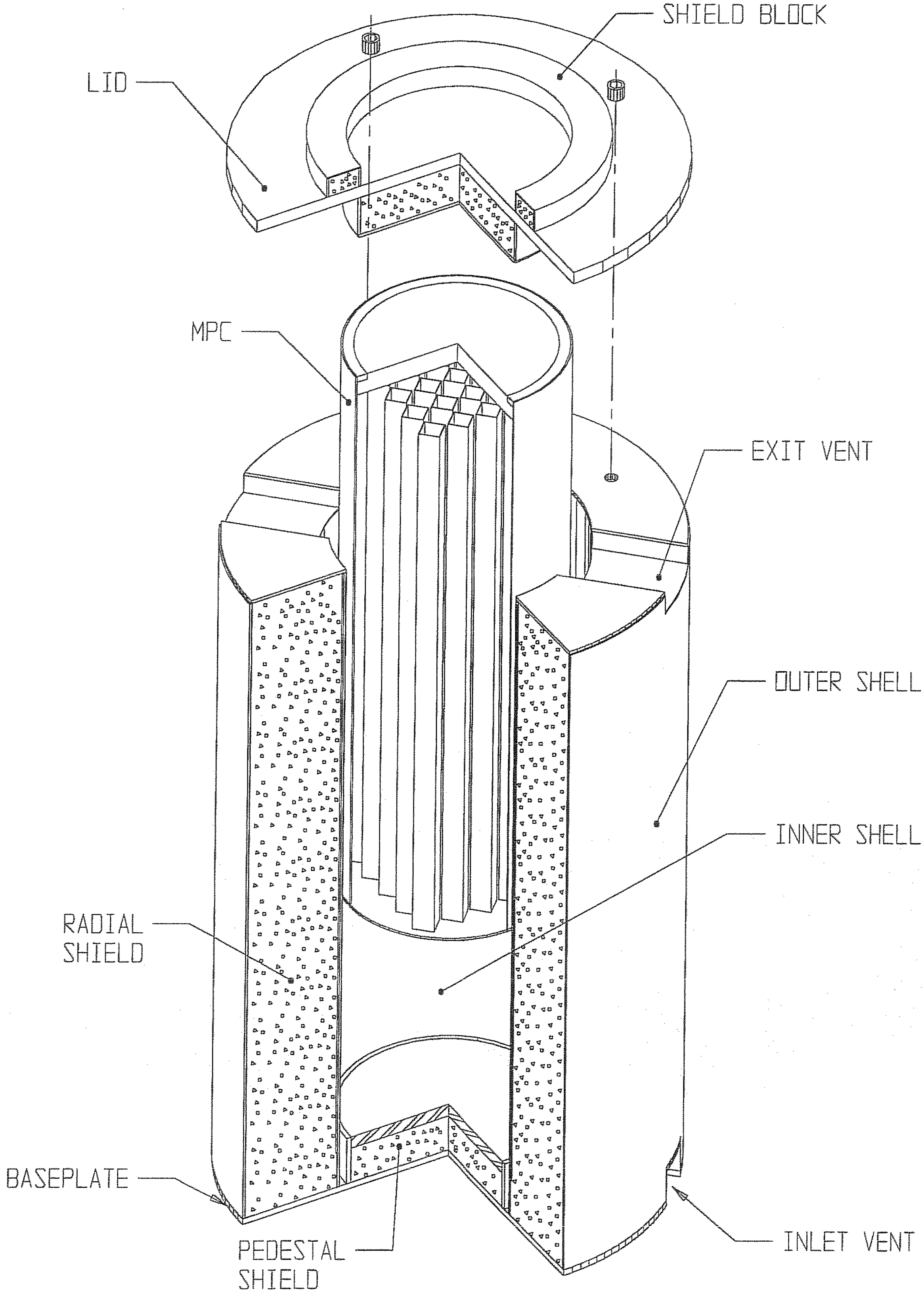

FIGURE 1.1.1; HI-STORM 100 OVERPACK WITH MPC PARTIALLY INSERTED

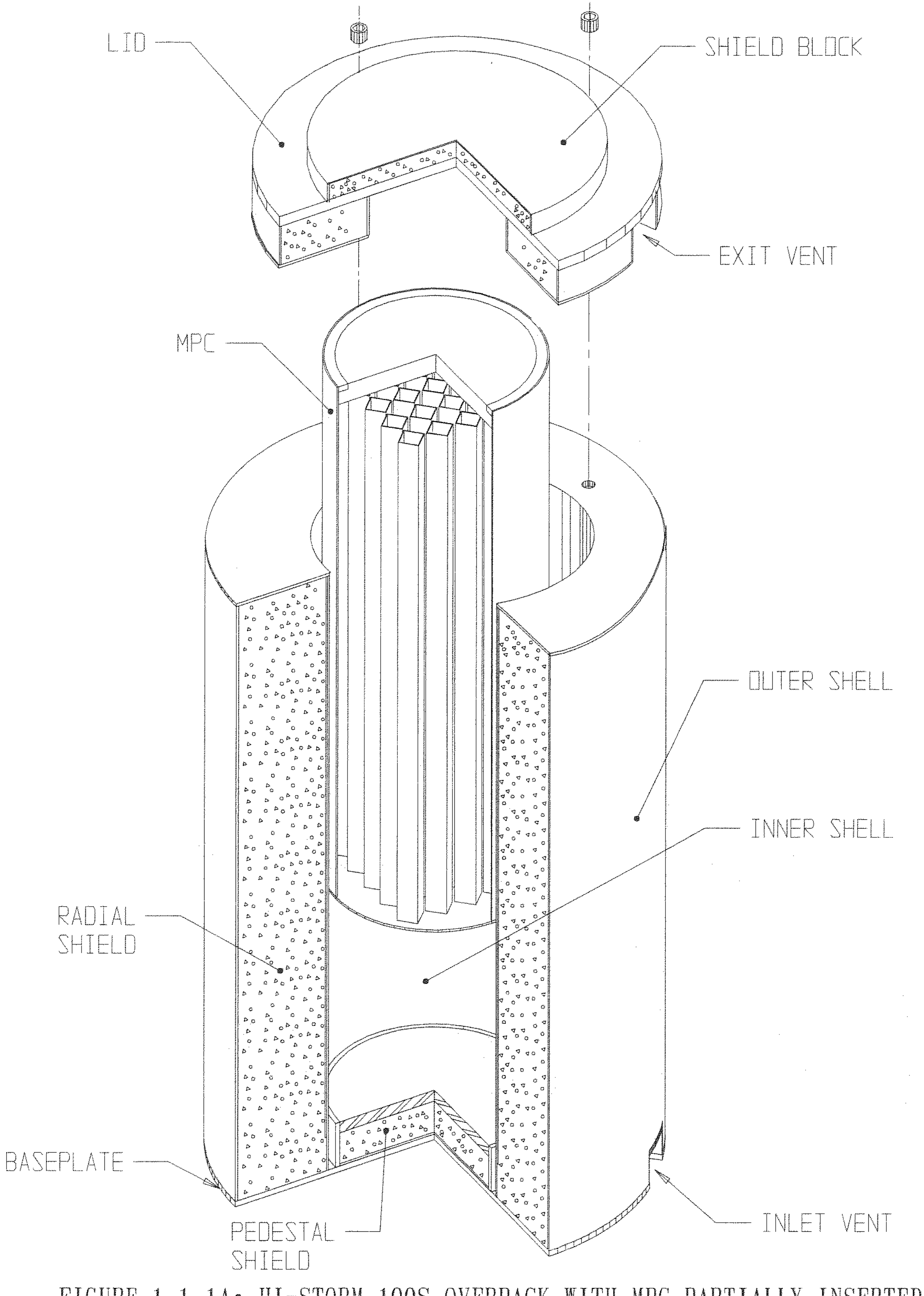

FIGURE 1.1.1A; HI-STORM 100S OVERPACK WITH MPC PARTIALLY INSERTED

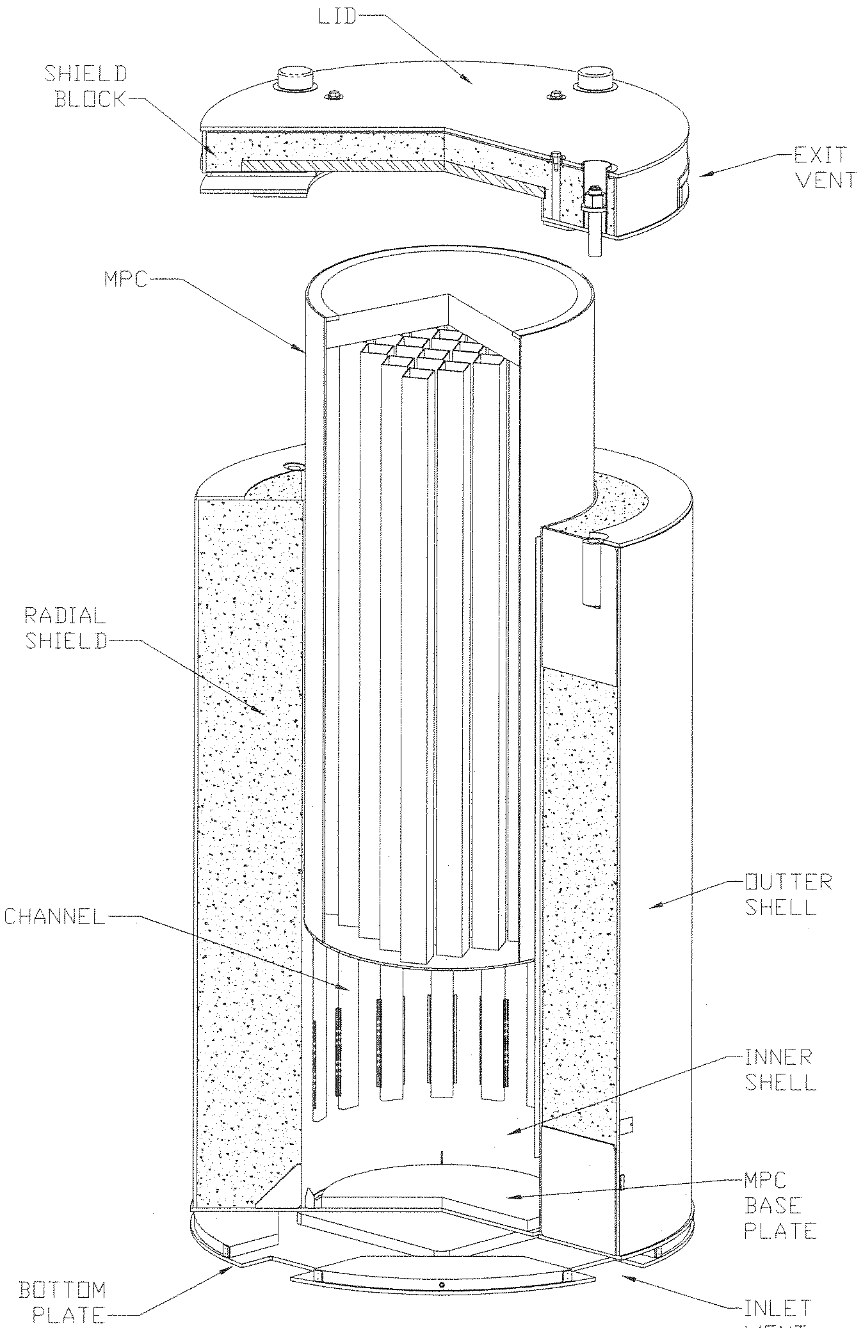

FIGURE 1.1.1B; HI-STORM 100S VERSION B OVERPACK WITH MPC PARTIALLY INSERTED

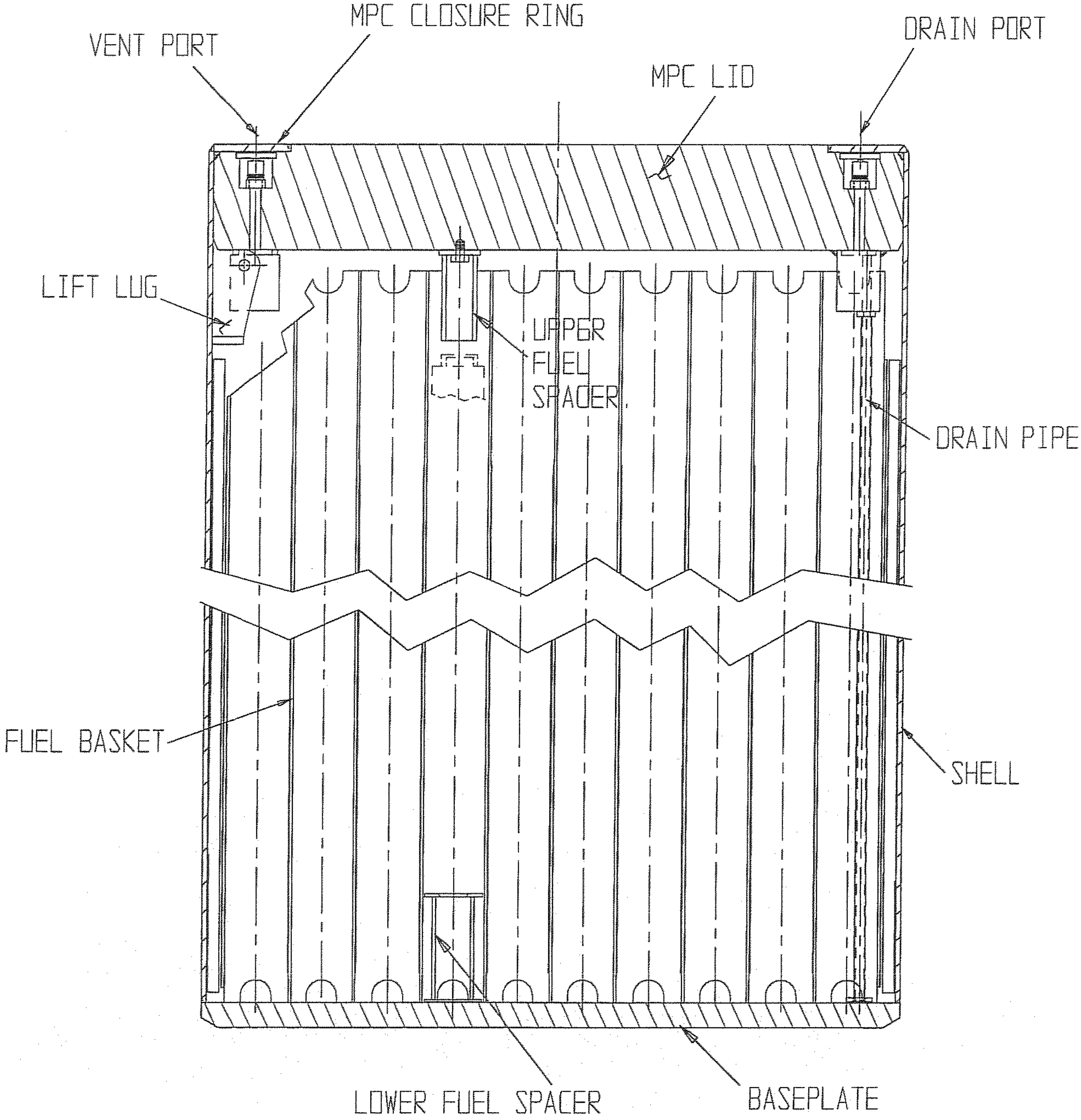

FIGURE 1.1.2; CROSS SECTION ELEVATION VIEW OF MPC

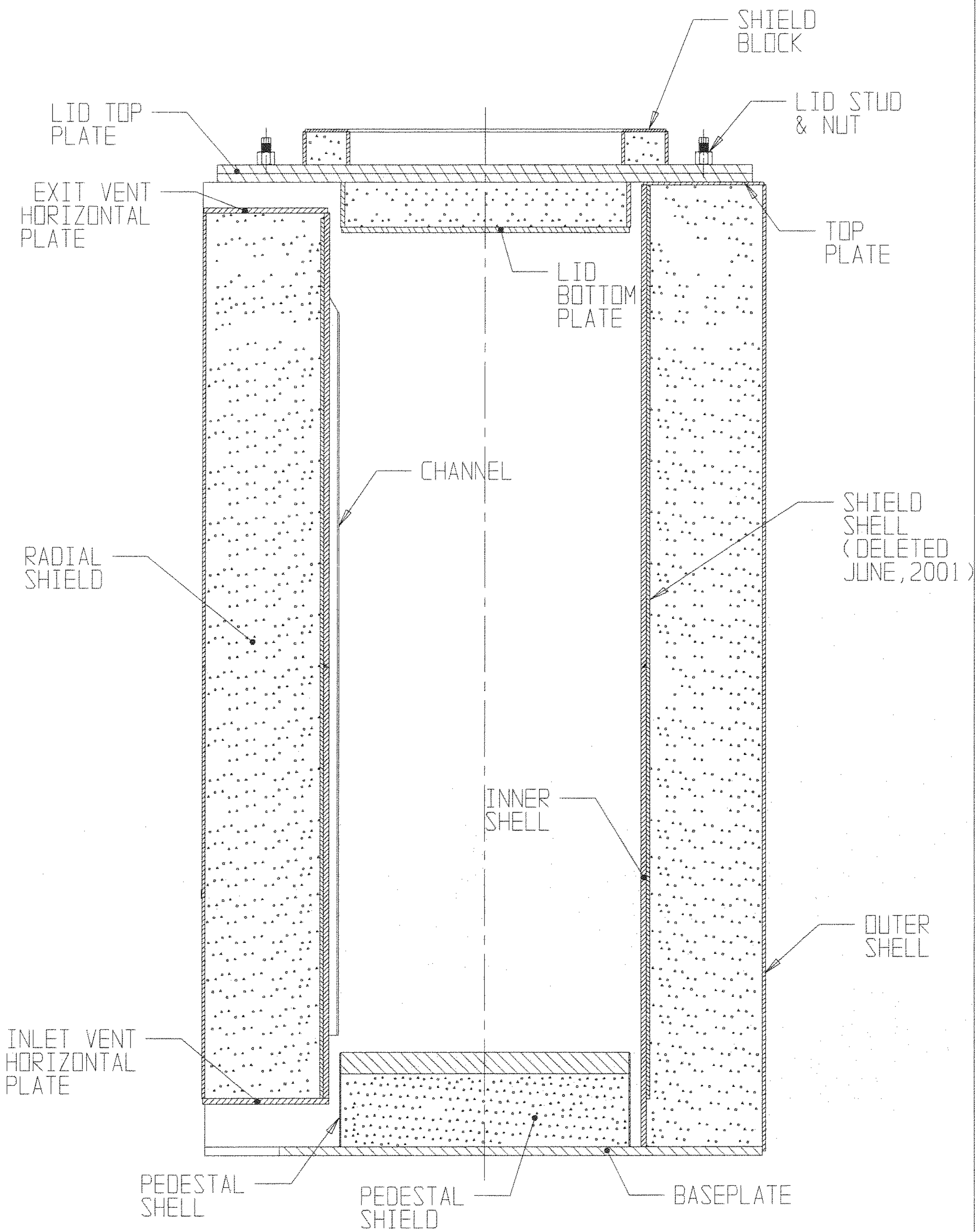

FIGURE 1.1.3; HI-STORM 100 OVERPACK CROSS SECTIONAL ELEVATION VIEW

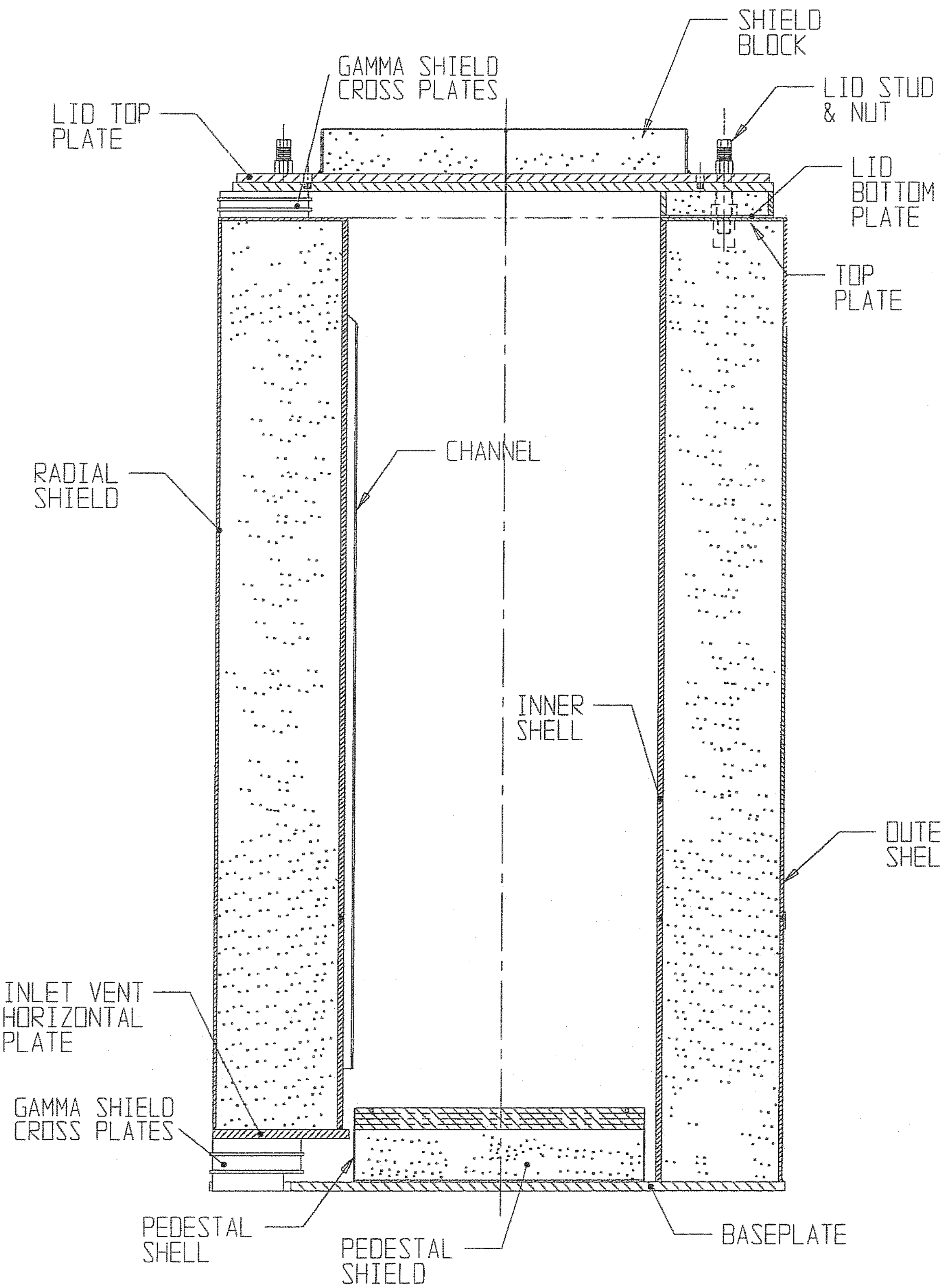

FIGURE 1.1.3A; HI-STORM 100S OVERPACK CROSS SECTIONAL ELEVATION VIEW

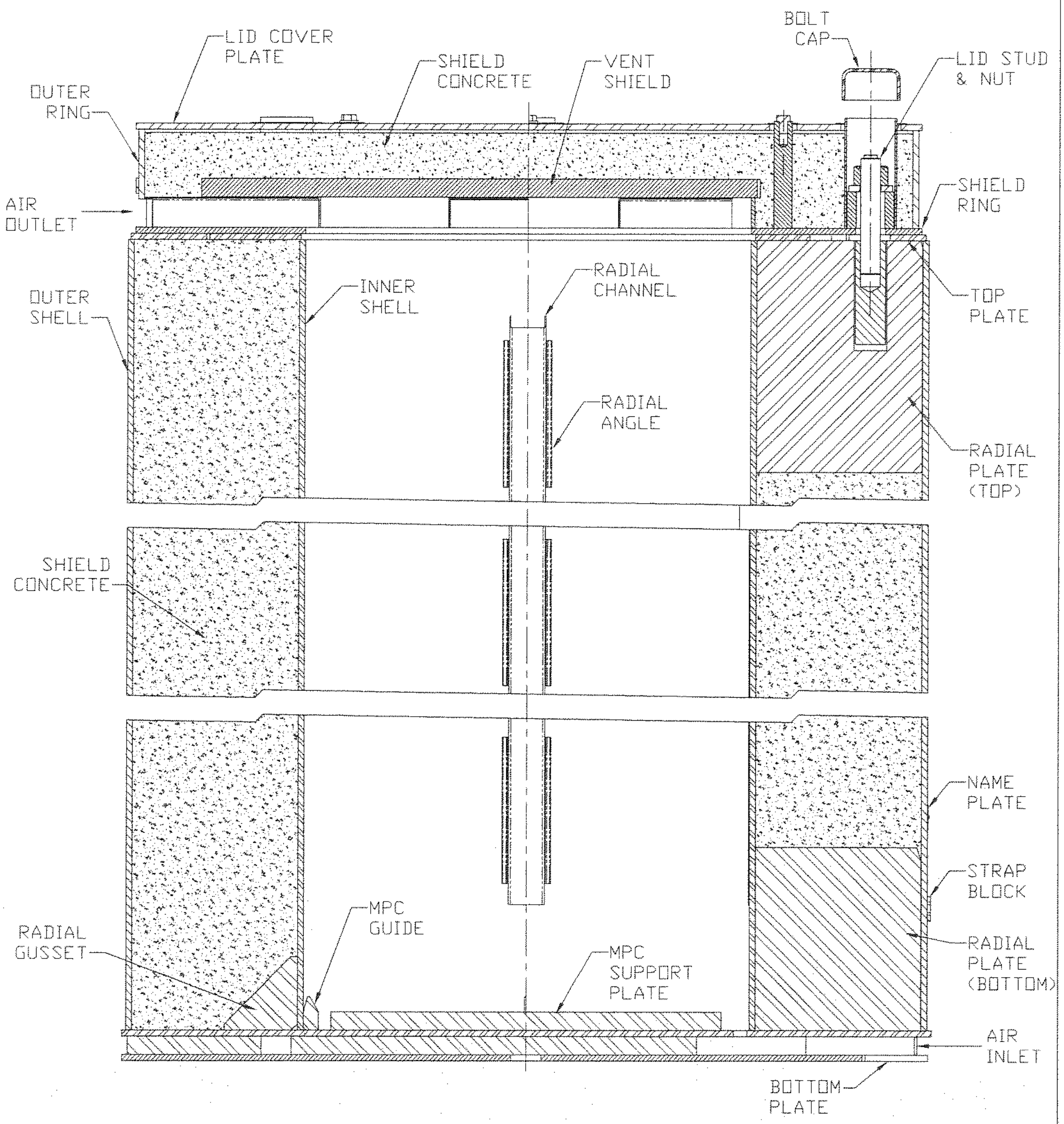

FIGURE 1.1.3B; HI-STORM 100S VERSION B OVERPACK CROSS SECTIONAL ELEVATION VIEW

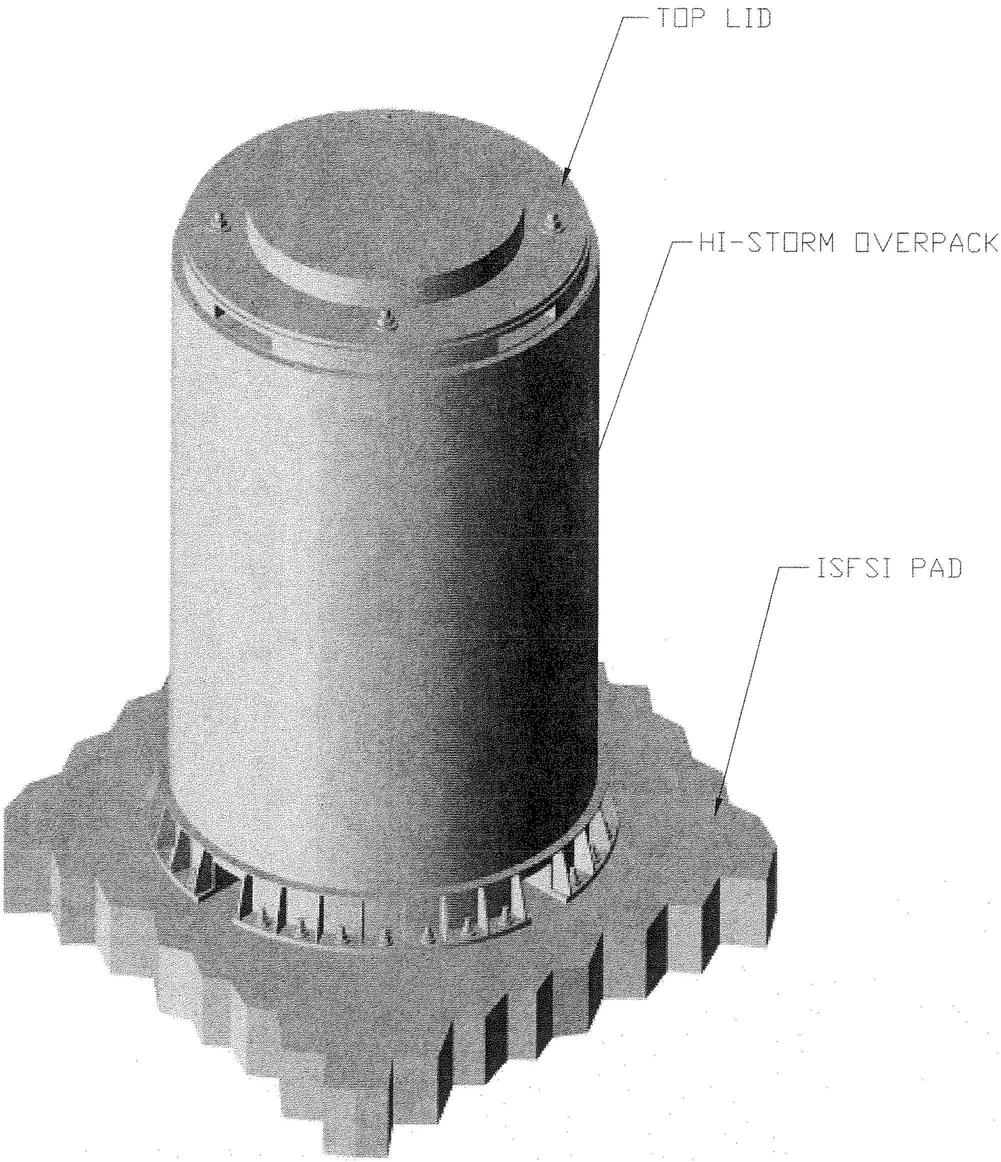

FIGURE 1.1.4; A PICTORAL VIEW OF THE HI-STORM 100A OVERPACK (100SA MODEL SHOWN)

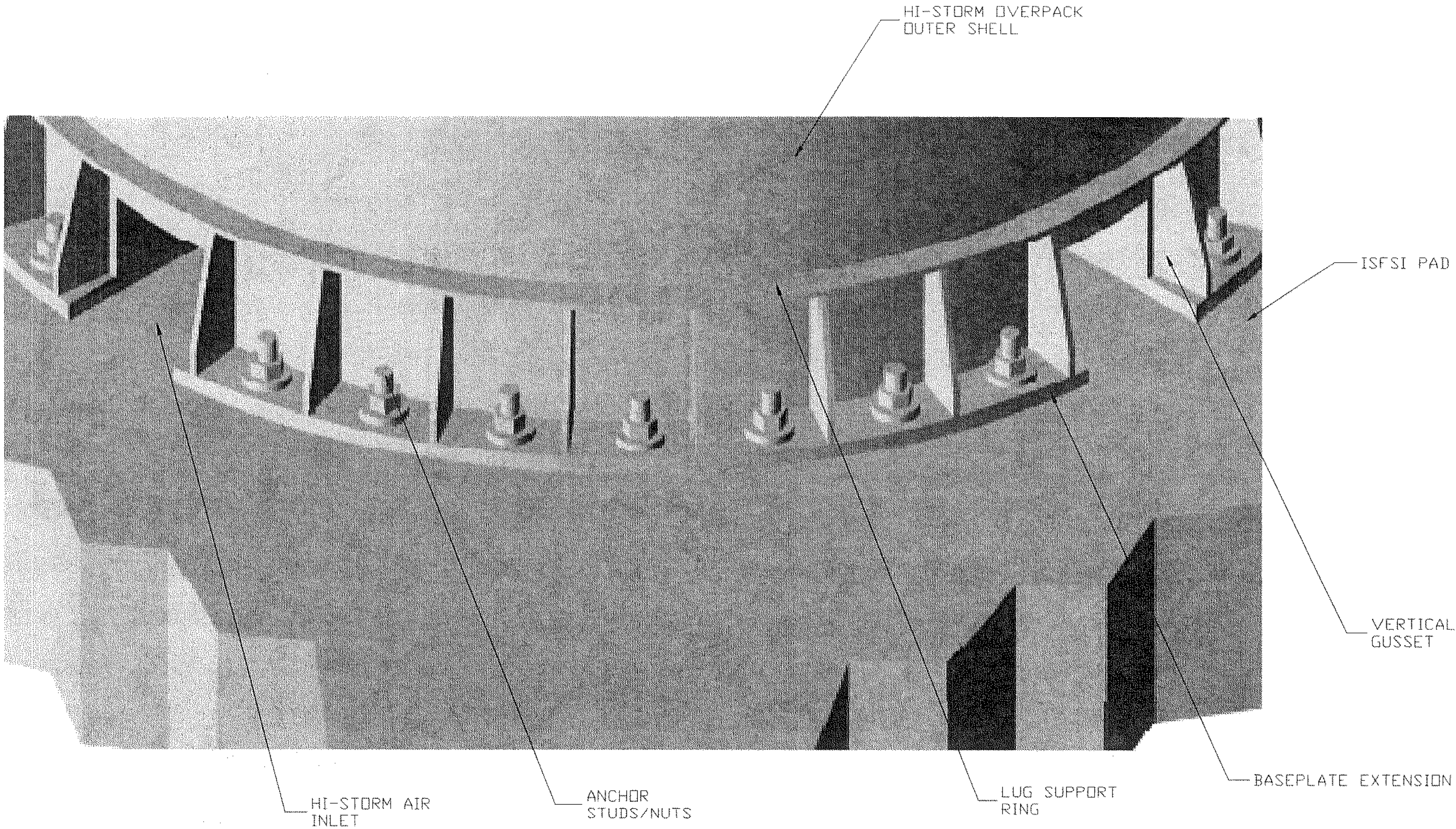

FIGURE 1.1.5; ANCHORING DETAIL FOR THE HI-STORM 100A AND 100SA OVERPACKS

1.2 GENERAL DESCRIPTION OF HI-STORM 100 System

1.2.1 System Characteristics

The basic HI-STORM 100 System consists of interchangeable MPCs providing a confinement boundary for BWR or PWR spent nuclear fuel, a storage overpack providing a structural and radiological boundary for long-term storage of the MPC placed inside it, and a transfer cask providing a structural and radiological boundary for transfer of a loaded MPC from a nuclear plant spent fuel storage pool to the storage overpack. Figures 1.2.1 and 1.2.1A provide example cross sectional views of the HI-STORM 100 System with an MPC inserted into HI-STORM 100 and HI-STORM 100S storage overpacks, respectively. Figure 1.1.1B provides similar information for the HI-STORM 100 System using a HI-STORM 100S Version B overpack. Each of these components is described below, including information with respect to component fabrication techniques and designed safety features. All structures, systems, and components of the HI-STORM 100 System, which are identified as Important to Safety are specified in Table 2.2.6. This discussion is supplemented with a full set of drawings in Section 1.5.

The HI-STORM 100 System is comprised of three discrete components:

- i. multi-purpose canister (MPC)
- ii. storage overpack (HI-STORM)
- iii. transfer cask (HI-TRAC)

Necessary auxiliaries required to deploy the HI-STORM 100 System for storage are:

- i. vacuum drying (or other moisture removal) system
- ii. helium (He) backfill system with leakage detector (or other system capable of the same backfill condition)
- iii. lifting and handling systems
- iv welding equipment
- v. transfer vehicles/trailer

All MPCs have identical external diameters . The outer diameter of the MPC is 68-3/8 inches[†] and the maximum overall length is 190-1/2 inches. See Section 1.5 for the MPC drawings. Due to the differing storage contents of each MPC, the maximum loaded weight differs among MPCs. See Table 3.2.1 for each MPC weight. However, the maximum weight of a loaded MPC is approximately 44-1/2 tons. Tables 1.2.1 and 1.2.2 contain the key system data and parameters for the MPCs.

[†] Dimensions discussed in this section are considered nominal values.

A single, base HI-STORM overpack design is provided which is capable of storing each type of MPC. The overpack inner cavity is sized to accommodate the MPCs. The inner diameter of the overpack inner shell is 73-1/2 inches and the height of the cavity is 191-1/2 inches. The overpack inner shell is provided with channels distributed around the inner cavity to present an inside diameter of 69-1/2 inches. The channels are intended to offer a flexible medium to absorb some of the impact during a non-mechanistic tip-over, while still allowing the cooling air flow through the ventilated overpack. The outer diameter of the overpack is 132-1/2 inches. The overall height of the HI-STORM 100 overpack is 239-1/2 inches.

There are two variants of the HI-STORM 100S overpack, differing from each other only in height and weight. The HI-STORM 100S(232) is 232 inches high, and the HI-STORM 100S(243) is 243 inches high. The HI-STORM 100S(243) is approximately 10,100 lbs heavier assuming standard density concrete. Hereafter in the text, these two versions of the HI-STORM 100S overpack will only be referred to as HI-STORM 100S and will be discussed separately only if the design feature being discussed is different between the two overpacks. See Section 1.5 for drawings.

There are also variants of the HI-STORM 100S Version B overpack, differing from each other only in height and weight. The HI-STORM 100S-218 is 218 inches high, and the HI-STORM 100S-229 is 229 inches high. The HI-STORM 100S-229 is approximately 8,700 lbs heavier, including standard density concrete. Hereafter in the text, the versions of the HI-STORM 100S Version B overpack will only be referred to as HI-STORM 100S Version B and will be discussed separately only if the design feature being discussed is different between the overpacks. See Section 1.5 for drawings.

The weight of the overpack without an MPC varies from approximately 135 tons to 160 tons. See Table 3.2.1 for the detailed weights.

Before proceeding to present detailed physical data on the HI-STORM 100 System, it is of contextual importance to summarize the design attributes which enhance the performance and safety of the system. Some of the principal features of the HI-STORM 100 System which enhance its effectiveness as an SNF storage device and a safe SNF confinement structure are:

- the honeycomb design of the MPC fuel basket;
- the effective distribution of neutron and gamma shielding materials within the system;
- the high heat dissipation capability;
- engineered features to promote convective heat transfer;
- the structural robustness of the steel-concrete-steel overpack construction.

The honeycomb design of the MPC fuel baskets renders the basket into a multi-flange plate weldment where all structural elements (i.e., box walls) are arrayed in two orthogonal sets of plates. Consequently, the walls of the cells are either completely co-planar (i.e., no offset) or orthogonal with each other. There is complete edge-to-edge continuity between the contiguous cells.

Among the many benefits of the honeycomb construction is the uniform distribution of the metal mass of the basket over the entire length of the basket. Physical reasoning suggests that a uniformly distributed mass provides a more effective shielding barrier than can be obtained from a nonuniform basket. In other words, the honeycomb basket is a most effective radiation attenuation device. The complete cell-to-cell connectivity inherent in the honeycomb basket structure provides an uninterrupted heat transmission path, making the MPC an effective heat rejection device.

The composite shell construction in the overpack, steel-concrete-steel, allows ease of fabrication and eliminates the need for the sole reliance on the strength of concrete.

A description of each of the components is provided in the following sections, along with information with respect to its fabrication and safety features. This discussion is supplemented with the full set of drawings in Section 1.5.

1.2.1.1 Multi-Purpose Canisters

The MPCs are welded cylindrical structures as shown in cross sectional views of Figures 1.2.2 through 1.2.4. The outer diameter of each MPC is fixed. Each spent fuel MPC is an assembly consisting of a honeycombed fuel basket, a baseplate, canister shell, a lid, and a closure ring, as depicted in the MPC cross section elevation view, Figure 1.2.5. The number of spent nuclear fuel storage locations in each of the MPCs depends on the fuel assembly characteristics.

There are eight MPC models, distinguished by the type and number of fuel assemblies authorized for loading. Section 1.2.3 and Table 1.2.1 summarize the allowable contents for each MPC model. Section 2.1.9 provides the detailed specifications for the contents authorized for storage in the HI-STORM 100 System. Drawings for the MPCs are provided in Section 1.5.

The MPC provides the confinement boundary for the stored fuel. Figure 1.2.6 provides an elevation view of the MPC confinement boundary. The confinement boundary is defined by the MPC baseplate, shell, lid, port covers, and closure ring. The confinement boundary is a strength-welded enclosure of all stainless steel construction.

The PWR MPC-24, MPC-24E and MPC-24EF differ in construction from the MPC-32 (including the MPC-32F) and the MPC-68 (including the MPC-68F and MPC-68FF) in one important aspect: the fuel storage cells in the MPC-24 series are physically separated from one another by a "flux trap", for criticality control. The PWR MPC-32 and -32F are designed similar to the MPC-68 (without flux traps) and its design includes credit for soluble boron in the MPC water during wet fuel loading and unloading operations for criticality control.

The MPC fuel baskets of non-flux trap construction (namely, MPC-68, MPC-68F, MPC-68FF, MPC-32, and MPC-32F) are formed from an array of plates welded to each other at their intersections. In the flux-trap type fuel baskets (MPC-24, MPC-24E, and MPC-24EF), formed angles are interposed onto the orthogonally configured plate assemblage to create the required flux-trap channels (see MPC-24 and MPC-24E fuel basket drawings in Section 1.5). In both configurations, two key attributes of the basket are preserved:

i. The cross section of the fuel basket simulates a multi-flanged closed section beam, resulting in extremely high bending rigidity.

ii. The principal structural frame of the basket consists of co-planar plate-type members (i.e., no offset).

This structural feature eliminates the source of severe bending stresses in the basket structure by eliminating the offset between the cell walls that must transfer the inertia load of the stored SNF to the basket/MPC interface during the various postulated accident events (e.g., non-mechanistic tipover, uncontrolled lowering of a cask during on-site transfer, or off-site transport events, etc.).

The MPC fuel basket is positioned and supported within the MPC shell by a set of basket supports welded to the inside of the MPC shell. Between the periphery of the basket, the MPC shell, and the basket supports, optional aluminum heat conduction elements (AHCEs) may have been installed in the early vintage MPCs fabricated, certified, and loaded under the original version or Amendment 1 of the HI-STORM 100 System CoC. The presence of these aluminum heat conduction elements is acceptable for MPCs loaded under the original CoC or Amendment 1, since the governing thermal analysis for Amendment 1 conservatively modeled the AHCEs as restrictions to convective flow in the basket, but took no credit for heat transfer through them. The heat loads authorized under Amendment 1 bound those for the original CoC, with the same MPC design. For MPCs loaded under Amendment 2 or a later version of the HI-STORM 100 CoC, the aluminum heat conduction elements shall not be installed. MPCs both with and without aluminum heat conduction elements installed are compatible with all HI-STORM overpacks. If used, these heat conduction elements are fabricated from thin aluminum alloy 1100 in shapes and a design that allows a snug fit in the confined spaces and ease of installation. If used, the heat conduction elements are installed along the full length of the MPC basket except at the drain pipe location to create a nonstructural thermal connection that facilitates heat transfer from the basket to shell. In their operating condition, the heat conduction elements contact the MPC shell and basket walls.

Lifting lugs attached to the inside surface of the MPC canister shell serve to permit placement of the empty MPC into the HI-TRAC transfer cask. The lifting lugs also serve to axially locate the MPC lid prior to welding. These internal lifting lugs are not used to handle a loaded MPC. Since the MPC lid is installed prior to any handling of a loaded MPC, there is no access to the lifting lugs once the MPC is loaded.

The top end of the MPC incorporates a redundant closure system. Figure 1.2.6 shows the MPC closure details. The MPC lid is a circular plate (fabricated from one piece, or two pieces - split top and bottom) edge-welded to the MPC outer shell. If the two-piece lid design is employed, only the top piece is analyzed as part of the enclosure vessel pressure boundary. The bottom piece acts as a radiation shield and is attached to the top piece with a non-structural, non-pressure retaining weld. The lid is equipped with vent and drain ports that are utilized to remove moisture and air from the MPC, and backfill the MPC with a specified amount of inert gas (helium). The vent and drain ports are covered and seal welded before the closure ring is installed. The closure ring is a circular ring edge-welded to the MPC shell and lid. The MPC lid provides sufficient rigidity to allow the entire MPC loaded with SNF to be lifted by threaded holes in the MPC lid.

For fuel assemblies that are shorter than the design basis length, upper and lower fuel spacers (as appropriate) maintain the axial position of the fuel assembly within the MPC basket. The upper fuel spacers are threaded into the underside of the MPC lid as shown in Figure 1.2.5. The lower fuel spacers are placed in the bottom of each fuel basket cell. The upper and lower fuel spacers are designed to withstand normal, off-normal, and accident conditions of storage. An axial clearance of approximately 2 to 2-1/2 inches is provided to account for the irradiation and thermal growth of the fuel assemblies. The suggested values for the upper and lower fuel spacer lengths are listed in Tables 2.1.9 and 2.1.10 for each fuel assembly type. The actual length of fuel spacers will be determined on a site-specific or fuel assembly-specific basis.

The MPC is constructed entirely from stainless steel alloy materials (except for the neutron absorber and optional aluminum heat conduction elements). No carbon steel parts are permitted in the MPC. Concerns regarding interaction of coated carbon steel materials and various MPC operating environments [1.2.1] are not applicable to the MPC. All structural components in a MPC shall be made of Alloy X, a designation which warrants further explanation.

Alloy X is a material that is expected to be acceptable as a Mined Geological Disposal System (MGDS) waste package and which meets the thermophysical properties set forth in this document.

At this time, there is considerable uncertainty with respect to the material of construction for an MPC that would be acceptable as a waste package for the MGDS. Candidate materials being considered for acceptability by the DOE include:

- Type 316
- Type 316LN
- Type 304
- Type 304LN

The DOE material selection process is primarily driven by corrosion resistance in the potential environment of the MGDS. As the decision regarding a suitable material to meet disposal requirements is not imminent, the MPC design allows the use of any one of the four Alloy X materials.

For the MPC design and analysis, Alloy X (as defined in this FSAR) may be one of the following materials. Any steel part in an MPC may be fabricated from any of the acceptable Alloy X materials listed below, except that the steel pieces comprising the MPC shell (i.e., the 1/2" thick cylinder) must be fabricated from the same Alloy X stainless steel type.

- Type 316
- Type 316LN
- Type 304
- Type 304LN

The Alloy X approach is accomplished by qualifying the MPC for all mechanical, structural, neutronic, radiological, and thermal conditions using material thermophysical properties that are the least favorable for the entire group for the analysis in question. For example, when calculating the rate of heat rejection to the outside environment, the value of thermal conductivity used is the lowest for the candidate material group. Similarly, the stress analysis calculations use the lowest value of the ASME Code allowable stress intensity for the entire group. Stated differently, we have defined a material, which is referred to as Alloy X, whose thermophysical properties, from the MPC design perspective, are the least favorable of the candidate materials.

The evaluation of the Alloy X constituents to determine the least favorable properties is provided in Appendix 1.A.

The Alloy X approach is conservative because no matter which material is ultimately utilized in the MPC construction, the Alloy X approach guarantees that the performance of the MPC will exceed the analytical predictions contained in this document.

1.2.1.2 Overpacks

1.2.1.2.1 HI-STORM Overpack

The HI-STORM overpacks are rugged, heavy-walled cylindrical vessels. Figures 1.1.3B, 1.2.7, 1.2.8, and 1.2.8A provide cross sectional views of the HI-STORM 100 System, showing all of the overpack designs. The HI-STORM 100A overpack design is an anchored variant of the HI-STORM 100 and -100S designs and hereinafter is identified by name only when the discussion specifically applies to the anchored overpack. The HI-STORM 100A differs only in the diameter of the overpack baseplate and the presence of bolt holes and associated anchorage hardware (see Figures 1.1.4 and 1.1.5).The main structural function of the storage overpack is provided by carbon steel, and the main shielding function is provided by plain concrete. The overpack plain concrete is enclosed by cylindrical steel shells, a thick steel baseplate, and a top plate. The overpack lid has appropriate concrete shielding to provide neutron and gamma attenuation in the vertical direction.

The storage overpack provides an internal cylindrical cavity of sufficient height and diameter for housing an MPC. The inner shell of the overpack has channels attached to its inner diameter. The channels provide guidance for MPC insertion and removal and a flexible medium to absorb impact loads during the non-mechanistic tip-over, while still allowing the cooling air flow to circulate through the overpack. Shims may be attached to channels to allow the proper inner diameter dimension to be obtained.

The storage system has air ducts to allow for passive natural convection cooling of the contained MPC. A minimum of four air inlets and four air outlets are located at the lower and upper extremities of the storage system, respectively. The location of the air outlets in the HI-STORM 100 and the HI-STORM 100S (including Version B) design differ in that the outlet ducts for the HI-STORM 100 overpack are located in the overpack body and are aligned vertically with the inlet ducts at the bottom of the overpack body. The air outlet ducts in the HI-STORM 100S and –100S Version B are integral to the lid assembly and are not in vertical alignment with the inlet ducts. See the drawings in Section 1.5 for details of the overpack air inlet and outlet duct designs. The air inlets and outlets are covered by a screen to reduce the potential for blockage. Routine inspection of the screens (or, alternatively, temperature monitoring) ensures that blockage of the screens themselves will be detected and removed in a timely manner. Analysis, described in Chapter 11 of this FSAR, evaluates the effects of partial and complete blockage of the air ducts.

The air inlets and air outlets are penetrations through the thick concrete shielding provided by the HI-STORM 100 overpack. The outlet air ducts for the HI-STORM 100S and –100S Version B overpack designs, integral to the lid, present a similar break in radial shielding. Within the air inlets and outlets, an array of gamma shield cross plates are installed (see Figure 5.3.19 for a pictorial representation of the gamma shield cross plate designs). These gamma shield cross plates are designed to scatter any radiation traveling through the ducts. The result of scattering the radiation in the ducts is a significant decrease in the local dose rates around the air inlets and air outlets. The configuration of the gamma shield cross plates is such that the increase in the resistance to flow in the air inlets and outlets is minimized. For the HI-STORM 100 and –100S overpack designs, the shielding analysis conservatively credits only the mandatory version of the gamma shield cross plate design because they provide less shielding than the optional design. Conversely, the thermal analysis conservatively evaluates the optional gamma shield cross plate design because it conservatively provides greater resistance to flow than the mandatory design. There is only one gamma shield cross plate design employed with the HI-STORM 100S Version B overpack design, which has been appropriately considered in the shielding and thermal analyses.

Four threaded anchor blocks at the top of the overpack are provided for lifting. The anchor blocks are integrally welded to the radial plates, which in turn are full-length welded to the overpack inner shell, outer shell, and baseplate (HI-STORM 100) or the inlet air duct horizontal plates (HI-STORM 100S) (see Figure 1.2.7). The HI-STORM 100S Version B overpack design incorporates partial-length radial plates at the top of the overpack to secure the anchor blocks and uses both gussets and partial-length radial plates at the bottom of the overpack for structural stability. Details of this arrangement are shown in the drawings in Section 1.5.

The four anchor blocks are located on 90° arcs around the circumference of the top of the overpack lid. The overpack may also be lifted from the bottom using specially-designed lifting transport devices, including hydraulic jacks, air pads, Hillman rollers, or other design based on site-specific needs and capabilities. Slings or other suitable devices mate with lifting lugs that are inserted into threaded holes in the top surface of the overpack lid to allow lifting of the overpack lid. After the lid is bolted to the storage overpack main body, these lifting bolts shall be removed and replaced with flush plugs.

The plain concrete between the overpack inner and outer steel shells is specified to provide the necessary shielding properties (dry density) and compressive strength. The concrete shall be in accordance with the requirements specified in Appendix 1.D.

The principal function of the concrete is to provide shielding against gamma and neutron radiation. However, in an implicit manner it helps enhance the performance of the HI-STORM overpack in other respects as well. For example, the massive bulk of concrete imparts a large thermal inertia to the HI-STORM overpack, allowing it to moderate the rise in temperature of the system under hypothetical conditions when all ventilation passages are assumed to be blocked. The case of a postulated fire accident at the ISFSI is another example where the high thermal inertia characteristics of the HI-STORM concrete control the temperature of the MPC. Although the annular concrete mass in the overpack shell is not a structural member, it does act as an elastic/plastic filler of the inter-shell space, such that, while its cracking and crushing under a tip-over accident is not of significant consequence, its deformation characteristics are germane to the analysis of the structural members.

Density and compressive strength are the key parameters that delineate the performance of concrete in the HI-STORM System. The density of concrete used in the inter-shell annulus, pedestal (HI-STORM 100 and –100S overpacks only), and overpack lid has been set as defined in Appendix 1.D. For evaluating the physical properties of concrete for completing the analytical models, conservative formulations of Reference [1.0.5] are used.

To ensure the stability of the concrete at temperature, the concrete composition has been specified in accordance with NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems" [1.0.3]. Thermal analyses, presented in Chapter 4, show that the temperatures during normal storage conditions do not threaten the physical integrity of the HI-STORM overpack concrete.

There are three base HI-STORM overpack designs - HI-STORM 100, HI-STORM 100S, and HI-STORM 100S Version B. The significant differences among the three are overpack height, MPC pedestal height, location of the air outlet ducts, and the vertical alignment of the inlet and outlet air ducts. The HI-STORM 100 overpack is approximately 240 inches high from the bottom of the baseplate to the top of the lid bolts and 227 inches high without the lid installed. There are two variants of the HI-STORM 100S overpack design, differing only in height and weight. The HI-STORM 100S(232) is approximately 232 inches high from the bottom of the baseplate to the top of the lid in its final storage configuration and approximately 211 inches high without the lid installed. The HI-STORM 100S(243) is approximately 243 inches high from the bottom of the baseplate to the top of the lid in its final storage configuration and approximately 222 inches high without the lid installed. There are also variants of the HI-STORM 100S Version B overpack design, differing only in height and weight. The HI-STORM 100S-218 is approximately 218 inches high from the bottom of the baseplate to the top of the lid in its final storage configuration and approximately 199 inches high without the lid installed. The HI-STORM 100S-229 is approximately 229 inches high from the bottom of the baseplate to the top of the lid in its final storage configuration and 210 inches high without the lid installed.

The HI-STORM 100S Version B overpack design does not include a concrete-filled pedestal to support the MPC. Instead, the MPC rests upon a steel plate that maintains the MPC sufficiently above the inlet air ducts to prevent direct radiation shine through the ducts. To facilitate this change, the inlet air ducts for the HI-STORM 100S Version B are shorter in height but larger in width. See the drawings in Section 1.5 for details.

The anchored embodiment of the HI-STORM overpack is referred to as HI-STORM 100A or HI-STORM 100SA. The HI-STORM 100S version B overpack design may not be deployed in the anchored configuration at this time. As explained in the foregoing, the HI-STORM overpack is a steel weldment, which makes it a relatively simple matter to extend the overpack baseplate, form lugs, and then anchor the cask to the reinforced concrete structure of the ISFSI. In HI-STORM terminology, these lugs are referred to as "sector lugs." The sector lugs, as shown in Figure 1.1.5 and the drawing in Section 1.5, are formed by extending the HI-STORM overpack baseplate, welding vertical gussets to the baseplate extension and to the overpack outer shell and, finally, welding a horizontal lug support ring in the form of an annular sector to the vertical gussets and to the outer shell. The baseplate is equipped with regularly spaced clearance holes (round or slotted) through which the anchor studs can pass. The sector lugs are bolted to the ISFSI pad using anchor studs that are made of a creep-resistant, high-ductility, environmentally compatible material. The bolts are pre-loaded to a precise axial stress using a "stud tensioner" rather than a torque wrench. Pre-tensioning the anchors using a stud tensioner eliminates any shear stress in the bolt, which is unavoidable if a torquing device is employed (Chapter 3 of the text "Mechanical Design of Heat Exchangers and Pressure Vessel Components", by Arcturus Publishers, 1984, K.P. Singh and A.I. Soler, provides additional information on stud tensioners). The axial stress in the anchors induced by pre-tensioning is kept below 75% of the material yield stress, such that during the seismic event the maximum bolt axial stress remains below the limit prescribed for bolts in the ASME Code, Section III, Subsection NF (for Level D conditions). Figures 1.1.4 and 1.1.5 provide visual depictions of the anchored HI-STORM 100A configuration. This configuration also applies to the HI-STORM 100SA.

The anchor studs pass through liberal clearance holes (circular or slotted) in the sector lugs (0.75" minimum clearance) such that the fastening of the studs to the ISFSI pad can be carried out without mechanical interference from the body of the sector lug. The two clearance hole configurations give the ISFSI pad designer flexibility in the design of the anchor embedment in the ISFSI concrete. The axial force in the anchors produces a compressive load at the overpack/pad interface. This compressive force, F, imputes a lateral load bearing capacity to the cask/pad interface that is equal to μF ($\mu \leq 0.53$ per Table 2.2.8). As is shown in Chapter 3 of this FSAR, the lateral load-bearing capacity of the HI-STORM/pad interface (μF) is many times greater than the horizontal (sliding) force exerted on the cask under the postulated DBE seismic event. Thus, the potential for lateral sliding of the HI-STORM 100A System during a seismic event is precluded, as is the potential for any bending action on the anchor studs.

The seismic loads, however, will produce an overturning moment on the overpack that would cause a redistribution of the compressive contact pressure between the pad and the overpack. To determine the pulsation in the tensile load in the anchor studs and in the interface contact pressure, bounding static analysis of the preloaded configuration has been performed. The results of the static analysis demonstrate that the initial preloading minimizes pulsations in the stud load. A confirmatory non-linear dynamic analysis has also been performed using the time-history methodology described in Chapter 3, wherein the principal nonlinearities in the cask system are incorporated and addressed.

The calculated results from the dynamic analysis confirm the static analysis results and that the presence of pre-stress helps minimize the pulsation in the anchor stud stress levels during the seismic event, thus eliminating any concern with regard to fatigue failure under extended and repetitive seismic excitations.

The sector lugs in HI-STORM 100A are made of the same steel material as the baseplate and the shell (SA516- Gr. 70) which helps ensure high quality fillet welds used to join the lugs to the body of the overpack. The material for the anchor studs can be selected from a family of allowable stud materials listed in the ASME Code (Section II). A representative sampling of permitted materials is listed in Table 1.2.7. The menu of materials will enable the ISFSI owner to select a fastener material that is resistant to corrosion in the local ISFSI environment. For example, for ISFSIs located in marine environments (e.g., coastal reactor sites), carbon steel studs would not be recommended without concomitant periodic inspection and coating maintenance programs. Table 1.2.7 provides the chemical composition of several acceptable fastener materials to help the ISFSI owner select the most appropriate material for his site. The two mechanical properties, ultimate strength σ_u and yield strength σ_y are also listed. For purposes of structural evaluations, the lower bound values of σ_u and σ_y from the menu of materials listed in Table 1.2.7 are used (see Table 3.4.10).

As shown in the drawing, the anchor studs are spaced sufficiently far apart such that a practical reinforced concrete pad with embedded receptacles can be designed to carry the axial pull from the anchor studs without overstressing the enveloping concrete monolith. The design specification and supporting analyses in this FSAR are focused on qualifying the overpack structures, including the sector lugs and the anchor studs. The design of the ISFSI pad, and its anchor receptacle will vary from site to site, depending on the geology and seismological characteristics of the sub-terrain underlying the ISFSI pad region. The data provided in this FSAR, however, provide the complete set of factored loads to which the ISFSI pad, its sub-grade, and the anchor receptacles must be designed within the purview of ACI-349-97 [1.0.4]. Detailed requirements on the ISFSI pads for anchored casks are provided in Section 2.0.4.

1.2.1.2.2 HI-TRAC (Transfer Cask) - Standard Design

Like the storage overpack, the HI-TRAC transfer cask is a rugged, heavy-walled cylindrical vessel. The main structural function of the transfer cask is provided by carbon steel, and the main neutron and gamma shielding functions are provided by water and lead, respectively. The transfer cask is a steel, lead, steel layered cylinder with a water jacket attached to the exterior. Figure 1.2.9 provides a typical cross section of the standard design HI-TRAC-125 with the pool lid installed. See Section 1.2.1.2.3 for discussion of the optional HI-TRAC 100D and 125D designs.

The transfer cask provides an internal cylindrical cavity of sufficient size for housing an MPC. The top lid of the HI-TRAC 125 has additional neutron shielding to provide neutron attenuation in the vertical direction (from SNF in the MPC below). The MPC access hole through the HI-TRAC top lid is provided to allow the lowering/raising of the MPC between the HI-TRAC transfer cask, and the HI-STORM or HI-STAR overpacks. The standard design HI-TRAC (comprised of HI-TRAC 100 and HI-TRAC 125) is provided with two bottom lids, each used separately. The pool lid is bolted to the bottom flange of the HI-TRAC and is utilized during MPC fuel loading and sealing operations. In addition to providing shielding in the axial direction, the pool lid incorporates a seal that is designed to hold clean demineralized water in the HI-TRAC inner cavity, thereby preventing contamination of the exterior of the MPC by the contaminated fuel pool water. After the MPC has been drained, dried, and sealed, the pool lid is removed and the HI-TRAC transfer lid is attached (standard design only). The transfer lid incorporates two sliding doors that allow the opening of the HI-TRAC bottom for the MPC to be raised/lowered. Figure 1.2.10 provides a cross section of the HI-TRAC with the transfer lid installed.

In the standard design, trunnions are provided for lifting and rotating the transfer cask body between vertical and horizontal positions. The lifting trunnions are located just below the top flange and the pocket trunnions are located above the bottom flange. The two lifting trunnions are provided to lift and vertically handle the HI-TRAC, and the pocket trunnions provide a pivot point for the rotation of the HI-TRAC for downending or upending.

Two standard design HI-TRAC transfer casks of different weights are provided to house the MPCs. The 125 ton HI-TRAC weight does not exceed 125 tons during any loading or transfer operation. The 100 ton HI-TRAC weight does not exceed 100 tons during any loading or transfer operation. The internal cylindrical cavities of the two standard design HI-TRACs are identical. However, the external dimensions are different. The 100ton HI-TRAC has a reduced thickness of lead and water shielding and consequently, the external dimensions are different. The structural steel thickness is identical in the two HI-TRACs. This allows most structural analyses of the 125 ton HI-TRAC to bound the 100 ton HI-TRAC design. Additionally, as the two HI-TRACs are identical except for a reduced thickness of lead and water, the 125 ton HI-TRAC has a larger thermal resistance than the smaller and lighter 100 ton HI-TRAC. Therefore, for normal conditions the 125 ton HI-TRAC thermal analysis bounds that of the 100 ton HI-TRAC. Separate shielding analyses are performed for each HI-TRAC since the shielding thicknesses are different between the two.

1.2.1.2.3 <u>HI-TRAC 100D and 125D Transfer Casks</u>

As an option to using either of the standard HI-TRAC transfer cask designs, users may choose to use the optional HI-TRAC 100D or 125D designs. Figure 1.2.9A provides a typical cross section of the HI-TRAC-125D with the pool lid installed. The HI-TRAC 100D (figure not shown) is similar to the HI-TRAC 125D except for the top lid (which contains no Holtite). Like the standard designs, the optional designs are designed and constructed in accordance with ASME III, Subsection NF, with certain NRC-approved alternatives, as discussed in Section 2.2.4. Functionally equivalent, the major differences between the HI-TRAC 100D and 125D designs and the standard designs are as follows:

- No pocket trunnions are provided for downending/upending
- The transfer lid is not required
- A new ancillary, the HI-STORM mating device (Figure 1.2.18) is required during MPC transfer operations
- A wider baseplate with attachment points for the mating device is provided
- The baseplate incorporates gussets for added structural strength
- The number of pool lid bolts is reduce

The interface between the MPC and the transfer cask is the same between the standard designs and the optional designs. The optional designs are capable of withstanding all loads defined in the design basis for the transfer cask during normal, off-normal, and accident modes of operation with adequate safety margins. In lieu of swapping the pool lid for the transfer lid to facilitate MPC transfer, the pool lids remain on the HI-TRAC 100D and 125D until MPC transfer is required. The HI-STORM mating device is located between, and secured with bolting (if required by seismic analysis), to the top of the HI-STORM overpack and the HI-TRAC 100D or 125D transfer cask. The mating device is used to remove the pool lid to provide a pathway for MPC transfer between the overpack and the transfer cask. Section 1.2.2.2 provides additional detail on the differences between the standard transfer cask designs and the optional HI-TRAC 100D or 125D designs during operations.

1.2.1.3 Shielding Materials

The HI-STORM 100 System is provided with shielding to ensure the radiation and exposure requirements in 10CFR72.104 and 10CFR72.106 are met. This shielding is an important factor in minimizing the personnel doses from the gamma and neutron sources in the SNF in the MPC for ALARA considerations during loading, handling, transfer, and storage. The fuel basket structure of edge-welded composite boxes and neutron absorber panels attached to the fuel storage cell vertical surfaces provide the initial attenuation of gamma and neutron radiation emitted by the radioactive spent fuel. The MPC shell, baseplate, lid and closure ring provide additional thicknesses of steel to further reduce the gamma flux at the outer canister surfaces.

In the HI-STORM storage overpack, the primary shielding in the radial direction is provided by concrete and steel. In addition, the storage overpack has a thick circular concrete slab attached to the lid, and the HI-STORM 100 and –100S have a thick circular concrete pedestal upon which the MPC rests. This concrete pedestal is not necessary in the HI-STORM 100S Version B overpack design. These slabs provide gamma and neutron attenuation in the axial direction. The thick overpack lid and concrete shielding integral to the lid provide additional gamma attenuation in the upward direction, reducing both direct radiation and skyshine. Several steel plate and shell elements provide additional gamma shielding as needed in specific areas, as well as incremental improvements in the overall shielding effectiveness. Gamma shield cross plates, as depicted in Figure 5.3.19, provide attenuation of scattered gamma radiation as it exits the inlet and outlet air ducts.

In the HI-TRAC transfer cask radial direction, gamma and neutron shielding consists of steel-lead-steel and water, respectively. In the axial direction, shielding is provided by the top lid, and the pool or transfer lid, as applicable. In the HI-TRAC pool lid, layers of steel-lead-steel provide an additional measure of gamma shielding to supplement the gamma shielding at the bottom of the MPC. In the transfer lid, layers of steel-lead-steel provide gamma attenuation. For the HI-TRAC 125 transfer lid, the neutron shield material, Holtite-A, is also provided. The HI-TRAC 125 and HI-TRAC 125D top lids are composed of steel-neutron shield-steel, with the neutron shield material being Holtite-A. The HI-TRAC 100 and HI-TRAC 100D top lids are composed of steel only providing gamma attenuation.

1.2.1.3.1 Fixed Neutron Absorbers

1.2.1.3.1.1 Boral™

Boral is a thermal neutron poison material composed of boron carbide and aluminum (aluminum powder and plate). Boron carbide is a compound having a high boron content in a physically stable and chemically inert form. The boron carbide contained in Boral is a fine granulated powder that conforms to ASTM C-750-80 nuclear grade Type III. The Boral cladding is made of alloy aluminum, a lightweight metal with high tensile strength which is protected from corrosion by a highly resistant oxide film. The two materials, boron carbide and aluminum, are chemically compatible and ideally suited for long-term use in the radiation, thermal, and chemical environment of a nuclear reactor, spent fuel pool, or dry cask.

The documented historical applications of Boral, in environments comparable to those in spent fuel pools and fuel storage casks, dates to the early 1950s (the U.S. Atomic Energy Commission's AE-6 Water-Boiler Reactor [1.2.2]). Technical data on the material was first printed in 1949, when the report "Boral: A New Thermal Neutron Shield" was published [1.2.3]. In 1956, the first edition of the Reactor Shielding Design Manual [1.2.4] was published and it contained a section on Boral and its properties.

In the research and test reactors built during the 1950s and 1960s, Boral was frequently the material of choice for control blades, thermal-column shutters, and other items requiring very good thermal-neutron absorption properties. It is in these reactors that Boral has seen its longest service in environments comparable to today's applications.

Boral found other uses in the 1960s, one of which was a neutron poison material in baskets used in the shipment of irradiated, enriched fuel rods from Canada's Chalk River laboratories to Savannah River. Use of Boral in shipping containers continues, with Boral serving as the poison in current British Nuclear Fuels Limited casks and the Storable Transport Cask by Nuclear Assurance Corporation [1.2.5].

Boral has been licensed by the NRC for use in numerous BWR and PWR spent fuel storage racks and has been extensively used in international nuclear installations.

Boral has been exclusively used in fuel storage applications in recent years. Its use in spent fuel pools as the neutron absorbing material can be attributed to its proven performance and several unique characteristics, such as:

- The content and placement of boron carbide provides a very high removal cross section for thermal neutrons.

- Boron carbide, in the form of fine particles, is homogeneously dispersed throughout the central layer of the Boral panels.

- The boron carbide and aluminum materials in Boral do not degrade as a result of long-term exposure to radiation.

- The neutron absorbing central layer of Boral is clad with permanently bonded surfaces of aluminum.

- Boral is stable, strong, durable, and corrosion resistant.

Boral absorbs thermal neutrons without physical change or degradation of any sort from the anticipated exposure to gamma radiation and heat. The material does not suffer loss of neutron attenuation capability when exposed to high levels of radiation dose.

Holtec International's QA Program ensures that Boral is manufactured under the control and surveillance of a Quality Assurance/Quality Control Program that conforms to the requirements of 10CFR72, Subpart G. Holtec International has procured over 200,000 panels of Boral from AAR Advanced Structures in over 30 projects. Boral has always been purchased with a minimum ^{10}B loading requirement. Coupons extracted from production runs were tested using the wet chemistry procedure. The actual ^{10}B loading, out of thousands of coupons tested, has never been found to fall below the design specification. The size of this coupon database is sufficient to provide reasonable assurance that all future Boral procurements will continue to yield Boral with full compliance with the stipulated minimum loading. Furthermore, the surveillance, coupon testing, and material tracking processes which have so effectively controlled the quality of Boral are expected to continue to yield Boral of similar quality in the future. Nevertheless, to add another layer of insurance, only 75% ^{10}B credit of the fixed neutron absorber is assumed in the criticality analysis consistent with Chapter 6.0, IV, 4.c of NUREG-1536, Standard Review Plan for Dry Cask Storage Systems.

Operating experience in nuclear plants with fuel loading of Boral equipped MPCs as well as laboratory test data indicate that the aluminium used in the manufacture of the Boral may react with water, resulting in the generation of hydrogen. The numerous variables (i.e., aluminium particle size, pool temperature, pool chemistry, etc.) that influence the extent of the hydrogen produced make it impossible to predict the amount of hydrogen that may be generated during MPC loading or unloading at a particular plant. Therefore, due to the variability in hydrogen generation from the Boral-water reaction, the operating procedures in Chapter 8 require monitoring for combustible gases and either exhausting or purging the space beneath the MPC lid during loading and unloading operations when an ignition event could occur (i.e., when the space beneath the MPC lid is open to the welding or cutting operation).

1.2.1.3.1.2 METAMIC®

METAMIC® is a neutron absorber material developed by the Reynolds Aluminum Company in the mid-1990s for spent fuel reactivity control in dry and wet storage applications. Metallurgically, METAMIC® is a metal matrix composite (MMC) consisting of a matrix of 6061 aluminum alloy reinforced with Type 1 ASTM C-750 boron carbide. METAMIC® is characterized by extremely fine aluminum (325 mesh or better) and boron carbide powder. Typically, the average B_4C particle size is between 10 and 15 microns. As described in the U.S. patents held by METAMIC, Inc.[*†], the high performance and reliability of METAMIC® derives from the particle size distribution of its constituents, rendered into a metal matrix composite by the powder metallurgy process. This yields excellent and uniform homogeneity.

The powders are carefully blended without binders or other additives that could potentially adversely influence performance. The maximum percentage of B_4C that can be dispersed in the aluminum alloy 6061 matrix is approximately 40 wt.%, although extensive manufacturing and testing experience is limited to approximately 31 wt.%. The blend of powders is isostatically compacted into a green billet under high pressure and vacuum sintered to near theoretical density.

According to the manufacturer, billets of any size can be produced using this technology. The billet is subsequently extruded into one of a number of product forms, ranging from sheet and plate to angle, channel, round and square tube, and other profiles. For the METAMIC® sheets used in the MPCs, the extruded form is rolled down into the required thickness.

METAMIC® has been subjected to an extensive array of tests sponsored by the Electric Power Research Institute (EPRI) that evaluated the functional performance of the material at elevated temperatures (up to 900°F) and radiation levels (1E+11 rads gamma). The results of the tests documented in an EPRI report (Ref. [1.2.11]) indicate that METAMIC® maintains its physical and neutron absorption properties with little variation in its properties from the unirradiated state. The main conclusions provided in the above-referenced EPRI report are summarized below:

- The metal matrix configuration produced by the powder metallurgy process with a complete absence of open porosity in METAMIC® ensures that its density is essentially equal to the theoretical density.

- The physical and neutronic properties of METAMIC® are essentially unaltered under exposure to elevated temperatures (750° F - 900° F).

- No detectable change in the neutron attenuation characteristics under accelerated corrosion test conditions has been observed.

In addition, independent measurements of boron carbide particle distribution show extremely small particle-to-particle distance[†] and near-perfect homogeneity.

An evaluation of the manufacturing technology underlying METAMIC® as disclosed in the above-

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[*] U.S. Patent No. 5,965,829, "Radiation Absorbing Refractory Composition".

[†] U.S. Patent No. 6,042,779, "Extrusion Fabrication Process for Discontinuous Carbide Particulate Metal Matrix Composites and Super, Hypereutectic Al/Si."

[†] Medium measured neighbor-to-neighbor distance is 10.08 microns according to the article, "METAMIC Neutron Shielding", by K. Anderson, T. Haynes, and R. Kazmier, EPRI Boraflex Conference, November 19-20, 1998.

referenced patents and of the extensive third-party tests carried out under the auspices of EPRI makes METAMIC® an acceptable neutron absorber material for use in the MPCs. Holtec's technical position on METAMIC® is also supported by the evaluation carried out by other organizations (see, for example, USNRC's SER on NUHOMS-61BT, Docket No. 72-1004).

Consistent with its role in reactivity control, all METAMIC® material procured for use in the Holtec MPCs will be qualified as important-to-safety (ITS) Category A item. ITS category A manufactured items, as required by Holtec's NRC-approved Quality Assurance program, must be produced to essentially preclude the potential of an error in the procurement of constituent materials and the manufacturing processes. Accordingly, material and manufacturing control processes must be established to eliminate the incidence of errors, and inspection steps must be implemented to serve as an independent set of barriers to ensure that all critical characteristics defined for the material by the cask designer are met in the manufactured product.

All manufacturing and in-process steps in the production of METAMIC® shall be carried out using written procedures. As required by the company's quality program, the material manufacturer's QA program and its implementation shall be subject to review and ongoing assessment, including audits and surveillances as set forth in the applicable Holtec QA procedures to ensure that all METAMIC® panels procured meet with the requirements appropriate for the quality genre of the MPCs. Additional details pertaining to the qualification and production tests for METAMIC® are summarized in Subsection 9.1.5.3.

Because of the absence of interconnected porosities, the time required to dehydrate a METAMIC®-equipped MPC is expected to be less compared to an MPC containing Boral.

NUREG/CR-5661 (Ref. [1.2.14]) recommends limiting poison material credit to 75% of the minimum ^{10}B loading because of concerns for potential "streaming" of neutrons, and allows for greater percentage credit in criticality analysis "if comprehensive acceptance tests, capable of verifying the presence and uniformity of the neutron absorber, are implemented". The value of 75% is characterized in NUREG/CR-5661 as a very conservative value, based on experiments with neutron poison containing relatively large B_4C particles, such as BORAL with an average particle size in excess of 100 microns. METAMIC®, however, has a much smaller particle size of typically between 10 and 15 microns on average. Any streaming concerns would therefore be drastically reduced.

Analyses performed by Holtec International show that the streaming due to particle size is practically non-existent in METAMIC®. Further, EPRI's neutron attenuation measurements on 31 and 15 B_4C weight percent METAMIC® showed that METAMIC® exhibits very uniform ^{10}B areal density. This makes it easy to reliably establish and verify the presence and microscopic and macroscopic uniformity of the ^{10}B in the material. Therefore, 90% credit is applied to the minimum ^{10}B areal density in the criticality calculations, i.e. a 10% penalty is applied. This 10% penalty is considered conservative since there are no significant remaining uncertainties in the ^{10}B areal density. In Chapter 9 the qualification and on production tests for METAMIC® to support 90% ^{10}B credit are specified. With 90% credit, the target weight percent of boron carbide in METAMIC® is 31 for all MPCs, as summarized in Table 1.2.8, consistent with the test coupons used in the EPRI evaluations [1.2.11]. The maximum permitted value is 33.0 wt% to allow for necessary fabrication flexibility.

Because METAMIC® is a solid material, there is no capillary path through which spent fuel pool water can penetrate METAMIC® panels and chemically react with aluminum in the interior of the material to generate hydrogen. Any chemical reaction of the outer surfaces of the METAMIC® neutron absorber panels with water to produce hydrogen occurs rapidly and reduces to an insignificant amount in a short period of time. Nevertheless, combustible gas monitoring for METAMIC® -equipped MPCs and purging or exhausting the space under the MPC lid during welding and cutting operations, is required until sufficient field experience is gained that confirms that little or no hydrogen is released by METAMIC® during these operations.

Mechanical properties of 31 wt.% METAMIC® based on coupon tests of the material in the as-fabricated condition and after 48 hours of an elevated temperature state at 900°F are summarized below from the EPRI report [1.2.11].

Mechanical Properties of 31wt.% B_4C METAMIC		
Property	As-Fabricated	After 48 hours of 900°F Temperature Soak
Yield Strength (psi)	32937 ± 3132	28744 ± 3246
Ultimate Strength (psi)	40141 ± 1860	34608 ± 1513
Elongation (%)	1.8 ± 0.8	5.7 ± 3.1

The required flexural strain of the neutron absorber to ensure that it will not fracture when the supporting basket wall flexes due to the worst case lateral loading is 0.2%, which is the flexural strain of the Alloy X basket panel material. The 1% minimum elongation of 31wt.% B_4C METAMIC® indicated by the above table means that a large margin of safety against cracking exists, so there is no need to perform testing of the METAMIC® for mechanical properties.

EPRI's extensive characterization effort [1.2.11], which was focused on 15 and 31 wt.% B_4C METAMIC® served as the principal basis for a recent USNRC SER for 31wt.% B_4C METAMIC for used in wet storage [1.2.12]. Additional studies on METAMIC® [1.2.13], EPRI's and others work provide the confidence that 31wt.% B_4C METAMIC® will perform its intended function in the MPCs.

1.2.1.3.1.3 <u>Locational Fixity of Neutron Absorbers</u>

Both Boral and METAMIC® neutron absorber panels are completely enclosed in Alloy X (stainless steel) sheathing that is stitch welded to the MPC basket cell walls along their entire periphery. The edges of the sheathing are bent toward the cell wall to make the edge weld. Thus, the neutron absorber is contained in a tight, welded pocket enclosure. The shear strength of the pocket weld joint, which is an order of magnitude greater than the weight of a fuel assembly, guarantees that the neutron absorber and its enveloping sheathing pocket will maintain their as-installed position under all loading, storage, and transient evolutions. Finally, the pocket joint detail ensures that fuel assembly insertion or withdrawal into or out of the MPC basket will not lead to a disconnection of the sheathing from the cell wall.

1.2.1.3.2 Neutron Shielding

The specification of the HI-STORM overpack and HI-TRAC transfer cask neutron shield material is predicated on functional performance criteria. These criteria are:

- Attenuation of neutron radiation to appropriate levels;
- Durability of the shielding material under normal conditions, in terms of thermal, chemical, mechanical, and radiation environments;
- Stability of the homogeneous nature of the shielding material matrix;
- Stability of the shielding material in mechanical or thermal accident conditions to the desired performance levels; and
- Predictability of the manufacturing process under adequate procedural control to yield an in-place neutron shield of desired function and uniformity.

Other aspects of a shielding material, such as ease of handling and prior nuclear industry use, are also considered, within the limitations of the main criteria. Final specification of a shield material is a result of optimizing the material properties with respect to the main criteria, along with the design of the shield system, to achieve the desired shielding results.

Neutron attenuation in the HI-STORM overpack is provided by the thick walls of concrete contained in the steel vessel, lid, and pedestal (only for the HI-STORM 100 and –100S overpack designs). Concrete is a shielding material with a long proven history in the nuclear industry. The concrete composition has been specified to ensure its continued integrity at the long term temperatures required for SNF storage.

The HI-TRAC transfer cask is equipped with a water jacket providing radial neutron shielding. Demineralized water will be utilized in the water jacket. To ensure operability for low temperature conditions, ethylene glycol (25% in solution) will be added to reduce the freezing point for low temperature operations (e.g., below 32°F) [1.2.7].

Neutron shielding in the HI-TRAC 125 and 125D transfer casks in the axial direction is provided by Holtite-A within the top lid. HI-TRAC 125 also contains Holtite-A in the transfer lid. Holtite-A is a poured-in-place solid borated synthetic neutron-absorbing polymer. Holtite-A is specified with a nominal B_4C loading of 1 weight percent for the HI-STORM 100 System. Appendix 1.B provides the Holtite-A material properties germane to its function as a neutron shield. Holtec has performed confirmatory qualification tests on Holtite-A under the company's QA program.

In the following, a brief summary of the performance characteristics and properties of Holtite-A is provided.

Density

The specific gravity of Holtite-A is 1.68 g/cm^3 as specified in Appendix 1.B. To conservatively bound any potential weight loss at the design temperature and any inability to reach the theoretical density, the density is reduced by 4% to 1.61 g/cm^3. The density used for the shielding analysis is conservatively assumed to be 1.61 g/cm^3 to underestimate the shielding capabilities of the neutron shield.

Hydrogen

The weight concentration of hydrogen is 6.0%. However, all shielding analyses conservatively assume 5.9% hydrogen by weight in the calculations.

Boron Carbide

Boron carbide dispersed within Holtite-A in finely dispersed powder form is present in 1% (nominal) weight concentration. Holtite-A may be specified with a B_4C content of up to 6.5 weight percent. For the HI-STORM 100 System, Holtite-A is specified with a nominal B_4C weight percent of 1%.

Design Temperature

The design temperatures of Holtite-A are provided in Table 1.B.1.. The maximum spatial temperatures of Holtite-A under all normal operating conditions must be demonstrated to be below these design temperatures, as applicable.

Thermal Conductivity

The Holtite-A neutron shielding material is stable below the design temperature for the long term and provides excellent shielding properties for neutrons. A conservative, lower bound conductivity is stipulated for use in the thermal analyses of Chapter 4 (Section 4.2) based on information in the technical literature.

1.2.1.3.3 Gamma Shielding Material

For gamma shielding, the HI-STORM 100 storage overpack primarily relies on massive concrete sections contained in a robust steel vessel. A carbon steel plate, the shield shell, is located adjacent to the overpack inner shell to provide additional gamma shielding (Figure 1.2.7)†. Carbon steel supplements the concrete gamma shielding in most portions of the storage overpack, most notably the pedestal (HI-STORM 100 and –100S overpack designs only) and the lid. To reduce the radiation streaming through the overpack air inlets and outlets, gamma shield cross plates are installed in the ducts (Figures 1.2.8 and 1.2.8A) to scatter the radiation. This scattering acts to significantly reduce the local dose rates adjacent to the overpack air inlets and outlets. See Figure 5.3.19 and the drawings in Section 1.5 for more details of the gamma shield cross plate designs for each overpack design.

In the HI-TRAC transfer cask, the primary gamma shielding is provided by lead. As in the storage overpack, carbon steel supplements the lead gamma shielding of the HI-TRAC transfer cask.

1.2.1.4 Lifting Devices

Lifting of the HI-STORM 100 System may be accomplished either by attachment at the top of the storage overpack ("top lift"), as would typically be done with a crane, or by attachment at the bottom ("bottom lift"), as would be effected by a number of lifting/handling devices.

For a top lift, the storage overpack is equipped with four threaded anchor blocks arranged circumferentially around the overpack. These anchor blocks are used for overpack lifting as well as securing the overpack lid to the overpack body. The storage overpack may be lifted with a lifting device that engages the anchor blocks with threaded studs and connects to a crane or similar equipment.

A bottom lift of the HI-STORM 100 storage overpack is effected by the insertion of four hydraulic jacks underneath the inlet vent horizontal plates (Figure 1.2.1). A slot in the overpack baseplate allows the hydraulic jacks to be placed underneath the inlet vent horizontal plate. The hydraulic jacks lift the loaded overpack to provide clearance for inserting or removing a device for transportation.

The standard design HI-TRAC transfer cask is equipped with two lifting trunnions and two pocket trunnions. The HI-TRAC 100D and 125D are equipped with only lifting trunnions. The lifting trunnions are positioned just below the top forging. The two pocket trunnions are located above the bottom forging and attached to the outer shell. The pocket trunnions are designed to allow rotation of the HI-TRAC. All trunnions are built from a high strength alloy with proven corrosion and non-galling characteristics. The lifting trunnions are designed in accordance with NUREG-0612 and

† The shield shell design feature was deleted in June, 2001 after overpack serial number 7 was fabricated. Those overpacks without the shield shell are required to have a higher concrete density in the overpack body to provide compensatory shielding. See Table 1.D.1.

ANSI N14.6. The lifting trunnions are installed by threading into tapped holes just below the top forging.

The top of the MPC lid is equipped with four threaded holes that allow lifting of the loaded MPC. These holes allow the loaded MPC to be raised/lowered through the HI-TRAC transfer cask using lifting cleats. The threaded holes in the MPC lid are designed in accordance with NUREG-0612 and ANSI N14.6.

1.2.1.5 Design Life

The design life of the HI-STORM 100 System is 40 years. This is accomplished by using material of construction with a long proven history in the nuclear industry and specifying materials known to withstand their operating environments with little to no degradation. A maintenance program, as specified in Chapter 9, is also implemented to ensure the HI-STORM 100 System will exceed its design life of 40 years. The design considerations that assure the HI-STORM 100 System performs as designed throughout the service life include the following:

HI-STORM Overpack and HI-TRAC Transfer Cask

- Exposure to Environmental Effects
- Material Degradation
- Maintenance and Inspection Provisions

MPC

- Corrosion
- Structural Fatigue Effects
- Maintenance of Helium Atmosphere
- Allowable Fuel Cladding Temperatures
- Neutron Absorber Boron Depletion

The adequacy of the HI-STORM 100 System for its design life is discussed in Sections 3.4.11 and 3.4.12.

1.2.2 Operational Characteristics

1.2.2.1 Design Features

The HI-STORM 100 System incorporates some unique design improvements. These design innovations have been developed to facilitate the safe long term storage of SNF. Some of the design originality is discussed in Subsection 1.2.1 and below.

The free volume of the MPCs is inerted with 99.995% pure helium gas during the spent nuclear fuel loading operations. Table 1.2.2 specifies the helium fill requirements for the MPC internal cavity.

The HI-STORM overpack has been designed to synergistically combine the benefits of steel and concrete. The steel-concrete-steel construction of the HI-STORM overpack provides ease of fabrication, increased strength, and an optimal radiation shielding arrangement. The concrete is primarily provided for radiation shielding and the steel is primarily provided for structural functions.

The strength of concrete in tension and shear is conservatively neglected. Only the compressive strength of the concrete is accounted for in the analyses.

The criticality control features of the HI-STORM 100 are designed to maintain the neutron multiplication factor k-effective (including uncertainties and calculational bias) at less than 0.95 under all normal, off-normal, and accident conditions of storage as analyzed in Chapter 6. This level of conservatism and safety margins is maintained, while providing the highest storage capacity.

1.2.2.2 Sequence of Operations

Table 1.2.6 provides the basic sequence of operations necessary to defuel a spent fuel pool using the HI-STORM 100 System. The detailed sequence of steps for storage-related loading and handling operations is provided in Chapter 8 and is supported by the drawings in Section 1.5. A summary of the general actions needed for the loading and unloading operations is provided below. Figures 1.2.16 and 1.2.17 provide a pictorial view of typical loading and unloading operations, respectively.

Loading Operations

At the start of loading operations, the HI-TRAC transfer cask is configured with the pool lid installed. The HI-TRAC water jacket is filled with demineralized water or a 25% ethylene glycol solution depending on the ambient temperature conditions. The lift yoke is used to position HI-TRAC in the designated preparation area or setdown area for HI-TRAC inspection and MPC insertion. The annulus is filled with plant demineralized water, and an inflatable annulus seal is installed. The inflatable seal prevents contact between spent fuel pool water and the MPC shell reducing the possibility of contaminating the outer surfaces of the MPC. The MPC is then filled with water (borated if necessary). Based on the MPC model and fuel enrichment, this may be borated water or plant demineralized water (see Section 2.1). HI-TRAC and the MPC are lowered into the spent fuel pool for fuel loading using the lift yoke. Pre-selected assemblies are loaded into the MPC and a visual verification of the assembly identification is performed.

While still underwater, a thick shielding lid (the MPC lid) is installed. The lift yoke is remotely engaged to the HI-TRAC lifting trunnions and is used to lift the HI-TRAC close to the spent fuel pool surface. As an ALARA measure, dose rates are measured on the top of the HI-TRAC and MPC prior to removal from the pool to check for activated debris on the top surface. The MPC lift bolts (securing the MPC lid to the lift yoke) are removed. As HI-TRAC is removed from the spent fuel pool, the lift yoke and HI-TRAC are sprayed with demineralized water to help remove contamination.

HI-TRAC is removed from the pool and placed in the designated preparation area. The top surfaces of the MPC lid and the upper flange of HI-TRAC are decontaminated. The inflatable annulus seal is removed, and an annulus shield is installed. The annulus shield provides additional personnel shielding at the top of the annulus and also prevents small items from being dropped into the annulus. The Automated Welding System baseplate shield (if used) is installed to reduce dose rates around the top of the cask. The MPC water level is lowered slightly and the MPC lid is seal-welded using the Automated Welding System (AWS) or other approved welding process. Liquid penetrant examinations are performed on the root and final passes. A multi-layer liquid penetrant or volumetric examination is also performed on the MPC lid-to-shell weld. The MPC water is displaced from the MPC by blowing pressurized helium or nitrogen gas into the vent port of the MPC, thus displacing the water through the drain line. At the appropriate time in the sequence of activities, based on the type of test performed (hydrostatic or pneumatic), a pressure test of the MPC enclosure vessel is performed.

For MPCs containing all moderate burnup fuel, a Vacuum Drying System (VDS) may be used to remove moisture from the MPC cavity. The VDS is connected to the MPC and is used to remove liquid water from the MPC in a stepped evacuation process. The stepped evacuation process is used to preclude the formation of ice in the MPC and Vacuum Drying System lines. The internal pressure is reduced and held for a duration to ensure that all liquid water has evaporated. This process is continued until the pressure in the MPC meets the technical specification limit and can be held there for the required amount of time.

For storage of high burnup fuel and as an option for storage of moderate burnup fuel, the reduction of residual moisture in the MPC to trace amounts is accomplished using a Forced Helium Dehydration (FHD) system, as described in Appendix 2.B. Relatively warm and dry helium is recirculated through the MPC cavity, which helps maintain the SNF in a cooled condition while moisture is being removed. The warm, dry gas is supplied to the MPC drain port and circulated through the MPC cavity where it absorbs moisture. The humidified gas travels out of the MPC and through appropriate equipment to cool and remove the absorbed water from the gas. The dry gas may be heated prior to its return to the MPC in a closed loop system to accelerate the rate of moisture removal in the MPC. This process is continued until the temperature of the gas exiting the demoisturizing module described in Appendix 2.B meets the specified limit.

Following moisture removal, the MPC is backfilled with a predetermined amount of helium gas. The helium backfill ensures adequate heat transfer during storage and provides an inert atmosphere for long-term fuel integrity. Cover plates are installed and seal-welded over the MPC vent and drain ports with liquid penetrant examinations performed on the root and final passes. The cover plates are helium leakage tested to confirm that they meet the established leakage rate criteria.

The MPC closure ring is then placed on the MPC, aligned, tacked in place, and seal welded, providing redundant closure of the MPC lid and cover plates confinement closure welds. Tack welds are visually examined, and the root and final welds are inspected using the liquid penetrant examination technique to ensure weld integrity. The annulus shield is removed and the remaining water in the annulus is drained. The AWS Baseplate shield is removed. The MPC lid and accessible areas of the top of the MPC shell are smeared for removable contamination and HI-TRAC dose rates are measured. The HI-TRAC top lid is installed and the bolts are torqued. The MPC lift cleats are installed on the MPC lid. The MPC lift cleats are the primary lifting point of the MPC.

Rigging is installed between the MPC lift cleats and the lift yoke. . The rigging supports the MPC within HI-TRAC while the pool lid is replaced with the transfer lid. For the standard design transfer cask, the HI-TRAC is manipulated to replace the pool lid with the transfer lid. The MPC lift cleats and rigging support the MPC during the transfer operations.

MPC transfer from the HI-TRAC transfer cask into the overpack may be performed inside or outside the fuel building. Similarly, HI-TRAC and HI-STORM may be transferred to the ISFSI in several different ways. The loaded HI-TRAC may be handled in the vertical or horizontal orientation. The loaded HI-STORM can only be handled vertically.

For MPC transfers inside the fuel building, the empty HI-STORM overpack is inspected and staged with the lid removed, the alignment device positioned, and, for the HI-STORM 100 overpack, the vent duct shield inserts installed. If using HI-TRAC 100D or 125D, the HI-STORM mating device is placed (bolted if required by generic or site specific seismic evaluation) to the top of the empty overpack (Figure 1.2.18). The loaded HI-TRAC is placed using the fuel building crane on top of HI-STORM, or the mating device, as applicable. After the HI-TRAC is positioned atop the HI-STORM or positioned (bolted if required by generic or site specific seismic evaluation) atop the mating device, as applicable, the MPC is raised slightly. With the standard HI-TRAC design, the transfer lid door locking pins are removed and the doors are opened. With the HI-TRAC 100D and 125D, the pool lid is removed using the mating device. The MPC is lowered into HI-STORM. Following verification that the MPC is fully lowered, slings are disconnected and lowered onto the MPC lid. For the HI-STORM 100, the doors are closed and the HI-TRAC is prepared for removal from on top of HI-STORM (with HI-TRAC 100D and 125D, the transfer cask must first be disconnected from the mating device). For the HI-STORM 100S and HI-STORM 100S Version B, the standard design HI-TRAC may need to be lifted above the overpack to a height sufficient to allow closure of the transfer lid doors without interfering with the MPC lift cleats. The HI-TRAC is then removed and placed in its designated storage location. The MPC lift cleats and slings are removed from atop the MPC. The alignment device, vent duct shield inserts, and/or mating device is/are removed, as applicable. The pool lid is removed from the mating device and re-attached to the HI-TRAC 100D or 125D prior to its next use. The HI-STORM lid is installed, and the upper vent screens and gamma shield cross plates are installed. The HI-STORM lid studs are installed and torqued.

For MPC transfers outside of the fuel building, the empty HI-STORM overpack is inspected and staged with the lid removed, the alignment device positioned, and, for the HI-STORM 100, the vent duct shield inserts installed. For HI-TRAC 100D and 125D, the mating device is positioned (bolted if required by generic or site specific seismic evaluation) atop the overpack. The loaded HI-TRAC is transported to the cask transfer facility in the vertical or horizontal orientation. A number of methods may be utilized as long as the handling limitations prescribed in the technical specifications are not exceeded.

To place the loaded HI-TRAC in a horizontal orientation, a transport frame or "cradle" is utilized. If the cradle is equipped with rotation trunnions they are used to engage the HI-TRAC 100 or 125 pocket trunnions. While the loaded HI-TRAC is lifted by the lifting trunnions, the HI-TRAC is lowered onto the cradle rotation trunnions. Then, the crane lowers and the HI-TRAC pivots around the pocket trunnions and is placed in the horizontal position in the cradle.

The HI-TRAC 100D and 125D do not include pocket trunnions in their designs. Therefore, the user must downend the transfer cask onto the transport frame using appropriately designed rigging in accordance with the site's heavy load control program.

If the loaded HI-TRAC is transferred to the cask transfer facility in the horizontal orientation, the HI-TRAC transport frame and/or cradle are placed on a transport vehicle. The transport vehicle may be an air pad, railcar, heavy-haul trailer, dolly, etc. If the loaded HI-TRAC is transferred to the cask transfer facility in the vertical orientation, the HI-TRAC may be lifted by the lifting trunnions or seated on the transport vehicle. During the transport of the loaded HI-TRAC, standard plant heavy load handling practices shall be applied including administrative controls for the travel path and tie-down mechanisms.

For MPCs containing any HBF, the Supplemental Cooling System (SCS) is required to be operational during the time the loaded and backfilled MPC is in HI-TRAC to ensure fuel cladding temperatures remain within limits. The SCS is discussed in detail in Section 4.5 and the design criteria for the system are provided in Appendix 2.C. The SCS is not required when the MPC is inside the overpack, regardless of decay heat load.

After the loaded HI-TRAC arrives at the cask transfer facility, the HI-TRAC is upended by a crane if the HI-TRAC is in a horizontal orientation. The loaded HI-TRAC is then placed, using the crane located in the transfer area, on top of HI-STORM, which has been inspected and staged with the lid removed, vent duct shield inserts installed, the alignment device positioned, and the mating device installed, as applicable.

After the HI-TRAC is positioned atop the HI-STORM or the mating device, the MPC is raised slightly. In the standard design, the transfer lid door locking pins are removed and the doors are opened. With the HI-TRAC 100D and 125D, the pool lid is removed using the mating device. The MPC is lowered into HI-STORM. Following verification that the MPC is fully lowered, slings are disconnected and lowered onto the MPC lid. For the HI-STORM 100, the doors are closed and HI-TRAC is removed from on top of HI-STORM or disconnected from the mating device, as applicable. For the HI-STORM 100S and the HI-STORM 100S Version B, the standard design HI-TRAC may need to be lifted above the overpack to a height sufficient to allow closure of the transfer lid doors without interfering with the MPC lift cleats. The HI-TRAC is then removed and placed in its designated storage location. The MPC lift cleats and slings are removed from atop the MPC. The alignment device, vent duct shield inserts, and mating device is/are removed, as applicable. The pool lid is removed from the mating device and re-attached to the HI-TRAC 100D or 125D prior to its next use. The HI-STORM lid is installed, and the upper vent screens and gamma shield cross plates are installed. The HI-STORM lid studs and nuts are installed.

After the HI-STORM has been loaded either within the fuel building or at a dedicated cask transfer facility, the HI-STORM is then moved to its designated position on the ISFSI pad. The HI-STORM overpack may be moved using a number of methods as long as the handling limitations listed in the technical specifications are not exceeded. The loaded HI-STORM must be handled in the vertical orientation, and may be lifted from the top by the anchor blocks or from the bottom by the inlet vents. After the loaded HI-STORM is lifted, it may be placed on a transport mechanism or continue to be lifted by the lid studs and transported to the storage location. The transport mechanism may be an air pad, crawler, railcar, heavy-haul trailer, dolly, etc. During the transport of the loaded HI-STORM, standard plant heavy load handling practices shall be applied including administrative controls for the travel path and tie-down mechanisms. Once in position at the storage pad, vent operability testing is performed to ensure that the system is functioning within its design parameters.

In the case of HI-STORM 100A, the anchor studs are installed and fastened into the anchor receptacles in the ISFSI pad in accordance with the design requirements.

Unloading Operations

The HI-STORM 100 System unloading procedures describe the general actions necessary to prepare the MPC for unloading, cool the stored fuel assemblies in the MPC, flood the MPC cavity, remove the lid welds, unload the spent fuel assemblies, and recover HI-TRAC and empty the MPC. Special precautions are outlined to ensure personnel safety during the unloading operations, and to prevent the risk of MPC overpressurization and thermal shock to the stored spent fuel assemblies.

The MPC is recovered from HI-STORM either at the cask transfer facility or the fuel building using any of the methodologies described in Section 8.1. The HI-STORM lid is removed, the alignment device positioned, and, for the HI-STORM 100, the vent duct shield inserts are installed, and the MPC lift cleats are attached to the MPC. For HI-TRAC 100D and 125D, the mating device is installed. Rigging is attached to the MPC lift cleats. For the HI-STORM 100S and HI-STORM 100S Version B with the standard HI-TRAC design, the transfer doors may need to be opened to avoid interfering with the MPC lift cleats. For the HI-TRAC 100D and 125D, the mating device (possibly containing the pool lid) is secured to the top of the overpack. HI-TRAC is raised and positioned on top of HI-STORM or bolted (if necessary) to the mating device, as applicable. For the HI-TRAC 100D and 125D, the pool lid is ensured to be out of the transfer path for the MPC. The MPC is raised into HI-TRAC. Once the MPC is raised into HI-TRAC, the standard design HI-TRAC transfer lid doors are closed and the locking pins are installed. For the HI-TRAC 100D and 125D, the pool lid is installed and the transfer cask is unsecured from the mating device. HI-TRAC is removed from on top of HI-STORM. As required based on the presence of high burnup fuel, the Supplemental Cooling System is installed and placed into operation.

The HI-TRAC is brought into the fuel building and, for the standard design, manipulated for bottom lid replacement. The transfer lid is replaced with the pool lid. The MPC lift cleats and rigging support the MPC during lid transfer operations.

HI-TRAC and its enclosed MPC are returned to the designated preparation area and the rigging, MPC lift cleats, and HI-TRAC top lid are removed. The annulus is filled with plant demineralized water (borated, if necessary). The annulus and HI-TRAC top surfaces are protected from debris that will be produced when removing the MPC lid.

The MPC closure ring and vent and drain port cover plates are core drilled. Local ventilation is established around the MPC ports. The RVOAs are attached to the vent and drain port. The RVOAs allow access to the inner cavity of the MPC, while providing a hermetic seal. The MPC is flooded with borated or unborated water, as required.. The MPC lid-to-MPC shell weld is removed. Then, all weld removal equipment is removed with the MPC lid left in place.

The MPC lid is rigged to the lift yoke and the lift yoke is engaged to HI-TRAC lifting trunnions. If weight limitations require, the neutron shield jacket is drained. HI-TRAC is placed in the spent fuel pool and the MPC lid is removed. All fuel assemblies are returned to the spent fuel storage racks and the MPC fuel cells are vacuumed to remove any assembly debris. HI-TRAC and MPC are returned to the designated preparation area where the MPC water is removed. The annulus water is drained and the MPC and HI-TRAC are decontaminated in preparation for re-utilization.

1.2.2.3 Identification of Subjects for Safety and Reliability Analysis

1.2.2.3.1 Criticality Prevention

Criticality is controlled by geometry and neutron absorbing materials in the fuel basket. The MPC-24/24E/24EF (all with lower enriched fuel) and the MPC-68/68F/68FF do not rely on soluble boron credit during loading or the assurance that water cannot enter the MPC during storage to meet the stipulated criticality limits.

Each MPC model is equipped with neutron absorber plates affixed to the fuel cell walls as shown on the drawings in Section 1.5. The minimum ^{10}B areal density specified for the neutron absorber in each MPC model is shown in Table 1.2.2. These values are chosen to be consistent with the assumptions made in the criticality analyses.

The MPC-24, MPC-24E and 24EF (all with higher enriched fuel) and the MPC-32 and MPC-32F take credit for soluble boron in the MPC water for criticality prevention during wet loading and unloading operations. Boron credit is only necessary for these PWR MPCs during loading and unloading operations that take place under water. During storage, with the MPC cavity dry and sealed from the environment, criticality control measures beyond the fixed neutron poisons affixed to the storage cell walls are not necessary because of the low reactivity of the fuel in the dry, helium filled canister and the design features that prevent water from intruding into the canister during storage.

1.2.2.3.2 Chemical Safety

There are no chemical safety hazards associated with operations of the HI-STORM 100 dry storage system. A detailed evaluation is provided in Section 3.4.

1.2.2.3.3 Operation Shutdown Modes

The HI-STORM 100 System is totally passive and consequently, operation shutdown modes are unnecessary. Guidance is provided in Chapter 8, which outlines the HI-STORM 100 unloading procedures, and Chapter 11, which outlines the corrective course of action in the wake of postulated accidents.

1.2.2.3.4 Instrumentation

As stated earlier, the HI-STORM 100 confinement boundary is the MPC, which is seal welded, non-destructively examined and pressure tested. The HI-STORM 100 is a completely passive system with appropriate margins of safety; therefore, it is not necessary to deploy any instrumentation to monitor the cask in the storage mode. At the option of the user, temperature elements may be utilized to monitor the air temperature of the HI-STORM overpack exit vents in lieu of routinely inspecting the ducts for blockage. See Subsection 2.3.3.2 for additional details.

1.2.2.3.5 Maintenance Technique

Because of their passive nature, the HI-STORM 100 System requires minimal maintenance over its lifetime. No special maintenance program is required. Chapter 9 describes the acceptance criteria and maintenance program set forth for the HI-STORM 100.

1.2.3 Cask Contents

The HI-STORM 100 System is designed to house different types of MPCs. The MPCs are designed to store both BWR and PWR spent nuclear fuel assemblies. Tables 1.2.1 and 1.2.2 provide key system data and parameters for the MPCs. A description of acceptable fuel assemblies for storage in the MPCs is provided in Section 2.1. This includes fuel assemblies classified as damaged fuel assemblies and fuel debris in accordance with the definitions of these terms in Table 1.0.1. A summary of the types of fuel authorized for storage in each MPC model is provided below. All fuel assemblies, non-fuel hardware, and neutron sources must meet the fuel specifications provided in Section 2.1. All fuel assemblies classified as damaged fuel or fuel debris must be stored in damaged fuel containers.

MPC-24

The MPC-24 is designed to accommodate up to twenty-four (24) PWR fuel assemblies classified as intact fuel assemblies, with or without non-fuel hardware.

MPC-24E

The MPC-24E is designed to accommodate up to twenty-four (24) PWR fuel assemblies, with or without non-fuel hardware. Up to four (4) fuel assemblies may be classified as damaged fuel assemblies, with the balance being classified as intact fuel assemblies. Damaged fuel assemblies must be stored in fuel storage locations 3, 6, 19, and/or 22 (see Figure 1.2.4).

MPC-24EF

The MPC-24EF is designed to accommodate up to twenty-four (24) PWR fuel assemblies, with or without non-fuel hardware. Up to four (4) fuel assemblies may be classified as damaged fuel assemblies or fuel debris, with the balance being classified as intact fuel assemblies. Damaged fuel assemblies and fuel debris must be stored in fuel storage locations 3, 6, 19, and/or 22 (see Figure 1.2.4).

MPC-32

The MPC-32 is designed to accommodate up to thirty-two (32) PWR fuel assemblies with or without non-fuel hardware. Up to eight (8) of these assemblies may be classified as damaged fuel assemblies, with the balance being classified as intact fuel assemblies. Damaged fuel assemblies must be stored in fuel storage locations 1, 4, 5, 10, 23, 28, 29, and/or 32 (see Figure 1.2.3).

MPC-32F

The MPC-32F is designed to store up to thirty two (32) PWR fuel assemblies with or without non-fuel hardware. Up to eight (8) of these assemblies may be classified as damaged fuel assemblies or fuel debris, with the balance being classified as intact fuel assemblies. Damaged fuel assemblies and fuel debris must be stored in fuel storage locations 1, 4, 5, 10, 23, 28, 29, and/or 32 (see Figure 1.2.3).

MPC-68

The MPC-68 is designed to accommodate up to sixty-eight (68) BWR intact and/or damaged fuel assemblies, with or without channels. For the Dresden Unit 1 or Humboldt Bay plants, the number of damaged fuel assemblies may be up to a total of 68. For damaged fuel assemblies from plants other than Dresden Unit 1 and Humboldt Bay, the number of damaged fuel assemblies is limited to sixteen (16) and must be stored in fuel storage locations 1, 2, 3, 8, 9, 16, 25, 34, 35, 44, 53, 60, 61, 66, 67, and/or 68 (see Figure 1.2.2).

MPC-68F

The MPC-68F is designed to accommodate up to sixty-eight (68) Dresden Unit 1 or Humboldt Bay BWR fuel assemblies (with or without channels) made up of any combination of fuel assemblies classified as intact fuel assemblies, damaged fuel assemblies, and up to four (4) fuel assemblies classified as fuel debris.

MPC-68FF

The MPC-68FF is designed to accommodate up to sixty-eight (68) BWR fuel assemblies with or without channels. Any number of these fuel assemblies may be Dresden Unit 1 or Humboldt

Bay BWR fuel assemblies classified as intact fuel or damaged fuel. Dresden Unit 1 and Humboldt Bay fuel debris is limited to eight (8) DFCs. DFCs containing Dresden Unit 1 or Humboldt Bay fuel debris may be stored in any fuel storage location. For BWR fuel assemblies from plants other than Dresden Unit 1 and Humboldt Bay, the total number of fuel assemblies classified as damaged fuel assemblies or fuel debris is limited to sixteen (16), with up to eight (8) of the 16 fuel assemblies classified as fuel debris. These fuel assemblies must be stored in fuel storage locations 1, 2, 3, 8, 9, 16, 25, 34, 35, 44, 53, 60, 61, 66, 67, and/or 68 (see Figure 1.2.2). The balance of the fuel storage locations may be filled with intact BWR fuel assemblies, up to a total of 68.

Table 1.2.1

KEY SYSTEM DATA FOR HI-STORM 100 SYSTEM

ITEM	QUANTITY	NOTES
Types of MPCs included in this revision of the submittal	8	5 for PWR 3 for BWR
MPC storage capacity†:	MPC-24 MPC-24E MPC-24EF	Up to 24 intact ZR or stainless steel clad PWR fuel assemblies with or without non-fuel hardware. Up to four damaged fuel assemblies may be stored in the MPC-24E and up to four (4) damaged fuel assemblies and/or fuel assemblies classified as fuel debris may be stored in the MPC-24EF OR
	MPC-32 MPC-32F (See Note 1 on next page)	Up to 32 intact ZR or stainless steel clad PWR fuel assemblies with or without non-fuel hardware. Up to 8 damaged fuel assemblies may be stored in the MPC-32 and up to 8 damaged fuel assemblies and/or fuel assemblies classified as fuel debris may be stored in the MPC-32F.
	MPC-68	Any combination of Dresden Unit 1 or Humboldt Bay damaged fuel assemblies in damaged fuel containers and intact fuel assemblies, up to a total of 68. For damaged fuel other than Dresden Unit 1 and Humboldt Bay, the number of fuel assemblies is limited to 16, with the balance being intact fuel assemblies. OR

† See Section 2.1 for a complete description of authorized cask contents and fuel specifications.

Table 1.2.1 (continued)
KEY SYSTEM DATA FOR HI-STORM 100 SYSTEM

ITEM	QUANTITY	NOTES
MPC storage capacity:	MPC-68F MPC-68FF	Up to 4 damaged fuel containers with ZR clad Dresden Unit 1 (D-1) or Humboldt Bay (HB) BWR fuel debris and the complement damaged ZR clad Dresden Unit 1 or Humboldt Bay BWR fuel assemblies in damaged fuel containers or intact Dresden Unit 1 or Humboldt Bay BWR intact fuel assemblies. OR Up to 68 Dresden Unit 1 or Humboldt Bay intact fuel or damaged fuel and up to 8 damaged fuel containers containing D-1 or HB fuel debris. For other BWR plants, up to 16 damaged fuel containers containing BWR damaged fuel and/or fuel debris with the complement intact fuel assemblies, up to a total of 68. The number of damaged fuel containers containing BWR fuel debris is limited to eight (8) for all BWR plants.

Notes:

1. The stated information does not apply to the Indian Point Unit 1 MPC-32s. Supplement 1.II provides the storage capacity for the IP1 MPC-32s.

Table 1.2.2

KEY PARAMETERS FOR HI-STORM 100 MULTI-PURPOSE CANISTERS

	PWR	BWR
Pre-disposal service life (years)	40	40
Design temperature, max./min. (°F)	725°† / -40°††	725°† / -40°††
Design internal pressure (psig) Normal conditions Off-normal conditions Accident Conditions	 100 110 200	 100 110 200
Total heat load, max. (kW)	28.74	28.19
Maximum permissible peak fuel cladding temperature: Long Term Normal (°F) Short Term Operations (°F) Off-normal and Accident (°F)	 752 752 or 1058††† 1058	 752 752 or 1058††† 1058

† Maximum normal condition design temperatures for the MPC fuel basket. A complete listing of design temperatures for all components is provided in Table 2.2.3.

†† Temperature based on off-normal minimum environmental temperatures specified in Section 2.2.2.2 and no fuel decay heat load.

††† See Section 4.5 for discussion of the applicability of the 1058°F temperature limit during MPC drying.

Table 1.2.2 (cont'd)

KEY PARAMETERS FOR HI-STORM 100 MULTI-PURPOSE CANISTERS

	PWR	BWR
MPC internal environment Helium fill (99.995% fill helium purity)	(all pressure ranges are at a reference temperature of 70°F)	(all pressure ranges are at a reference temperature of 70°F)
MPC-24 (heat load ≤ 27.77 kW)	≥ 29.3 psig and ≤ 33.3 psig OR 0.1212 +/-10% g-moles/liter	
MPC-24E/24EF (heat load ≤ 28.17 kW)	≥ 29.3 psig and ≤ 33.3 psig OR 0.1212 +/-10% g-moles/liter	
MPC-68/68F/68FF (heat load ≤ 28.19 kW)		≥ 29.3 psig and ≤ 33.3 psig OR 0.1218 +/-10% g-moles/liter
MPC-32/32F (heat load ≤ 28.74 kW) (See Note 2)	≥ 29.3 psig and ≤ 33.3 psig OR 0.1212 +/-10% g-moles/liter	
Maximum permissible multiplication factor (k_{eff}) including all uncertainties and biases	< 0.95	< 0.95
Fixed Neutron Absorber ^{10}B Areal Density (g/cm^2) Boral/Metamic	0.0267/0.0223 (MPC-24) 0.0372/0.0310 (MPC-24E, MPC-24EF MPC-32 & MPC-32F)	0.0372/0.0310 (MPC-68 & MPC-68FF) 0.01/NA (MPC-68F) (See Note 1)
End closure(s)	Welded	Welded
Fuel handling	Opening compatible with standard grapples	Opening compatible with standard grapples
Heat dissipation	Passive	Passive

NOTES:

1. All MPC-68F canisters are equipped with Boral neutron absorber.
2. The stated requirements do not apply to the Indian Point Unit 1 MPC-32s. Supplement 1.II provides Helium fill requirements for Indian Point Unit 1 MPC-32s.

Table 1.2.3

INTENTIONALLY DELETED

Table 1.2.4

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Table 1.2.5

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Table 1.2.6

HI-STORM 100 OPERATIONS SEQUENCE

Site-specific handling and operations procedures will be prepared, reviewed, and approved by each owner/user.	
1	HI-TRAC and MPC lowered into the fuel pool without lids
2	Fuel assemblies transferred into the MPC fuel basket
3	MPC lid lowered onto the MPC
4	HI-TRAC/MPC assembly moved to the decon pit and MPC lid welded in place, volumetrically or multi-layer PT examined, and pressure and leakage tested
5	MPC dewatered, moisture removed, backfilled with helium, and the closure ring welded
6	HI-TRAC annulus drained and external surfaces decontaminated
7	MPC lifting cleats installed and MPC weight supported by rigging
8	HI-TRAC pool lid removed and transfer lid attached (not applicable to HI-TRAC 100D or 125D)
9	MPC lowered and seated on HI-TRAC transfer lid (not applicable to HI-TRAC 100D or 125D)
9a	HI-STORM mating device secured to top of empty HI-STORM overpack (HI-TRAC 100D and 125D only)
10	HI-TRAC/MPC assembly transferred to atop the HI-STORM overpack or mating device, as applicable
11	MPC weight supported by rigging and transfer lid doors opened (standard design HI-TRAC) or pool lid removed (HI-TRAC 100D and 125D)
12	MPC lowered into HI-STORM overpack, and HI-TRAC removed from atop the HI-STORM overpack/mating device
12a	HI-STORM mating device removed (HI-TRAC 100D and 125D only)
13	HI-STORM overpack lid installed and bolted in place
14	HI-STORM overpack placed in storage at the ISFSI pad
15	For HI-STORM 100A (or 100SA) users, the overpack is anchored to the ISFSI pad by installation of nuts onto studs and torquing to the minimum required torque.

Table 1.2.7

REPRESENTATIVE ASME BOLTING AND THREADED ROD MATERIALS ACCEPTABLE
FOR THE HI-STORM 100A ANCHORAGE SYSTEM

ASME MATERIALS FOR BOLTING

Composition	I.D.	Type Grade or UNC No.	Ultimate Strength (ksi)	Yield Strength (ksi)	Code Permitted Size Range†
C	SA-354	BC K04100	125	109	t ≤ 2.5"
¾ Cr	SA-574	51B37M	170	135	t ≥ 5/8"
1 Cr – 1/5 Mo	SA-574	4142	170	135	t ≥ 5/8"
1 Cr-1/2 Mo-V	SA-540	B21 (K 14073)	165	150	t ≤ 4"
5 Cr – ½ Mo	SA-193	B7	125	105	t ≤ 2.5"
$2N_i$ – ¾ Cr – ¼ Mo	SA-540	B23 (H-43400)	135	120	
$2N_i$ – ¾ Cr – 1/3 Mo	SA-540	B-24 (K-24064)	135	120	
17Cr-4Ni-4Cu	SA-564	630 (H-1100)	140	115	
17Cr-4Ni-4Cu	SA-564	630 (H-1075)	145	125	
25Ni-15Cr-2Ti	SA-638	660	130	85	
22CR-13Ni-5Mn	SA-479	XM-19 (S20910)	135	105	

Note: The materials listed in this table are representative of acceptable materials and have been abstracted from the ASME Code, Section II, Part D, Table 3. Other materials listed in the Code are also acceptable as long as they meet the size requirements, the minimum requirements on yield and ultimate strength (see Table 2.0.4), and are suitable for the environment.

† Nominal diameter of the bolt (or rod) as listed in the Code tables. Two-inch diameter studs/rods are specified for the HI-STORM 100A.

Table 1.2.8

METAMIC® DATA FOR HOLTEC MPCs

MPC Type	Min. B-10 areal density required by criticality analysis (g/cm^2)	Nominal Weight Percent of B_4C and Reference *METAMIC®* Panel Thickness			
		100% Credit	90% Credit	75% Credit	Ref. Thickness (inch) (see note)
MPC-24	0.020	27.6	31	37.2	0.075
MPC-68, -68FF, -32, -32F, -24E, and -24EF	0.0279	27.8	31	37.4	0.104

Note: The drawings in Section 1.5 show slightly larger thickness to ensure that the minimum B-10 areal density is conservative under all conditions.

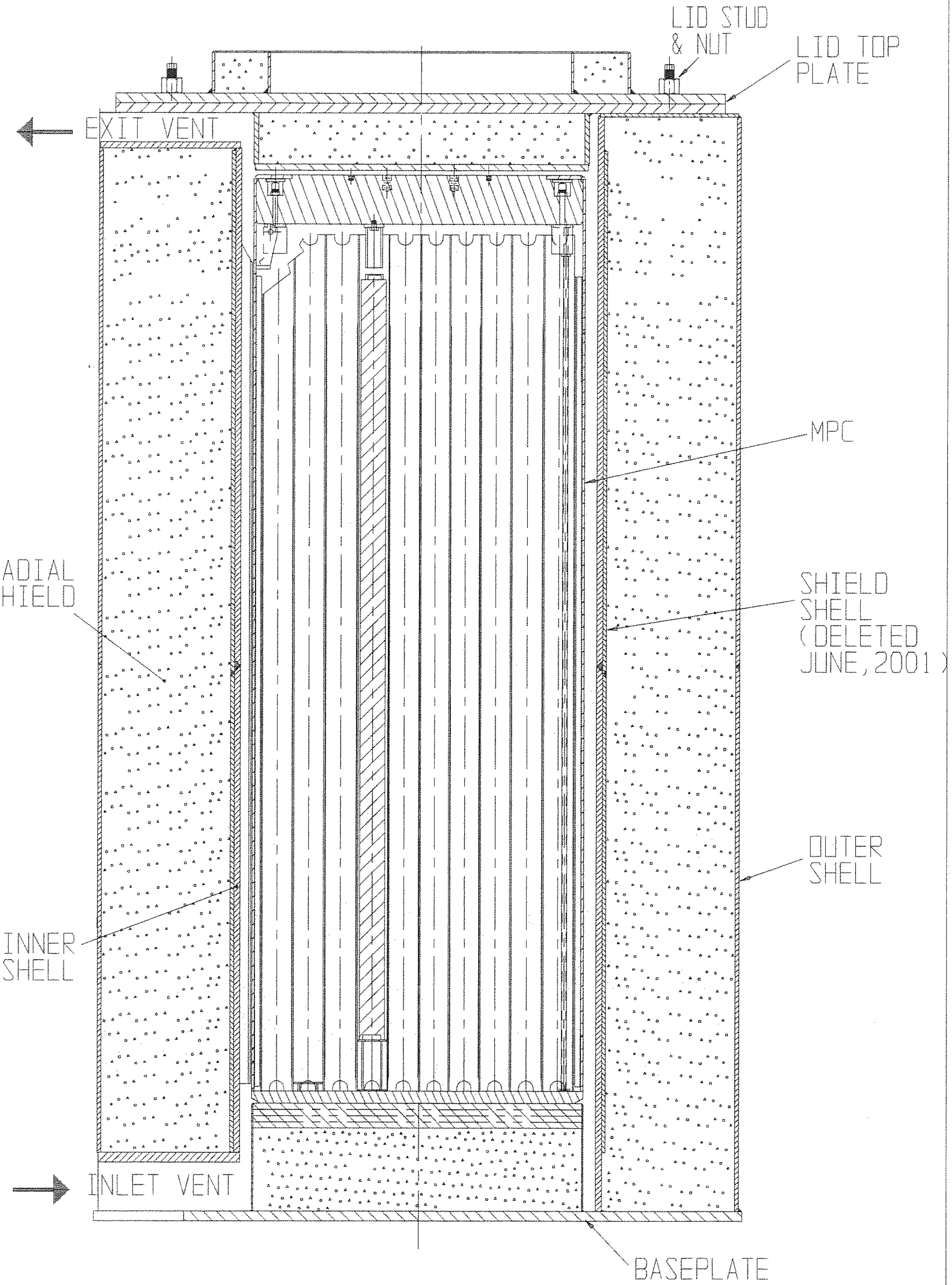

FIGURE 1.2.1; CROSS SECTION VIEW OF THE HI-STORM 100 SYSTEM

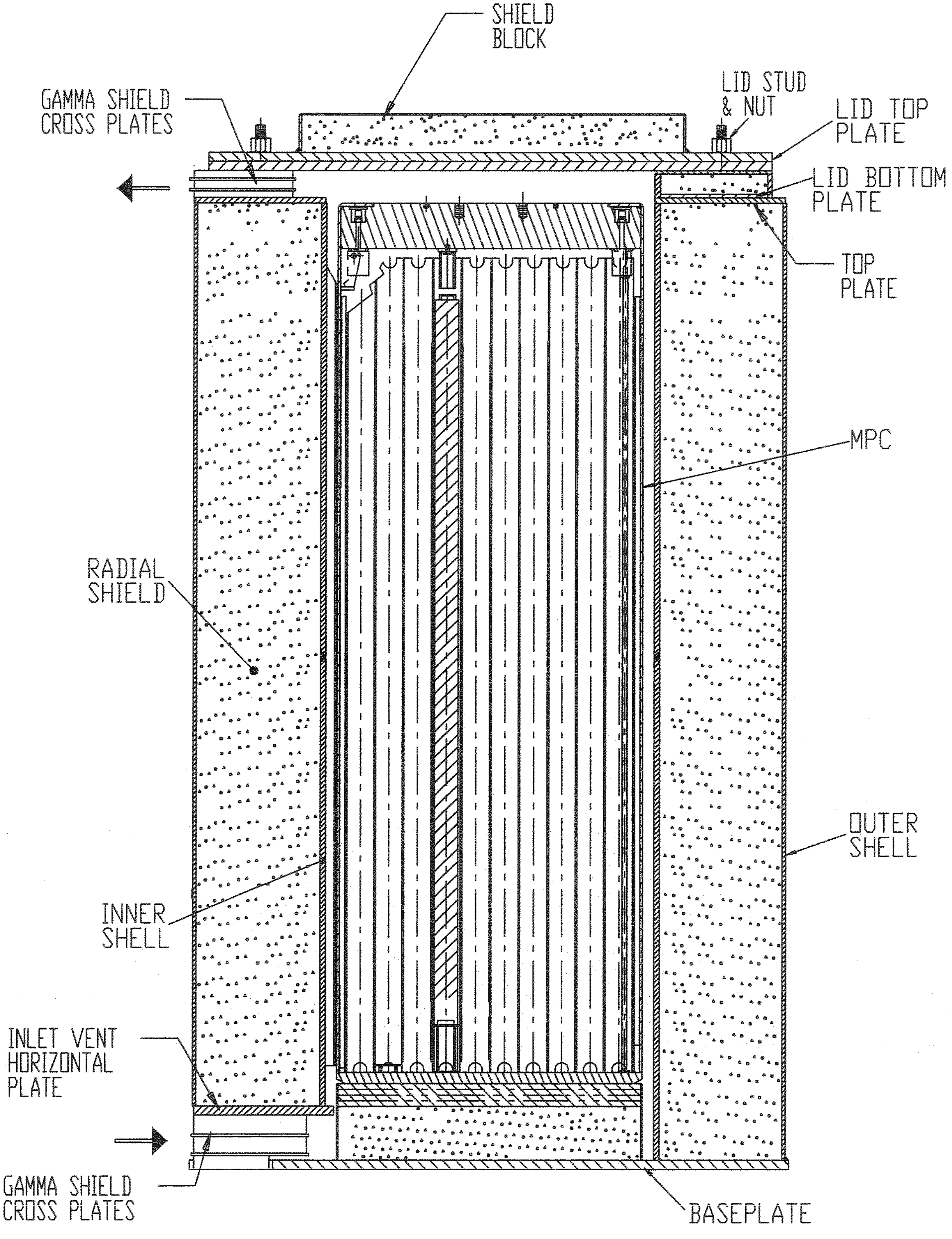

FIGURE 1.2.1A; CROSS SECTION VIEW OF THE HI-STORM 100S SYSTEM

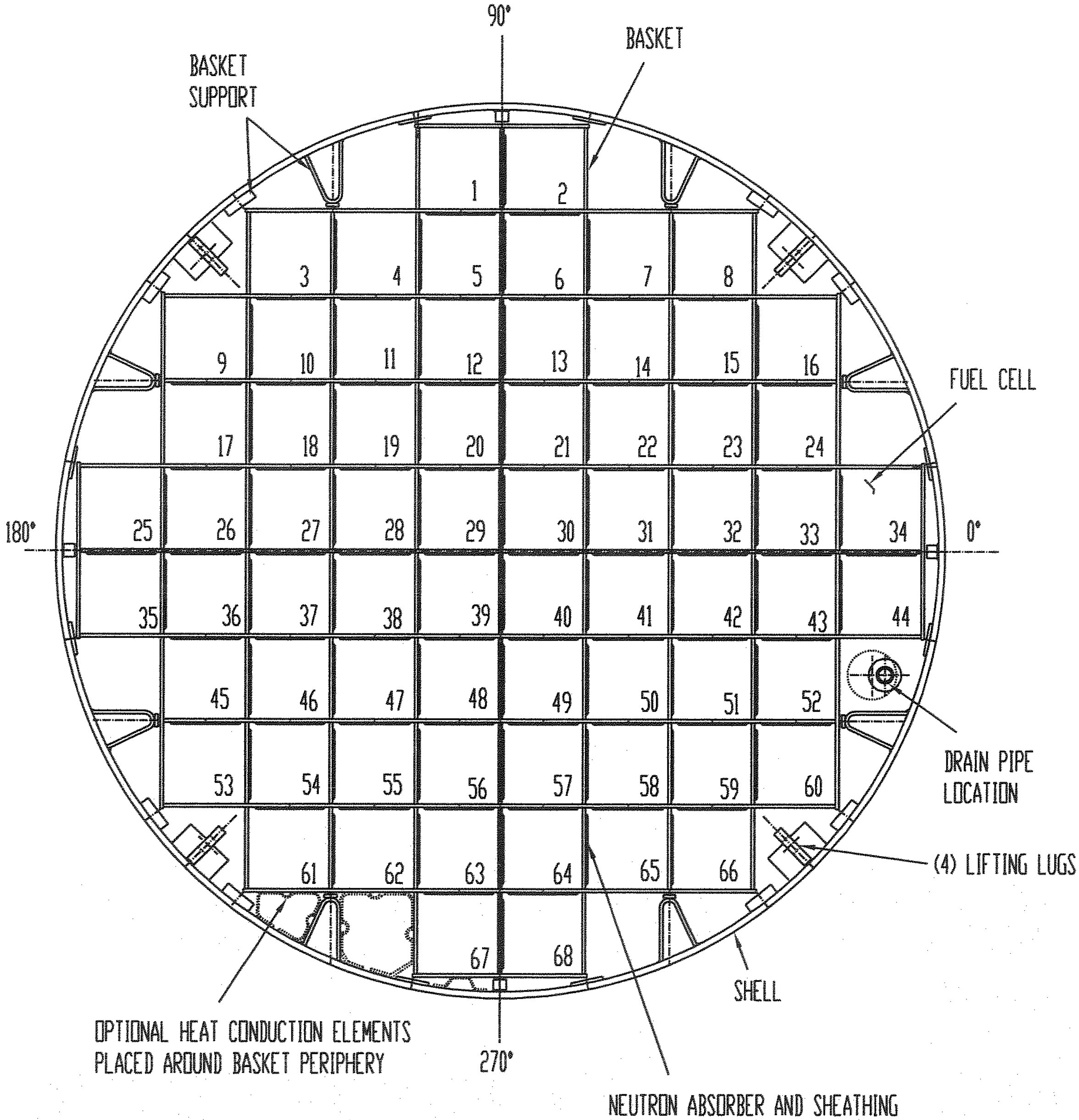

FIGURE 1.2.2; MPC-68/68F/68FF CROSS SECTION VIEW

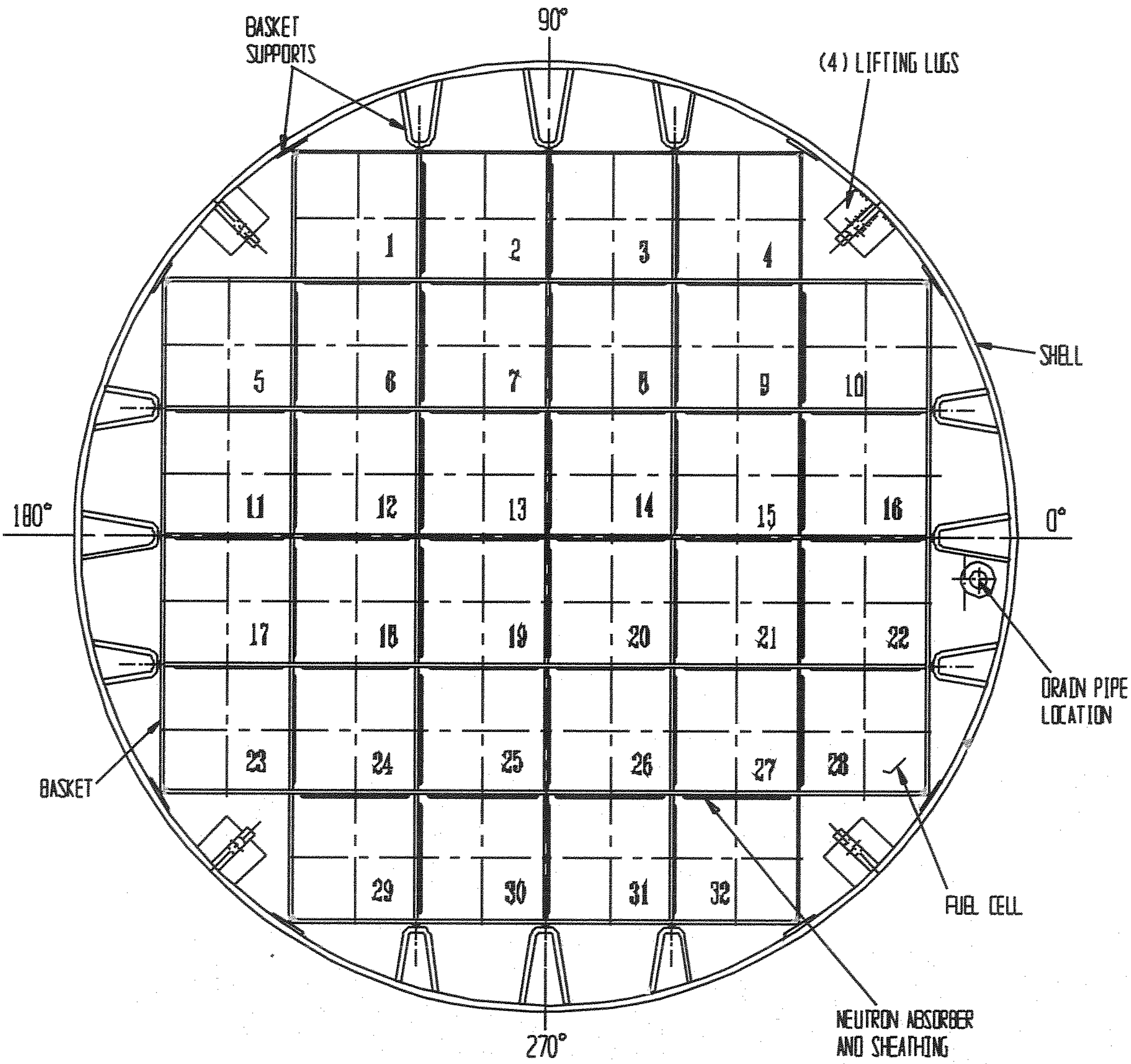

FIGURE 1.2.3; MPC-32/32F CROSS SECTION

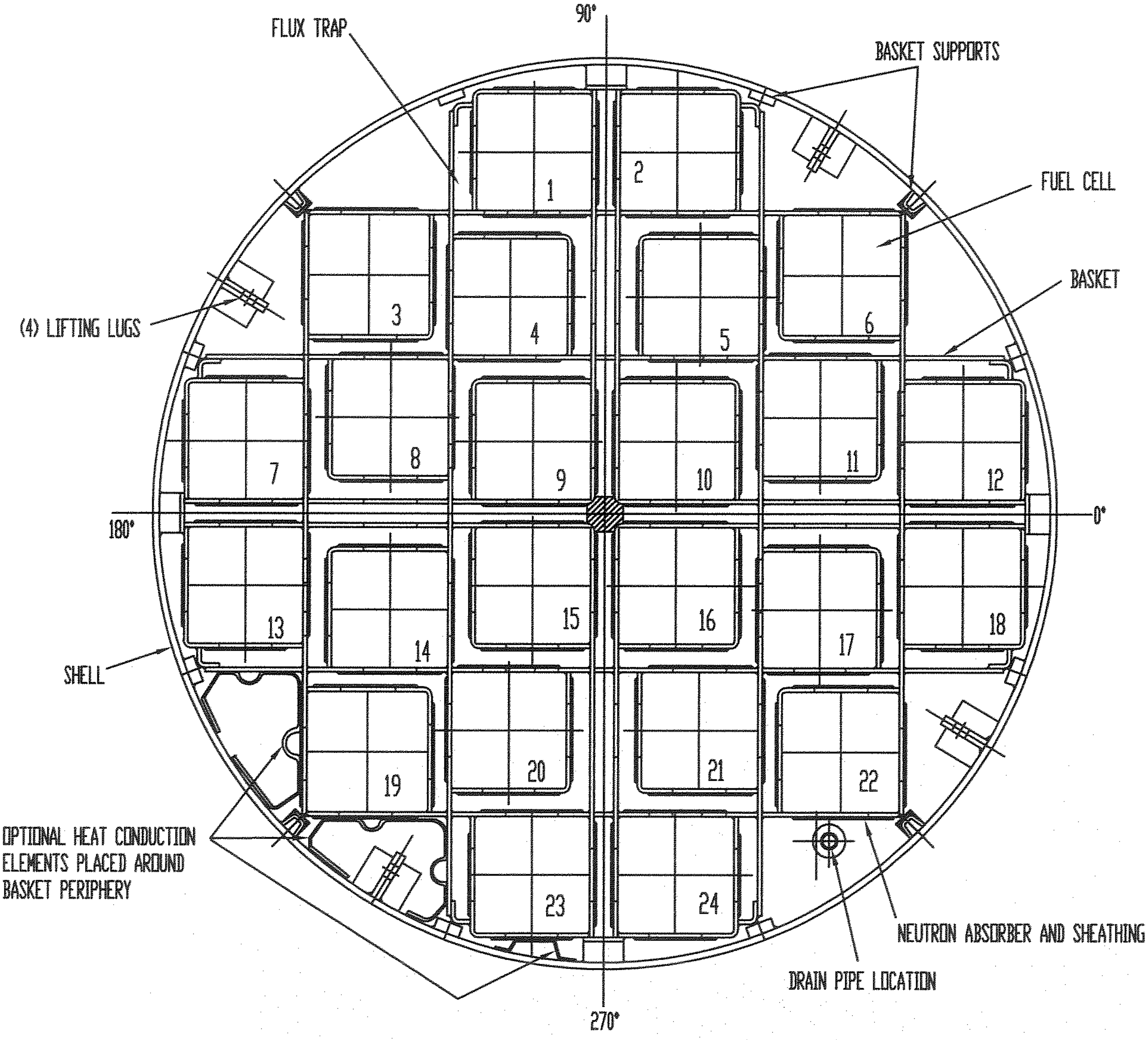

FIGURE 1.2.4; MPC-24/24E/24EF CROSS SECTION VIEW

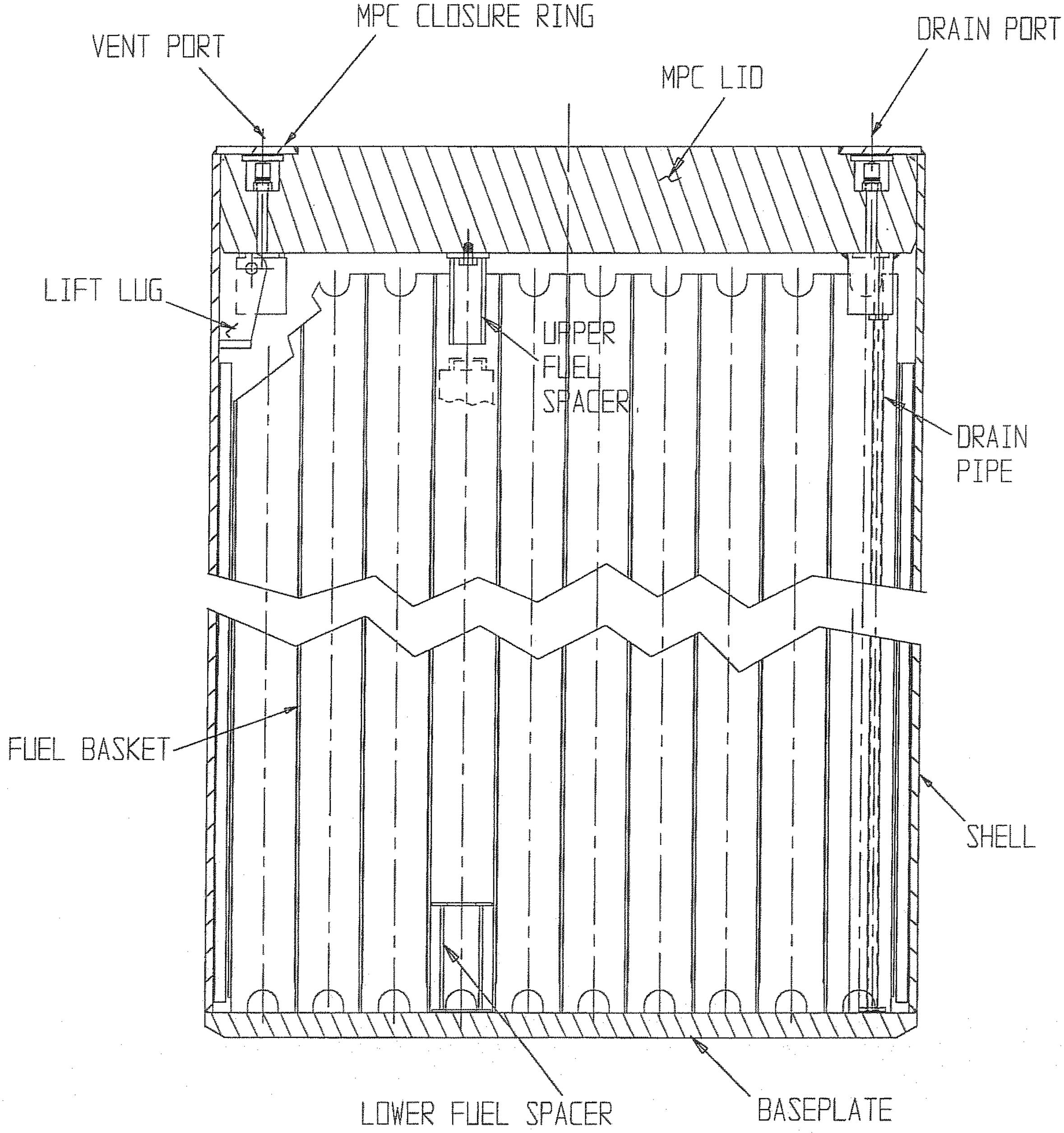

FIGURE 1.2.5; CROSS SECTION ELEVATION VIEW OF MPC

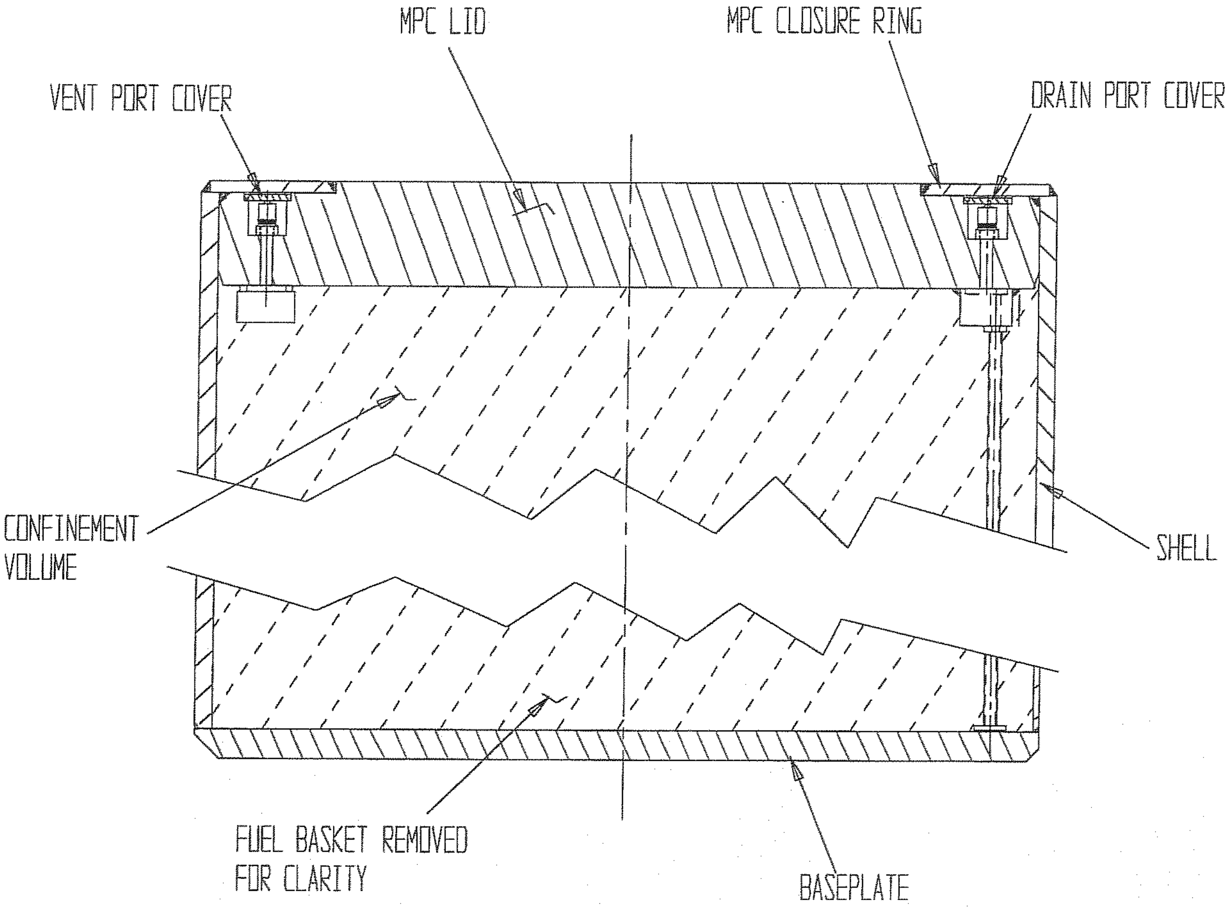

FIGURE 1.2.6; MPC CONFINEMENT BOUNDARY

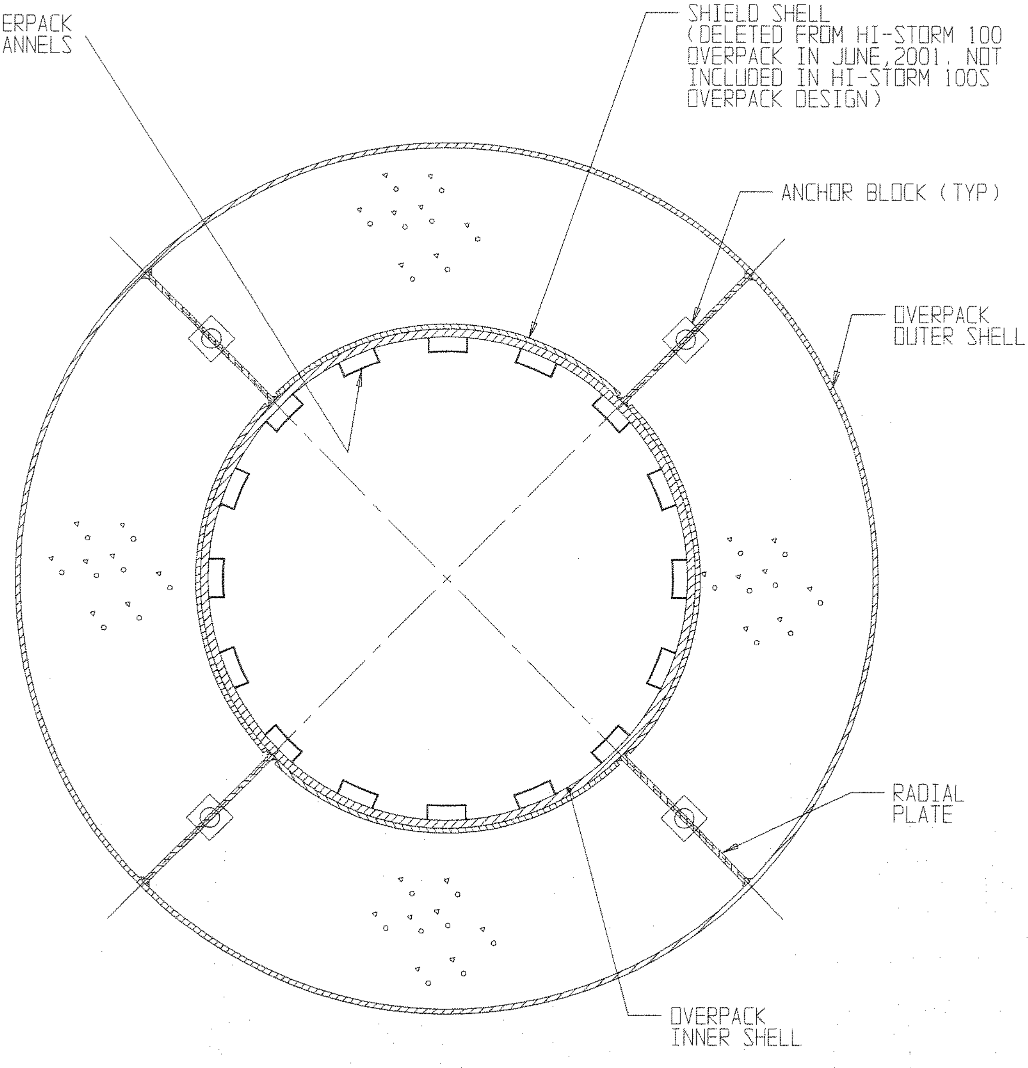

FIGURE 1.2.7; CROSS SECTION OF HI-STORM OVERPACK

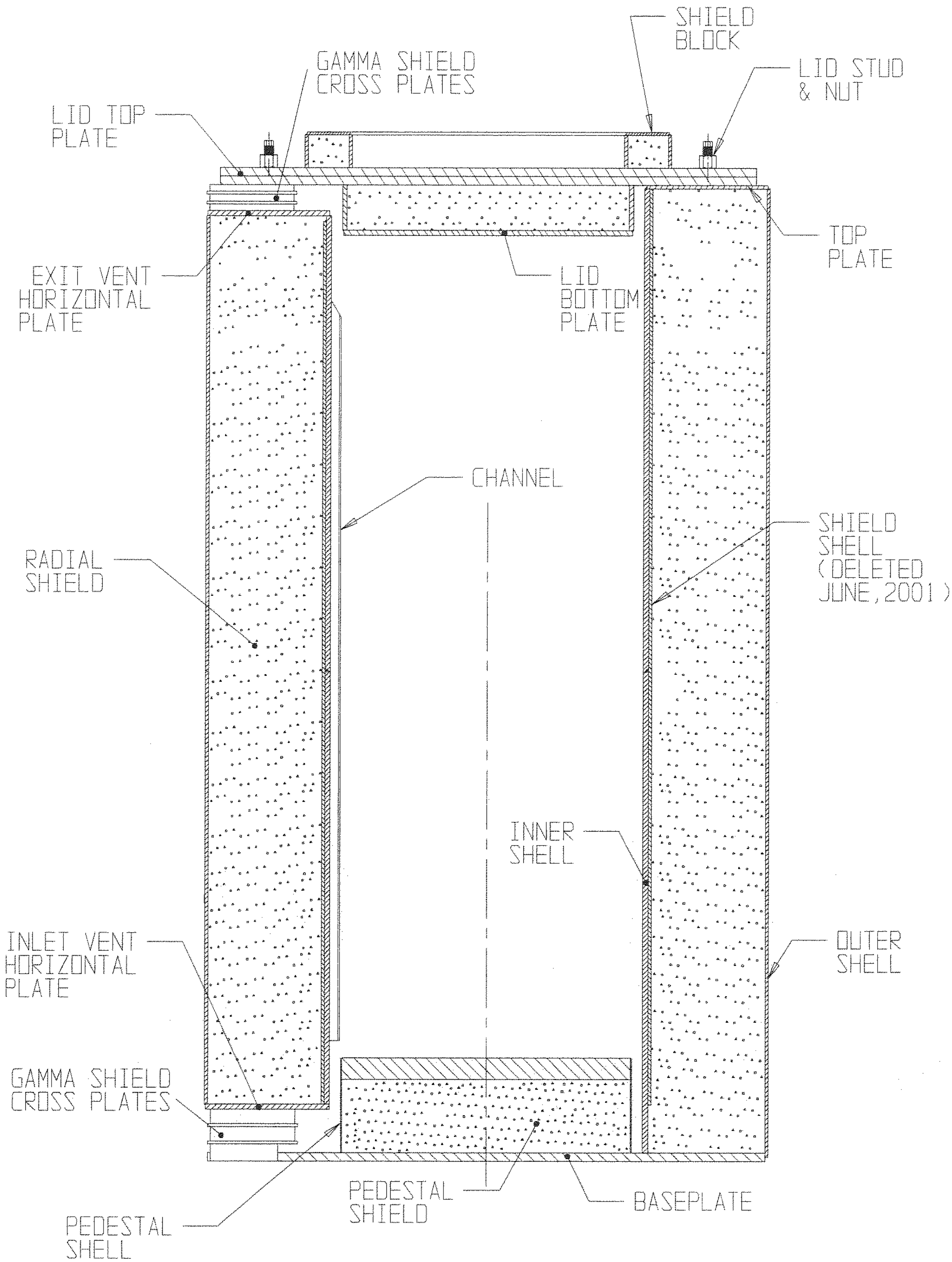

FIGURE 1.2.8; HI-STORM 100 OVERPACK CROSS SECTIONAL ELEVATION VIEW

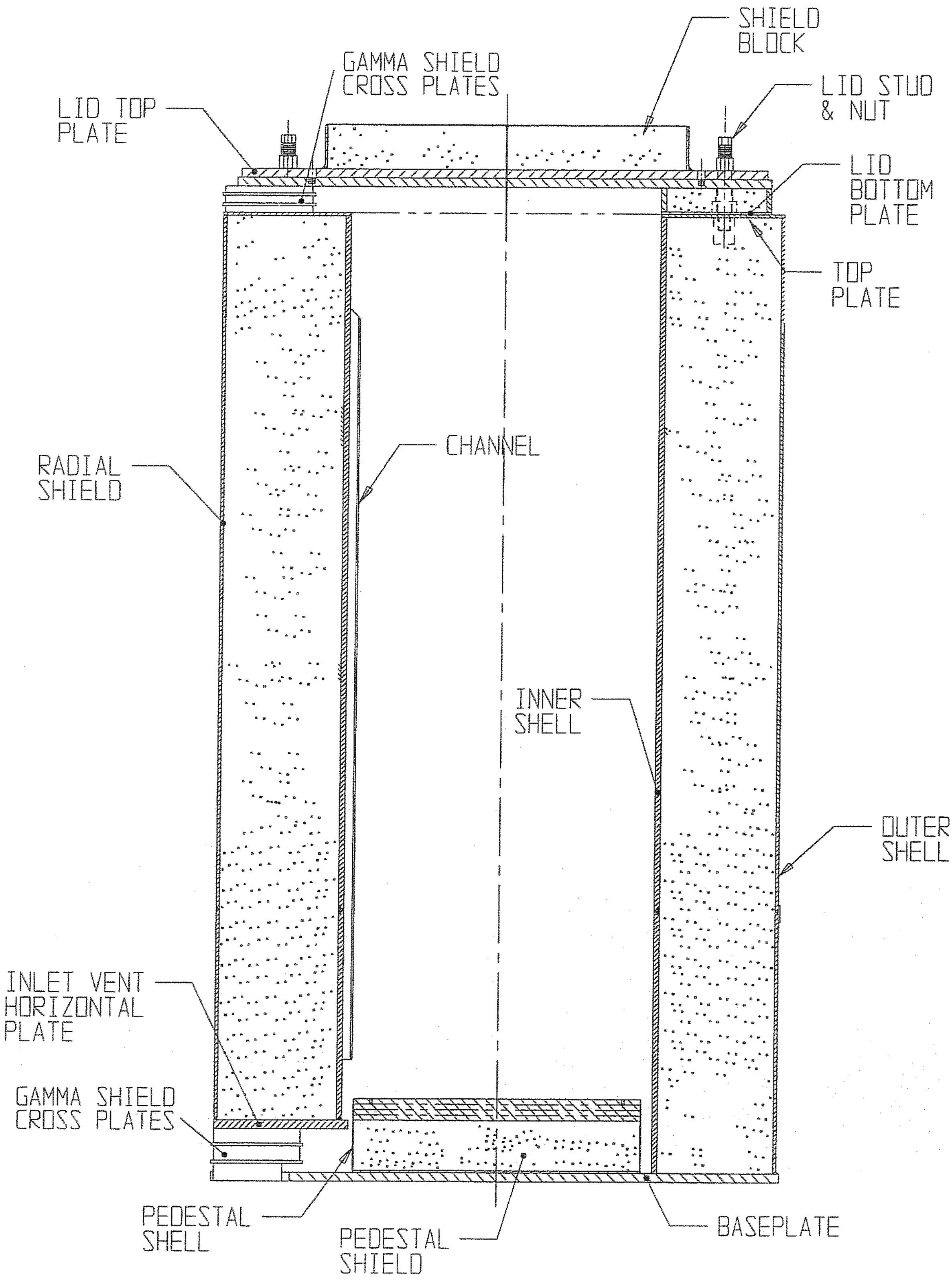

FIGURE 1.2.8A; HI-STORM 100S OVERPACK CROSS SECTIONAL ELEVATION VIEW

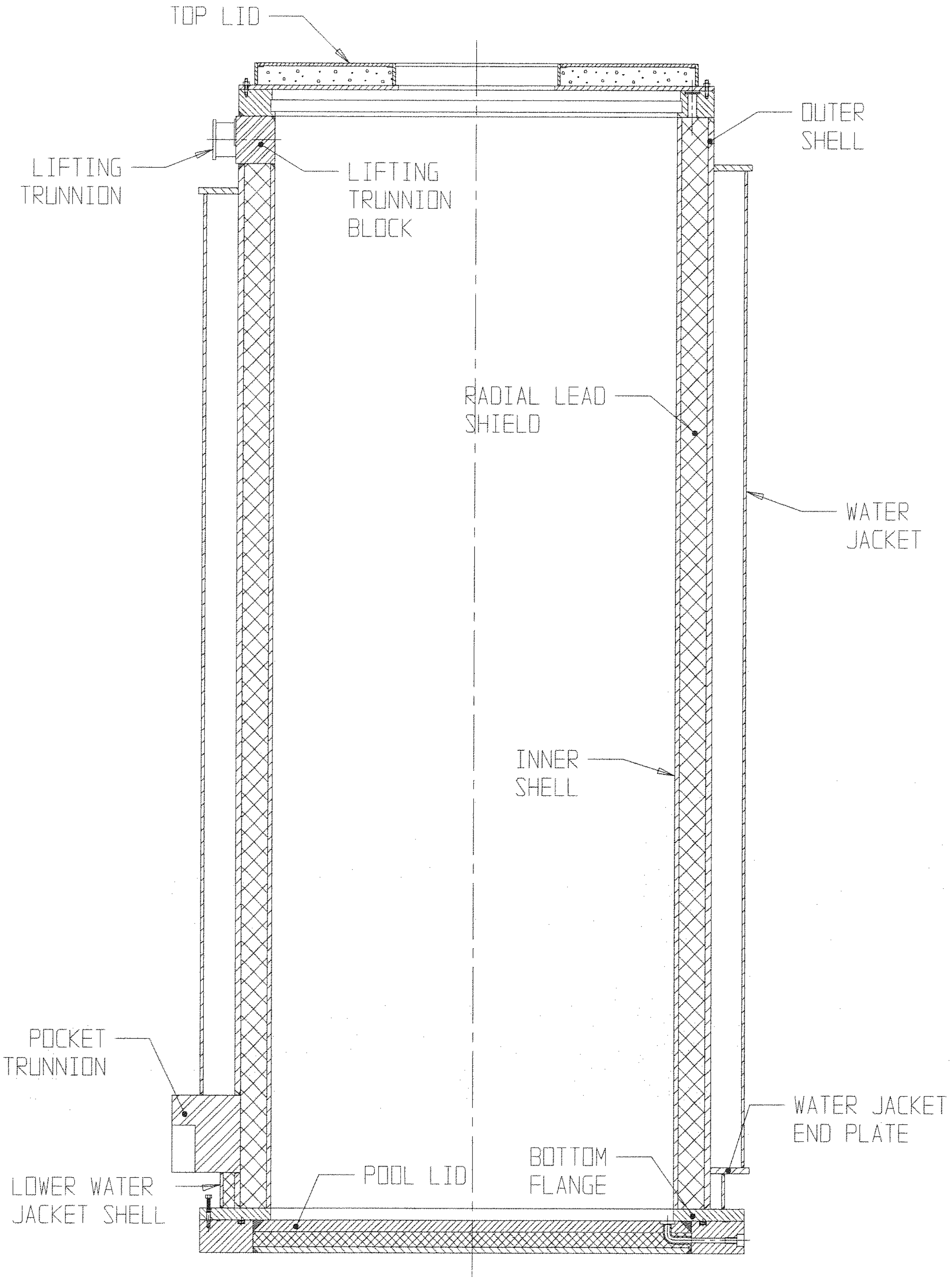

FIGURE 1.2.9; 125TON HI-TRAC TRANSFER CASK WITH POOL LID CROSS SECTIONAL ELEVATION VIEW

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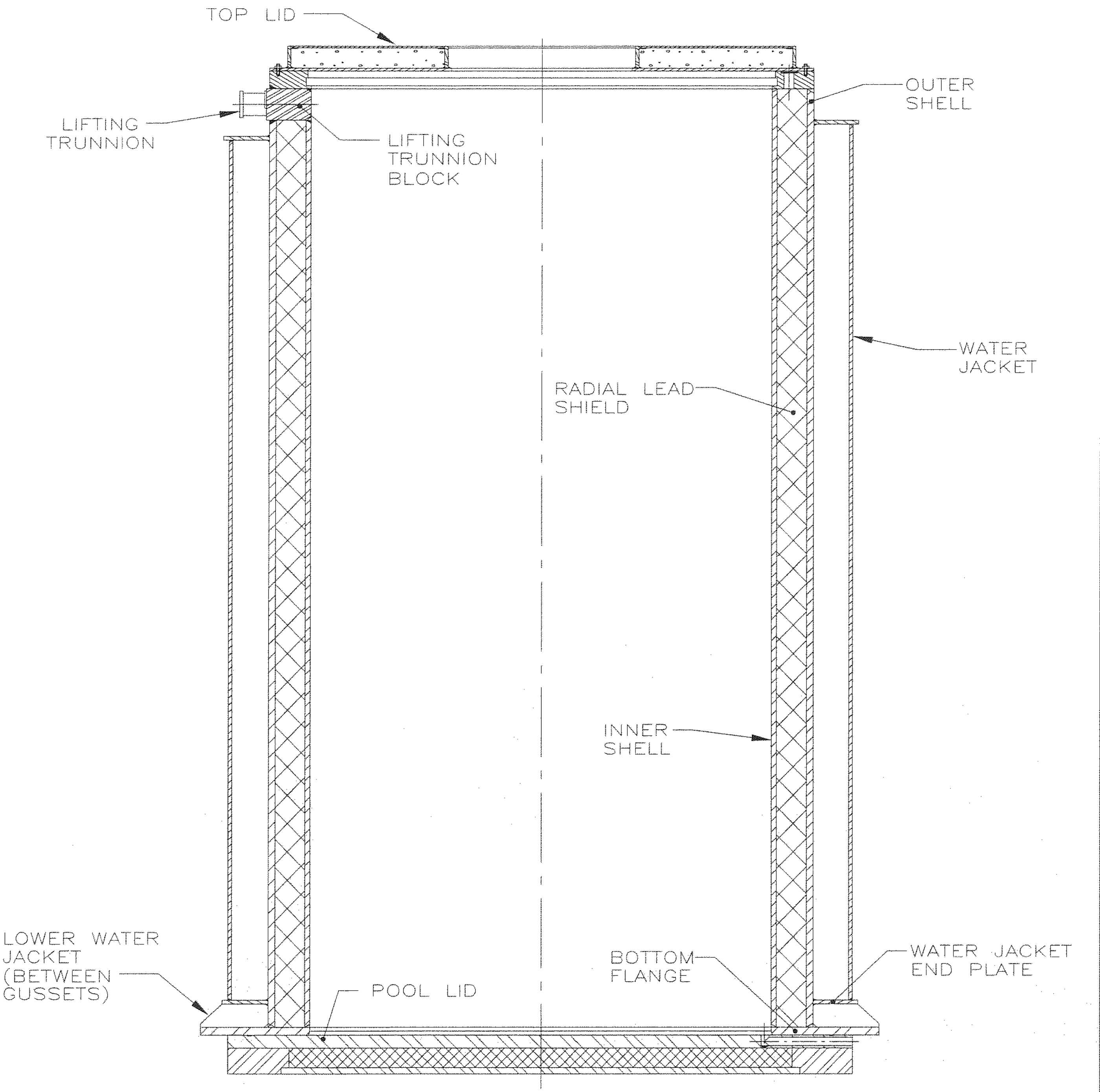

FIGURE 1.2.9A; HI-TRAC 125D TRANSFER CASK CROSS SECTIONAL ELEVATION VIEW

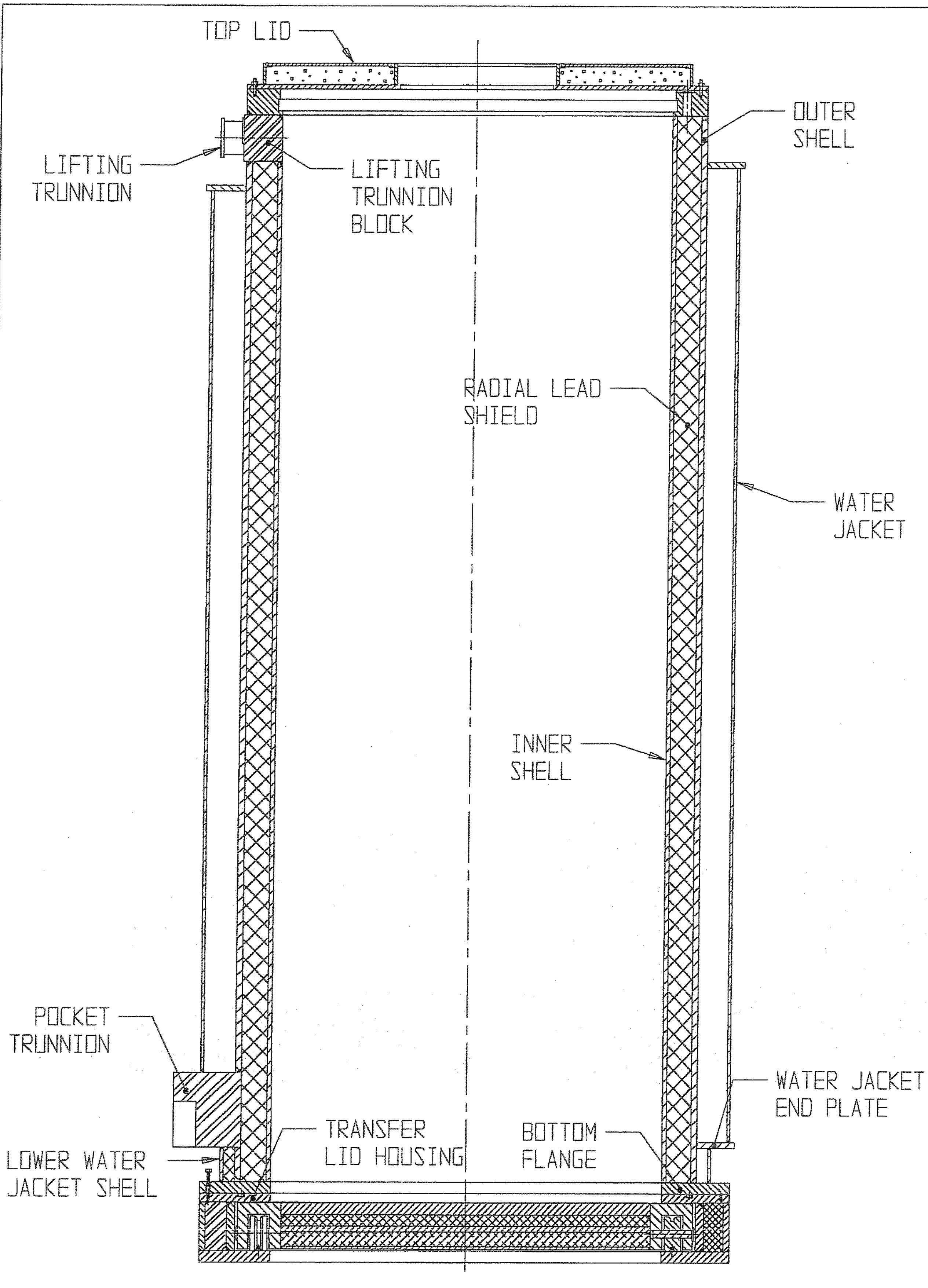

FIGURE 1.2.10; 125TON HI-TRAC TRANSFER CASK WITH TRANSFER LID
CROSS SECTIONAL ELEVATION VIEW

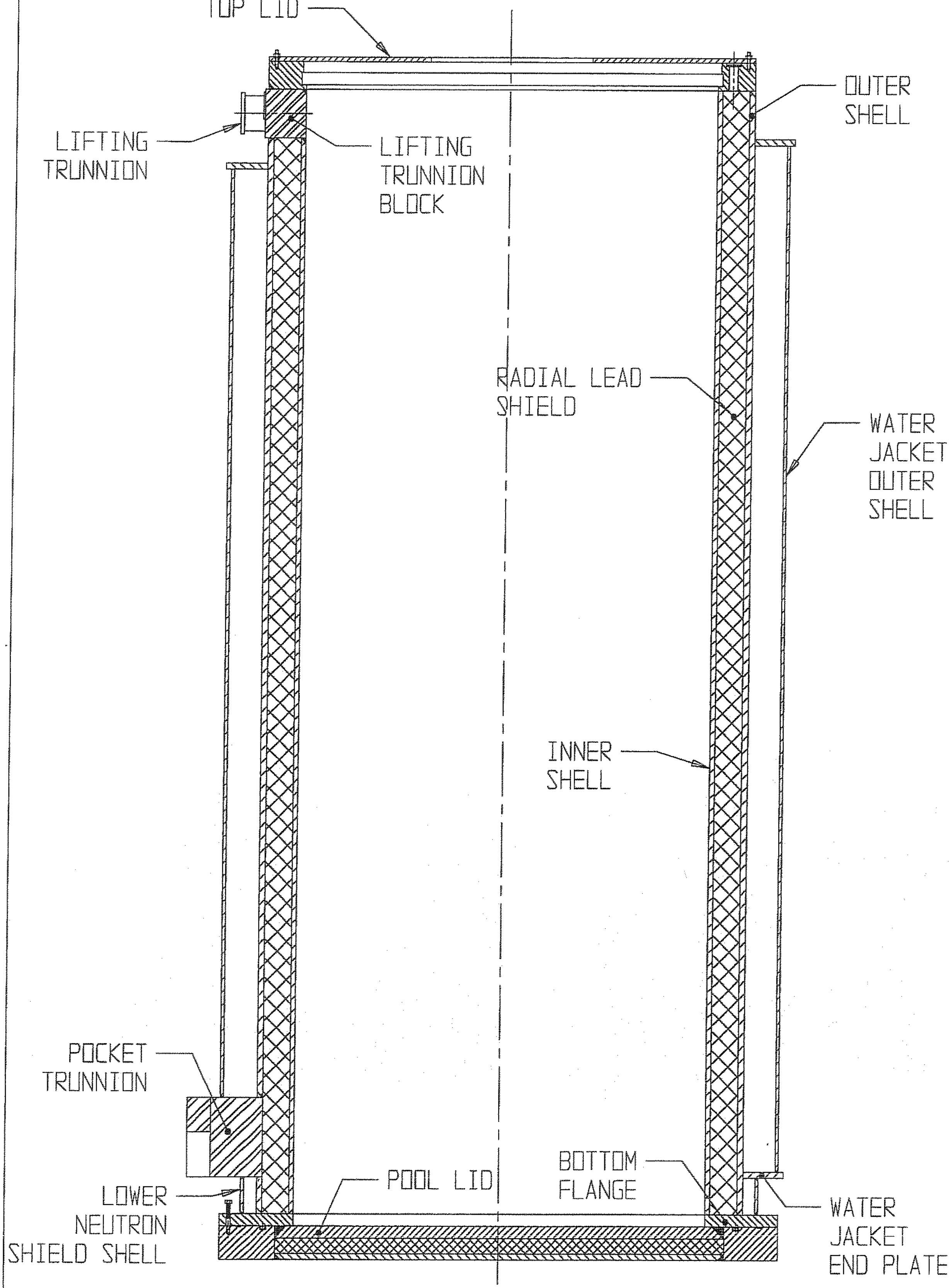

FIGURE 1.2.11; 100 HI-TRAC TRANSFER CASK WITH POOL LID CROSS SECTIONAL ELEVATION VIEW

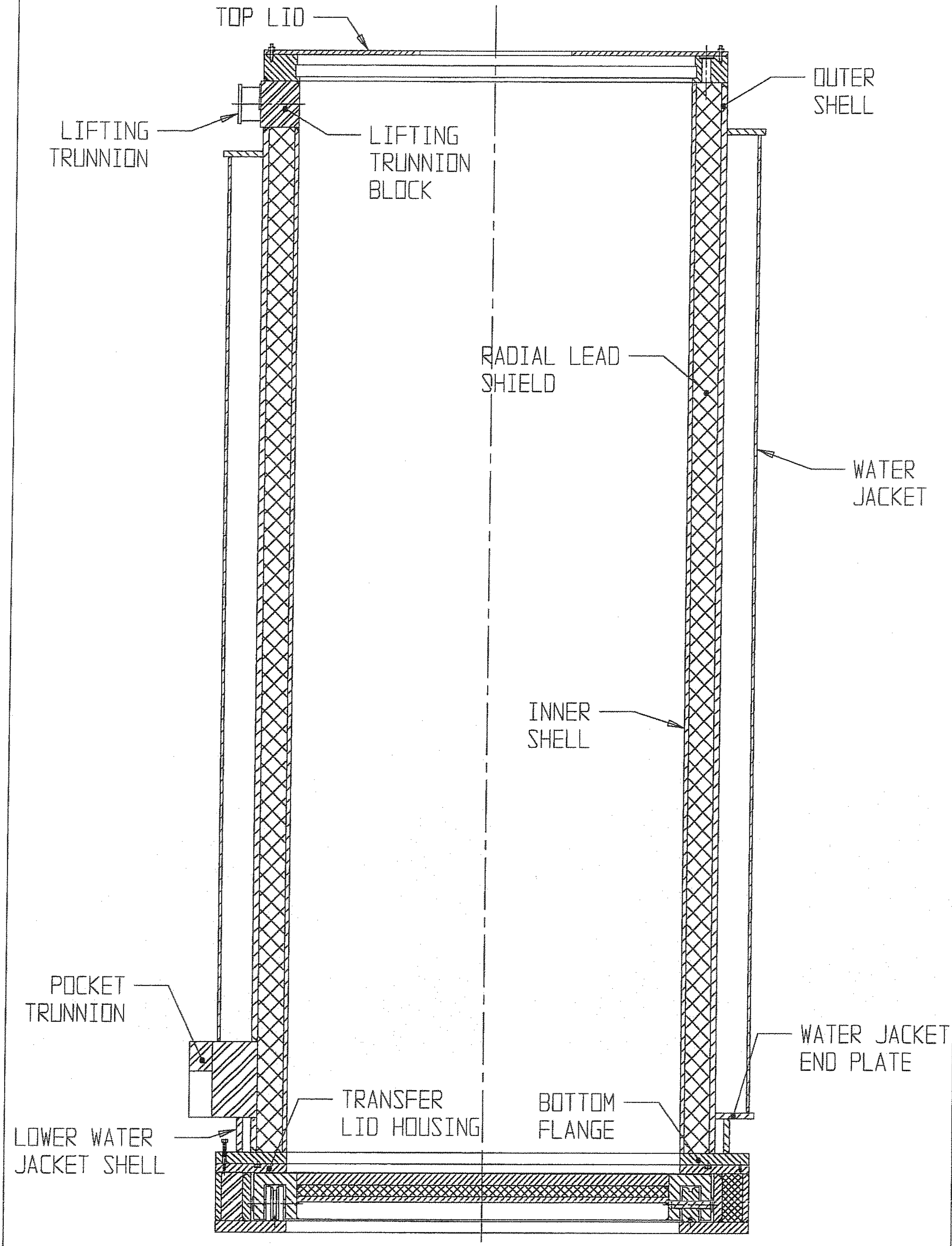

FIGURE 1.2.12; 100 TON HI-TRAC TRANSFER CASK WITH TRANSFER LID CROSS SECTIONAL ELEVATION VIEW

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FIGURE 1.2.13; DELETED

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FIGURE 1.2.14; DELETED

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FIGURE 1.2.15; DELETED

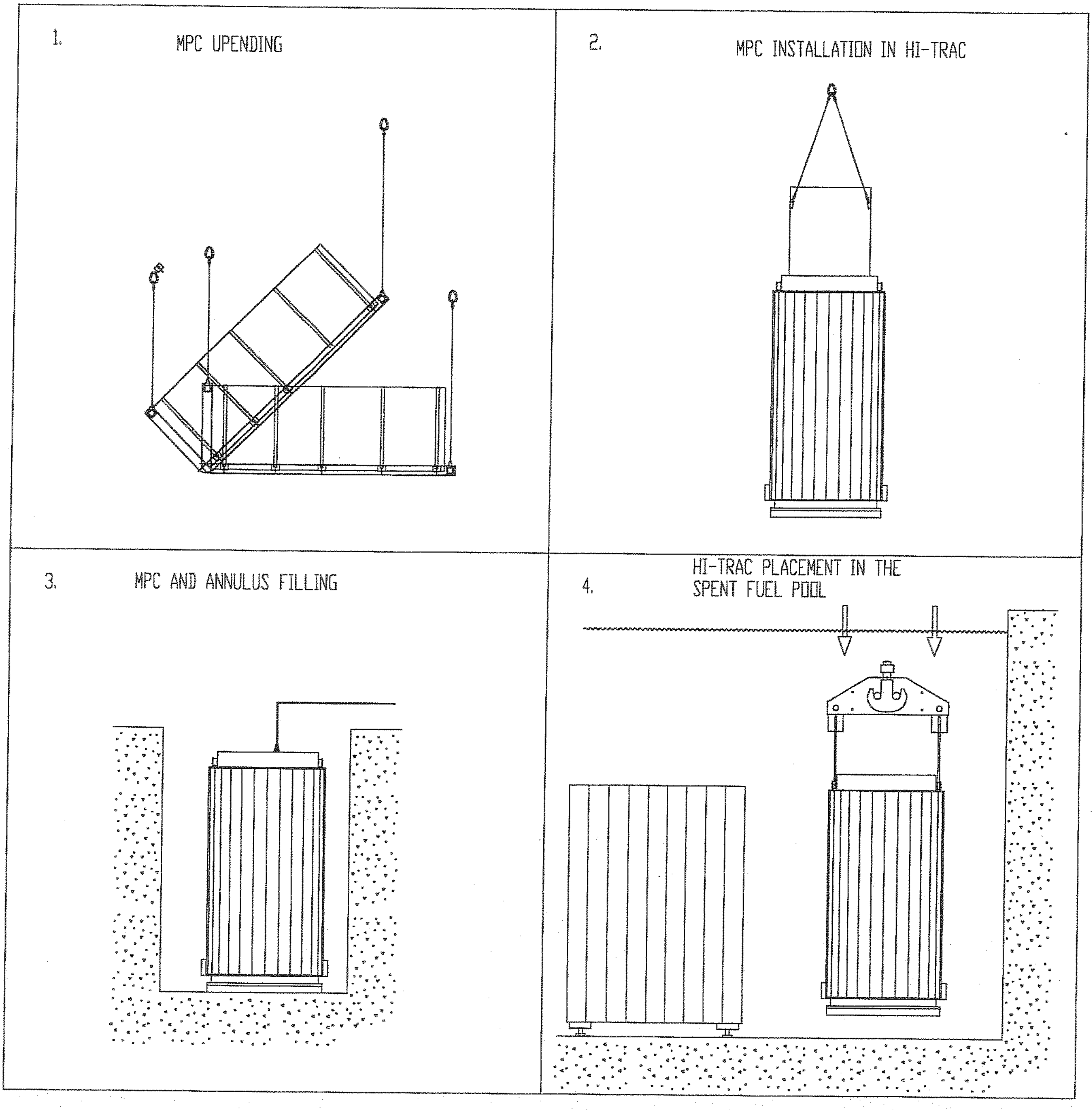


Figure 1.2.16a; Major HI-STORM 100 Loading Operations (Sheet 1 of 6)

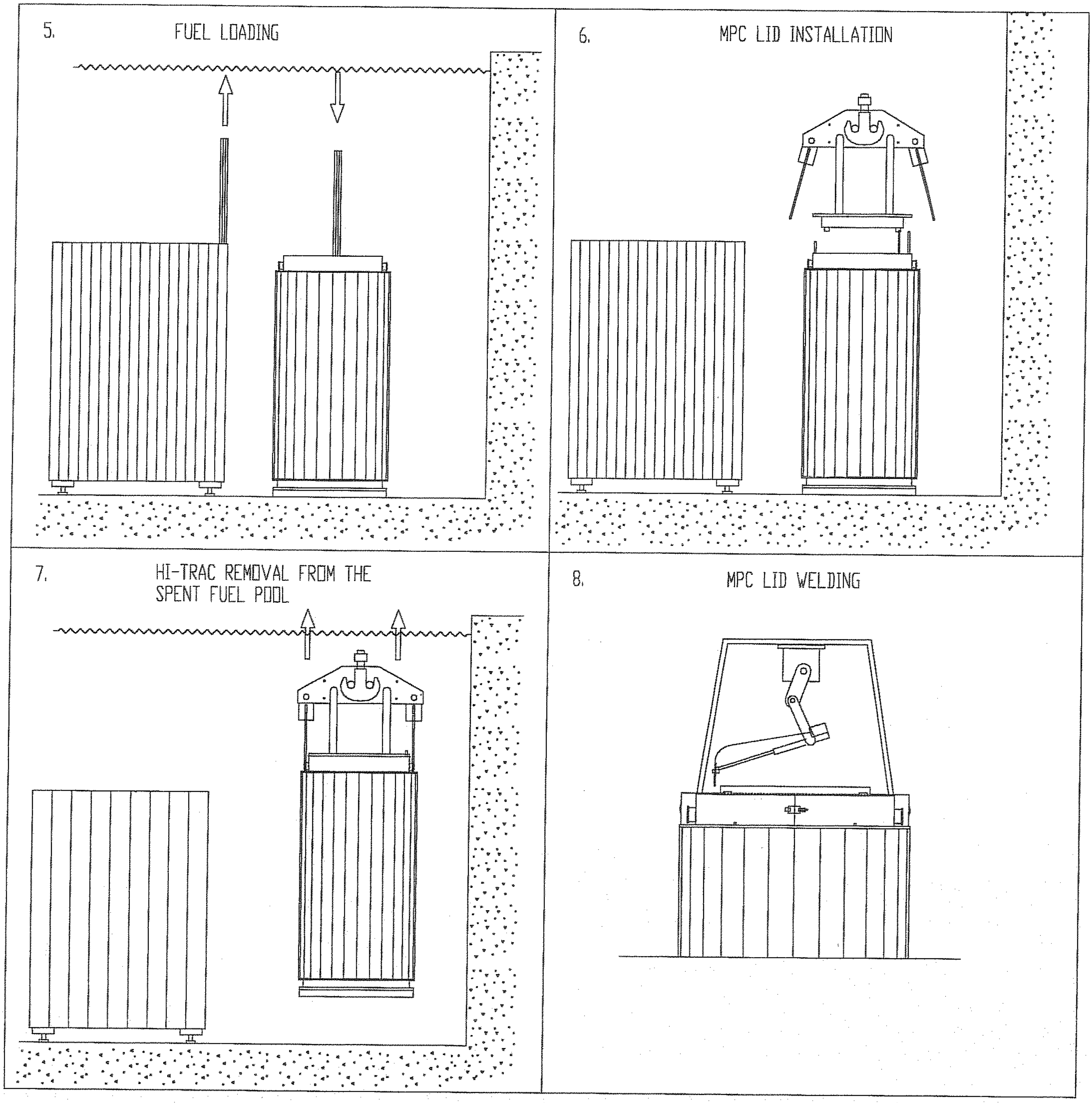


Figure 1.2.16b; Major HI-STORM 100 Loading Operations (Sheet 2 of 6)

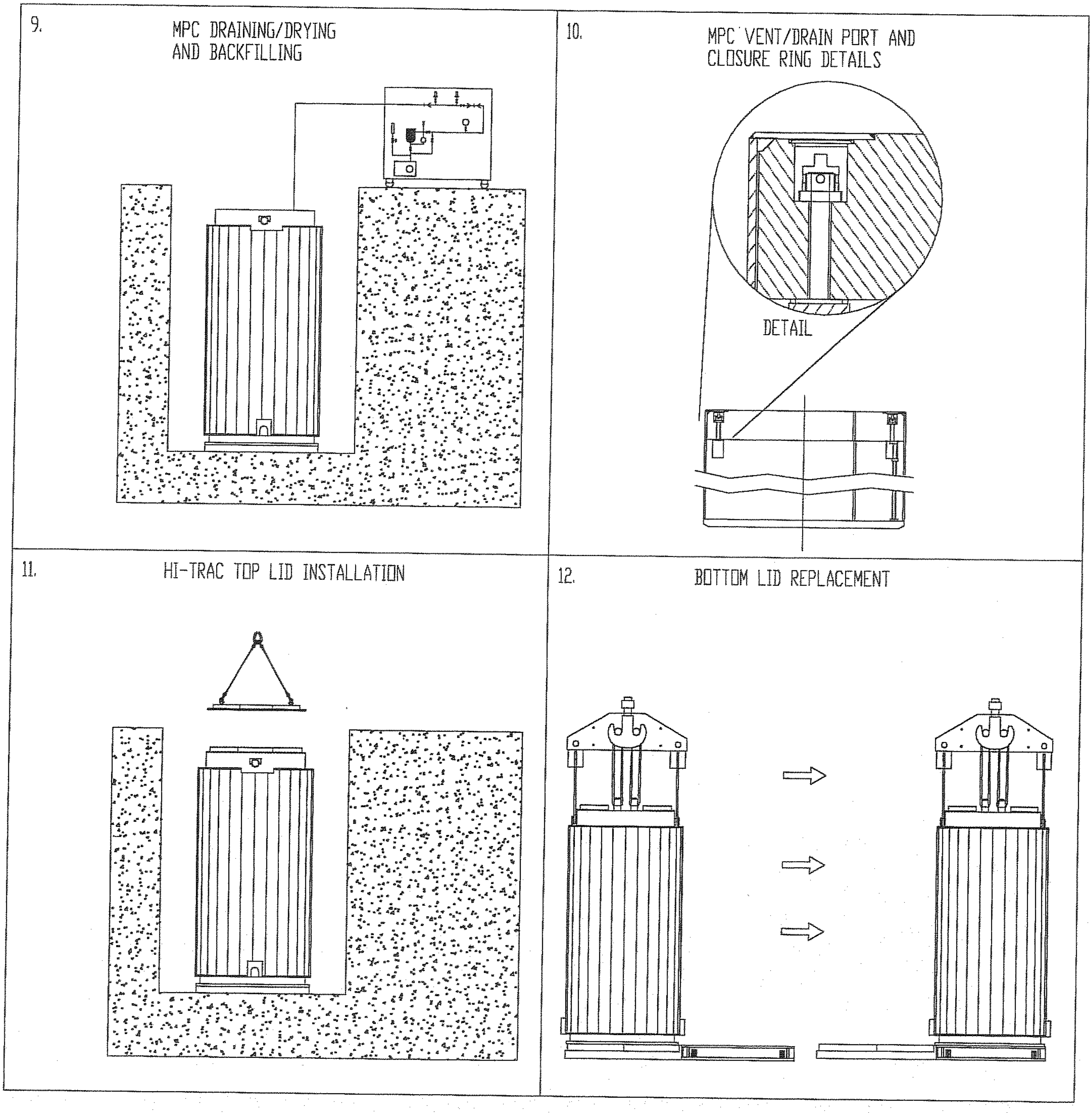


Figure 1.2.16c; Major HI-STORM 100 Loading Operations (Sheet 3 of 6)

13. SAMPLE MPC TRANSFER MODES

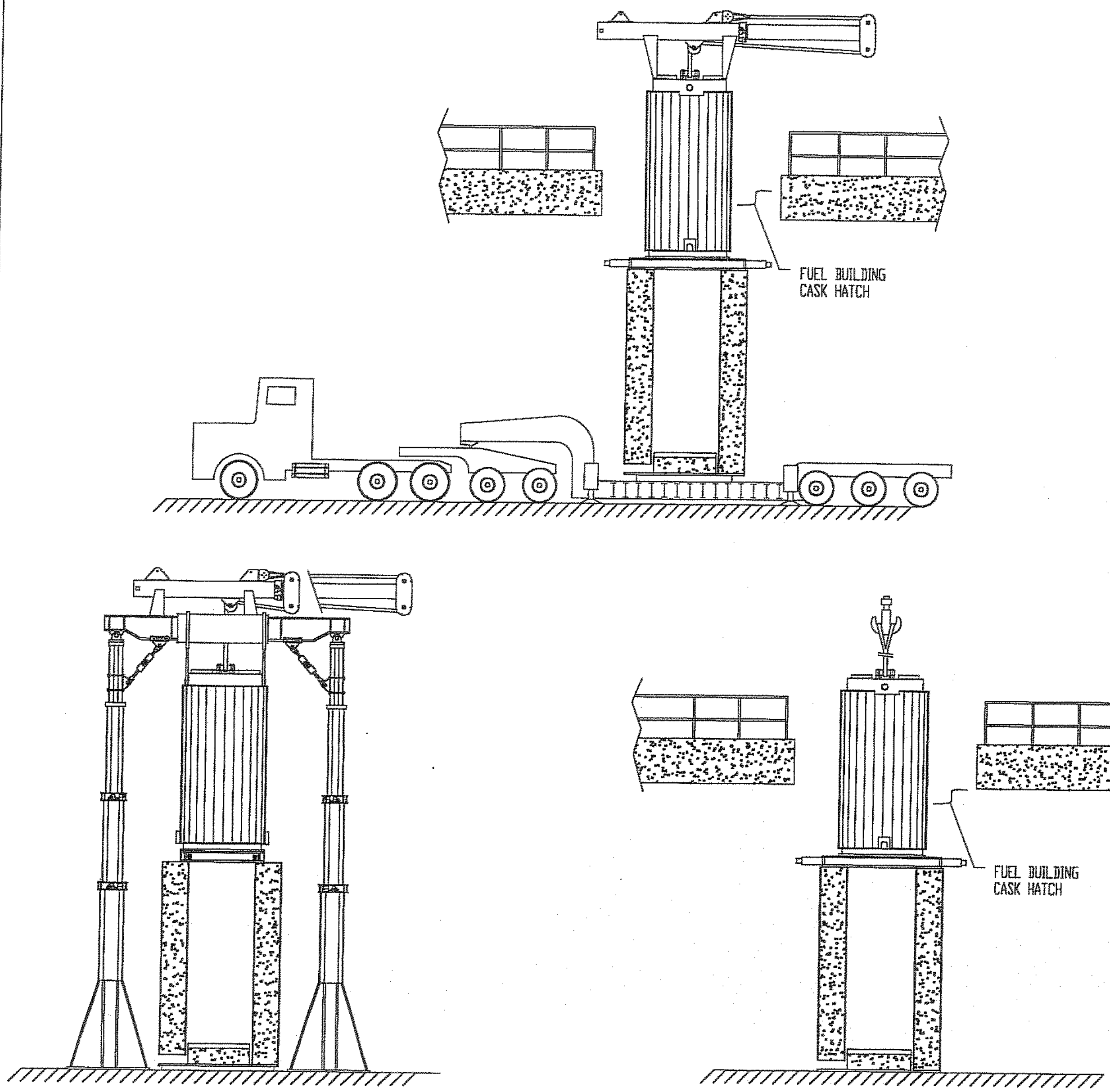


Figure 1.2.16d; Major HI-STORM 100 Loading Operations (Sheet 4 of 6)

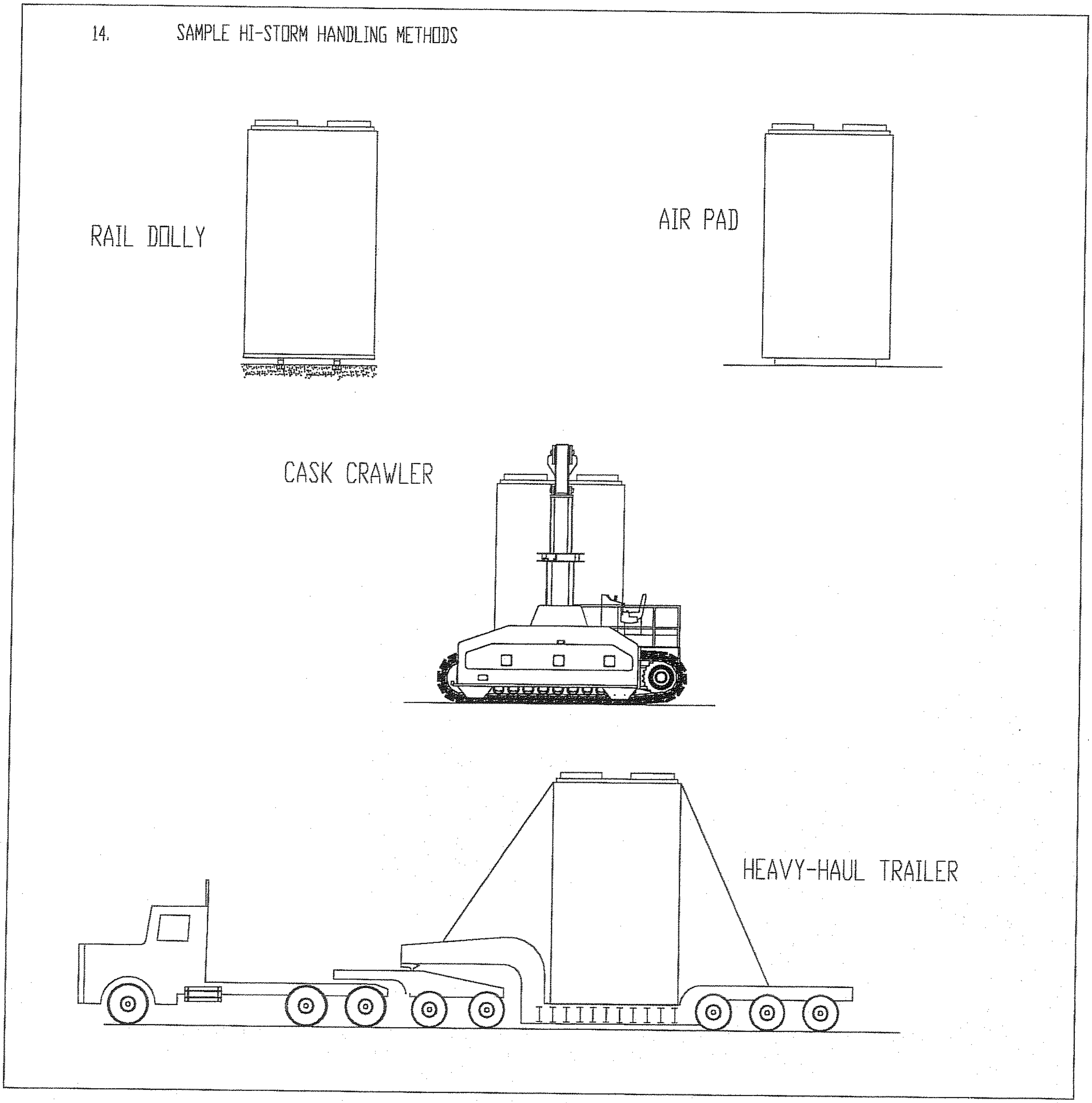


Figure 1.2.16e; Example of HI-STORM 100 Handling Options (Sheet 5 of 6)

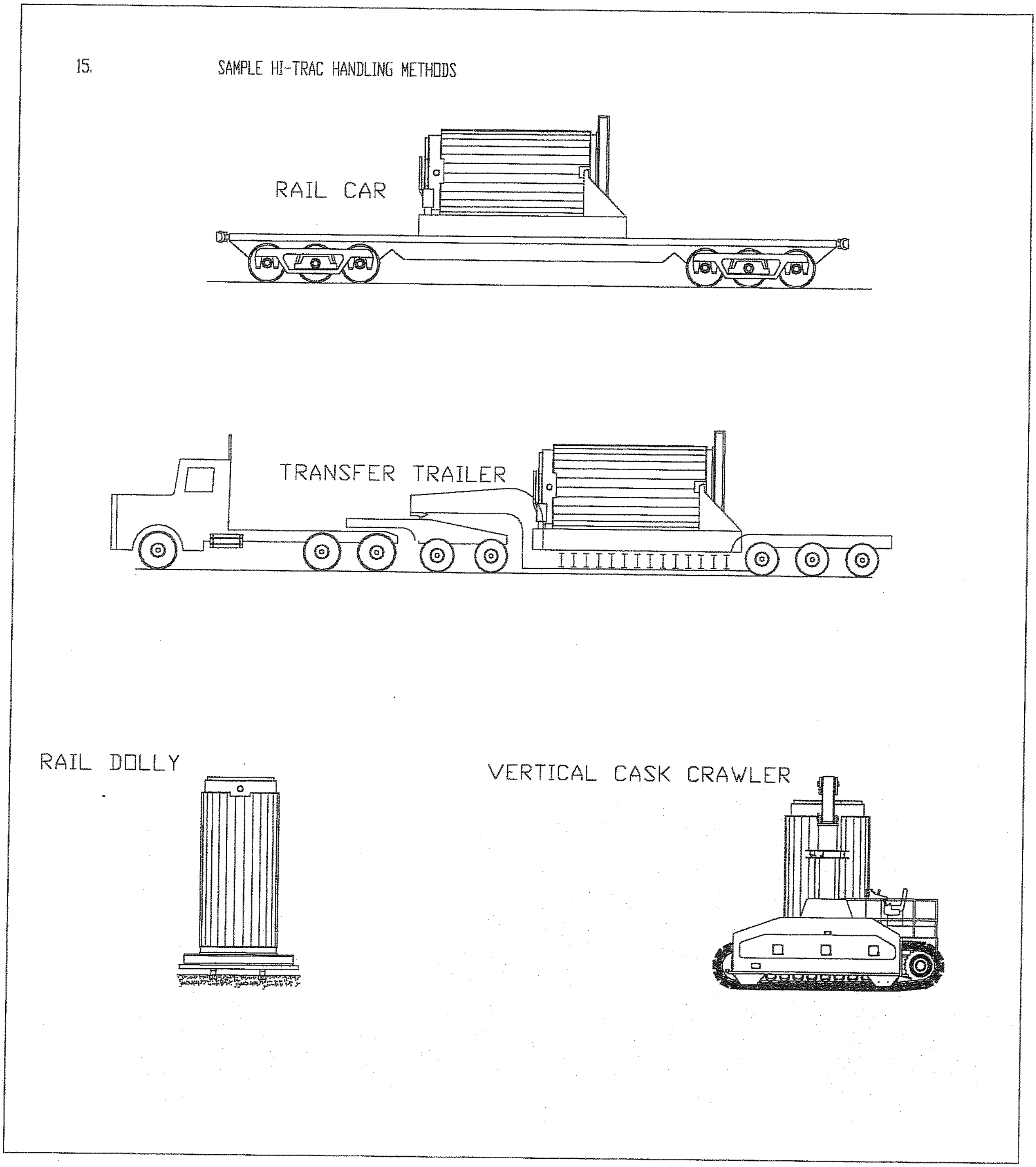


Figure 1.2.16f; Example of HI-TRAC Handling Options (Sheet 6 of 6)

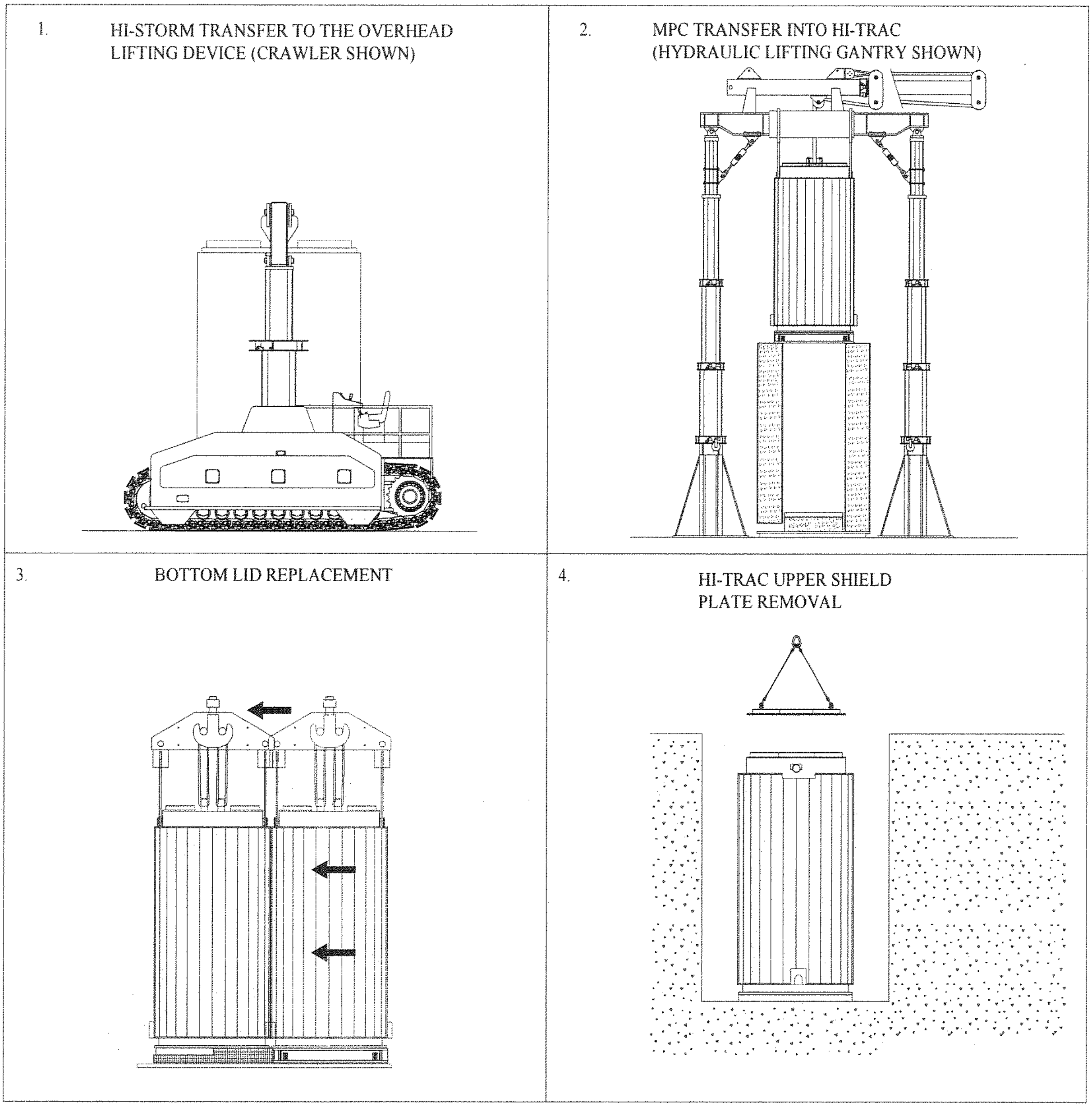


Figure 1.2.17a; Major HI-STORM 100 Unloading Operations (Sheet 1 of 4)

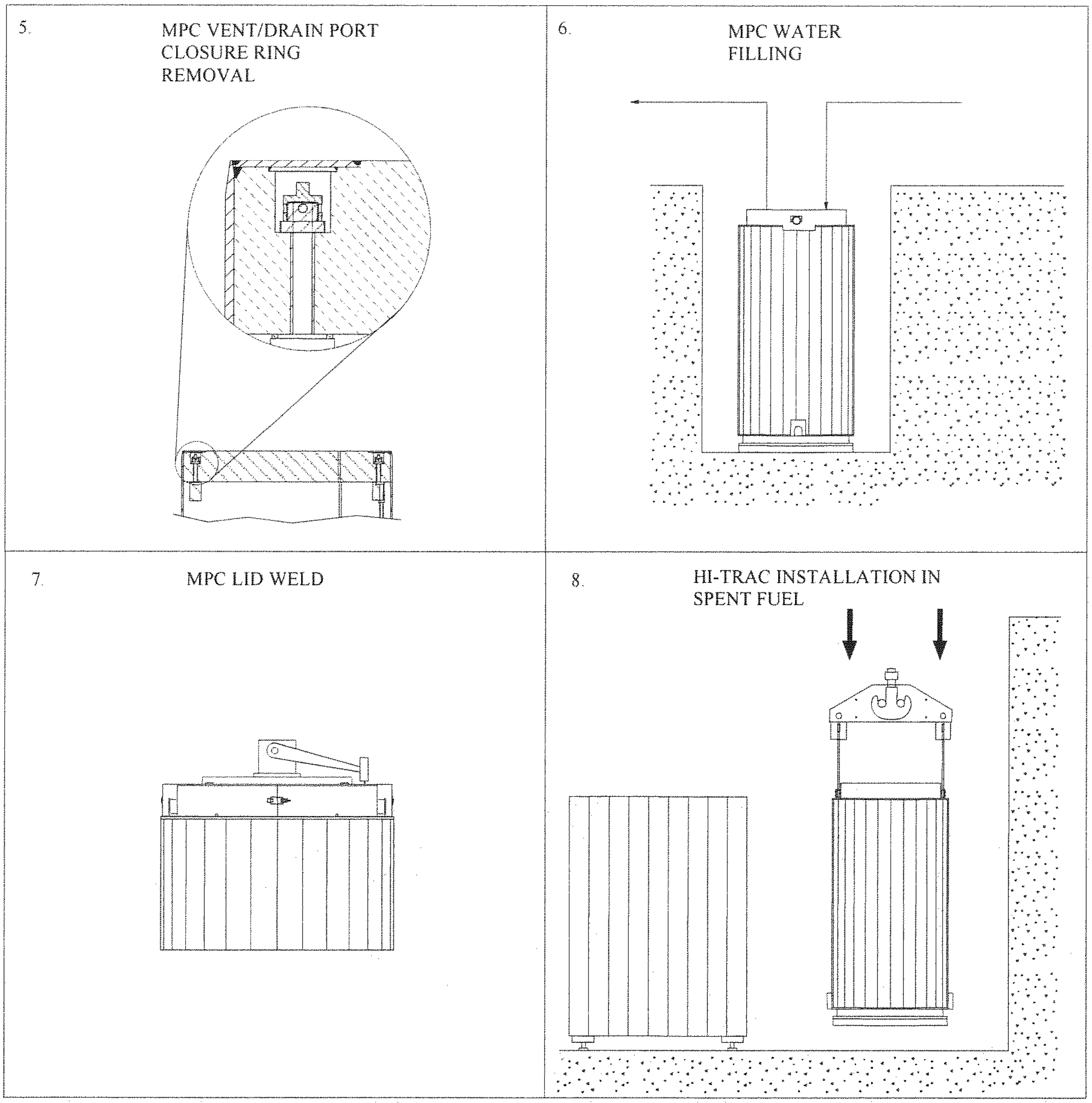


Figure 1.2.17b; Major HI-STORM 100 Unloading Operations (Sheet 2 of 4)

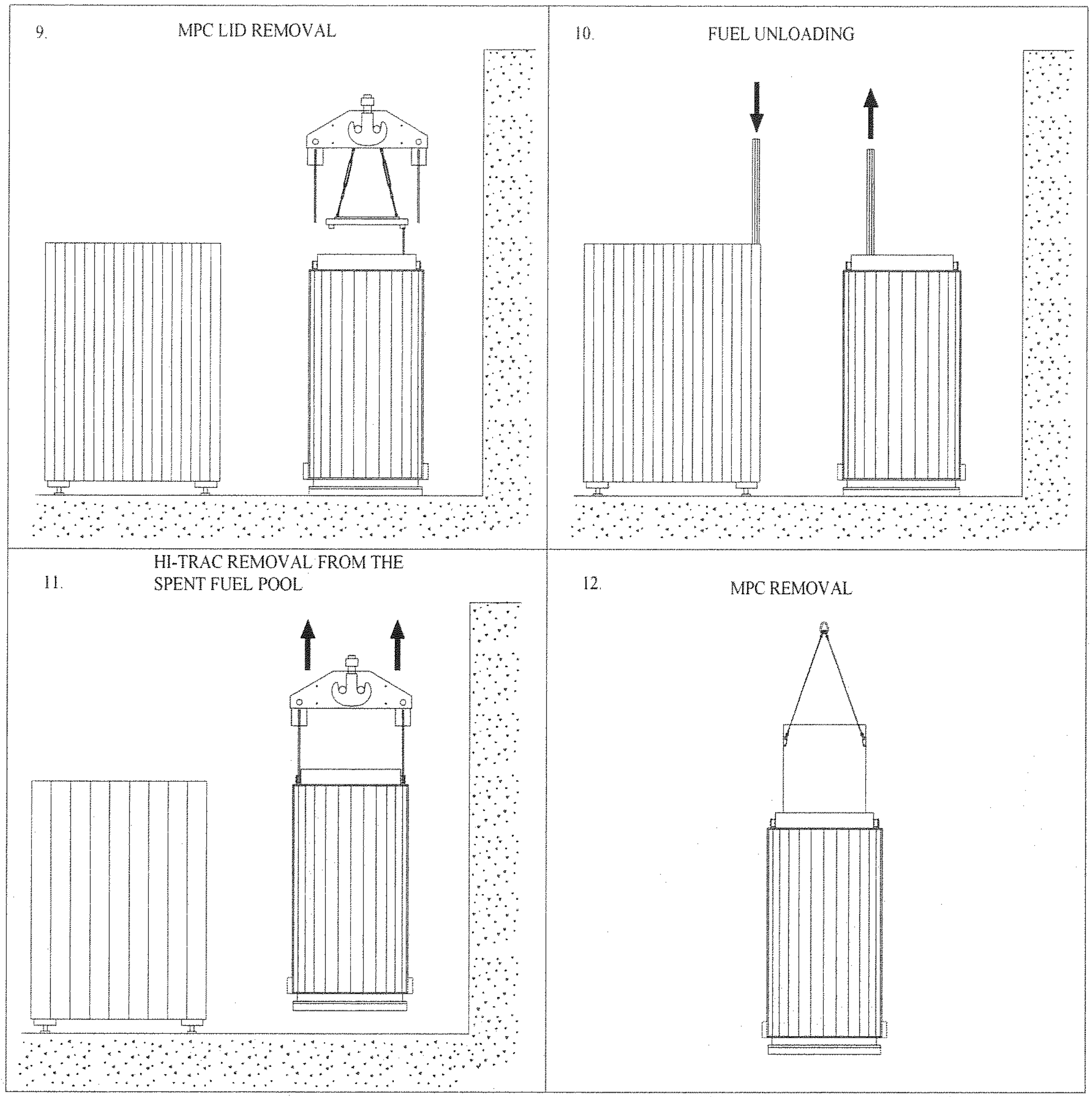


Figure 1.2.17c; Major HI-STORM 100 Unloading Operations (Sheet 3 of 4)

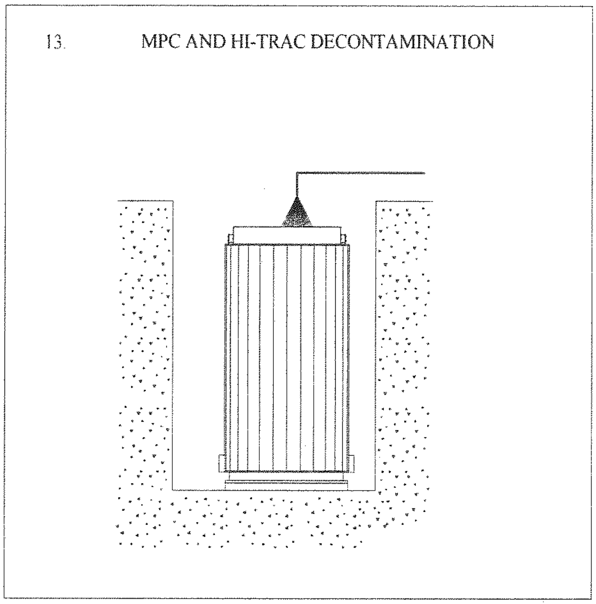


Figure 1.2.17d; Major HI-STORM 100 Unloading Operations (Sheet 4 of 4)

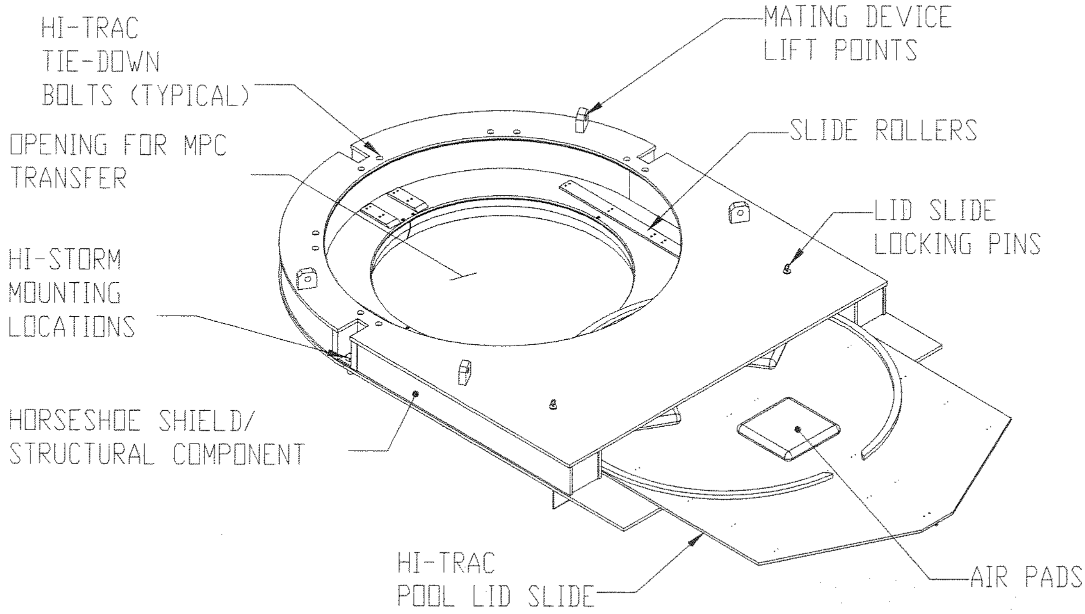


FIGURE 1.2.18; HI-STORM MATING DEVICE

1.3 IDENTIFICATION OF AGENTS AND CONTRACTORS

Holtec International is a specialty engineering company with a principal focus on spent fuel storage technologies. Holtec has carried out turnkey wet storage capacity expansions (engineering, licensing, fabrication, removal of existing racks, performance of underwater modifications, volume reduction of the old racks and hardware, installation of new racks, and commissioning of the pool for increased storage capacity) in numerous plants around the world. Over 45 plants in the U.S., Britain, Brazil, Korea, and Taiwan have utilized Holtec's wet storage technology to extend their in-pool storage capacity.

Holtec's corporate engineering consists of experts with advanced degrees (Ph.D.'s) in every discipline germane to the fuel storage technologies, namely structural mechanics, heat transfer, computational fluid dynamics, and nuclear physics. All engineering analyses for Holtec's fuel storage projects (including HI-STORM 100) are carried out in-house.

Holtec International's quality assurance program was originally developed to meet NRC requirements delineated in 10CFR50, Appendix B, and was expanded to include provisions of 10CFR71, Subpart H, and 10CFR72, Subpart G, for structures, systems, and components designated as important to safety. The Holtec quality assurance program, which satisfies all 18 criteria in 10CFR72, Subpart G, that apply to the design, fabrication, construction, testing, operation, modification, and decommissioning of structures, systems, and components important to safety is incorporated by reference into this FSAR as described in Chapter 13.

The HI-STORM 100 System is fabricated by Holtec Manufacturing Division (HMD) of Pittsburgh, Pennsylvania; formerly UST&D. HMD is an N-Stamp holder and a highly respected fabricator of nuclear components. HMD is on Holtec's Approved Vendors List (AVL) and has a quality assurance program meeting 10CFR50 Appendix B criteria. Extensive prototypical fabrication of the MPCs has been carried out at the HMD shop to resolve fixturing and tolerance issues. If another fabricator is to be used for the fabrication of any part of the HI-STORM 100 System, the proposed fabricator will be evaluated and audited in accordance with Holtec International's quality assurance program.

Construction, assembly, and operations on-site may be performed by Holtec or a licensee as the prime contractor. A licensee shall be suitably qualified and experienced to perform selected activities. Typical licensees are technically qualified and experienced in commercial nuclear power plant construction and operation activities under a quality assurance program meeting 10CFR50 Appendix B criteria.

1.4 GENERIC CASK ARRAYS

The HI-STORM 100 System is stored in a vertical configuration. The required center-to-center spacing between the modules (layout pitch) is guided by operational considerations. Tables 1.4.1 and 1.4.2 provide the nominal layout pitch information. Site-specific pitches are determined by practical operation with supporting heat transfer calculations in Chapter 4. The pitch values in Tables 1.4.1 and 1.4.2 are nominal and may be varied to suit the user's specific needs.

Table 1.4.1 provides recommended cask spacing data for array(s) of two by N casks. The pitch between adjacent rows of casks and between each adjacent column of casks are denoted by P_1 and P_2 In Table 1.4.1. There may be an unlimited number of rows. The distance between adjacent arrays of two by N casks (P3) shall be as specified in Table 1.4.1. See Figure 1.4.1 for further clarification. The pattern of required pitches and distances may be repeated for an unlimited number of columns.

For a square array of casks the pitch between adjacent casks may be in accordance with Table 1.4.2. See Figure 1.4.2 for further clarification. The data in Table 1.4.2 provide nominal values for large ISFSIs (i.e., those with hundreds of casks in a uniform layout), where access of feed air to the centrally located casks may become a matter of thermal consideration. From a thermal standpoint, regardless of the size of the ISFSI, the casks should be arrayed in such a manner that the tributary area for each cask (open ISFSI area attributable to a cask) is a minimum of 225 ft^2. Subsection 4.4.1.1.7 provides the detailed thermal evaluation of the required tributary area. For specific sites, a smaller tributary area can be utilized after appropriate thermal evaluations for the site-specific conditions are performed.

Table 1.4.1

CASK LAYOUT PITCH DATA FOR 2 BY N ARRAYS

Orientation	**Nominal Cask Pitch (ft.)**
Between adjacent rows, P1, and adjacent columns, P2	13.5
Between adjacent sets of two columns, P3	38

Table 1.4.2

CASK LAYOUT PITCH DATA FOR SQUARE ARRAYS

Orientation	**Nominal Cask Pitch (ft.)**
Between adjacent casks	18' - 8"

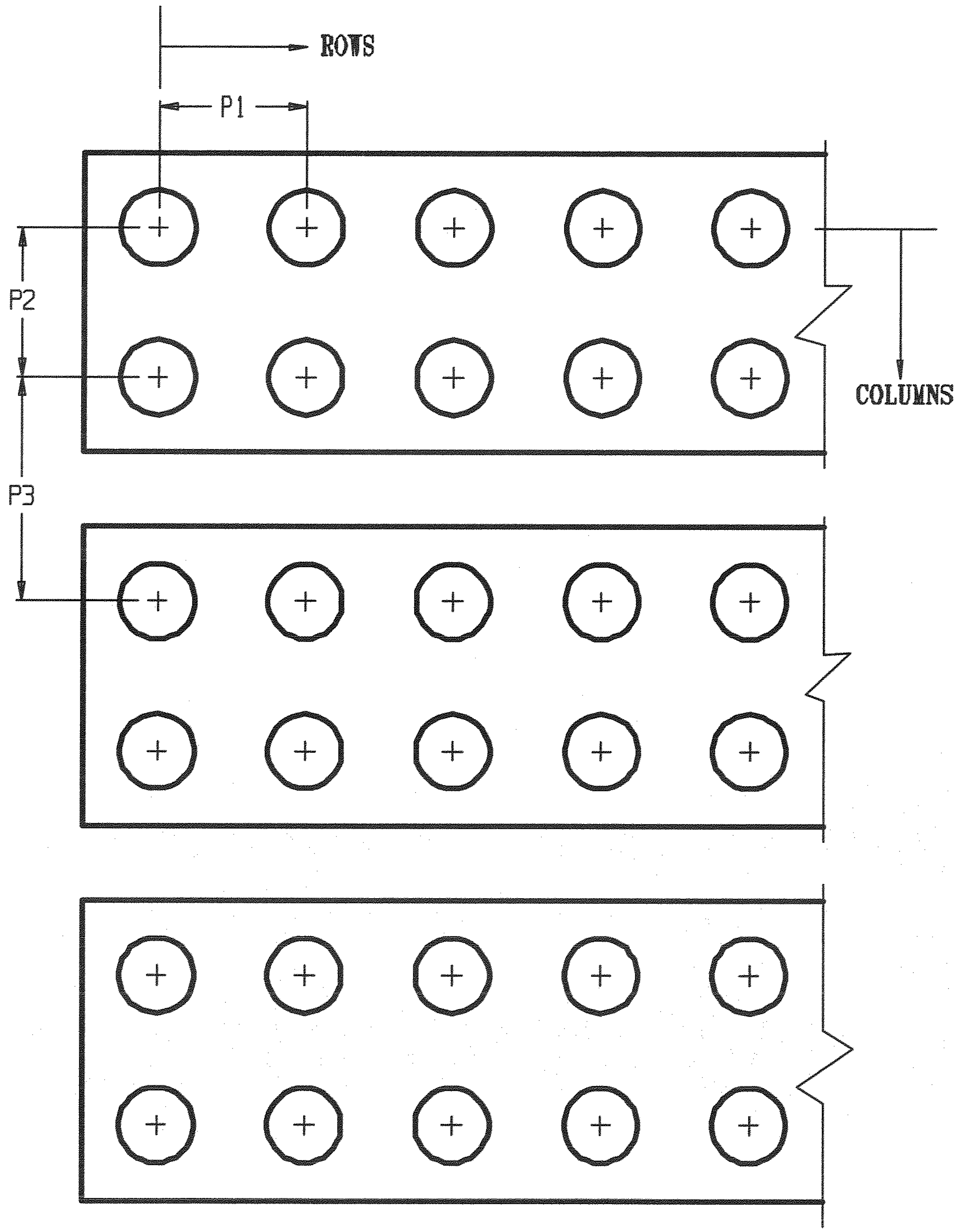


FIGURE 1.4.1; CASK LAYOUT PITCH REQUIREMENTS BASED ON 2 BY N ARRAY(S)

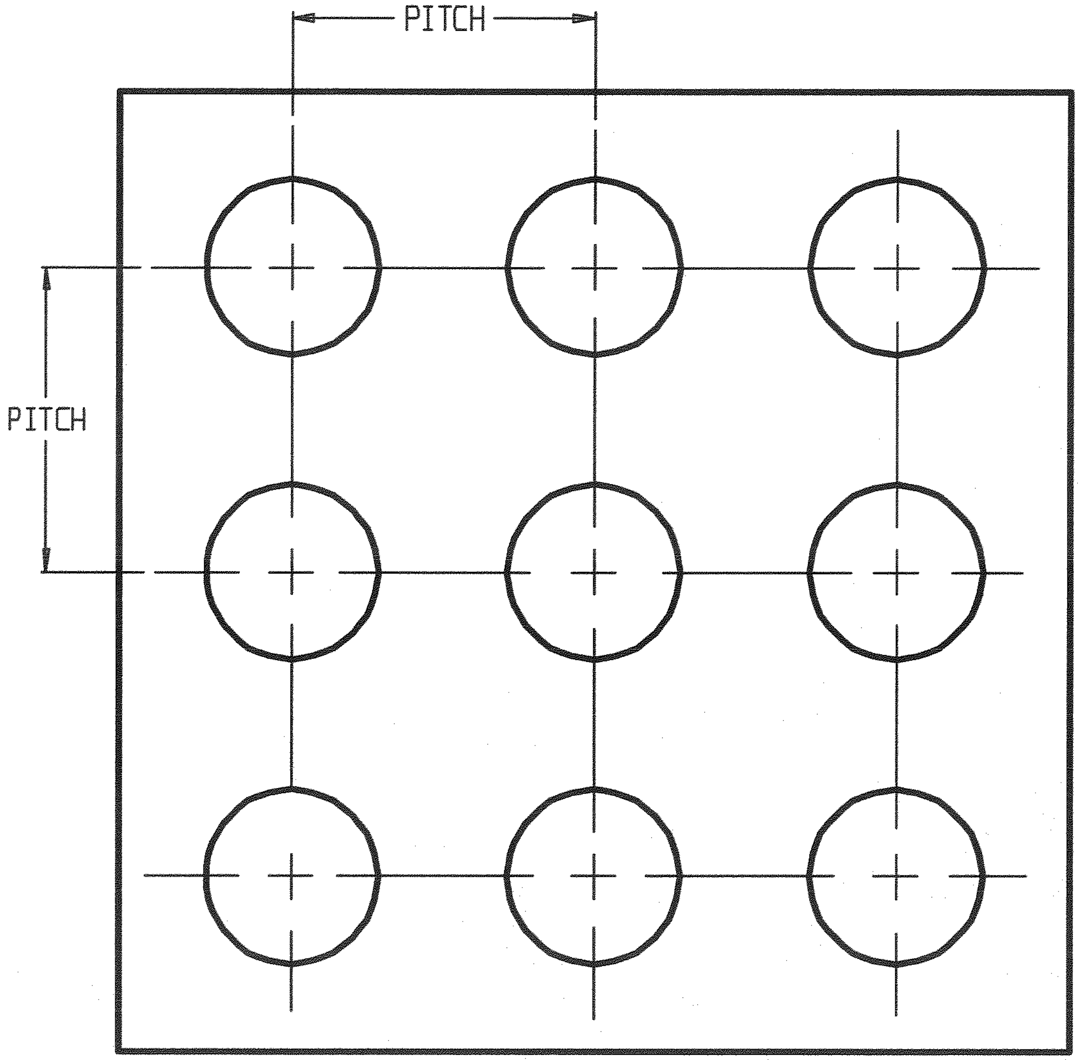


FIGURE 1.4.2; CASK LAYOUT PITCH REQUIREMENTS BASED ON A SQUARE ARRAY

1.5 DRAWINGS

The following HI-STORM 100 System drawings and bills of materials are provided on subsequent pages in this subsection:

Drawing Number/Sheet	Description	Rev.
3923	MPC Enclosure Vessel	17
3925	MPC-24E/EF Fuel Basket Assembly	7
3926	MPC-24 Fuel Basket Assembly	9
3927	MPC-32 Fuel Basket Assembly	13
3928	MPC-68/68F/68FF Basket Assembly	11
1495 Sht 1/6	HI-STORM 100 Assembly	13
1495 Sht 2/6	Cross Section "Z" - "Z" View of HI-STORM	18
1495 Sht 3/6	Section "Y" - "Y" of HI-STORM	12
1495 Sht 4/6	Section "X" -"X" of HI-STORM	13
1495 Sht 5/6	Section "W" -"W" of HI-STORM	15
1561 Sht 1/6	View "A" -"A" of HI-STORM	11
1561 Sht 2/6	Detail "B" of HI-STORM	15
1561 Sht 3/6	Detail of Air Inlet of HI-STORM	11
1561 Sht 4/6	Detail of Air Outlet of HI-STORM	12
3669	HI-STORM 100S Assembly	16
1880 Sht 1/10	125 Ton HI-TRAC Outline with Pool Lid	9
1880 Sht 2/10	125 Ton HI-TRAC Body Sectioned Elevation	10
1880 Sht 3/10	125 Ton HI-TRAC Body Sectioned Elevation "B" - "B"	9
1880 Sht 4/10	125 Ton Transfer Cask Detail of Bottom Flange	10
1880 Sht 5/10	125 Ton Transfer Cask Detail of Pool Lid	10
1880 Sht 6/10	125 Ton Transfer Cask Detail of Top Flange	10
1880 Sht 7/10	125 Ton Transfer Cask Detail of Top Lid	9
1880 Sht 8/10	125 Ton Transfer Cask View "Y" - "Y"	9
1880 Sht 9/10	125 Ton Transfer Cask Lifting Trunnion and Locking Pad	7
1880 Sht 10/10	125 Ton Transfer Cask View "Z" - "Z"	9
1928 Sht 1/2	125 Ton HI-TRAC Transfer Lid Housing Detail	11
1928 Sht 2/2	125 Ton HI-TRAC Transfer Lid Door Detail	10
2145 Sht 1/10	100 Ton HI-TRAC Outline with Pool Lid	8
2145 Sht 2/10	100 Ton HI-TRAC Body Sectioned Elevation	8
2145 Sht 3/10	100 Ton HI-TRAC Body Sectioned Elevation 'B-B'	8
2145 Sht 4/10	100 Ton HI-TRAC Detail of Bottom Flange	7
2145 Sht 5/10	100 Ton HI-TRAC Detail of Pool Lid	6
2145 Sht 6/10	100 Ton HI-TRAC Detail of Top Flange	8
2145 Sht 7/10	100 Ton HI-TRAC Detail of Top Lid	8
2145 Sht 8/10	100 Ton HI-TRAC View Y-Y	8
2145 Sht 9/10	100 Ton HI-TRAC Lifting Trunnions and Locking Pad	5
2145 Sht 10/10	100 Ton HI-TRAC View Z-Z	7

Drawing Number/Sheet	Description	Rev.
2152 Sht 1/2	100 Ton HI-TRAC Transfer Lid Housing Detail	10
2152 Sht 2/2	100 Ton HI-TRAC Transfer Lid Door Detail	8
3187	Lug and Anchoring Detail for HI-STORM 100A	2
BM-1575, Sht 1/2	Bill-of-Materials HI-STORM 100 Storage Overpack	19
BM-1575, Sht 2/2	Bill-of-Materials HI-STORM 100 Storage Overpack	19
BM-1880, Sht 1/2	Bill-of-Material for 125 Ton HI-TRAC	9
BM-1880, Sht 2/2	Bill-of-Material for 125 Ton HI-TRAC	7
BM-1928, Sht 1/1	Bill-of-Material for 125 Ton HI-TRAC Transfer Lid	10
BM-2145 Sht 1/2	Bill-of-Material for 100 Ton HI-TRAC	6
BM-2145 Sht 2/2	Bill-of-Material for 100 Ton HI-TRAC	5
BM-2152 Sht 1/1	Bill-of-Material for 100 Ton HI-TRAC Transfer Lid	8
3768	125 Ton HI-TRAC 125D Assembly	7
4116	HI-STORM 100S Version B	18
4128	100 Ton HI-TRAC 100D Assembly	5
4724	HI-TRAC 100D Version IP1 Assembly	0

CLIENT GENERAL

LICENSING DRAWING PACKAGE COVER SHEET

PROJECT NO. 5014	P.O. NO. N/A
DRAWING PACKAGE I.D. 3923	TOTAL SHEETS 7

LICENSING DRAWING PACKAGE CONTENTS:

SHEET	DESCRIPTION
1	COVER SHEET
2	MPC ENCLOSURE VESSEL GENERAL ARRANGEMENT
3	MPC ENCLOSURE VESSEL ELEVATION DETAILS
4	MPC ENCLOSURE VESSEL LID DETAILS
5	MPC FUEL SPACER DETAILS
6	MPC SERIAL #1021-040 ENCLOSURE VESSEL LID DETAILS
7	MPC ENCLOSURE VESSEL LID DETAILS (SMDR 1269 / 1364)

REVISION LOG

REV	AFFECTED DRAWING SHEET NUMBERS	SUMMARY OF CHANGES/ AFFECTED ECOs	PREPARED BY	APPROVAL DATE	VIR# †
11	ALL	1021-61, REV. 0, 1022-57, REV. 0, 1023-30, REV. 0	S.L.C	9/27/04	89001
12	SHEETS 4 & 6	ECO 5014-117, REV. 0	JJB	04/11/05	79255
13	SHEET 5	ECO 1023-30, REV. 1	S.L.C	04/27/05	67405
14	SHEET 6	ECO 1021-71, REV. 0	JJB	06/17/05	47815
15	SHEETS 3 & 5	ECO 1023-42, REV. 0	S.L.C	04/07/06	78291
16	SHEETS 1, 3, 4, & 7	ECO 1021-77, REV. 0, 1021-83, REV. 0	S.L.C	10/05/06	82938
17	SHEETS 1 & 3	ECO 1021-94, REV. 0, 1022-73, REV. 0, 1023-51, REV. 0	S.L.C	02/06/08	96115

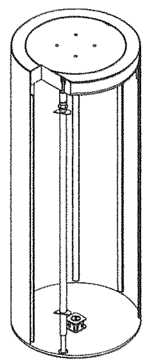
† THE VALIDATION IDENTIFICATION RECORD (VIR) NUMBER IS A COMPUTER GENERATED RANDOM NUMBER WHICH CONFIRMS THAT ALL APPROPRIATE REVIEWS OF THIS DRAWING ARE DOCUMENTED IN COMPANY'S NETWORK.

GENERAL NOTES:

1. THE EQUIPMENT DESIGN DOCUMENTED IN THIS DRAWING PACKAGE HAS BEEN CONFIRMED BY HOLTEC INTERNATIONAL TO COMPLY WITH THE SAFETY ANALYSES DESCRIBED IN THE SAFETY ANALYSIS REPORT.
2. DIMENSIONAL TOLERANCES ON THIS DRAWING ARE PROVIDED TO ENSURE THAT THE EQUIPMENT DESIGN IS CONSISTENT WITH THE SUPPORTING ANALYSES. HARDWARE IS FABRICATED IN ACCORDANCE WITH THE DESIGN DRAWINGS, WHICH MAY HAVE MORE RESTRICTIVE TOLERANCES, TO ENSURE COMPONENT FIT-UP. DO NOT USE WORST-CASE TOLERANCE STACK-UP FROM THIS DRAWING TO DETERMINE COMPONENT FIT-UP.
3. THE REVISION LEVEL OF EACH INDIVIDUAL SHEET IN THIS PACKAGE IS THE SAME AS THE REVISION LEVEL OF THIS COVER SHEET. A REVISION TO ANY SHEET(S) IN THIS PACKAGE REQUIRES UPDATING OF REVISION NUMBERS OF ALL SHEETS TO THE NEXT REVISION NUMBER.
4. THE ASME BOILER AND PRESSURE VESSEL CODE (ASME CODE), 1995 EDITION WITH ADDENDA THROUGH 1997 IS THE GOVERNING CODE FOR THE MPC ENCLOSURE VESSEL, WITH CERTAIN APPROVED ALTERNATIVES AS LISTED IN SAR TABLE 1.3.2 (TRANSPORTATION) AND FSAR TABLE 2.2.15 (STORAGE). THE MPC ENCLOSURE VESSEL IS CONSTRUCTED IN ACCORDANCE WITH ASME SECTION III, SUBSECTION NB WITH CERTAIN APPROVED CODE ALTERNATIVES AS DESCRIBED IN THE SAR (TRANSPORTATION) AND FSAR (STORAGE). NEW OR REVISED ASME CODE ALTERNATIVES REQUIRE PRIOR NRC APPROVAL BEFORE IMPLEMENTATION.
5. ALL MPC ENCLOSURE VESSEL STRUCTURAL MATERIALS ARE "ALLOY X" UNLESS OTHERWISE NOTED. ALLOY X IS ANY OF THE FOLLOWING STAINLESS STEEL TYPES: 316, 316LN, 304, AND 304LN. ALLOY X MATERIAL MUST COMPLY WITH ASME SECTION II, PART A. WELD MATERIAL COMPLIES WITH ASME SECTION II, PART C. MPC ENCLOSURE VESSEL WALL (I.E. CYCLINDER SHELL) WILL BE FABRICATED OF PIECES MADE FROM THE SAME TYPE OF STAINLESS STEEL.
6. ALL WELDS REQUIRE VISUAL EXAMINATION (VT). ADDITIONAL NDE INSPECTIONS ARE NOTED ON THE DRAWING AS REQUIRED. NDE TECHNIQUES AND ACCEPTANCE CRITERIA ARE GOVERNED BY ASME SECTIONS V AND III, RESPECTIVELY, AS CLARIFIED IN THE APPLICABLE SAFETY ANALYSIS REPORTS.
7. UNLESS OTHERWISE NOTED, FULL PENETRATION WELDS MAY BE MADE FROM EITHER SIDE OF A COMPONENT.
8. FUEL BASKET SUPPORTS ARE ILLUSTRATIVE. ACTUAL FUEL BASKET SUPPORT ARRANGEMENTS ARE SHOWN ON THE INDIVIDUAL FUEL BASKET DRAWINGS.
9. DIFFERENCES BETWEEN THE GENERIC MPC ENCLOSURE VESSEL AND THE TROJAN PLANT MPC ENCLOSURE VESSEL ARE SPECIFICALLY NOTED (FOR PART 71 USE ONLY).
10. ALL WELD SIZES ARE MINIMUMS. LARGER WELDS ARE PERMITTED. LOCAL AREAS OF UNDERSIZE WELDS ARE ACCEPTABLE WITHIN THE LIMITS SPECIFIED IN THE ASME CODE, AS APPLICABLE.

NOTES CON'T:

11. THIS COMPONENT IS CLASSIFIED AS ITS-A BASED ON THE HIGHEST CLASSIFICATION OF ANY SUBCOMPONENT. SUBCOMPONENT CLASSIFICATIONS ARE PROVIDED IN SAR TABLE 1.3.3 (TRANSPORTATION) AND FSAR TABLE 2.2.6 (STORAGE).
12. DELETED
13. LOCAL GRINDING OF THE MPC SHELL SHALL NOT RESULT IN GREATER THAN 10% LOSS IN BASE METAL THICKNESS OVER ANY AREA WHICH EXCEEDS 4 INCHES IN THE LONGITUDINAL OR CIRCUMFERENTIAL DIRECTION. FOR THE WELD AREA AND ADJACENT BASE METAL, AN ADDITIONAL ALLOWANCE OF 0.02" LOSS IN NOMINAL BASE METAL THICKNESS IS ALLOWED OVER THE ENTIRE LENGTH OF THE WELD. THE SUM OF ALL AREAS OF LOCAL METAL LOSS SHALL NOT EXCEED 10% OF THE OVERALL INSIDE SURFACE AREA OF THE MPC SHELL. FINAL THICKNESSES IN LOCAL AREAS OF GRINDING SHALL BE CONFIRMED BY UT EXAMINATION, AS APPROPRIATE.
14. FOR NON-CODE WELDS, THE PROVISIONS OF EITHER ASME IX OR AWS MAY BE FOLLOWED.
15. TOLERANCES FOR THICKNESS OF ASME CODE MPC ENCLOSURE VESSEL MATERIAL ARE SPECIFIED IN ASME SECTION II.
16. REFER TO THE COMPONENT COMPLETION RECORD (CCR) FOR THE COMPLETE LIST OF APPROVED DESIGN DEVIATIONS FOR EACH INDIVIDUAL SERIAL NUMBER.
17. DIMENSIONS NOTED AS NOMINAL ("NOM.") IN THIS DRAWING ARE FOR INFORMATION ONLY, IN ORDER TO INDICATE THE GENERAL SIZE OF THE COMPONENT OR PART. NOMINAL DIMENSIONS HAVE NO SPECIFIC TOLERANCE, BUT ARE MET THROUGH FABRICATION IN ACCORDANCE WITH OTHER DIMENSIONS THAT ARE TOLERANCED AND INSPECTED. NOMINAL DIMENSIONS ARE NOT SPECIFICALLY VERIFIED DURING THE FABRICATION PROCESS.
18. 17 DIFFERENCES BETWEEN THE GENERIC MPC ENCLOSURE VESSEL AND THE IP1 MPC ENCLOSURE VESSEL ARE SPECIFICALLY NOTED (FOR PART 72 USE ONLY).



MPC ENCLOSURE VESSEL
ISOMETRIC VIEW

HOLTEC INTERNATIONAL
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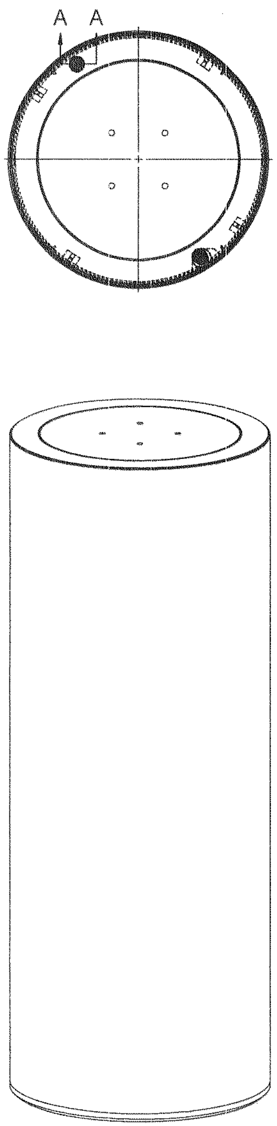
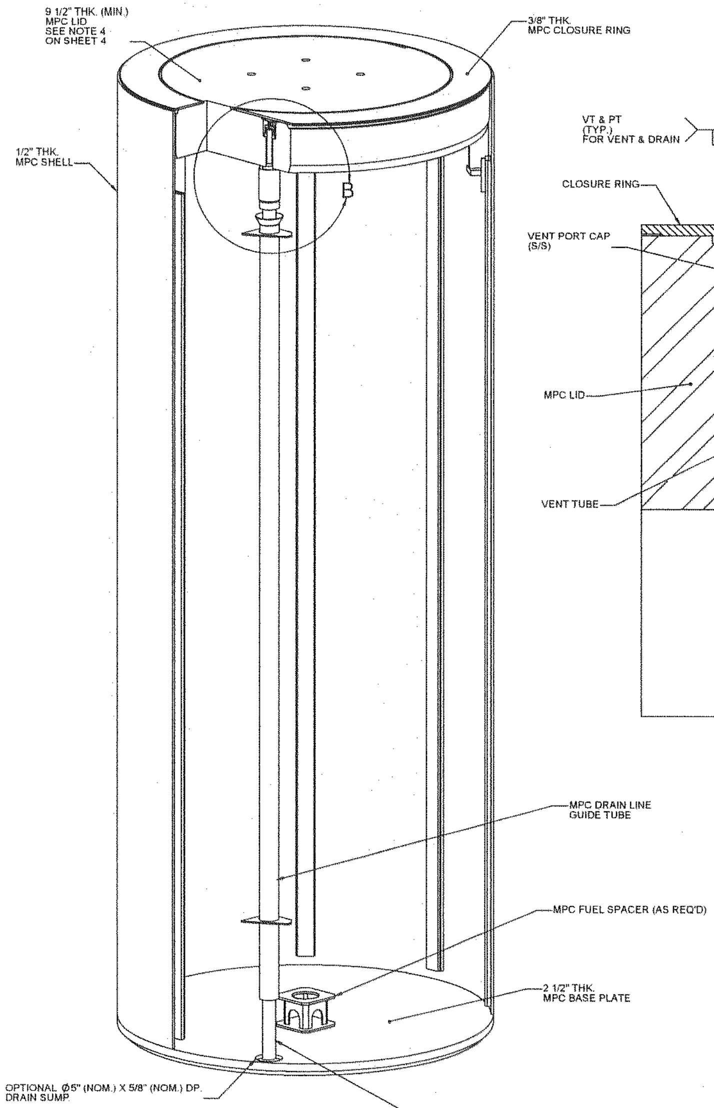
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

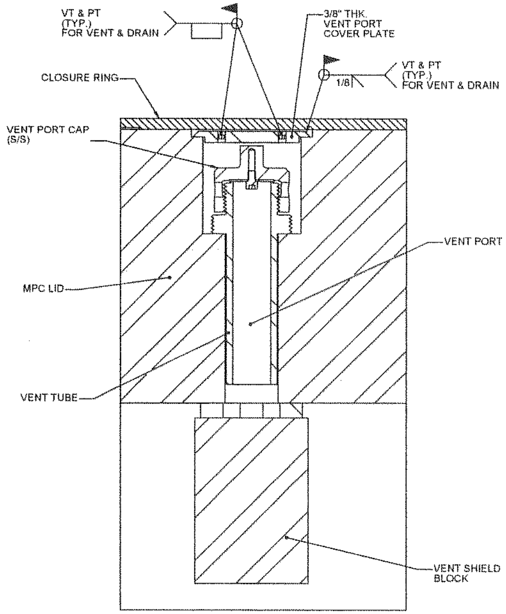
CLIENT	GENERAL		
DESCRIPTION	MPC ENCLOSURE VESSEL		
PROJECT NO. 5014	DRAWING NO. 3923	SHEET 1	TOTAL SHEETS 7
P.O. NO. N/A	FILE PATH N:\DRAWINGS\5014\3923		



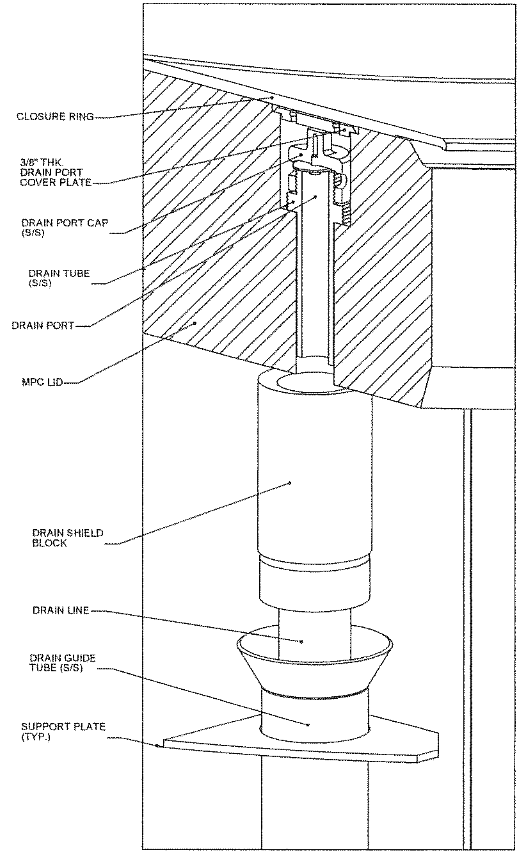
EXTERNAL VIEW



CUT AWAY VIEW



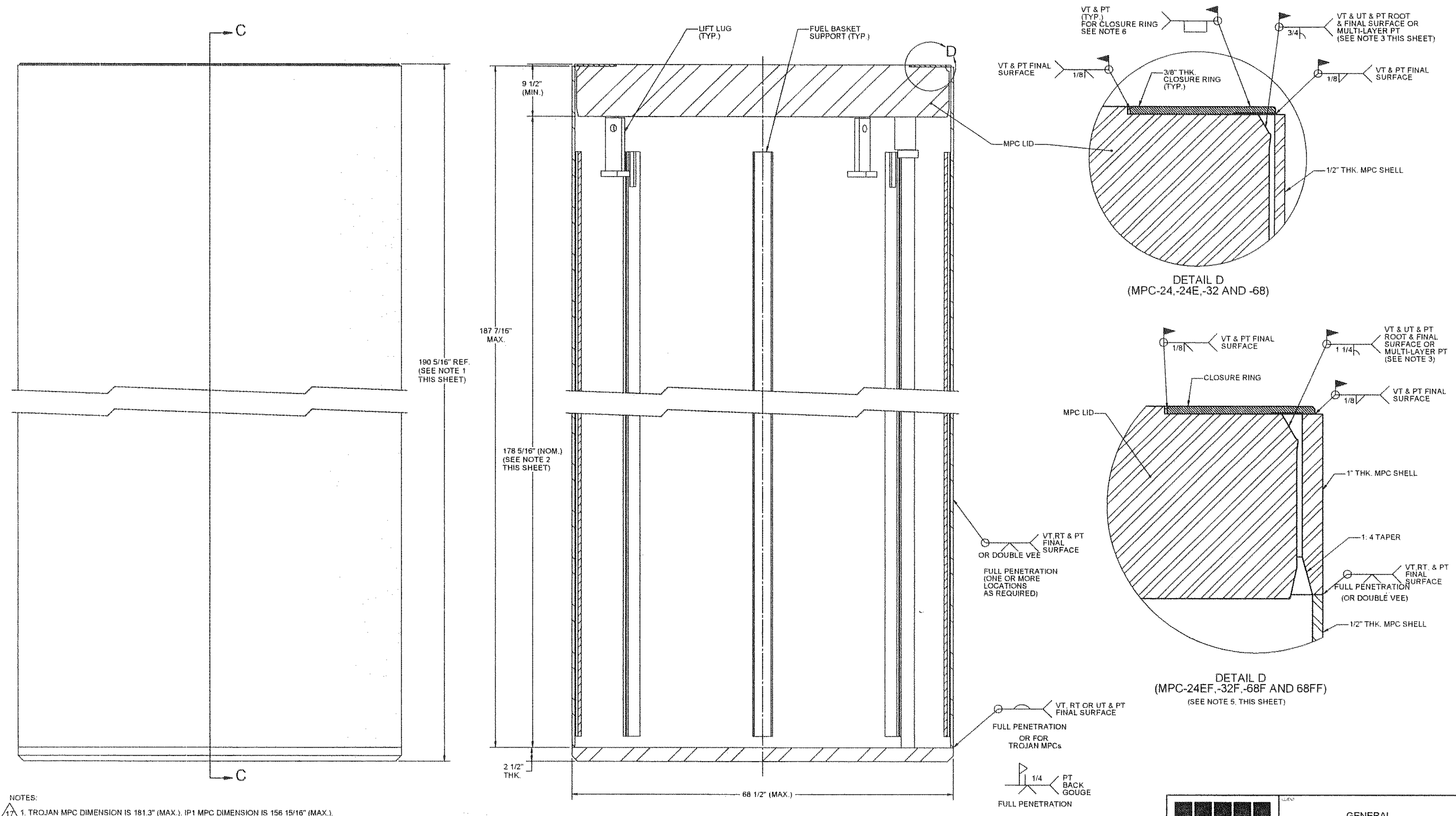
SECTION A-A
VENT PORT



DETAIL B
DRAIN PORT

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

CLIENT	GENERAL
DESCRIPTION	MPC ENCLOSURE VESSEL GENERAL ARRANGEMENT
PROJECT NO.	5014
	N/A
COMPANION DRAWINGS	3925, 3926, 3927, 3928
SIZE	D
DRAWING NO.	3923
SHEET	2
REV	17
SCALE	NONE



NOTES:

1. TROJAN MPC DIMENSION IS 181.3" (MAX.). IP1 MPC DIMENSION IS 156 15/16" (MAX.). 17
2. TROJAN MPC DIMENSION IS 169.3" (NOM.). IP1 MPC DIMENSION IS 144 15/16" (MAX.). 17
3. MULTI-LAYER PT SHALL INCLUDE ROOT AND FINAL PASSES AND EACH APPROXIMATELY 3/8" OF WELD DEPTH.
4. DELETED.
5. MPC-68FF IS NOT CERTIFIED FOR TRANSPORTATION UNDER 10CFR71.
6. OPTIONAL CONSTRUCTION FOR THE CLOSURE RING PROVIDES PENETRATIONS TO ALLOW HELIUM LEAKAGE TESTING OF THE MPC LID-TO-SHELL AND VENT/DRAIN PORT COVER PLATE WELDS DURING A SINGLE TEST. PLUG WELDS IN THE CLOSURE RING ARE IDENTICAL TO THE PLUG WELDS IN THE VENT/DRAIN PORT COVER PLATES AND, ACCORDINGLY, ARE ADEQUATE TO SEAL THE MPC.

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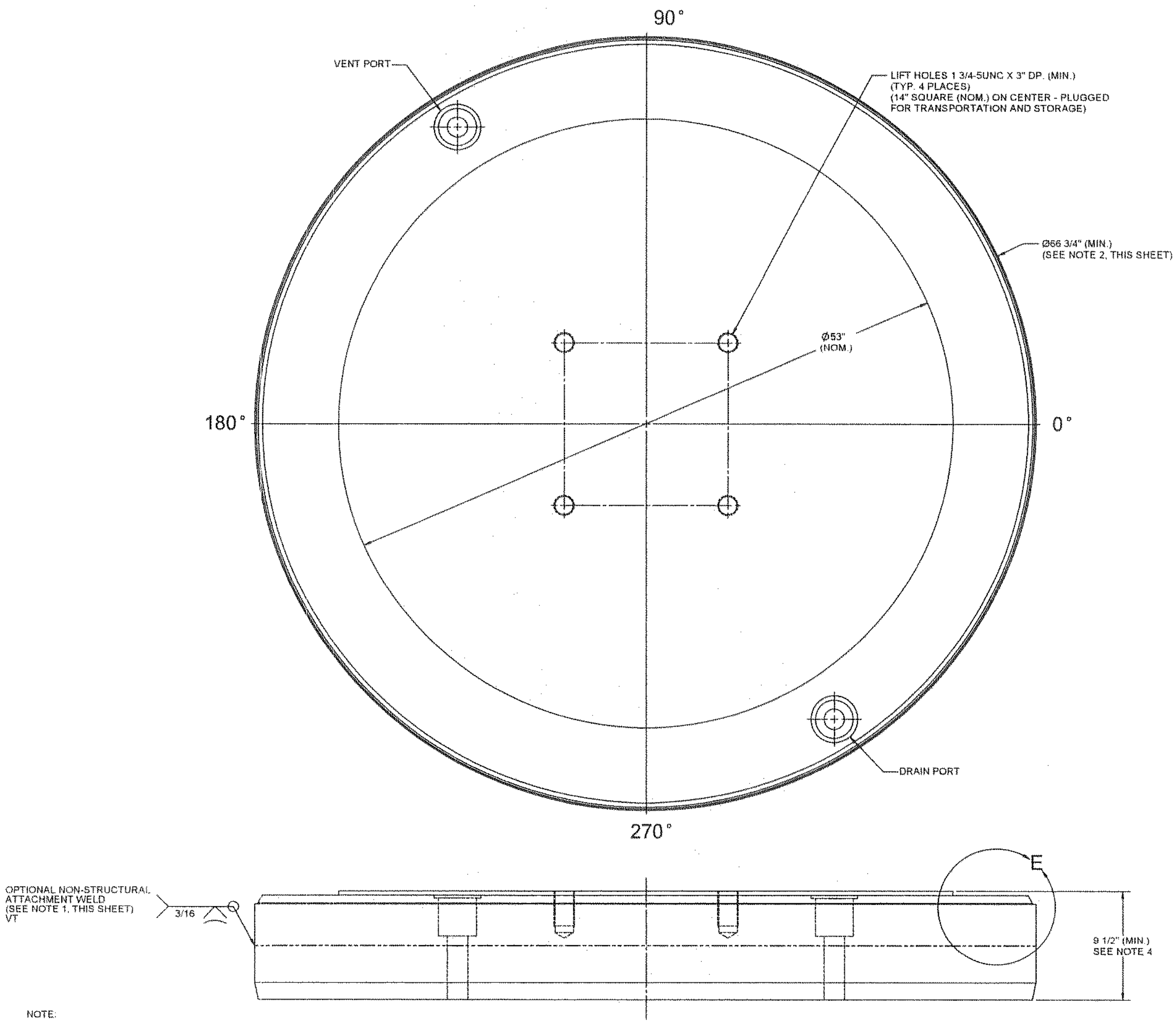
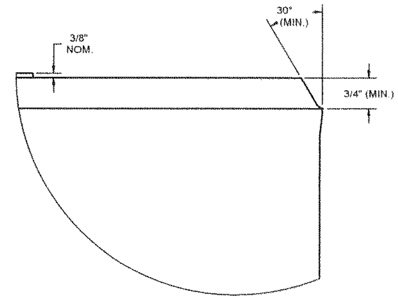
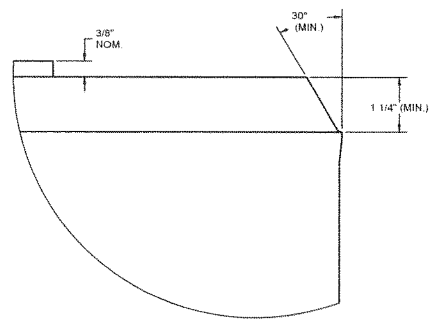
CLIENT	GENERAL
DESCRIPTION	MPC ENCLOSURE ENCLOSURE VESSEL ELEVATION DETAILS
PROJECT NO.	5014
	N/A
COMPANION DRAWINGS	3925, 3926, 3927, 3928
SIZE	D
DRAWING NO.	3923
SHEET	3
REV	17
SCALE	NONE



MPC LID



DETAIL E
(MPC-24,-24E, 32 AND 68)



DETAIL E
(MPC-24EF,-32F, -68F, AND 68FF)
(SEE NOTE 3, THIS SHEET)

NOTE:

1. THE MPC LID MAY BE FABRICATED FROM ONE PIECE OR TWO PIECES, SPLIT TOP AND BOTTOM, 4 3/4" (NOM.) THICK. THE TOP PIECE ACTS AS A STRUCTURAL MEMBER AND THE BOTTOM PIECE ACTS PRIMARILY AS A RADIATION SHIELD.
2. MPC LID IS 66 3/4" (MIN.) DIAMETER EXCEPT "F" MODEL, WHICH IS 65.8" (MIN.) DIAMETER.
3. MPC-68FF IS NOT CERTIFIED FOR TRANSPORTATION UNDER 10CFR71.
4 MPC-68 SERIAL #1021-040 HAS A ONE-TIME DEVIATION WITH RESPECT TO THE MPC LID THICKNESS. SHEET 6 DEPICTS THE SPECIFIC CONFIGURATION FOR THIS LID (SMDR-1021-929).

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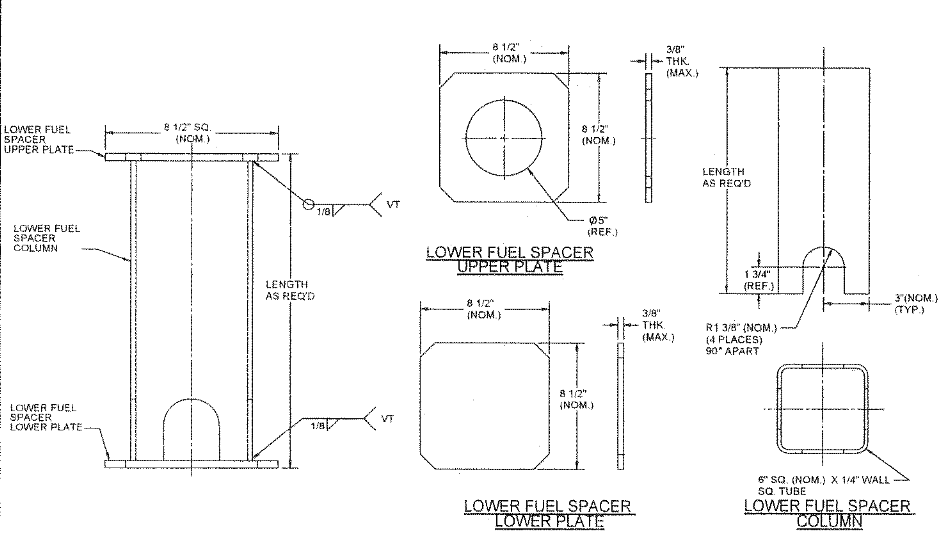
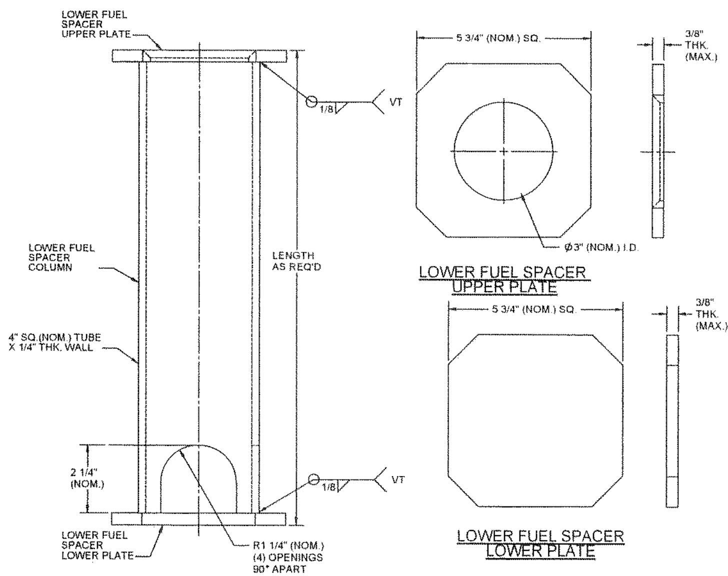
CLIENT	GENERAL
DESCRIPTION	MPC ENCLOSURE VESSEL LID DETAILS
PROJECT NO.	5014
	N/A
COMPANION DRAWINGS	3925, 3926, 3927, 3928
SIZE	D
DRAWING NO.	3923
SHEET	4
REV	17
SCALE	NONE
FILE PATH	N:\DRAWINGS\5014\3923



LOWER PWR FUEL SPACER ASSEMBLY

(SEE NOTE 1 THIS SHEET)

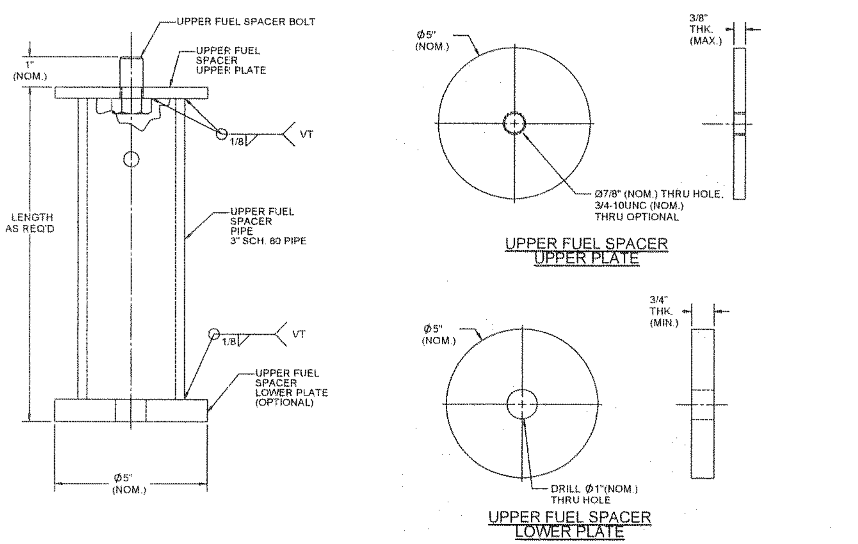


LOWER BWR FUEL SPACER ASSEMBLY

(SEE NOTE 1 THIS SHEET)

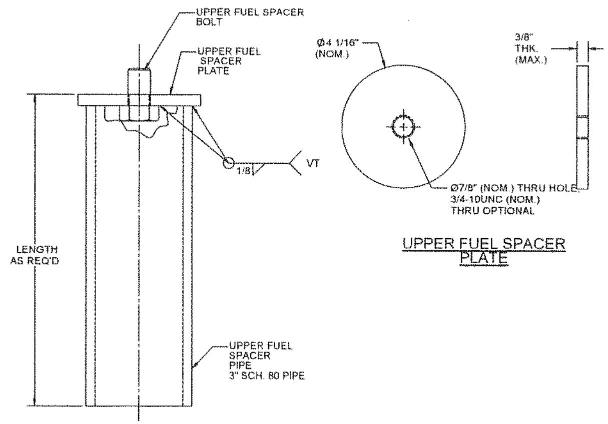
NOTES:

1. TOLERANCES ON PLATE AND COLUMN THICKNESS PER ASME SECTION II OR ASTM A554, AS APPLICABLE.
2. PWR LOWER FUEL SPACER COLUMN MATERIAL MUST BE TYPE 304 OR 304LN STAINLESS STEEL WITH TENSILE STRENGTH >/= 75 ksi, YIELD STRENGTH >/= 30ksi, AND CHEMICALS PER ASTM A554. BWR LOWER FUEL SPACER COLUMNS ARE "ALLOY X" WITH SAME TENSILE, YIELD, AND CHEMICAL REQUIREMENTS.



UPPER PWR FUEL SPACER ASSEMBLY

(SEE NOTE 1 THIS SHEET)



UPPER BWR FUEL SPACER ASSEMBLY

(SEE NOTE 1 THIS SHEET)

FUEL SPACER DESIGN DATA

ITEM	APPLICABLE CODE	SAFETY CLASS	MATERIAL
LOWER FUEL SPACER LOWER PLATE	NON-CODE	ITS	ALLOY X
LOWER FUEL SPACER LOWER PLATE	NON-CODE	ITS	ALLOY X
UPPER FUEL SPACER LOWER PLATE	NON-CODE	ITS	ALLOY X
UPPER FUEL SPACER UPPER PLATE	NON-CODE	ITS	ALLOY X
UPPER FUEL SPACER BOLT	NON-CODE	NITS	SA193B8 (OR EQUIV.)
LOWER FUEL SPACER COLUMN	ASME III, NG (STRESS ANALYSIS ONLY)	ITS	SEE NOTE 2, THIS SHEET
UPPER FUEL SPACER PIPE	ASME III, NG (STRESS ANALYSIS ONLY)	ITS	ALLOY X

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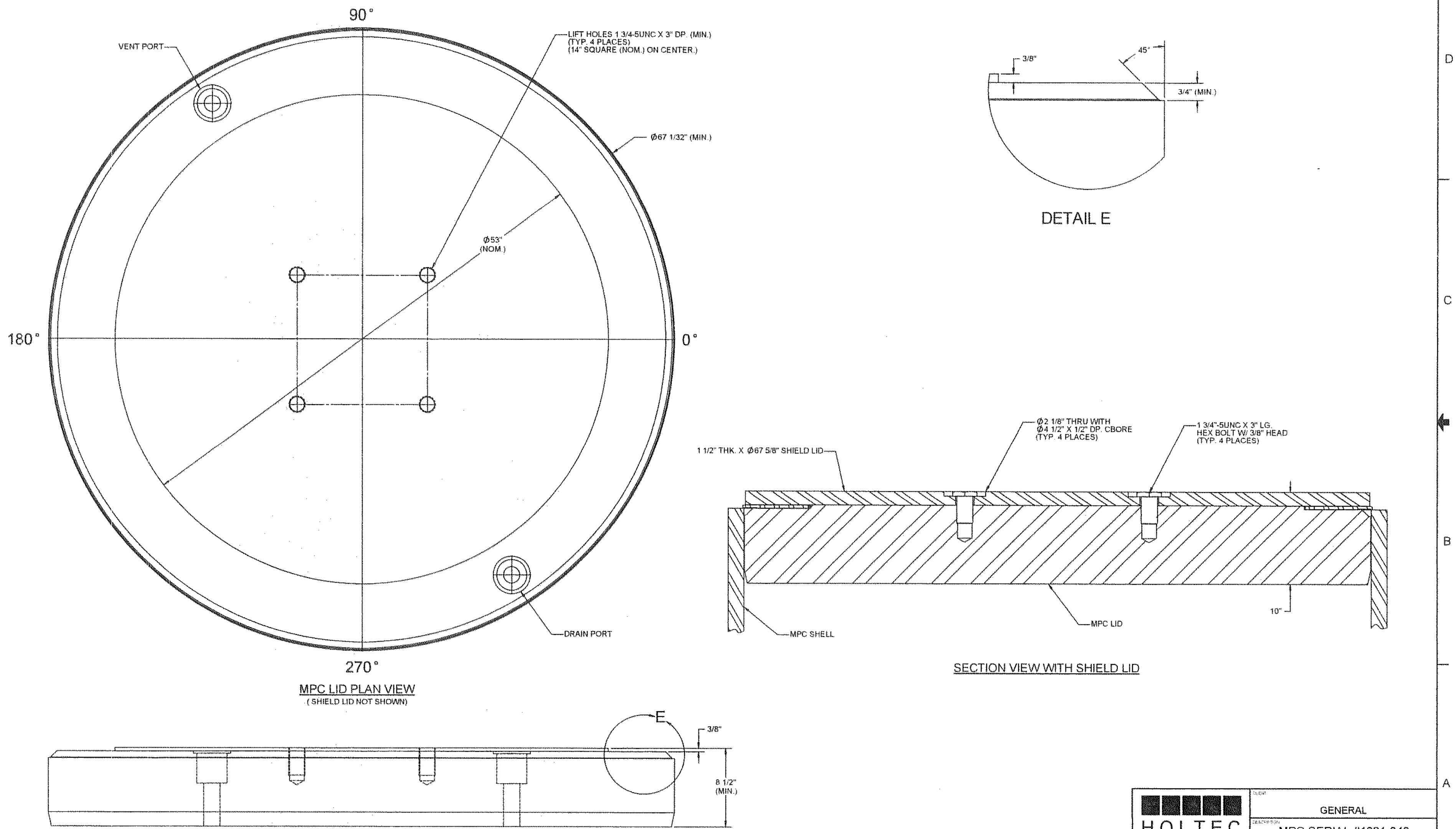
MARLTON, NJ 08053

CLIENT: GENERAL

DESCRIPTION: FUEL SPACER DETAILS

PROJECT NO.	COMPANION DRAWINGS	SIZE	DRAWING NO.	SHEET	REV
5014	3925, 3926, 3927, 3928	D	3923	5	17
N/A		SCALE: NONE	FILE PATH: N:\DRAWINGS\1022\3923		



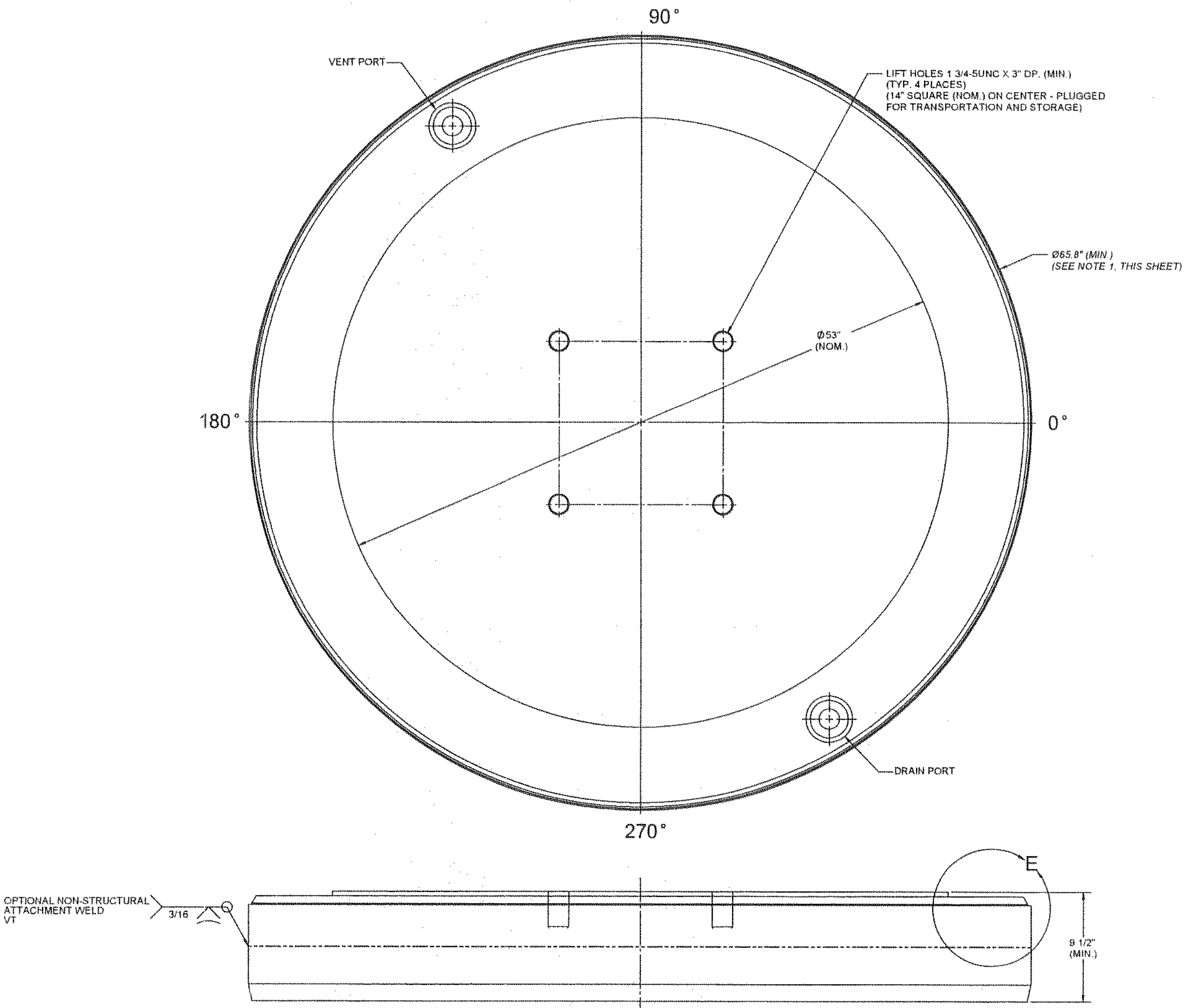
MPC LID PLAN VIEW
(SHIELD LID NOT SHOWN)

SECTION VIEW WITH SHIELD LID

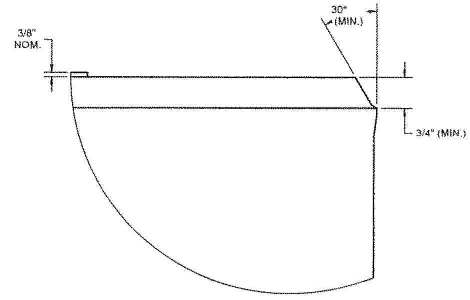
MPC LID ELEVATION VIEW
(SHIELD LID NOT SHOWN)

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

CLIENT	GENERAL
DESCRIPTION	MPC SERIAL #1021-040 ENCLOSURE VESSEL LID DETAILS
PROJECT NO	5014
PO NO	N/A
COMPANION DRAWINGS	3925, 3926, 3927, 3928
SIZE	D
DRAWING NO	3923
SHEET	6
REV	17
SCALE	NONE
FILE PATH	N:\DRAWINGS\5014\3923



MPC LID



DETAIL E
(SEE NOTE 1, THIS SHEET)

NOTE:

1. THE OPTIONAL LID DESIGN SHOWN ON THIS SHEET MAY BE USED WITH THE MPC-68 PROVIDED THE MPC SHELL IS MODIFIED, AS SHOWN ON DETAIL D (SHEET 3), WITH A 1" UPPER SHELL THICKNESS (SMDR 1269 AND SMDR 1364).

HOLTEC INTERNATIONAL

HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

GENERAL

MPC ENCLOSURE
VESSEL LID DETAILS
(SMDR 1269 / 1364)

PROJECT NO.	5014
	N/A
COMPANION DRAWINGS	3925, 3926, 3927, 3928
SIZE	D
DRAWING NO.	3923
SHEET	7
REV	17
SCALE	NONE

CLIENT GENERAL

PROJECT NO. 1022

P.O. NO. N/A

DRAWING PACKAGE I.D. 3925

TOTAL SHEETS 4

LICENSING DRAWING PACKAGE COVER SHEET

LICENSING DRAWING PACKAGE CONTENTS:

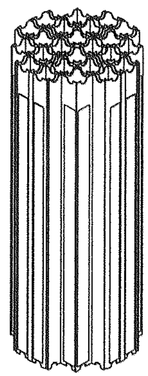
REVISION LOG

REV	AFFECTED DRAWING SHEET NUMBERS	SUMMARY OF CHANGES/ AFFECTED ECOs	PREPARED BY	APPROVAL DATE	VIR# †
0	INITIAL ISSUE	1022-38	SLC	5/30/02	17385
1	ALL	1022-38, REV. 1	SLC	8/28/02	69345
2	SHEETS 2 & 3	1022-30, REV. 0 & 5014-82, REV. 0	SLC	4/23/03	61822
3	SHEETS 1, 2, & 4	1022-48	SLC	5/19/03	40190
4	SHEETS 1, 3, & 4	1022-51	SLC	7/11/03	34515
5	SHEET 2	1022-57	SLC	9/27/04	57814
6	SHEETS 2, 3, & 4	1022-68, REV. 0	SLC	06/14/06	49580
7	SHEETS 1, 2, & 3	1022-67, REV. 0	SLC	10/05/06	35683

† THE VALIDATION IDENTIFICATION RECORD (VIR) NUMBER IS A COMPUTER GENERATED RANDOM NUMBER WHICH CONFIRMS THAT ALL APPROPRIATE REVIEWS OF THIS DRAWING ARE DOCUMENTED IN COMPANY'S NETWORK.

GENERAL NOTES:

1. THE EQUIPMENT DESIGN DOCUMENTED IN THIS DRAWING PACKAGE HAS BEEN CONFIRMED BY HOLTEC INTERNATIONAL TO COMPLY WITH THE SAFETY ANALYSES DESCRIBED IN THE SAFETY ANALYSIS REPORT.
2. DIMENSIONAL TOLERANCES ON THIS DRAWING ARE PROVIDED TO ENSURE THAT THE EQUIPMENT DESIGN IS CONSISTENT WITH THE SUPPORTING ANALYSIS. HARDWARE IS FABRICATED IN ACCORDANCE WITH THE DESIGN DRAWINGS, WHICH MAY HAVE MORE RESTRICTIVE TOLERANCES, TO ENSURE COMPONENT FIT-UP. DO NOT USE WORST-CASE TOLERANCE STACK-UP FROM THIS DRAWING TO DETERMINE COMPONENT FIT-UP.
3. THE REVISION LEVEL OF EACH INDIVIDUAL SHEET IN THIS PACKAGE IS THE SAME AS THE REVISION LEVEL OF THIS COVER SHEET. A REVISION TO ANY SHEET(S) IN THIS PACKAGE REQUIRES UPDATING OF REVISION NUMBERS OF ALL SHEETS TO THE NEXT REVISION NUMBER.
4. THE ASME BOILER AND PRESSURE VESSEL CODE (ASME CODE), 1995 EDITION WITH ADDENDA THROUGH 1997, IS THE GOVERNING CODE FOR THE HI-STAR 100 SYSTEM, WITH CERTAIN APPROVED ALTERNATIVES AS LISTED IN SAR TABLE 1.3.2 (TRANSPORTATION) AND FSAR TABLE 2.2.15 (STORAGE). THE MPC FUEL BASKET IS CONSTRUCTED IN ACCORDANCE WITH ASME SECTION III, SUBSECTION NG AS DESCRIBED IN THE SAR (TRANSPORTATION) AND FSAR (STORAGE). NEW OR REVISED ASME CODE ALTERNATIVES REQUIRE PRIOR NRC APPROVAL BEFORE IMPLEMENTATION.
5. ALL MPC BASKET STRUCTURAL MATERIALS COMPLY WITH THE REQUIREMENTS OF ASME SECTION II, PART A. WELD MATERIAL COMPLIES WITH THE REQUIREMENTS OF ASME SECTION II, PART C.
6. ALL WELDS REQUIRE VISUAL EXAMINATION (VT). ADDITIONAL NDE INSPECTIONS ARE NOTED ON THE DRAWING AS REQUIRED. NDE TECHNIQUES AND ACCEPTANCE CRITERIA ARE GOVERNED BY ASME SECTIONS V AND III, RESPECTIVELY, AS CLARIFIED IN THE APPLICABLE SAFETY ANALYSIS REPORTS.
7. FABRICATOR MAY ADD WELDS TO STITCH WELDS AT THEIR DISCRETION.
8. DO NOT MAKE A CONTINUOUS SEAL WELD BETWEEN THE SHEATHING AND THE CELL WALL.
9. ALL STRUCTURAL MATERIALS ARE "ALLOY X" UNLESS OTHERWISE NOTED. ALLOY X IS ANY OF THE FOLLOWING STAINLESS STEEL TYPES: 316, 316LN, 304, AND 304LN.
10. DIFFERENCES BETWEEN THE GENERIC MPC-24E/EF BASKET AND THE TROJAN PLANT MPC-24E/EF BASKET ARE SPECIFICALLY NOTED.
11. ⚠ BOTH BORAL AND METAMIC ARE APPROVED FOR USE AS NEUTRON ABSORBERS. NEUTRON ABSORBER PANELS ARE INTENDED TO HAVE NO SIGNIFICANT FLAWS. HOWEVER, TO ACCOUNT FOR MANUFACTURING DEVIATIONS OCCURING DURING INSTALLATION OF THE PANELS INTO THE MPC FUEL BASKET, NEUTRON ABSORBER DAMAGE OF UP TO THE EQUIVALENT OF A 1" DIAMETER HOLE IN EACH PANEL HAS BEEN ANALYZED AND FOUND TO BE ACCEPTABLE. ADDITIONALLY, LOCALIZED NEUTRON ABSORBER DAMAGE ALONG ONE EDGE OF A PANEL ONLY IS PERMITTED IF:
    - A) THE TOTAL AREA OF DAMAGE DOES NOT EXCEED 5 SQ. IN. AND;
    - B) THE DAMAGE IS LOCATED WITHIN THE TOP OR BOTTOM 27" OF THE PANEL AND;
    - C) THE DAMAGE DOES NOT EXTEND FARTHER THAN 1" FROM THE EDGE OF THE PANEL AND;
    - D) NO MORE THAN EIGHT PANELS WITHIN A BASKET HAVE THIS CONDITION.
12. THIS COMPONENT IS CLASSIFIED AS ITS-A BASED ON THE HIGHEST CLASSIFICATION OF ANY SUBCOMPONENT. SUBCOMPONENT CLASSIFICATIONS ARE PROVIDED IN SAR TABLE 1.3.3 (TRANSPORTATION) AND FSAR TABLE 2.2.6 (STORAGE).
13. DELETED.
14. TOLERANCES FOR THICKNESS OF ASME CODE MATERIAL ARE SPECIFIED IN ASME SECTION II.
15. ALL WELD SIZES ARE MINIMUMS. LARGER WELDS ARE PERMITTED. LOCAL AREAS OF UNDERSIZE WELDS ARE ACCEPTABLE WITHIN THE LIMITS SPECIFIED IN THE ASME CODE, AS CLARIFIED IN THE (F)SAR.
16. REFER TO THE COMPONENT COMPLETION RECORD (CCR) FOR THE COMPLETE LIST OF APPROVED DESIGN DEVIATIONS FOR EACH INDIVIDUAL SERIAL NUMBER.
17. THE MPC-24E/EF IS CERTIFIED FOR STORAGE AND TRANSPORTATION OF INTACT AND DAMAGED PWR FUEL AND PWR FUEL CLASSIFIED AS FUEL DEBRIS, AS SPECIFIED IN COCs 72-1014, AND 71-9261.
18. DIMENSIONS NOTED AS NOMINAL ("NOM.") IN THE DRAWING ARE FOR INFORMATION ONLY, IN ORDER TO INDICATE THE GENERAL SIZE OF THE COMPONENT OR PART. NOMINAL DIMENSIONS HAVE NO SPECIFIC TOLERANCE, BUT ARE MET THROUGH FABRICATION IN ACCORDANCE WITH OTHER DIMENSIONS THAT ARE TOLERANCED AND INSPECTED. NOMINAL DIMENSIONS ARE NOT SPECIFICALLY VERIFIED DURING THE FABRICATION PROCESS.
19. ⚠ NEUTRON ABSORBER PANELS MAY BE MADE UP OF ONE LONG PANEL OF INDICATED WIDTH OR TWO SHORTER PANELS OF INDICATED WIDTH AS LONG AS THE TOTAL LENGTH IS MAINTAINED AS INDICATED AND THE GAP BETWEEN PANELS IS MAINTAINED AT NO MORE THAN 1/4".
20. ⚠ NEUTRON ABSORBER PANELS MAY HAVE A REDUCTION IN WIDTH OF UP TO 1/32" OVER A LENGTH OF NO MORE THAN 12" PROVIDED THE AVERAGE WIDTH OF THE PANEL IS NO LESS THAN THE MINIMUM SPECIFIED.



MPC-24E/EF FUEL BASKET ISOMETRIC VIEW

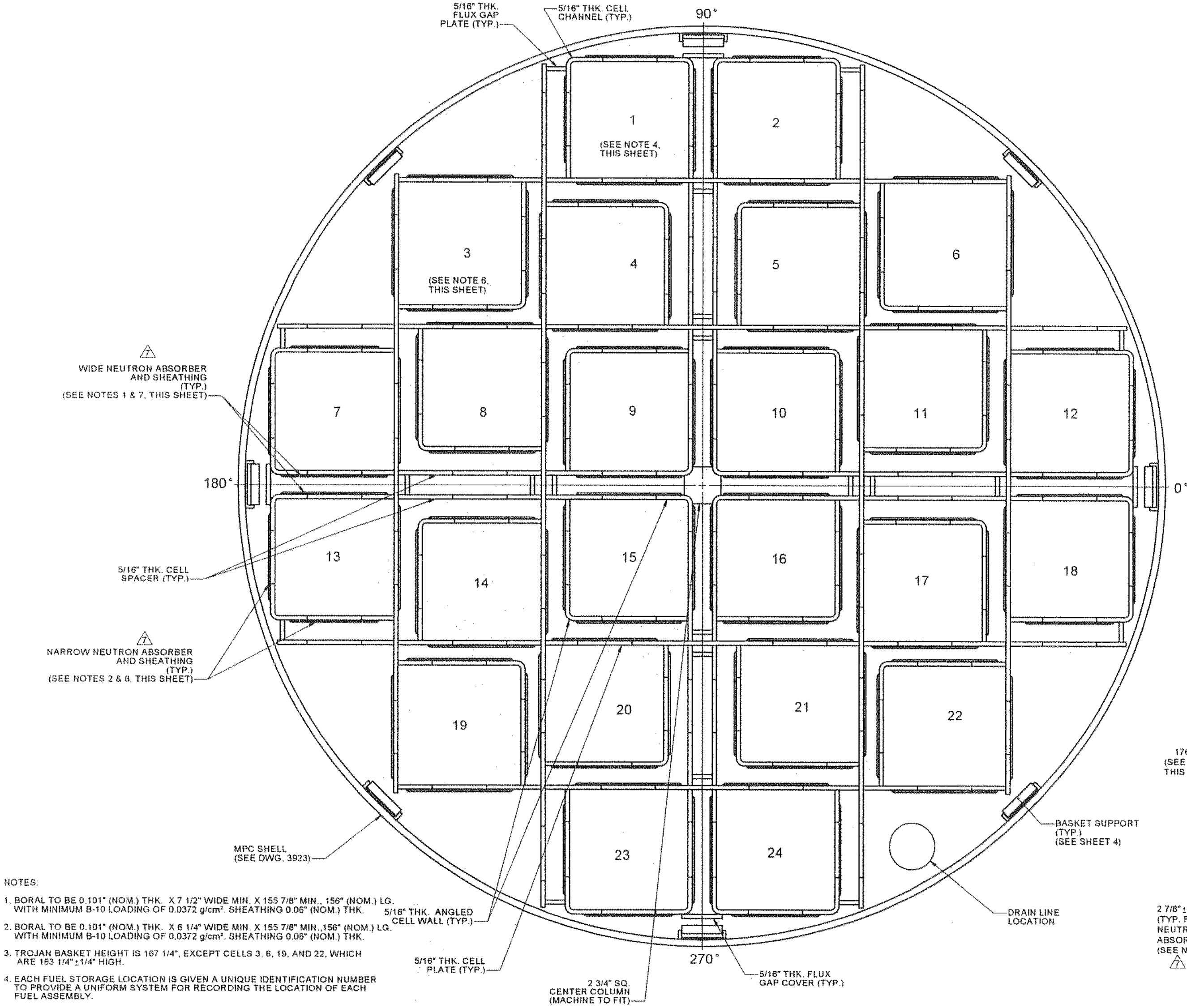
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

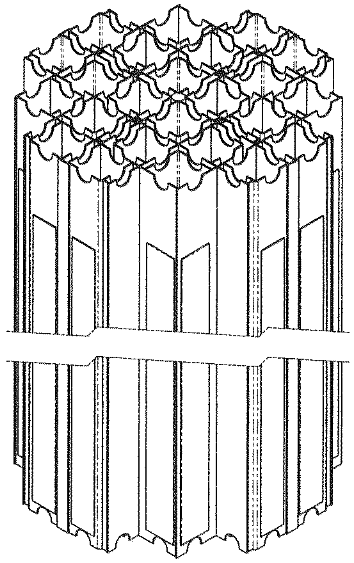
CLIENT: GENERAL

DESCRIPTION: MPC-24E/EF FUEL BASKET ASSEMBLY

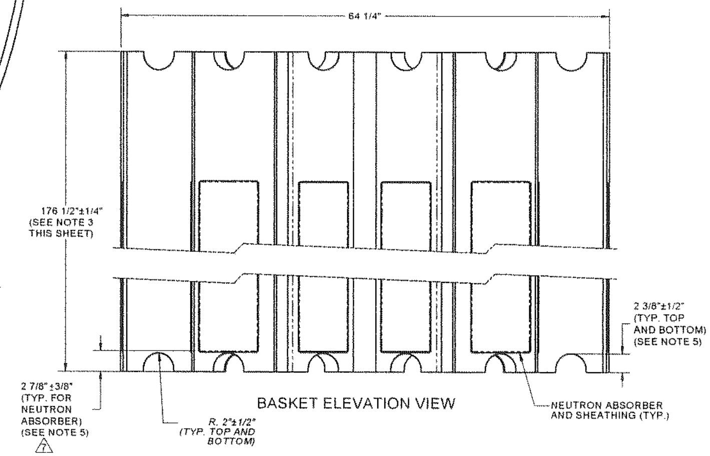
PROJECT NO. 1022 | P.O. NO. N/A | DRAWING NO. 3925 | SHEET 1 | TOTAL SHEETS 4

FILE PATH: G:\DRAWINGS\1022\3925





ISOMETRIC ASSEMBLY VIEW



BASKET ELEVATION VIEW

NOTES:

1. BORAL TO BE 0.101" (NOM.) THK. X 7 1/2" WIDE MIN. X 155 7/8" MIN., 156" (NOM.) LG. WITH MINIMUM B-10 LOADING OF 0.0372 g/cm². SHEATHING 0.06" (NOM.) THK.
2. BORAL TO BE 0.101" (NOM.) THK. X 6 1/4" WIDE MIN. X 155 7/8" MIN.,156" (NOM.) LG. WITH MINIMUM B-10 LOADING OF 0.0372 g/cm². SHEATHING 0.06" (NOM.) THK.
3. TROJAN BASKET HEIGHT IS 167 1/4", EXCEPT CELLS 3, 6, 19, AND 22, WHICH ARE 163 1/4" ±1/4" HIGH.
4. EACH FUEL STORAGE LOCATION IS GIVEN A UNIQUE IDENTIFICATION NUMBER TO PROVIDE A UNIFORM SYSTEM FOR RECORDING THE LOCATION OF EACH FUEL ASSEMBLY.
5. ON TROJAN BASKET BOTTOM MOUSEHOLES ARE NOMINALLY 1 1/4" HIGH BY 4" WIDE RECTANGULAR SLOTS AND BORAL HEIGHT ABOVE BASKET BOTTOM IS NOMINALLY 1 3/4". MPC-24 SERIAL #1022-029 FOR TROJAN HAS A ONE TIME DEVIATION WITH RESPECT TO THE LOCATION OF THE RECTANGULAR SLOTS AND MOUSEHOLES ON TWO CELL PLATES BETWEEN CELL NUMBERS 11 AND 17. THESE TWO CELL PLATES HAVE THE RECTANGULAR SLOTS ON THE TOP AND THE MOUSEHOLES ON THE BOTTOM. EVALUATION OF THIS DEVIATION HAS CONCLUDED THAT THERE IS A NEGLIGIBLE IMPACT ON THE DESIGN BASIS ANALYSES (SMDR-1022-926).
6. ONLY FUEL STORAGE LOCATIONS 3, 6, 19, AND 22 CAN ACCOMMODATE DAMAGED FUEL AND/OR FUEL DEBRIS.
7. (rev. 7) METAMIC TO BE 0.106" (NOM.) THK. X 7 1/2" WIDE MIN. X 155 7/8" MIN. (156" NOM.) LG. THE MINIMUM METAMIC B-10 LOADING IS 0.0310 g/cm² WITH A MINIMUM B4C LOADING OF 31.5% AND MAXIMUM OF 33%. METAMIC IS NOT REQUIRED TO BE PASSIVATED. SHEATHING 0.06" (NOM.) THK.
8. (rev. 7) METAMIC TO BE 0.106" (NOM.) THK. X 6 1/4" WIDE MIN. X 155 7/8" MIN. (156" NOM.) LG. THE MINIMUM METAMIC B-10 LOADING IS 0.0310 g/cm² WITH A MINIMUM B4C LOADING OF 31.5% AND MAXIMUM OF 33%. METAMIC IS NOT REQUIRED TO BE PASSIVATED. SHEATHING 0.06" (NOM.) THK.

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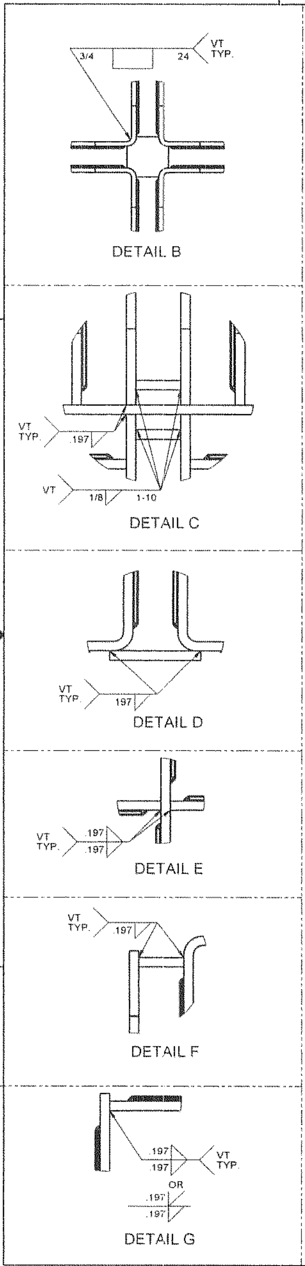
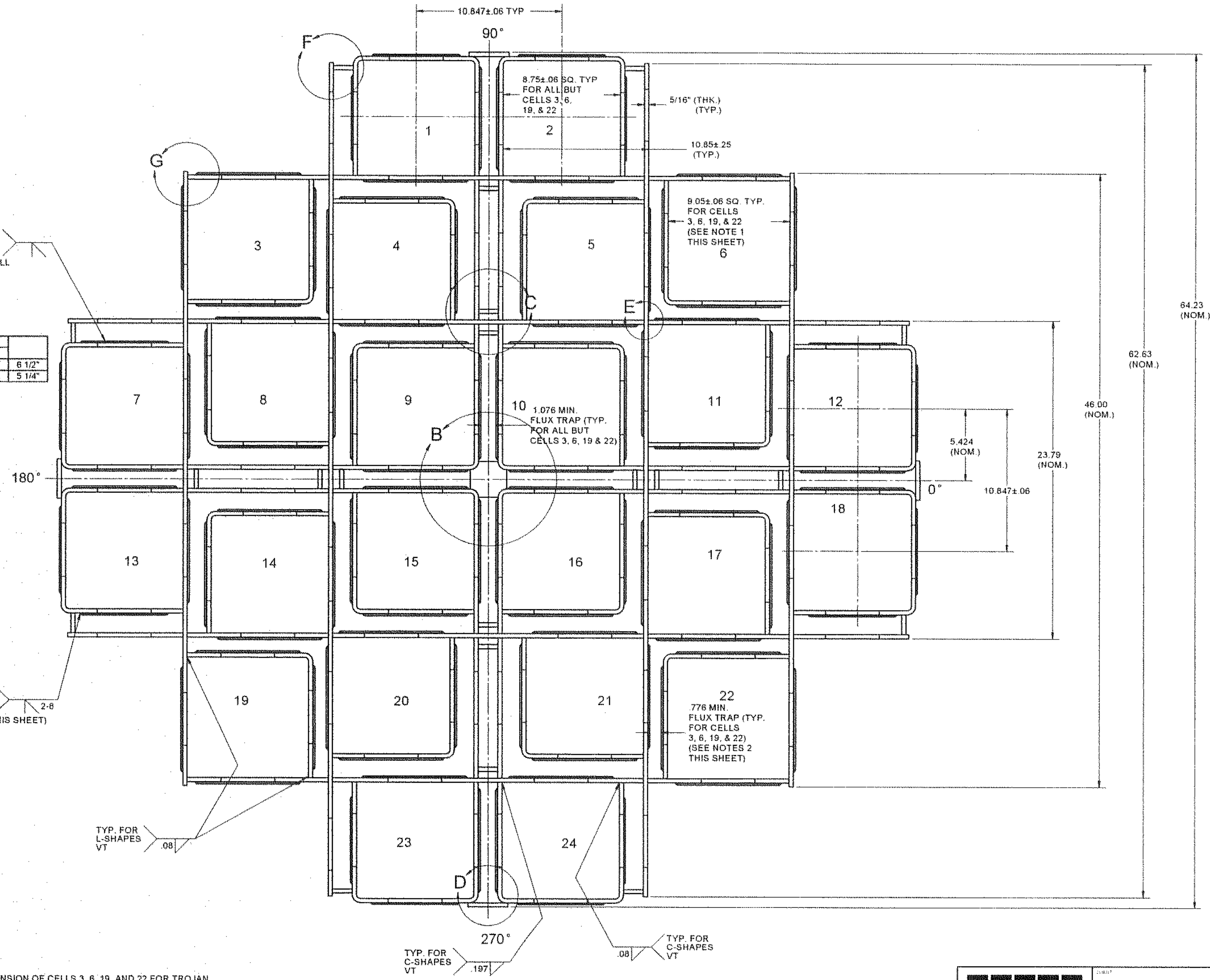
555 LINCOLN CENTER
MARLTON, NJ 08053

CLIENT	GENERAL
DESCRIPTION	MPC-24E/EF FUEL BASKET ASSEMBLY
PROJECT NO.	1022
	N/A
COMPANION DRAWING	3923
SIZE	D
DRAWING NO.	3925
SHEET	2
REV.	7
SCALE	NONE
FILE PATH	G:\DRAWINGS\1022\3925



MINIMUM WELD LENGTH	
WIDE NEUTRON ABSORBER PANEL	6 1/2"
NARROW NEUTRON ABSORBER PANEL	5 1/4"



NOTES:

1. DIMENSION OF CELLS 3, 6, 19, AND 22 FOR TROJAN BASKET IS 9.30" ±.06" SQ.
2. DIMENSION OF FLUX TRAP FOR TROJAN BASKET IS 0.526" MIN.
3. DELETED.
4. LENGTH AND SPACING OF WELD ON SIDES OF SHEATHING CAN VARY PROVIDED TOTAL SHEATHING WELD PER PIECE IS NOT LESS THAN 65" FOR WIDE NEUTRON ABSORBER PANELS OR 67.5" FOR NARROW NEUTRON ABSORBER PANELS, AND THERE IS A MINIMUM OF 19" OF WELD ALONG EACH SIDE OF THE SHEATHING PANEL.

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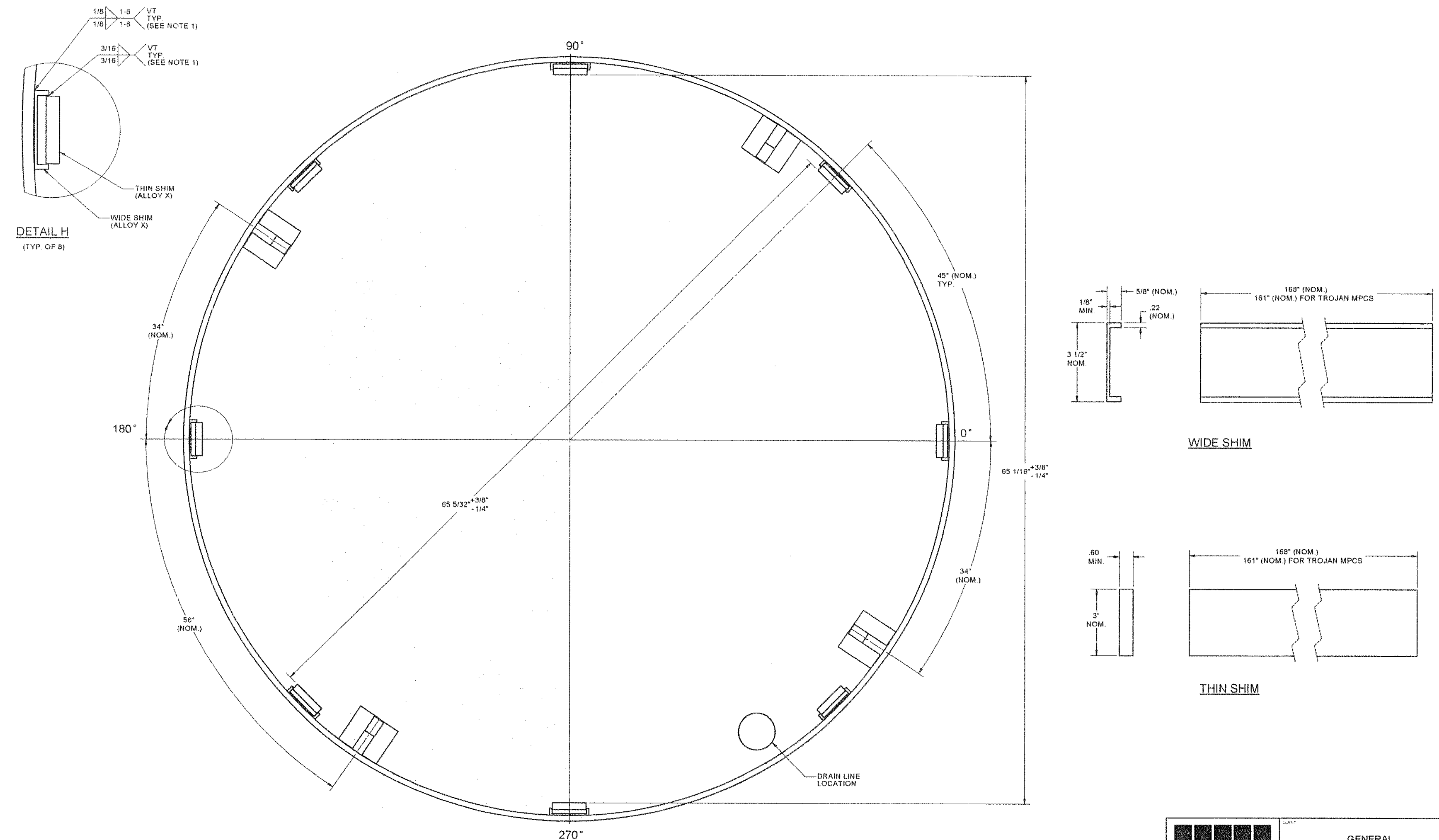
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

GENERAL

MPC-24E/EF
FUEL BASKET
LAYOUT AND WELD DETAILS

1022
N/A
3923
D | 3925 | 3 | 7
NONE
G:\DRAWINGS\1022\3925



NOTE:

1. THE MPC BASKET SUPPORTS ARE WELDED TO THE INSIDE SURFACE OF THE MPC SHELL. THEY MAY INCLUDE ADJUSTABLE SHIMS TO ENSURE THE NECESSARY CLEARANCE BETWEEN THE BASKET TOUCH POINTS AND THE BASKET SUPPORTS.

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GENERAL

MPC-24E/24EF FUEL BASKET SUPPORTS

1022	3923	D	3925	4	7
N/A		NONE	G:\DRAWINGS\1022\3925		

LICENSING DRAWING PACKAGE COVER SHEET

CLIENT GENERAL

PROJECT NO. 1022 | P.O. NO. N/A

DRAWING PACKAGE I.D. 3926 | TOTAL SHEETS 4

LICENSING DRAWING PACKAGE CONTENTS:

SHEET	DESCRIPTION
1	COVER SHEET
2	FUEL BASKET ARRANGEMENT
3	FUEL BASKET LAYOUT AND WELD DETAILS
4	FUEL BASKET SUPPORTS

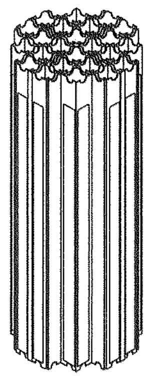
REVISION LOG

REV	AFFECTED DRAWING SHEET NUMBERS	SUMMARY OF CHANGES/ AFFECTED ECOs	PREPARED BY	APPROVAL DATE	VIR# †
0	INITIAL ISSUE	1022-38	SLC	5/30/02	74916
1	ALL	1022-38, REV. 1	SLC	8/28/02	37611
2	SHEET 1	1022-43, REV. 0	SLC	10/9/02	84086
3	SHEET 3	5014-82, REV. 0	SLC	3/25/03	70654
4	SHEETS 1, 2, & 4	1022-48	SLC	5/19/03	13075
5	SHEETS 1, 3, & 4	1022-51	SLC	7/11/03	81349
6	SHEETS 1, 2 & 3	1022-58 REV. 1	JJB	05/12/05	70914
7	SHEETS 1& 2	1022-59 REV. 1	JJB	06/17/05	42496
8	SHEETS 2 & 4	1022-68, REV. 0	SLC	06/14/06	34908
9	SHEETS 1, 2 & 3	1022-67, REV. 0	SLC	10/05/06	86844

† THE VALIDATION IDENTIFICATION RECORD (VIR) NUMBER IS A COMPUTER GENERATED RANDOM NUMBER WHICH CONFIRMS THAT ALL APPROPRIATE REVIEWS OF THIS DRAWING ARE DOCUMENTED IN COMPANY'S NETWORK.

GENERAL NOTES:

1. THE EQUIPMENT DESIGN DOCUMENTED IN THIS DRAWING PACKAGE HAS BEEN CONFIRMED BY HOLTEC INTERNATIONAL TO COMPLY WITH THE SAFETY ANALYSES DESCRIBED IN THE SAFETY ANALYSIS REPORT.
2. DIMENSIONAL TOLERANCES ON THIS DRAWING ARE PROVIDED TO ENSURE THAT THE EQUIPMENT DESIGN IS CONSISTENT WITH THE SUPPORTING ANALYSIS. HARDWARE IS FABRICATED IN ACCORDANCE WITH THE DESIGN DRAWINGS, WHICH MAY HAVE MORE RESTRICTIVE TOLERANCES, TO ENSURE COMPONENT FIT-UP. DO NOT USE WORST-CASE TOLERANCE STACK-UP FROM THIS DRAWING TO DETERMINE COMPONENT FIT-UP.
3. THE REVISION LEVEL OF EACH INDIVIDUAL SHEET IN THIS PACKAGE IS THE SAME AS THE REVISION LEVEL OF THIS COVER SHEET. A REVISION TO ANY SHEET(S) IN THIS PACKAGE REQUIRES UPDATING OF REVISION NUMBERS OF ALL SHEETS TO THE NEXT REVISION NUMBER.
4. THE ASME BOILER AND PRESSURE VESSEL CODE (ASME CODE), 1995 EDITION WITH ADDENDA THROUGH 1997, IS THE GOVERNING CODE FOR THE HI-STAR 100 SYSTEM, WITH CERTAIN APPROVED ALTERNATIVES AS LISTED IN SAR TABLE 1.3.2 (TRANSPORTATION) AND FSAR TABLE 2.2.15 (STORAGE). THE MPC FUEL BASKET IS CONSTRUCTED IN ACCORDANCE WITH ASME SECTION III, SUBSECTION NG AS DESCRIBED IN THE SAR (TRANSPORTATION) AND FSAR (STORAGE). NEW OR REVISED ASME CODE ALTERNATIVES REQUIRE PRIOR NRC APPROVAL BEFORE IMPLEMENTATION.
5. ALL MPC BASKET STRUCTURAL MATERIALS COMPLY WITH THE REQUIREMENTS OF ASME SECTION II, PART A. WELD MATERIAL COMPLIES WITH THE REQUIREMENTS OF ASME SECTION II, PART C.
6. ALL WELDS REQUIRE VISUAL EXAMINATION (VT). ADDITIONAL NDE EXAMINATIONS ARE NOTED ON THE DRAWING, AS REQUIRED. NDE TECHNIQUES AND ACCEPTANCE CRITERIA ARE GOVERNED BY ASME SECTIONS V AND III, RESPECTIVELY, AS CLARIFIED IN THE APPLICABLE SAFETY ANALYSIS REPORTS.
7. FABRICATOR MAY ADD WELDS TO STITCH WELDS AT THEIR DISCRETION.
8. DO NOT MAKE A CONTINUOUS SEAL WELD BETWEEN THE SHEATHING AND THE CELL WALL.
9. ALL STRUCTURAL MATERIALS ARE "ALLOY X" UNLESS OTHERWISE NOTED. ALLOY X IS ANY OF THE FOLLOWING STAINLESS STEEL TYPES: 316, 316 LN, 304, AND 304 LN.
10. 9 BOTH BORAL AND METAMIC ARE APPROVED FOR USE AS NEUTRON ABSORBERS. NEUTRON ABSORBER PANELS ARE INTENDED TO HAVE NO SIGNIFICANT FLAWS. HOWEVER, TO ACCOUNT FOR MANUFACTURING DEVIATIONS OCCURING DURING INSTALLATION OF THE PANELS INTO THE MPC FUEL BASKET, NEUTRON ABSORBER DAMAGE OF UP TO THE EQUIVALENT OF A 1" DIAMETER HOLE IN EACH PANEL HAS BEEN ANALYZED AND FOUND TO BE ACCEPTABLE.
11. THIS COMPONENT IS CLASSIFIED AS ITS-A BASED ON THE HIGHEST CLASSIFICATION OF ANY SUBCOMPONENT. SUBCOMPONENT CLASSIFICATIONS ARE PROVIDED IN SAR TABLE 1.3.3 (TRANSPORTATION) AND FSAR TABLE 2.2.6 (STORAGE).
12. FOR HI-STAR STORAGE, ALUMINUM HEAT CONDUCTION ELEMENTS ARE REQUIRED.
13. DELETED.
14. TOLERANCES FOR THICKNESS OF ASME CODE MATERIAL ARE SPECIFIED IN ASME SECTION II.
15. ALL WELD SIZES ARE MINIMUMS. LARGER WELDS ARE PERMITTED. LOCAL AREAS OF UNDERSIZE WELDS ARE ACCEPTABLE WITHIN THE LIMITS SPECIFIED IN THE ASME CODE, AS CLARIFIED IN THE (F)SAR.
16. REFER TO THE COMPONENT COMPLETION RECORD (CCR) FOR THE COMPLETE LIST OF APPROVED DESIGN DEVIATIONS FOR EACH INDIVIDUAL SERIAL NUMBER.
17. THE MPC-24 IS CERTIFIED FOR STORAGE AND TRANSPORTATION OF INTACT PWR FUEL, AS SPECIFIED IN COCs 72-1008, 72-1014, AND 71-9261.
18. DIMENSIONS NOTED AS NOMINAL ("NOM.") IN THE DRAWING ARE FOR INFORMATION ONLY, IN ORDER TO INDICATE THE GENERAL SIZE OF THE COMPONENT OR PART. NOMINAL DIMENSIONS HAVE NO SPECIFIC TOLERANCE, BUT ARE MET THROUGH FABRICATION IN ACCORDANCE WITH OTHER DIMENSIONS THAT ARE TOLERANCED AND INSPECTED. NOMINAL DIMENSIONS ARE NOT SPECIFICALLY VERIFIED DURING THE FABRICATION PROCESS.
19. 9 NEUTRON ABSORBER PANELS MAY BE MADE UP OF ONE LONG PANEL OF INDICATED WIDTH OR TWO SHORTER PANELS OF INDICATED WIDTH AS LONG AS THE TOTAL LENGTH IS MAINTAINED AS INDICATED AND THE GAP BETWEEN PANELS IS MAINTAINED AT NO MORE THAN 1/4".
20. 9 NEUTRON ABSORBER PANELS MAY HAVE A REDUCTION IN WIDTH OF UP TO 1/32" OVER A LENGTH OF NO MORE THAN 12" PROVIDED THE AVERAGE WIDTH OF THE PANEL IS NO LESS THAN THE MINIMUM SPECIFIED.



MPC-24 FUEL BASKET ISOMETRIC VIEW

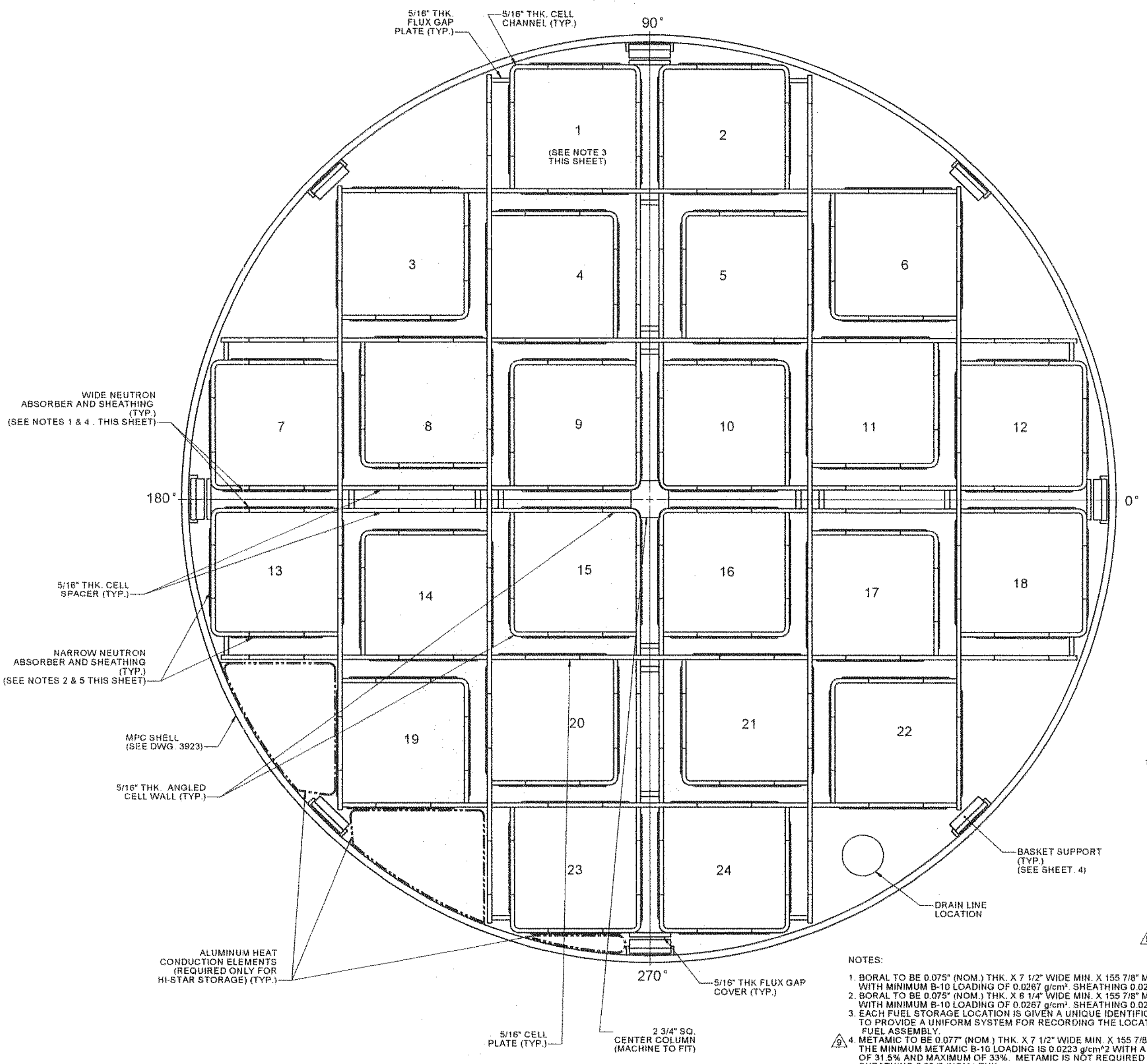
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

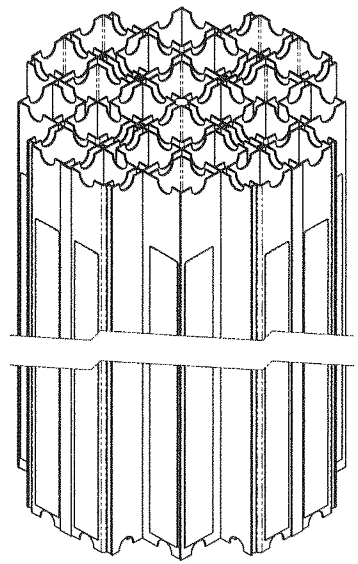
CLIENT: GENERAL

DESCRIPTION: MPC-24 FUEL BASKET ASSEMBLY

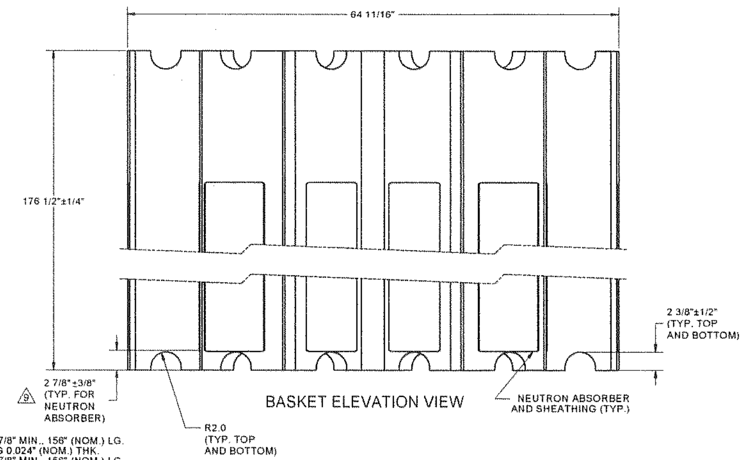
PROJECT NO. 1022 | DRAWING PACKAGE I.D. 3926 | SHEET 1 | TOTAL SHEETS 4

P.O. NO. N/A | G:\DRAWINGS\1022\3926





ISOMETRIC ASSEMBLY VIEW



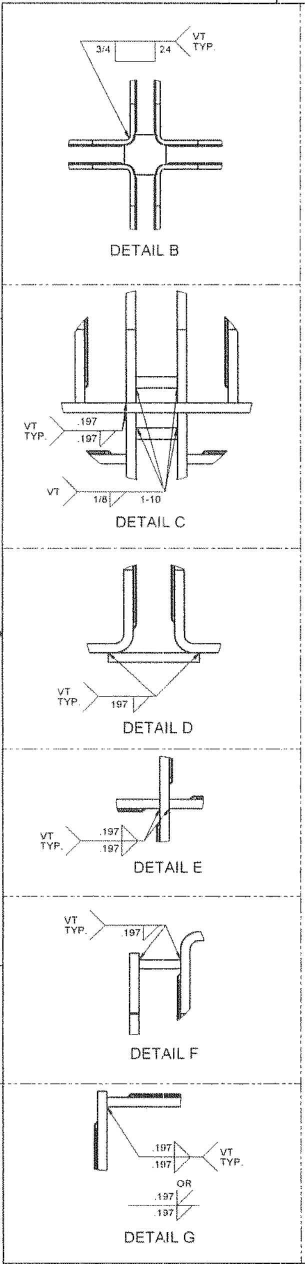
BASKET ELEVATION VIEW

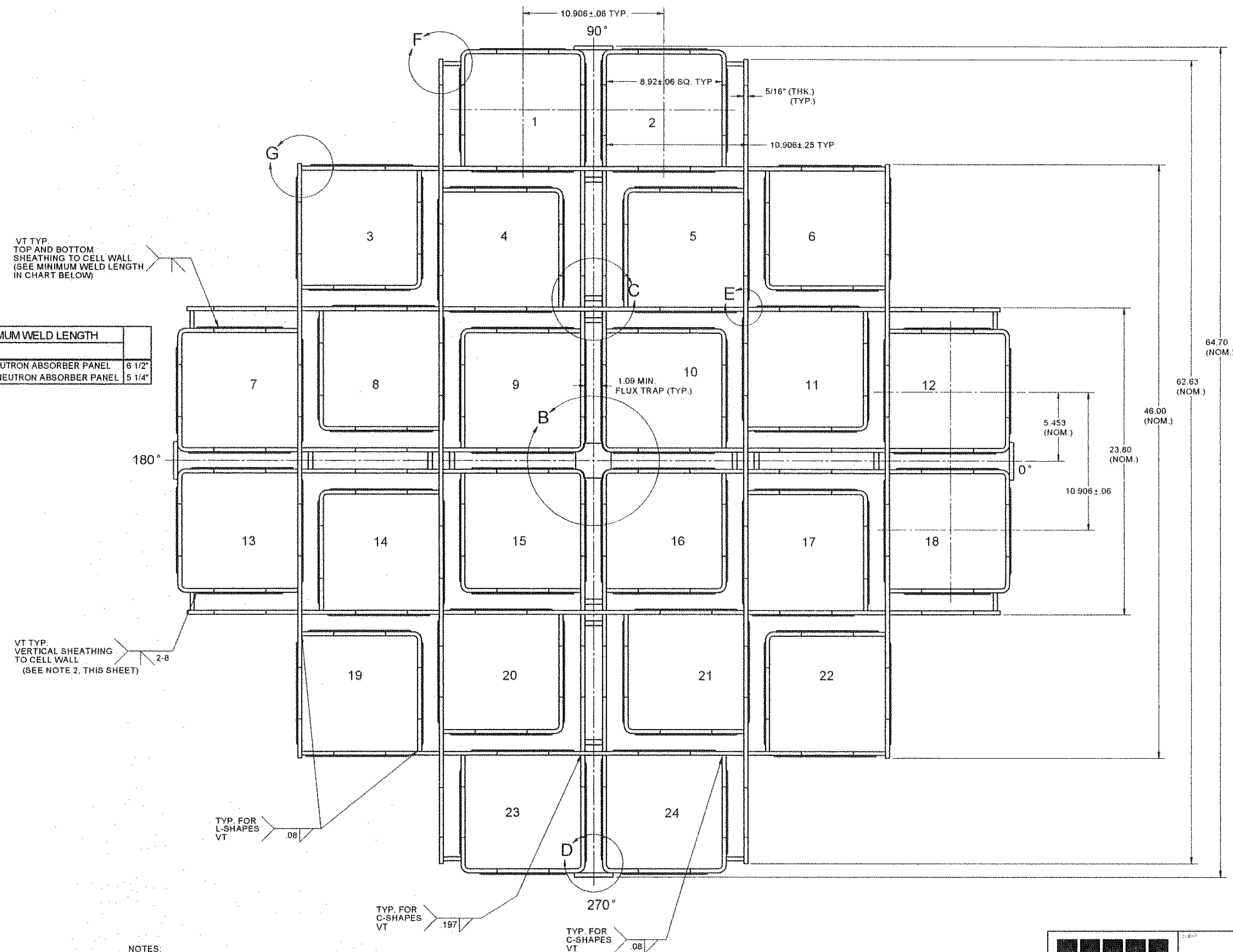
NOTES:

1. BORAL TO BE 0.075" (NOM.) THK. X 7 1/2" WIDE MIN. X 155 7/8" MIN., 156" (NOM.) LG. WITH MINIMUM B-10 LOADING OF 0.0267 g/cm². SHEATHING 0.024" (NOM.) THK.
2. BORAL TO BE 0.075" (NOM.) THK. X 6 1/4" WIDE MIN. X 155 7/8" MIN., 156" (NOM.) LG. WITH MINIMUM B-10 LOADING OF 0.0267 g/cm². SHEATHING 0.024" (NOM.) THK.
3. EACH FUEL STORAGE LOCATION IS GIVEN A UNIQUE IDENTIFICATION NUMBER TO PROVIDE A UNIFORM SYSTEM FOR RECORDING THE LOCATION OF EACH FUEL ASSEMBLY.
4. (9) METAMIC TO BE 0.077" (NOM.) THK. X 7 1/2" WIDE MIN. X 155 7/8" MIN. (156" NOM.) LG. THE MINIMUM METAMIC B-10 LOADING IS 0.0223 g/cm^2 WITH A MINIMUM B4C LOADING OF 31.5% AND MAXIMUM OF 33%. METAMIC IS NOT REQUIRED TO BE PASSIVATED. SHEATHING 0.024" (NOM.) THK.
5. (9) METAMIC TO BE 0.077" (NOM.) THK. X 6 1/4" WIDE MIN. X 155 7/8" MIN. (156" NOM.) LG. THE MINIMUM METAMIC B-10 LOADING IS 0.0223 g/cm^2 WITH A MINIMUM B4C LOADING OF 31.5% AND MAXIMUM OF 33%. METAMIC IS NOT REQUIRED TO BE PASSIVATED. SHEATHING 0.024" (NOM.) THK.

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

CLIENT	GENERAL
DESCRIPTION	MPC 24 FUEL BASKET ARRANGEMENT
PROJECT NO.	1022
	N/A
COMPANION DRAWINGS	3923
SIZE	D
DRAWING NO.	3926
SHEET	2
REV.	9
SCALE	NONE
FILE PATH	G:\DRAWINGS\1022\3926





MINIMUM WELD LENGTH	
WIDE NEUTRON ABSORBER PANEL	6 1/2"
NARROW NEUTRON ABSORBER PANEL	5 1/4"

NOTES:

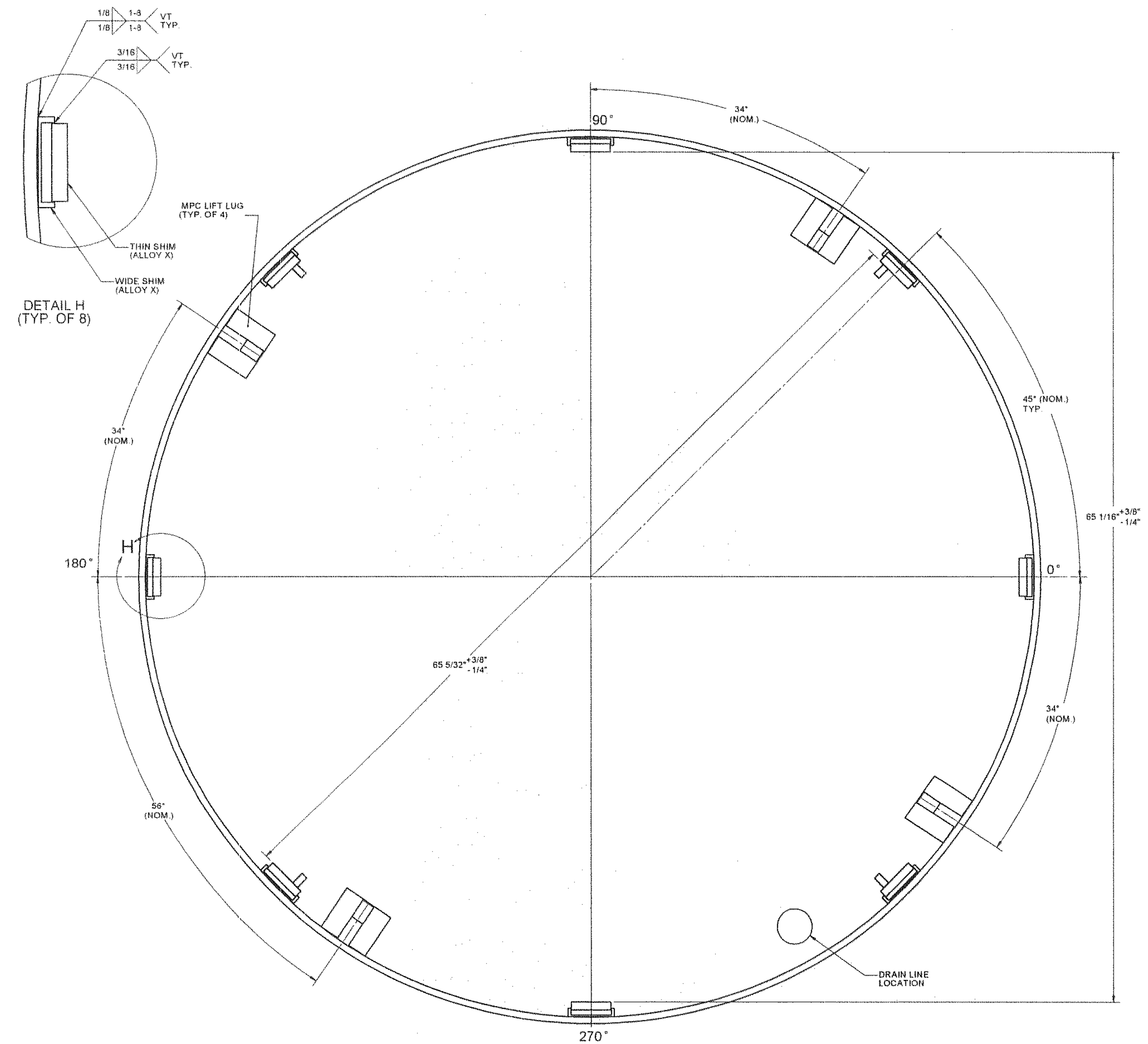
1. DELETED.
2. LENGTH AND SPACING OF WELD ON SIDES OF SHEATHING CAN VARY PROVIDED TOTAL VERTICAL SHEATHING WELD PER PIECE IS NOT LESS THAN 65" FOR WIDE NEUTRON ABSORBER PANELS OR 67.5" FOR NARROW NEUTRON ABSORBER PANELS, AND THERE IS A MINIMUM OF 19" OF WELD ALONG EACH SIDE OF THE SHEATHING PANEL. 9

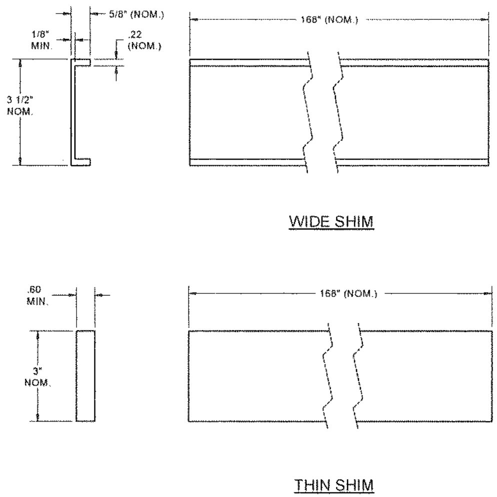
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

GENERAL

MPC-24
FUEL BASKET
LAYOUT AND WELD DETAILS

1022	3923	D	3926	3	9
N/A		NONE	G:\DRAWINGS\1022\3926		





NOTE:

1. THE MPC BASKET SUPPORTS ARE WELDED TO THE INSIDE SURFACE OF THE MPC SHELL. THEY MAY INCLUDE ADJUSTABLE SHIMS TO ENSURE THE NECESSARY CLEARANCE BETWEEN THE BASKET TOUCH POINTS AND THE BASKET SUPPORTS.

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

CLIENT	GENERAL
DESCRIPTION	MPC 24 FUEL BASKET SUPPORTS
PROJECT NO.	1022
P.O. NO.	N/A
COMPANION DRAWINGS	3923
SIZE	D
DRAWING NO.	3926
SHEET	4
REV.	9
SCALE	NONE

CLIENT GENERAL

LICENSING DRAWING PACKAGE COVER SHEET

PROJECT NO. 1023	P.O. NO. N/A
DRAWING PACKAGE I.D. 3927	TOTAL SHEETS 5

DESIGN DRAWING PACKAGE CONTENTS:

SHEET	DESCRIPTION
1	COVER SHEET
2	FUEL BASKET ARRANGEMENT
3	FUEL BASKET LAYOUT AND WELD DETAILS
4	STANDARD FUEL BASKET SUPPORTS
5	OPTIONAL FUEL BASKET SUPPORTS

REVISION LOG

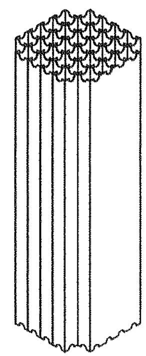
IT IS MANDATORY AT EACH REVISION TO COMPLETE THE REVIEW & APPROVAL LOG STORED IN HOLTEC'S DIRECTORY N:\PDOXWIN\WORKING\DBAL BY ALL RELEVANT TECHNICAL DISCIPLINES, PM AND QA PERSONNEL. EACH ATTACHED DRAWING SHEET CONTAINS ANNOTATED TRIANGLES INDICATING THE REVISION TO THE DRAWING.

REV	AFFECTED DRAWING SHEET NUMBERS	SUMMARY OF CHANGES/ AFFECTED ECOs	PREPARED BY	APPROVAL DATE	VIR# †
11	SHEET 4	1023-46 REV. 0	SLC	09/21/06	93452
12	SHEETS 1 & 2	1023-43, REV. 0	SLC	10/03/06	72109
13	SHEETS 1, 2, 4, & 5	1023-50, REV. 0	SLC	02/06/08	79022

† THE VALIDATION IDENTIFICATION RECORD (VIR) NUMBER IS A COMPUTER GENERATED RANDOM NUMBER WHICH CONFIRMS THAT ALL APPROPRIATE REVIEWS OF THIS DRAWING ARE DOCUMENTED IN COMPANY'S NETWORK.

GENERAL NOTES:

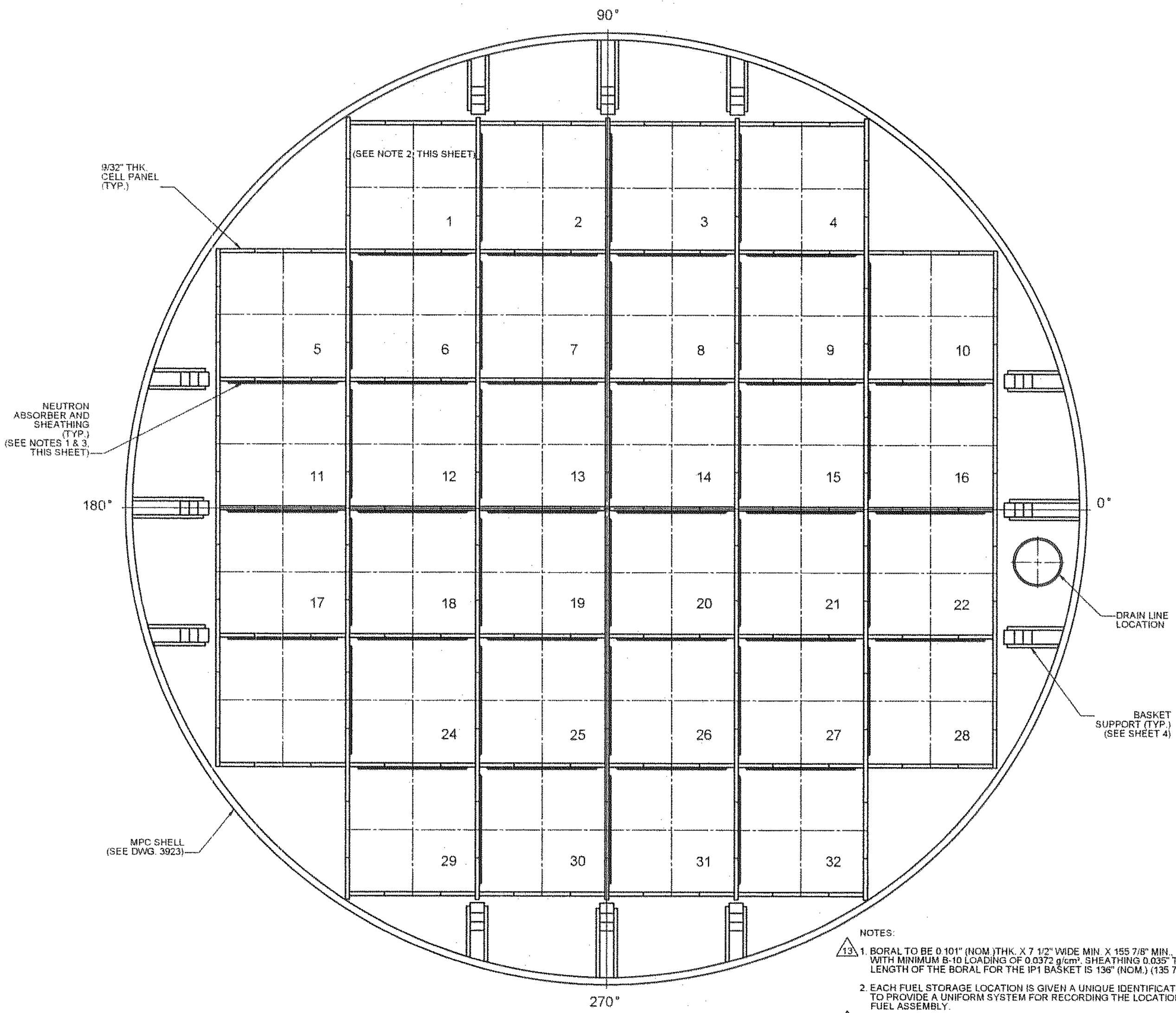
1. THE EQUIPMENT DESIGN DOCUMENTED IN THIS DRAWING PACKAGE HAS BEEN CONFIRMED BY HOLTEC INTERNATIONAL TO COMPLY WITH THE SAFETY ANALYSES DESCRIBED IN THE SAFETY ANALYSIS REPORT.
2. DIMENSIONAL TOLERANCES ON THIS DRAWING ARE PROVIDED TO ENSURE THAT THE EQUIPMENT DESIGN IS CONSISTENT WITH THE SUPPORTING ANALYSIS. HARDWARE IS FABRICATED IN ACCORDANCE WITH THE DESIGN DRAWINGS, WHICH MAY HAVE MORE RESTRICTIVE TOLERANCES, TO ENSURE COMPONENT FIT-UP. DO NOT USE WORST-CASE TOLERANCE STACK-UP FROM THIS DRAWING TO DETERMINE COMPONENT FIT-UP.
3. THE REVISION LEVEL OF EACH INDIVIDUAL SHEET IN THIS PACKAGE IS THE SAME AS THE REVISION LEVEL OF THIS COVER SHEET. A REVISION TO ANY SHEET(S) IN THIS PACKAGE REQUIRES UPDATING OF REVISION NUMBERS OF ALL SHEETS TO THE NEXT REVISION NUMBER.
4. THE ASME BOILER AND PRESSURE VESSEL CODE (ASME CODE), 1995 EDITION WITH ADDENDA THROUGH 1997, IS THE GOVERNING CODE FOR THE HI-STAR 100 SYSTEM, WITH CERTAIN APPROVED ALTERNATIVES AS LISTED IN SAR TABLE 1.3.2 (TRANSPORTATION) AND FSAR TABLE 2.2.15 (STORAGE). THE MPC FUEL BASKET IS CONSTRUCTED IN ACCORDANCE WITH ASME SECTION III, SUBSECTION NG AS DESCIBED IN THE SAR (TRANSPORTATION) AND FSAR (STORAGE). NEW OR REVISED ASME CODE ALTERNATIVES REQUIRE PRIOR NRC APPROVAL BEFORE IMPLEMENTATION.
5. ALL MPC BASKET STRUCTURAL MATERIALS COMPLY WITH THE REQUIREMENTS OF ASME SECTION II, PART A. WELD MATERIAL COMPLIES WITH THE REQUIREMENTS OF ASME SECTION II, PART C.
6. ALL WELDS REQUIRE VISUAL EXAMINATION (VT). ADDITIONAL NDE INSPECTIONS ARE NOTED ON THE DRAWING AS REQUIRED. NDE TECHNIQUES AND ACCEPTANCE CRITERIA ARE PROVIDED IN THE APPLICABLE CODES AS CLARIFIED IN THE APPLICABLE SAFETY ANALYSIS REPORTS.
7. FABRICATOR MAY ADD WELDS TO STITCH WELDS AT THEIR DISCRETION.
8. DO NOT MAKE A CONTINUOUS SEAL WELD BETWEEN THE SHEATHING AND THE CELL WALL.
9. ALL STRUCTURAL MATERIALS ARE "ALLOY X" UNLESS OTHERWISE NOTED. ALLOY X IS ANY OF THE FOLLOWING STAINLESS STEEL TYPES: 316, 316 LN, 304, AND 304 LN.
10. BOTH BORAL AND METAMIC ARE APPROVED FOR USE AS NEUTRON ABSORBERS.NEUTRON ABSORBER PANELS ARE INTENDED TO HAVE NO SIGNIFICANT FLAWS. HOWEVER, TO ACCOUNT FOR MANUFACTURING DEVIATIONS OCCURING DURING INSTALLATION OF THE PANELS INTO THE MPC FUEL BASKET, NEUTRON ABSORBER DAMAGE OF UP TO THE EQUIVALENT OF A 1" DIAMETER HOLE IN EACH PANEL HAS BEEN ANALYZED AND FOUND TO BE ACCEPTABLE.
11. THIS COMPONENT IS CLASSIFIED AS ITS-A BASED ON THE HIGHEST CLASSIFICATION OF ANY SUBCOMPONENT. SUBCOMPONENT CLASSIFICATIONS ARE PROVIDED IN SAR TABLE 1.3.3 (TRANSPORTATION) AND FSAR TABLE 2.2.6 (STORAGE).
12. DELETED.
13. TOLERANCES FOR THICKNESS OF ASME CODE MATERIAL ARE SPECIFIED IN ASME SECTION II.
14. ALL WELD SIZES ARE MINIMUMS. LARGER WELDS ARE PERMITTED. LOCAL AREAS OF UNDERSIZE WELDS ARE ACCEPTABLE WITHIN THE LIMITS SPECIFIED IN THE ASME CODE, AS CLARIFIED IN THE (F)SAR.
15. REFER TO THE COMPONENT COMPLETION RECORD (CCR) FOR THE COMPLETE LIST OF APPROVED DESIGN DEVIATIONS FOR EACH INDIVIDUAL SERIAL NUMBER.
16. THE MPC-32 IS CERTIFIED FOR STORAGE AND TRANSPORTATION OF INTACT PWR FUEL, AS SPECIFIED IN COCs 72-1014, AND 71-9261.
17. DIMENSIONS NOTED AS NOMINAL ("NOM.") IN THE DRAWING ARE FOR INFORMATION ONLY, IN ORDER TO INDICATE THE GENERAL SIZE OF THE COMPONENT OR PART. NOMINAL DIMENSIONS HAVE NO SPECIFIC TOLERANCE, BUT ARE MET THROUGH FABRICATION IN ACCORDANCE WITH OTHER DIMENSIONS THAT ARE TOLERANCED AND INSPECTED. NOMINAL DIMENSIONS ARE NOT SPECIFICALLY VERIFIED DURING THE FABRICATION PROCESS.
18. NEUTRON ABSORBER PANELS MAY BE MADE UP OF ONE LONG PANEL OF INDICATED WIDTH OR TWO SHORTER PANELS OF INDICATED WIDTH AS LONG AS THE TOTAL LENGTH IS MAINTAINED AS INDICATED AND THE GAP BETWEEN PANELS IS MAINTAINED AT NO MORE THAN 1/4".
19. NEUTRON ABSORBER PANELS MAY HAVE A REDUCTION IN WIDTH OF UP TO 1/32" OVER A LENGTH OF NO MORE THAN 12" PROVIDED THE AVERAGE WIDTH OF THE PANEL IS NO LESS THAN THE MINIMUM SPECIFIED.
20. 13 DIFFERENCES BETWEEN THE GENERIC MPC-32 AND THE IP1 MPC-32 ARE SPECIFICALLY NOTED (FOR PART 72 USE ONLY).



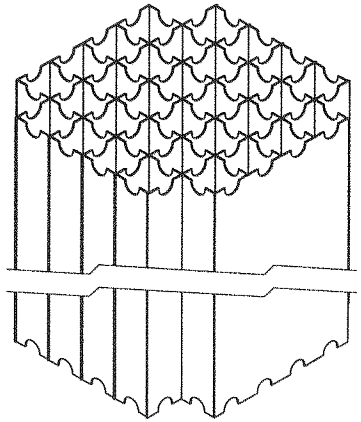
MPC-32 FUEL BASKET
ISOMETRIC VIEW

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

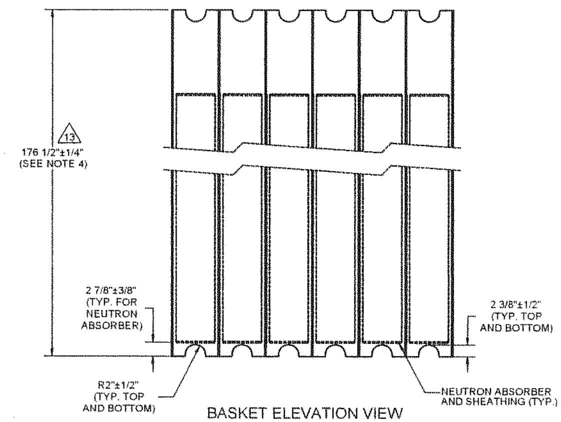
CLIENT	GENERAL
DESCRIPTION	MPC-32 FUEL BASKET ASSEMBLY
PROJECT NO. 1023	DRAWING NO. 3927
P.O. NO. N/A	SHEET 1 TOTAL SHEETS 5
	FILE PATH N:\DRAWINGS\1023\3927



CROSS SECTIONAL VIEW OF THE MPC-32



ISOMETRIC ASSEMBLY VIEW



BASKET ELEVATION VIEW

NOTES:

13 1. BORAL TO BE 0.101" (NOM.)THK. X 7 1/2" WIDE MIN. X 155 7/8" MIN., 156" (NOM.) LG. WITH MINIMUM B-10 LOADING OF 0.0372 g/cm². SHEATHING 0.035" THK. THE LENGTH OF THE BORAL FOR THE IP1 BASKET IS 136" (NOM.) (135 7/8" MIN.)

2. EACH FUEL STORAGE LOCATION IS GIVEN A UNIQUE IDENTIFICATION NUMBER TO PROVIDE A UNIFORM SYSTEM FOR RECORDING THE LOCATION OF EACH FUEL ASSEMBLY.

13 3. METAMIC TO BE 0.106" (NOM.) THK. X 7 1/2" WIDE MIN. X 155 7/8" MIN. (156" NOM.) LG. THE MINIMUM METAMIC B10 LOADING IS 0.0310 g/cm^2, WITH A MINIMUM B4C LOADING OF 31.5% AND MAXIMUM OF 33%. METAMIC IS NOT REQUIRED TO BE PASSIVATED. SHEATHING 0.035" THK. THE LENGTH OF METAMIC FOR THE IP1 BASKET IS 136" (NOM.) (135 7/8" MIN.)

13 4. THE IP1 BASKET DIMENSION IS 143 1/8"±1/4".

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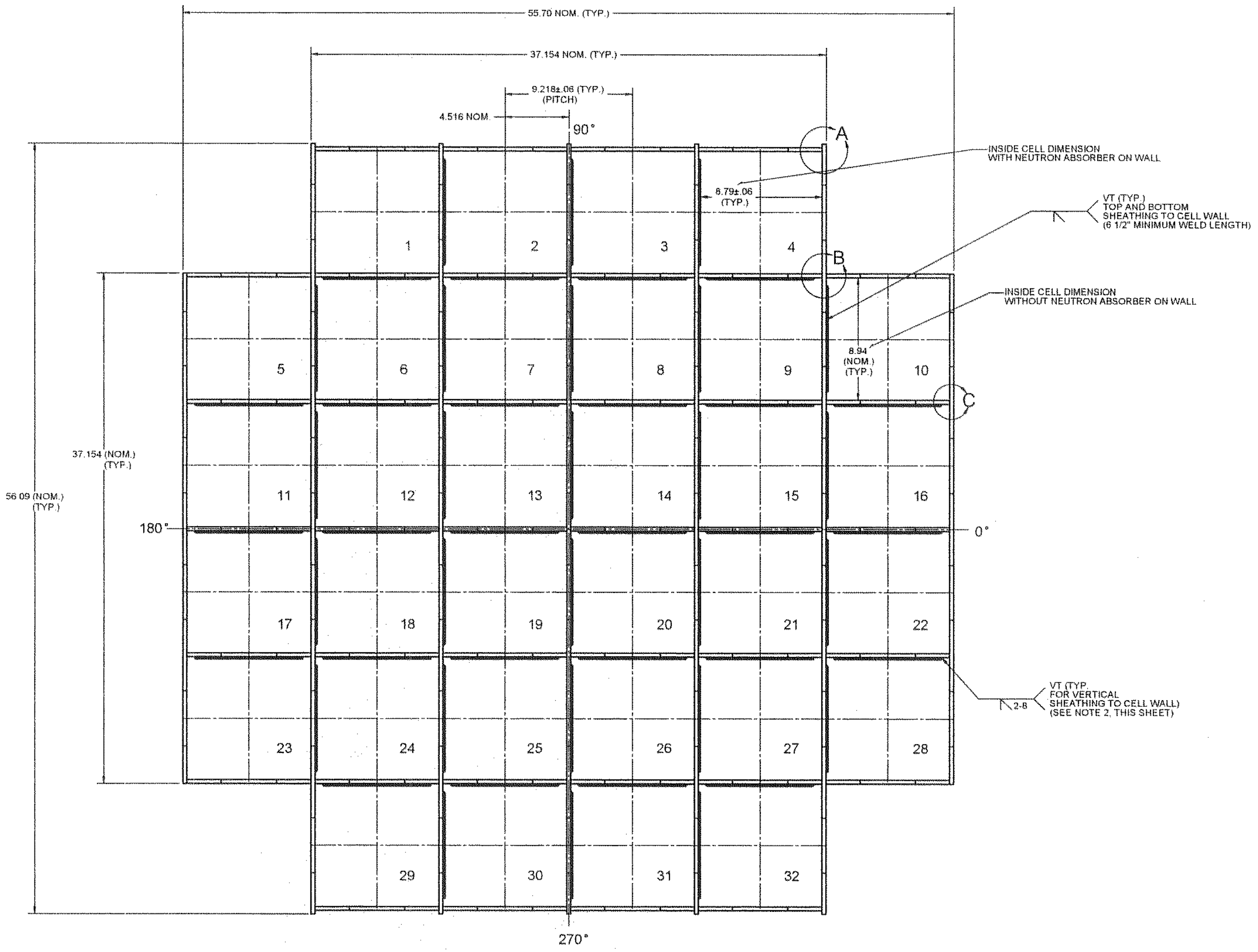
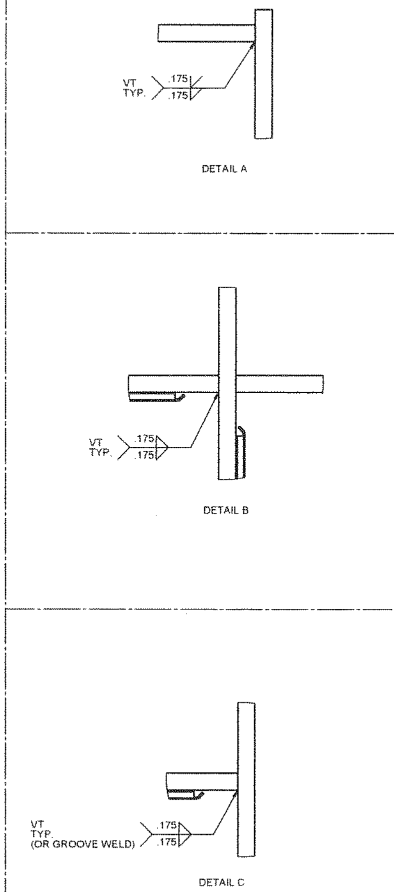
CLIENT	GENERAL
DESCRIPTION	MPC-32 FUEL BASKET ASSEMBLY
PROJECT NO.	1023
	N/A
COMPANION DRAWINGS	3923
SIZE	D
DRAWING NO.	3927
SHEET	2
REV	13
SCALE	NONE
FILE PATH	N:\DRAWINGS\1023\3927





NOTE:

1. DELETED.
2. LENGTH AND SPACING OF WELD ON SIDES OF SHEATHING CAN VARY PROVIDED TOTAL VERTICAL SHEATHING WELD PER PIECE IS NOT LESS THAN 65" AND THERE IS A MINIMUM OF 19" OF WELD ALONG EACH SIDE OF THE SHEATHING PANEL.

PROJECT NO.	1023
	N/A
COMPANY DRAWING NO.	3923

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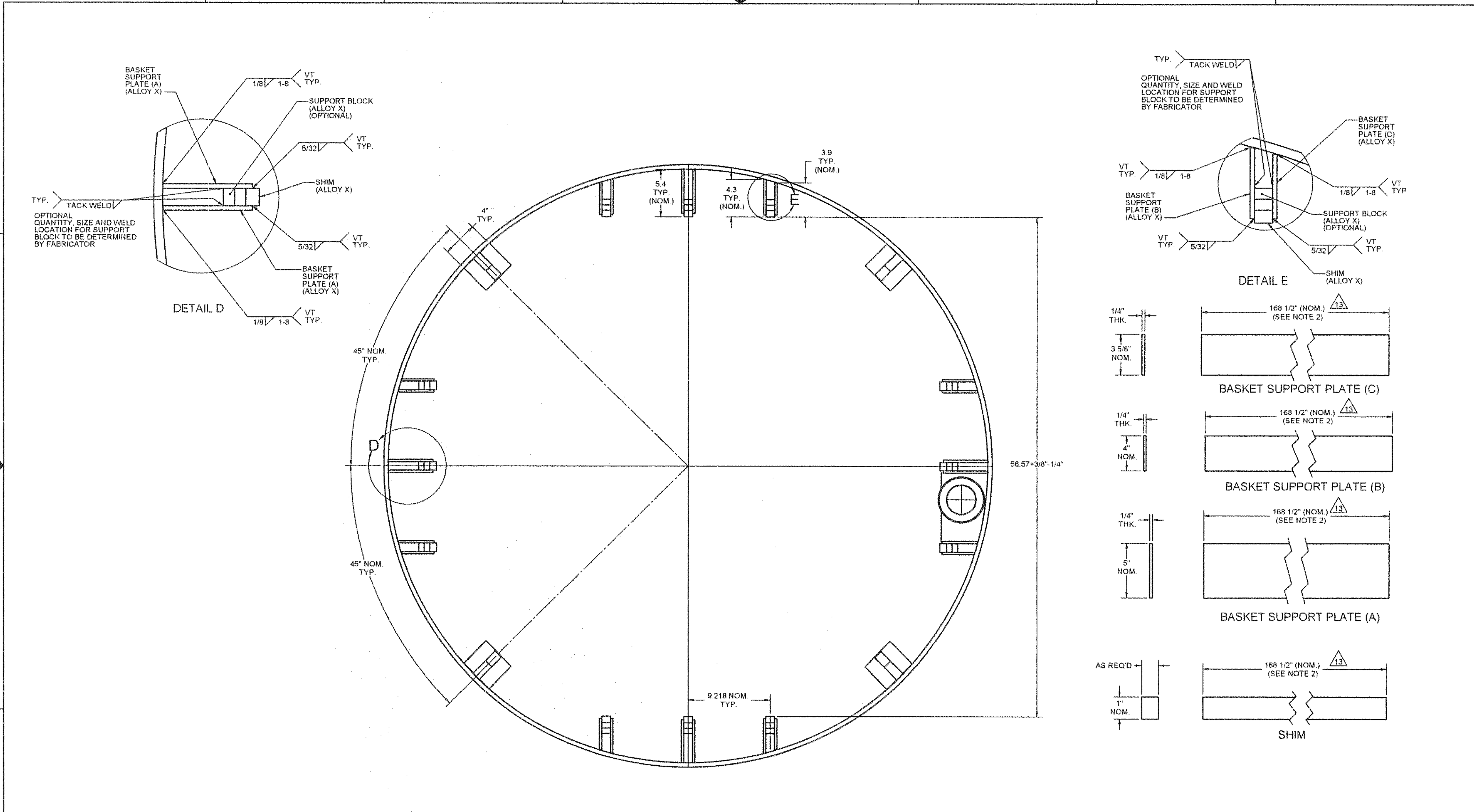
MARLTON, NJ 08053

CLIENT	GENERAL
DESCRIPTION	MPC-32 FUEL BASKET LAYOUT AND WELD DETAILS
SIZE	D
DRAWING NO.	3927
SHEET	3
REV	13
SCALE	NONE



NOTE:

1. THE MPC BASKET SUPPORTS ARE WELDED TO THE INSIDE SURFACE OF THE MPC SHELL. THEY MAY INCLUDE ADJUSTABLE SHIMS TO ENSURE THE NECESSARY CLEARANCE BETWEEN THE BASKET TOUCH POINTS AND THE BASKET SUPPORTS.

13 2. THE IP1 BASKET SUPPORT DIMENSION IS 135 1/8" (NOM.).

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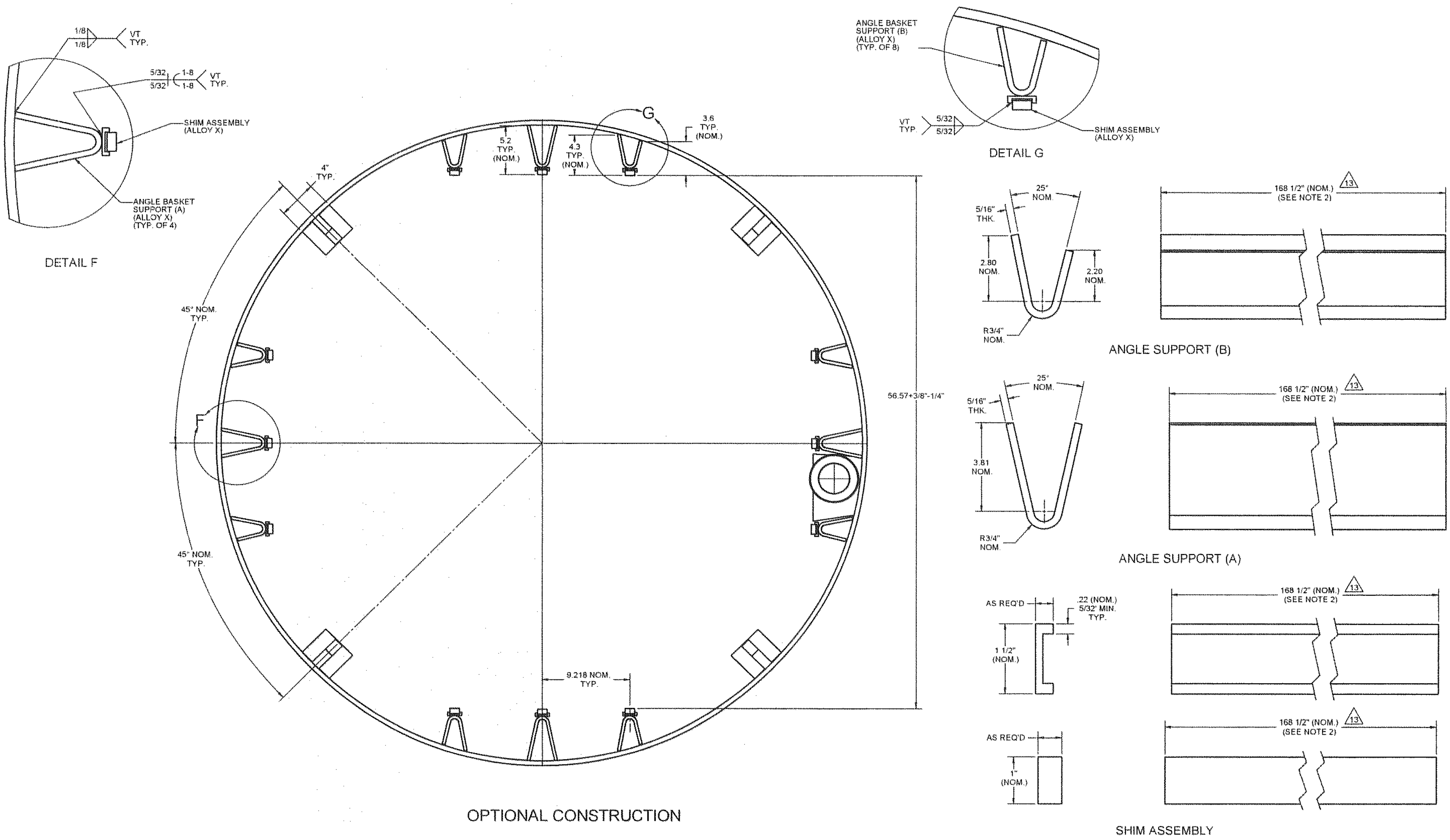
CLIENT	GENERAL
DESCRIPTION	MPC-32 FUEL BASKET SUPPORT
PROJECT NO.	1023
	N/A
COMPANY DRAWING	3923
SIZE	D
DRAWING NO.	3927
SHEET	4
REV	13
SCALE	NONE



NOTE:

1. THE MPC BASKET SUPPORTS ARE WELDED TO THE INSIDE SURFACE OF THE MPC SHELL. THEY MAY INCLUDE ADJUSTABLE SHIMS TO ENSURE THE NECESSARY CLEARANCE BETWEEN THE BASKET TOUCH POINTS AND THE BASKET SUPPORTS.

13 2. THE IP1 BASKET SUPPORT DIMENSION IS 135 1/8" (NOM.).

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HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

CLIENT	GENERAL
DESCRIPTION	MPC-32 FUEL BASKET SUPPORTS
PROJECT NO.	1023
	N/A
COMPANION DRAWING	3923
SIZE	D
DRAWING NO.	3927
SHEET	5
REV	13
SCALE	NONE

CLIENT
GENERAL

PROJECT NO. 1021 | P.O. NO. N/A

DRAWING PACKAGE I.D. 3928 | TOTAL SHEETS 4

LICENSING DRAWING PACKAGE COVER SHEET

LICENSING DRAWING PACKAGE CONTENTS:

SHEET	DESCRIPTION
1	COVER SHEET
2	FUEL BASKET ARRANGEMENT
3	FUEL BASKET LAYOUT AND WELD DETAILS
4	FUEL BASKET SUPPORTS

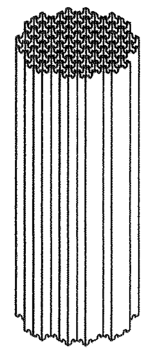
REVISION LOG

REV	AFFECTED DRAWING SHEET NUMBERS	SUMMARY OF CHANGES/ AFFECTED ECOs	PREPARED BY	APPROVAL DATE	VIR# †
11	SHEET 4	ECO 1021-89	RLS	12/04/06	91256

† THE VALIDATION IDENTIFICATION RECORD (VIR) NUMBER IS A COMPUTER GENERATED RANDOM NUMBER WHICH CONFIRMS THAT ALL APPROPRIATE REVIEWS OF THIS DRAWING ARE DOCUMENTED IN COMPANY'S NETWORK.

GENERAL NOTES:

1. THE EQUIPMENT DESIGN DOCUMENTED IN THIS DRAWING PACKAGE HAS BEEN CONFIRMED BY HOLTEC INTERNATIONAL TO COMPLY WITH THE SAFETY ANALYSES DESCRIBED IN THE SAFETY ANALYSIS REPORT.
2. DIMENSIONAL TOLERANCES ON THIS DRAWING ARE PROVIDED TO ENSURE THAT THE EQUIPMENT DESIGN IS CONSISTENT WITH THE SUPPORTING ANALYSIS. HARDWARE IS FABRICATED IN ACCORDANCE WITH THE DESIGN DRAWINGS, WHICH MAY HAVE MORE RESTRICTIVE TOLERANCES, TO ENSURE COMPONENT FIT-UP. DO NOT USE WORST-CASE TOLERANCE STACK-UP FROM THIS DRAWING TO DETERMINE COMPONENT FIT-UP.
3. THE REVISION LEVEL OF EACH INDIVIDUAL SHEET IN THIS PACKAGE IS THE SAME AS THE REVISION LEVEL OF THIS COVER SHEET. A REVISION TO ANY SHEET(S) IN THIS PACKAGE REQUIRES UPDATING OF REVISION NUMBERS OF ALL SHEETS TO THE NEXT REVISION NUMBER.
4. THE ASME BOILER AND PRESSURE VESSEL CODE (ASME CODE), 1995 EDITION WITH ADDENDA THROUGH 1997, IS THE GOVERNING CODE FOR THE HI-STAR 100 SYSTEM, WITH CERTAIN APPROVED ALTERNATIVES AS LISTED IN SAR TABLE 1.3.2 (TRANSPORTATION) AND FSAR TABLE 2.2.15 (STORAGE). THE MPC FUEL BASKET IS CONSTRUCTED IN ACCORDANCE WITH ASME SECTION III, SUBSECTION NG AS DESCRIBED IN THE SAR (TRANSPORTATION) AND FSAR (STORAGE). NEW OR REVISED ASME CODE ALTERNATIVES REQUIRE PRIOR NRC APPROVAL BEFORE IMPLEMENTATION.
5. ALL MPC BASKET STRUCTURAL MATERIALS COMPLY WITH THE REQUIREMENTS OF ASME SECTION II, PART A. WELD MATERIAL COMPLIES WITH THE REQUIREMENTS OF ASME SECTION II, PART C.
6. ALL WELDS REQUIRE VISUAL EXAMINATION (VT). ADDITIONAL NDE INSPECTIONS ARE NOTED ON THE DRAWING AS REQUIRED. NDE TECHNIQUES AND ACCEPTANCE CRITERIA ARE GOVERNED BY ASME SECTIONS V AND III, RESPECTIVELY, AS CLARIFIED IN THE APPLICABLE SAFETY ANALYSIS REPORTS.
7. FABRICATOR MAY ADD WELDS TO STITCH WELDS AT THEIR DISCRETION.
8. DO NOT MAKE A CONTINUOUS SEAL WELD BETWEEN THE SHEATHING AND THE CELL WALL.
9. ALL STRUCTURAL MATERIALS ARE "ALLOY X" UNLESS OTHERWISE NOTED. ALLOY X IS ANY OF THE FOLLOWING STAINLESS STEEL TYPES: 316, 316LN, 304, AND 304LN.
10. BOTH BORAL AND METAMIC ARE APPROVED FOR USE AS NEUTRON ABSORBERS. NEUTRON ABSORBER PANELS ARE INTENDED TO HAVE NO SIGNIFICANT FLAWS. HOWEVER, TO ACCOUNT FOR MANUFACTURING DEVIATIONS OCCURING DURING INSTALLATION OF THE PANELS INTO THE MPC FUEL BASKET, NEUTRON ABSORBER DAMAGE OF UP TO THE EQUIVALENT OF A 1" DIAMETER HOLE IN EACH PANEL HAS BEEN ANALYZED AND FOUND TO BE ACCEPTABLE.
11. THIS COMPONENT IS CLASSIFIED AS ITS-A BASED ON THE HIGHEST CLASSIFICATION OF ANY SUBCOMPONENT. SUBCOMPONENT CLASSIFICATIONS ARE PROVIDED IN SAR TABLE 1.3.3 (TRANSPORTATION) AND TABLE 2.2.6 (STORAGE).
12. DELETED.
13. TOLERANCES FOR THICKNESS OF ASME CODE MATERIAL ARE SPECIFIED IN ASME SECTION II.
14. ALL WELD SIZES ARE MINIMUMS. LARGER WELDS ARE PERMITTED. LOCAL AREAS OF UNDERSIZE WELDS ARE ACCEPTABLE WITHIN THE LIMITS SPECIFIED IN THE ASME CODE, AS CLARIFIED IN THE (F)SAR.
15. REFER TO THE COMPONENT COMPLETION RECORD (CCR) FOR THE COMPLETE LIST OF APPROVED DESIGN DEVIATIONS FOR EACH INDIVIDUAL SERIAL NUMBER.
16. THE MPC-68/68F IS CERTIFIED FOR STORAGE AND TRANSPORTATION OF INTACT AND DAMAGED BWR FUEL AND BWR FUEL CLASSIFIED AS FUEL DEBRIS, AS SPECIFIED IN COCs 72-1008, 72-1014, AND 71-9261. THE MPC-68FF IS CERTIFIED ONLY FOR STORAGE OF INTACT AND DAMAGED BWR FUEL AND BWR FUEL CLASSIFIED AS FUEL DEBRIS IN THE HI-STORM 100 SYSTEM UNDER COC 72-1014.
17. DIMENSIONS NOTED AS NOMINAL ("NOM.") IN THE DRAWING ARE FOR INFORMATION ONLY, IN ORDER TO INDICATE THE GENERAL SIZE OF THE COMPONENT OR PART. NOMINAL DIMENSIONS HAVE NO SPECIFIC TOLERANCE, BUT ARE MET THROUGH FABRICATION IN ACCORDANCE WITH OTHER DIMENSIONS THAT ARE TOLERANCED AND INSPECTED. NOMINAL DIMENSIONS ARE NOT SPECIFICALLY VERIFIED DURING THE FABRICATION PROCESS.
18. NEUTRON ABSORBER PANELS MAY BE MADE UP OF ONE LONG PANEL OF INDICATED WIDTH OR TWO SHORTER PANELS OF INDICATED WIDTH AS LONG AS THE TOTAL LENGTH IS MAINTAINED AS INDICATED AND THE GAP BETWEEN PANELS IS MAINTAINED AT NO MORE THAN 1/4".
19. NEUTRON ABSORBER PANELS MAY HAVE A REDUCTION IN WIDTH OF UP TO 1/32" OVER A LENGTH NO MORE THAN 12" PROVIDED THE AVERAGE WIDTH OF THE PANEL IS NO LESS THAN THE MINIMUM SPECIFIED.

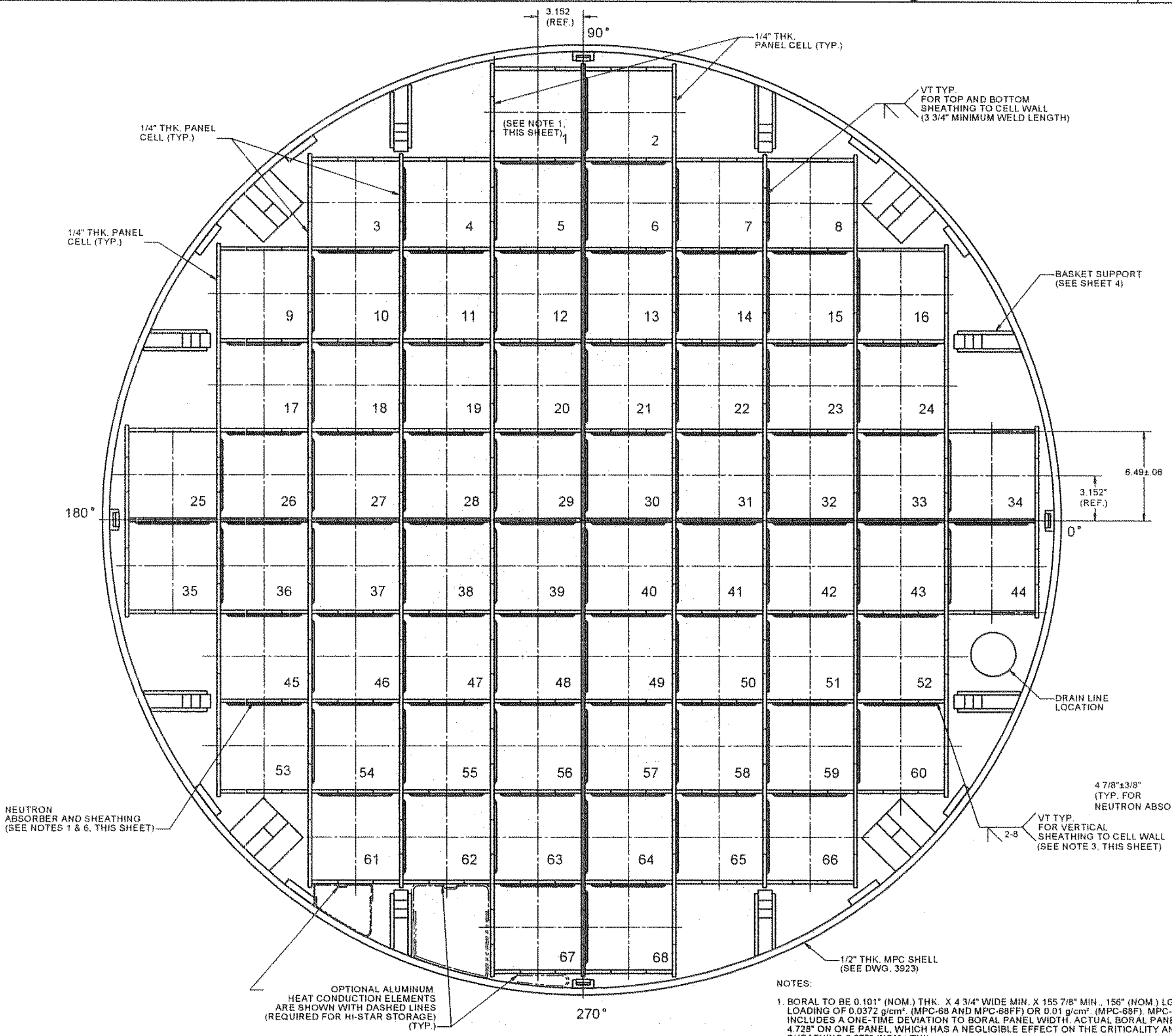


MPC-68/68F/68FF FUEL BASKET*
ISOMETRIC VIEW

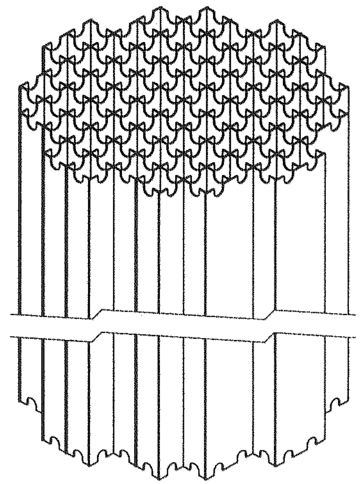
*MPC-68FF IS NOT CERTIFIED FOR TRANSPORTATION UNDER 10CFR71

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON NJ 08053

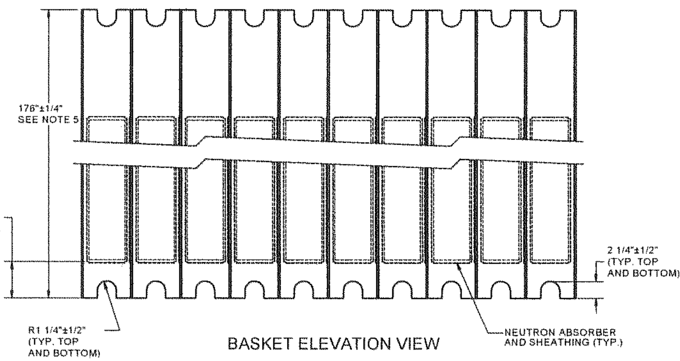
CLIENT: GENERAL
DESCRIPTION: MPC-68/68F/68FF FUEL BASKET
PROJECT NO. 1021 | DRAWING NO. 3928 | SHEET 1 | TOTAL SHEETS 4
P.O. NO. N/A | FILE PATH G:\DRAWINGS\1021\3928



PLAN VIEW



ISOMETRIC ASSEMBLY VIEW



BASKET ELEVATION VIEW

NOTES:

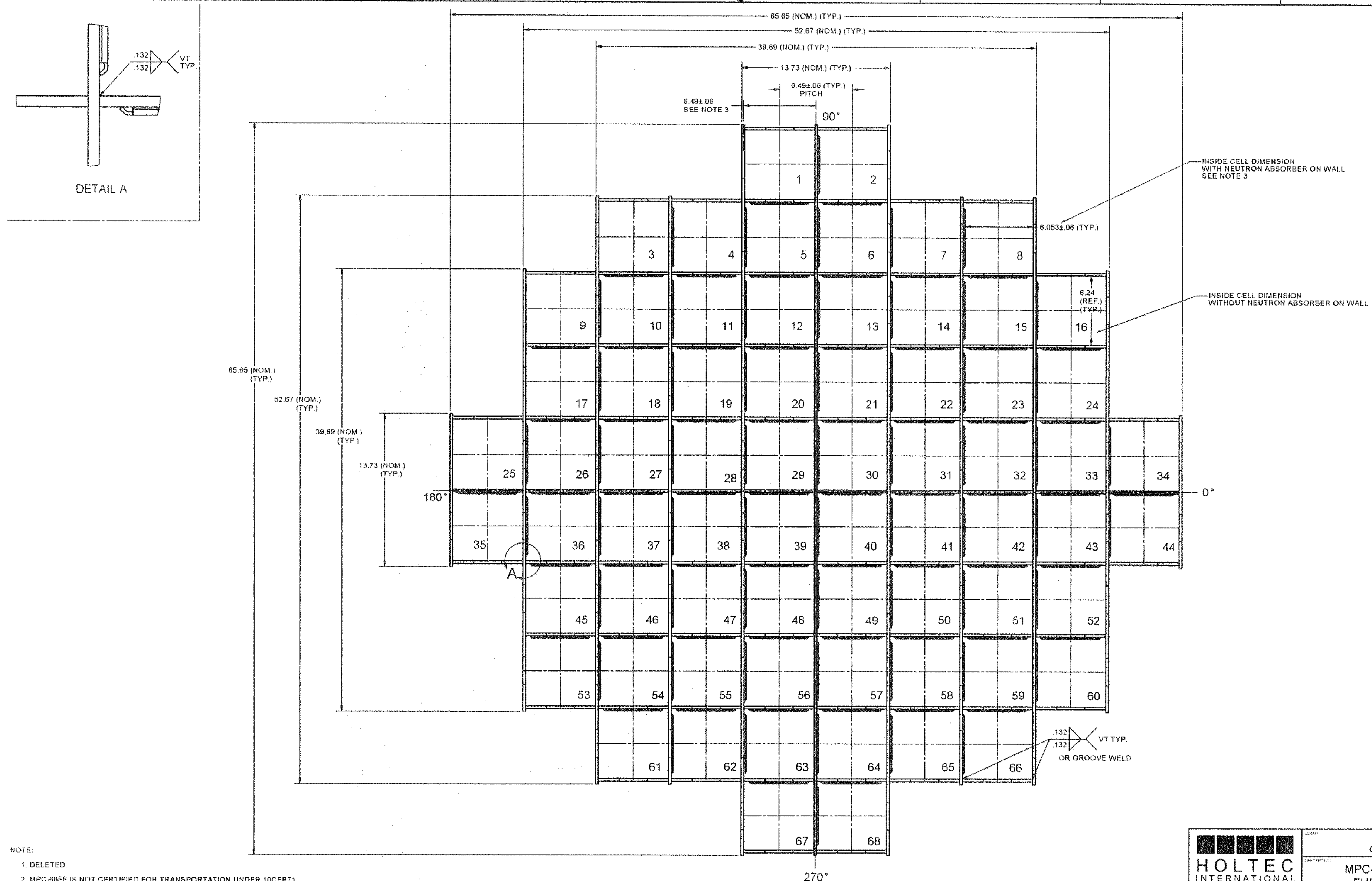
1. BORAL TO BE 0.101" (NOM.) THK. X 4 3/4" WIDE MIN. X 155 7/8" MIN., 156" (NOM.) LG. WITH MINIMUM B-10 LOADING OF 0.0372 g/cm². (MPC-68 AND MPC-68FF) OR 0.01 g/cm². (MPC-68F). MPC-68 SERIAL #1021-090 INCLUDES A ONE-TIME DEVIATION TO BORAL PANEL WIDTH. ACTUAL BORAL PANEL MINIMUM WIDTH WAS 4.728" ON ONE PANEL, WHICH HAS A NEGLIGIBLE EFFECT ON THE CRITICALITY ANALYSES (SMDR 1021-577). SHEATHING 0.075" (NOM.) THK.
2. EACH FUEL STORAGE LOCATION IS GIVEN A UNIQUE IDENTIFICATION NUMBER TO PROVIDE A UNIFORM SYSTEM FOR RECORDING THE LOCATION OF EACH FUEL ASSEMBLY.
3. LENGTH AND SPACING OF WELD ON SIDES OF SHEATHING CAN VARY PROVIDED TOTAL SHEATHING WELD PER PIECE IS NOT LESS THAN 70 1/2" AND THERE IS A MINIMUM OF 19" OF WELD ALONG EACH SIDE OF THE SHEATHING PANEL.
4. MPC-68FF IS NOT CERTIFIED FOR TRANSPORTATION UNDER 10CFR71.
5. MPC-68 SERIAL #1021-026 INCLUDES A ONE-TIME DEVIATION TO THE BASKET HEIGHT. ONE BASKET CELL PANEL IN CELL #68 HAS A HEIGHT OF 175 5/8" WHICH WILL HAVE A NEGLIGIBLE IMPACT ON THE DESIGN BASIS ANALYSES (SMDR-1021-674).
6. METAMIC TO BE 0.106" (NOM.) THK. X 4.75" WIDE MIN. X 155 7/8" MIN. (156" NOM.) LG. FOR MPC-68 THE MINIMUM METAMIC B10 LOADING IS 0.0310 g/cm^2 WITH A MINIMUM B4C LOADING OF 31.5% AND MAXIMUM OF 33%. METAMIC IS NOT REQUIRED TO BE PASSIVATED. SHEATHING 0.075" (NOM.) THK.

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

GENERAL

MPC-68/68F/68FF
FUEL BASKET

1021	3923	D	3928	2	11
N/A		NONE			

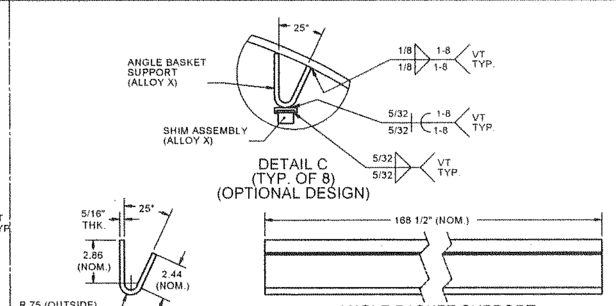


NOTE:

1. DELETED.
2. MPC-68FF IS NOT CERTIFIED FOR TRANSPORTATION UNDER 10CFR71.
3. MPC-68F SERIAL #1021-005 INCLUDES A ONE-TIME DEVIATION TO THE 6.49±.06 CELL OPENING AND 6.053±.06 INSIDE CELL DIMENSION WITH BORAL ON THE WALL FOR CELL NUMBERS 68 AND 64. THE CELL OPENING IS OVERSIZED BY A MAXIMUM OF 5/32" ALONG APPROXIMATELY 3 FEET OF THE CELL HEIGHT. AN EVALUATION HAS DETERMINED THAT THIS CONDITION HAS A NEGLIGIBLE IMPACT ON THE DESIGN BASIS (SMDR-1021-73).

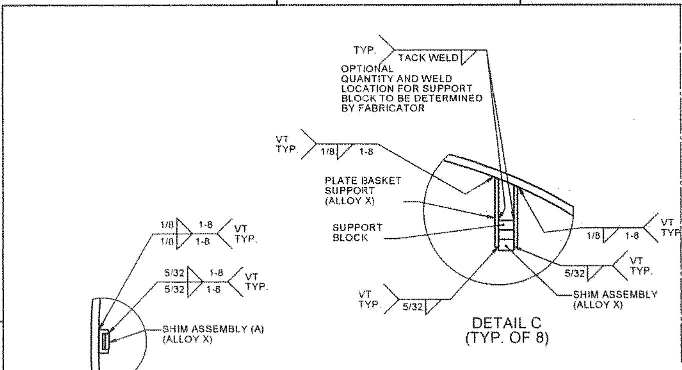
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

GENERAL	
MPC-68/68F/68FF FUEL BASKET LAYOUT AND WELD DETAILS	
PROJECT NO.	1021
P.O. NO.	N/A
COMPANION DRAWINGS	3923
SIZE	D
DRAWING NO.	3928
SHEET	3
REV.	11
SCALE	NONE
FILE PATH	G:\DRAWINGS\1021\3928

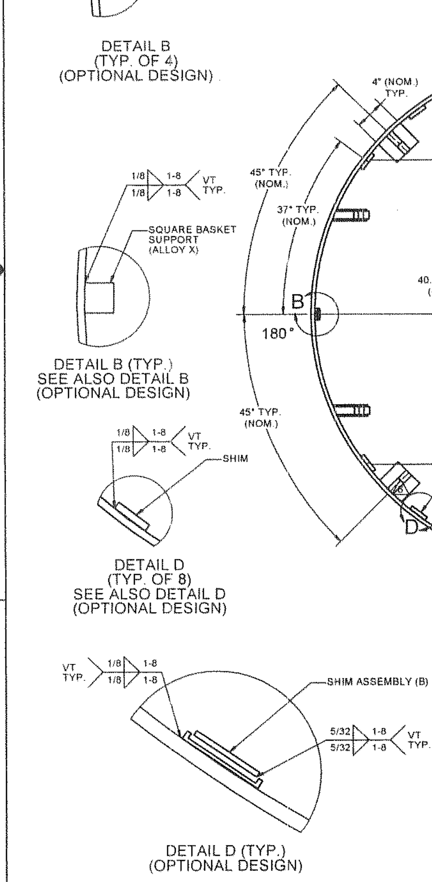


DETAIL C
(TYP. OF 8)
(OPTIONAL DESIGN)

ANGLE BASKET SUPPORT



DETAIL C
(TYP. OF 8)

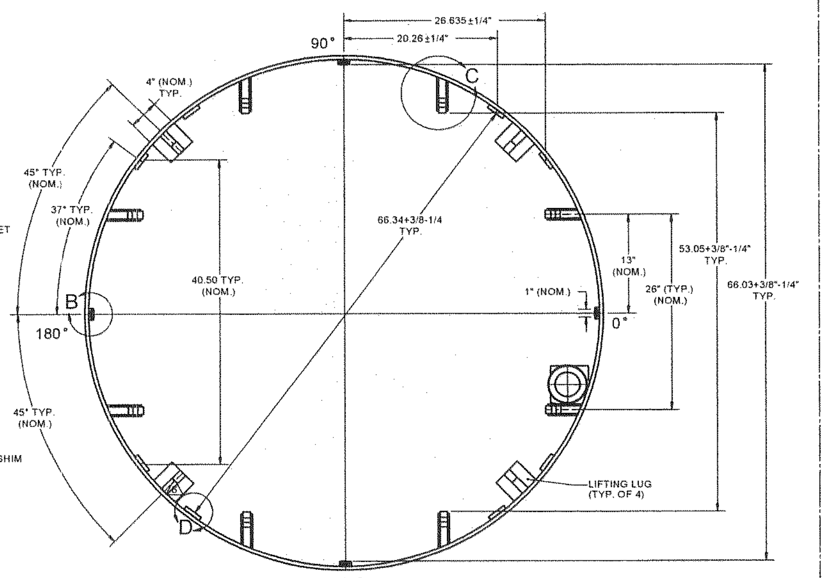


DETAIL B
(TYP. OF 4)
(OPTIONAL DESIGN)

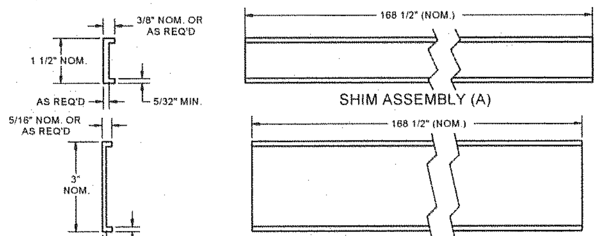
DETAIL B (TYP.)
SEE ALSO DETAIL B
(OPTIONAL DESIGN)

DETAIL D
(TYP. OF 8)
SEE ALSO DETAIL D
(OPTIONAL DESIGN)

DETAIL D (TYP.)
(OPTIONAL DESIGN)

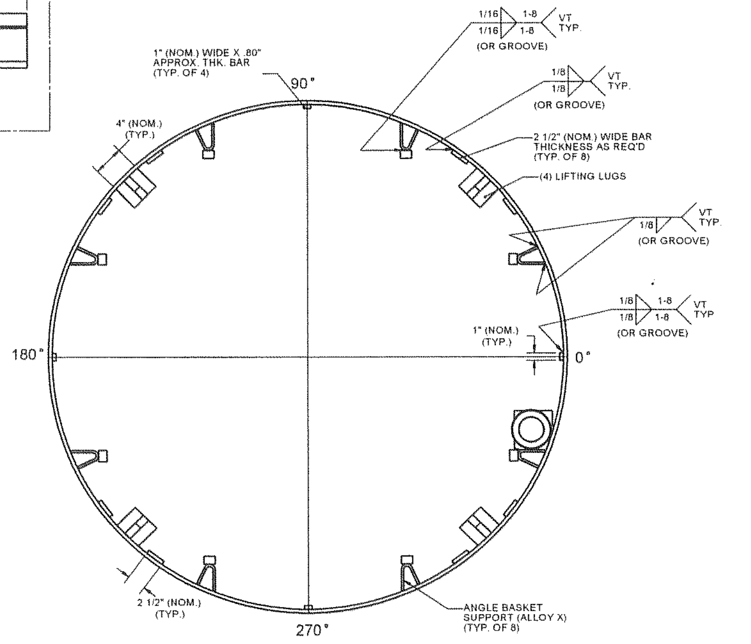


CROSS SECTIONAL VIEW OF MPC-68
BASKET SUPPORT STRUCTURE
(STANDARD CONSTRUCTION)

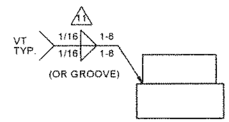


SHIM ASSEMBLY (A)

SHIM ASSEMBLY (B)



CROSS SECTIONAL VIEW OF MPC-68
BASKET SUPPORT STRUCTURE
(OPTIONAL CONSTRUCTION)
(SEE NOTE 4, THIS SHEET)

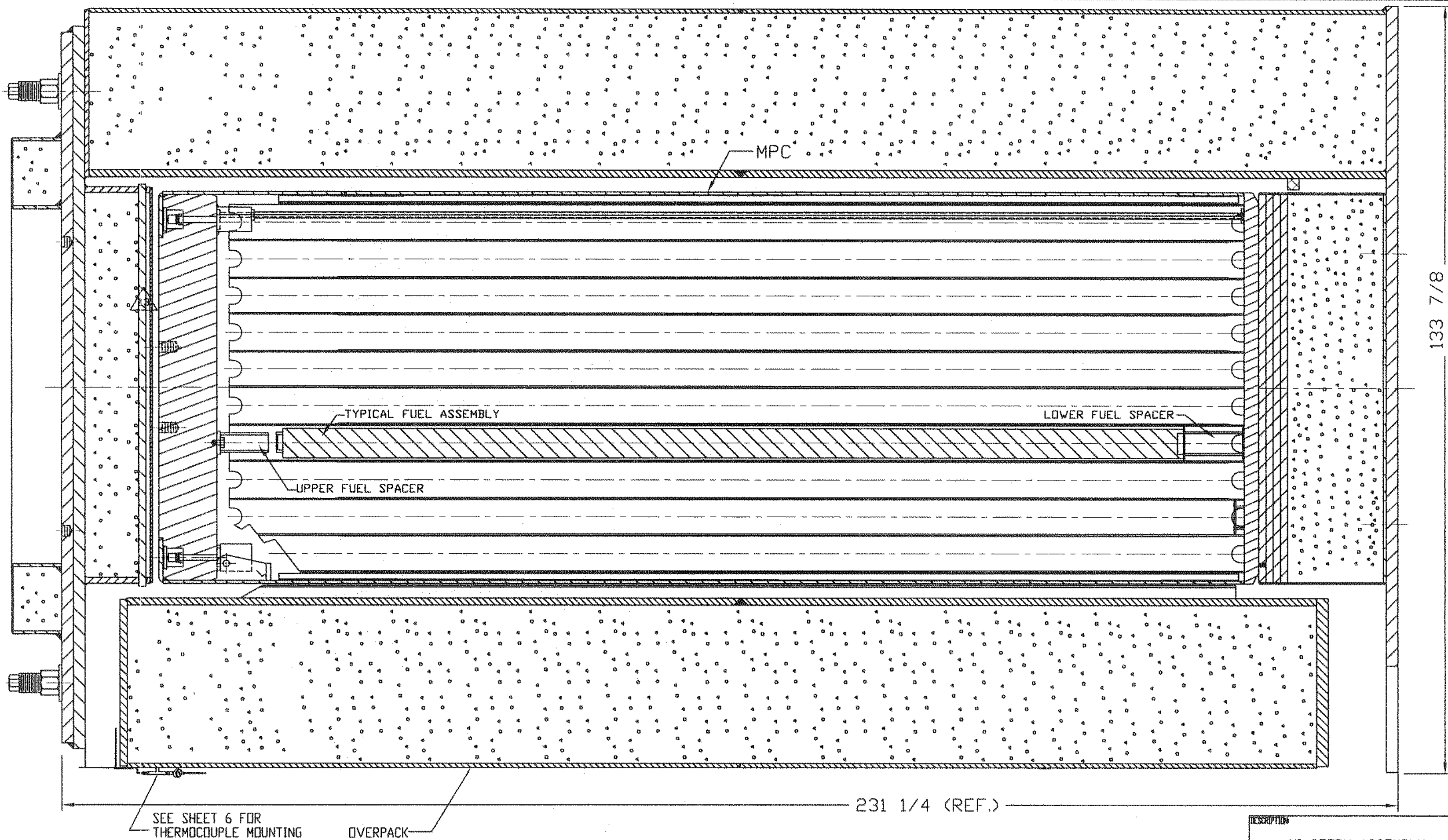

DETAIL SHIM-TO-SHIM OR SUPPORT-TO-SUPPORT WELD (SEE NOTE 2, THIS SHEET)

NOTES:

1. THE MPC BASKET SUPPORTS ARE WELDED TO THE INSIDE SURFACE OF THE MPC SHELL. THEY MAY INCLUDE ADJUSTABLE SHIMS TO ENSURE THE NECESSARY CLEARANCE BETWEEN THE BASKET TOUCH POINTS AND THE BASKET SUPPORTS.
2. THICKNESS OF SHIMS MAY BE MADE UP OF MORE THAN ONE PIECE. WELD SIZE SHALL BE AS DEFINED OR THICKNESS OF BASE METAL, WHICHEVER IS LESS.
3. MPC-68FF IS NOT CERTIFIED FOR TRANSPORTATION UNDER 10CFR71.
4. BASKET SUPPORT-TO-BASKET SUPPORT DIMENSIONS ARE COMMON TO STANDARD AND OPTIONAL CONSTRUCTION.

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

	GENERAL
	MPC 68/68F/68FF FUEL BASKET SUPPORT
1021	3923
N/A	D 3928 4 11
	NONE



11	INCORPORATED E.C.O.#: 1024-44 INCORPORATED NEW REVISION BLOCK	T.F.O.	2/6/02	57817	13	INCORPORATED E.C.O.#: 1024-77	S.L.C.	8/7/03	83932
REV.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP. BY:	APPROVAL DATE:	VIR#:	12	INCORPORATED E.C.O.#: 1024-61	T.F.O.	9/18/02	69340
	REVISIONS								

HOLTEC INTERNATIONAL

EQUIPMENT DESIGN
ANALYSIS
CONSULTING

DESCRIPTION: HI-STORM ASSEMBLY

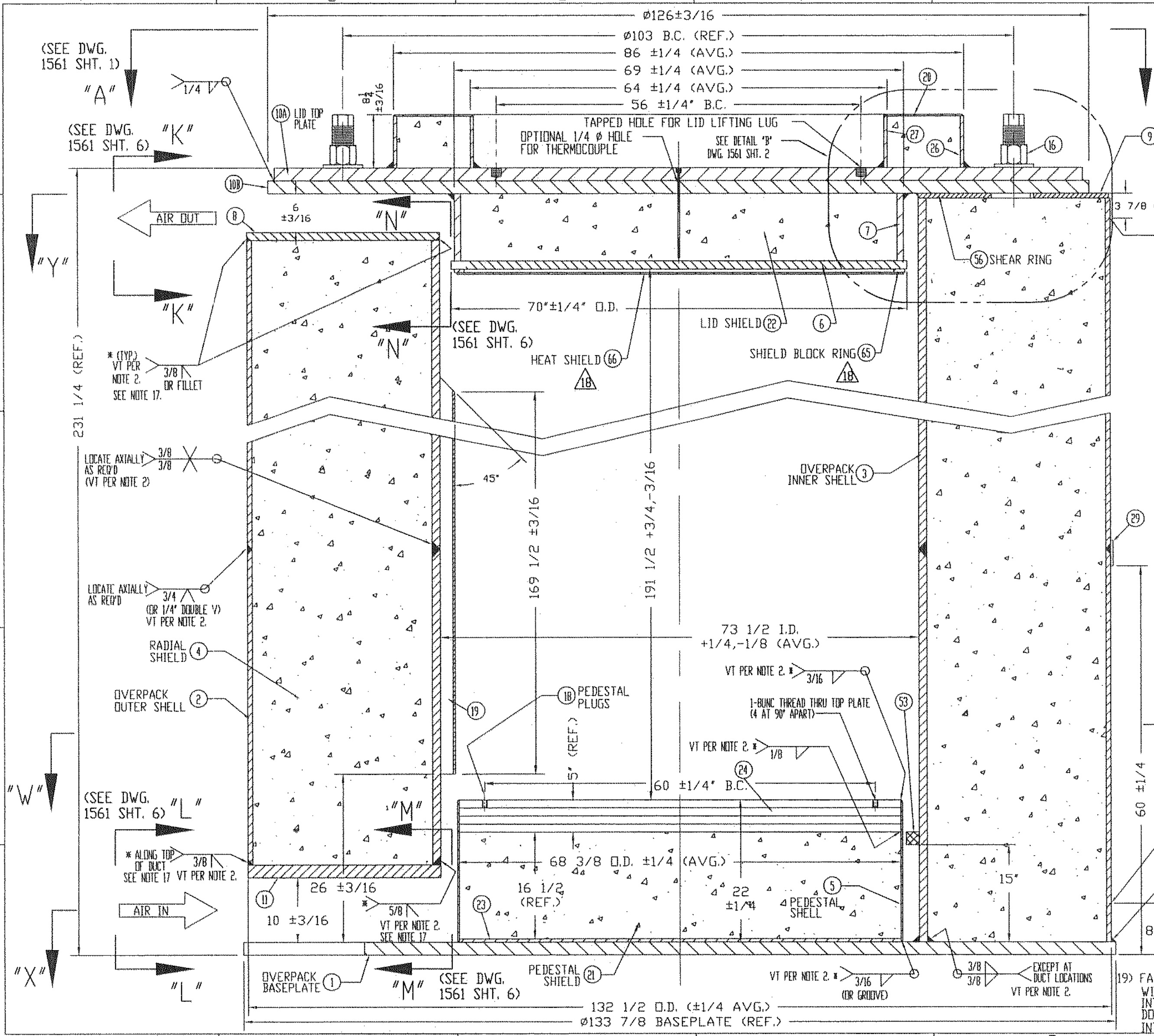
CLIENT: N/A

COMPANION DRAWINGS: 1561, B/M 1575

PROJECT No:	SCALE:	DRAWING No:	REV:
1024	.06 = 1	1495 (E.I.D. 3079)	13
PO No: N/A			SHEET: 1 of 6

G:\DRAWINGS\1024\1495-1R13

REVISIONS				
REV.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP. BY:	APPROVAL DATE:	VIR#:
12	INCORPORATED ECO 1024-44	T.F.D.	2/6/02	61397
13	INCORPORATED ECO 1024-47 ADDED SECTION K, L, M & N	S.L.C	2/27/02	74436
14	INCORPORATED ECO 1024-47, REV. 1	S.L.C	3/11/02	58424
15	INCORPORATED ECO 1024-50,	S.L.C	5/7/02	72436
16	INCORPORATED ECO 1024-55,	S.L.C	6/25/02	83463



1/4" DIA. THRD. HOLE (1/2" DEEP, 16 LOCATIONS) FOR INLET EXIT SCREENS.

"Y" SEE DWG. 1495 SHT. 3

NOTES:

1) ALL LINEAR DIMENSIONS ARE IN INCHES.
2) ALL WELDS REQUIRE VISUAL EXAMINATION PER ASME SECTION V, ARTICLE 9, ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5360.
3) EXCEPT WHERE STATED OTHERWISE, TOLERANCES ON FINISHED DIMENSIONS ARE ± 1/4".
4) ALL EXPOSED SURFACES OF THE OVERPACK SHALL BE PAINTED WITH THERMALINE 450 OR EQUIVALENT. THREADED HOLES SHALL NOT BE PAINTED
5) SERIAL NUMBERS ARE TO BE PLACED ON ALL LOOSE COMPONENTS TO PROVIDE TRACEABILITY.
6) THE CENTER-TO-CENTER DIMENSION BETWEEN ADJACENT ANCHOR BLOCKS IS 72 7/8"±1/2".
7) DELETED
8) STEEL USED IN FABRICATION SHALL MEET THE REQUIREMENTS OF ASME SECTION II A .
9) WELDING PROCEDURES AND WELDER QUALIFICATIONS SHALL BE PER ASME SECTION IX AND ASME SECTION III, SUBSECTION NF.
10) ALL ANGLES ARE FOR REFERENCE ONLY, UNLESS OTHERWISE STATED.
11) EXCEPT WHERE NOTED OTHERWISE, LONGITUDINAL WELDS ON CYLINDERS SHALL HAVE SAME WELD REQUIREMENTS AS CIRCUMFERENTIAL WELDS.
12) WELDS IDENTIFIED WITH AN * ARE CONSIDERED NON-NF WELDS. WELDS MAY BE MADE USING PREQUALIFIED WELDS IN ACCORDANCE WITH AWS D1.1 OR PER ASME SECTION IX.
13) DELETED
14) DELETED.
15) SHIELD SHELL (ITEM 28) DELETED FROM DESIGN IN JUNE 2001.
16) LID BOTTOM PLATE AND LID SHELL (ITEMS 6 & 7) REDESIGNED, TOP PLATE (ITEM 56) ADDED TO UNDERSIDE OF LID TOP PLATE (ITEM 10B) IN JANUARY 2002.
17) IDENTIFIED WELDS ARE NOT REQUIRED PROVIDED THE OPTIONAL CONSTRUCTION DETAILED ON DRAWING 1561 SHEET 6 IS IMPLEMENTED AT THE SUBJECT WELD LOCATION.
18) TOP LID, ITEMS 10A AND 10B MAY BE FABRICATED FROM MORE THAN ONE PIECE. PIECES SHALL BE ATTACHED BY 1/4" PARTIAL PENERATION DOUBLE BEVEL GROOVE WELD. WELD SEAMS MUST BE OUTSIDE 109" DIA. AND WELDS ON 10A AND 10B SHALL NOT COINCIDE.
19) FABRICATOR MAY ADD ADDITIONAL WELDS WITH THE APPROVAL OF HOLTEC INTERNATIONAL. ADDITIONAL TACK WELDS DO NOT NEED THE APPROVAL OF HOLTEC INTERNATIONAL.

SEE DWG. 1495 SHT.5 "W"

1/4" DIA. THRD. HOLE (1/2" DEEP, 8 LOCATIONS) FOR INLET VENT SCREENS.

SEE DWG. 1495 SHT.4 "X"

REV.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP. BY:	APPROVAL DATE:	VIR#:
18	INCORPORATED ECO 1024-77	S.L.C	8/7/03	46764
17	INCORPORATED ECO 1024-59 & 61	T.F.D.	9/18/02	28654

HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION: CROSS SECTION "Z" - "Z" VIEW OF HI-STORM

CLIENT: N/A

COMPANION DRAWINGS: 1561, B/M 1575

PROJECT No:	SCALE:	DRAWING No:	REV:
1024	.0625=1	1495 (E.I.D. 2901)	18
P.O. No: N/A			SHEET: 2 of 6

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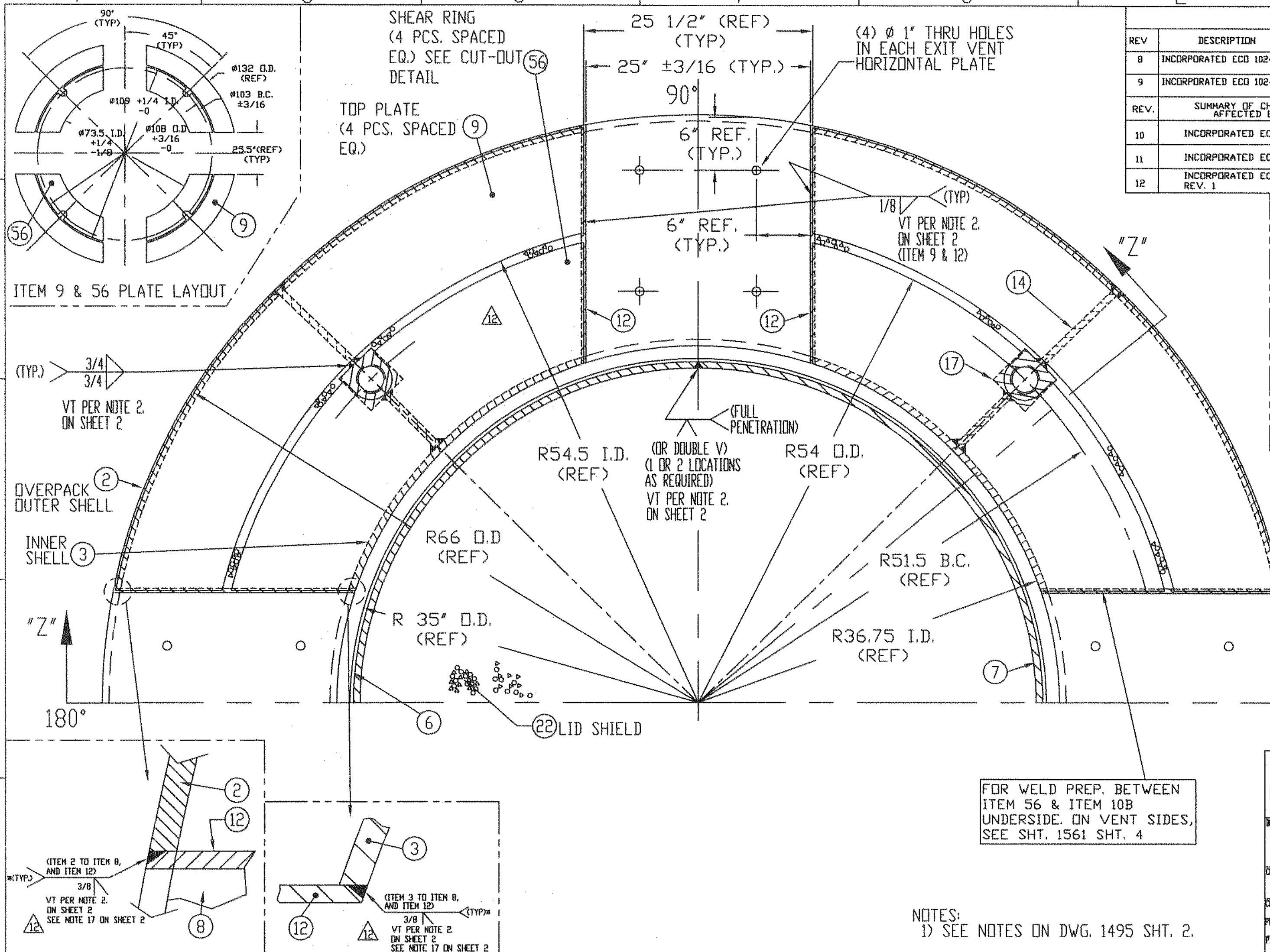
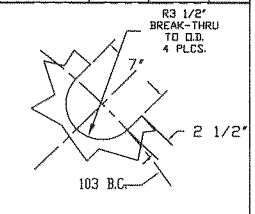


NOTES:
1) SEE NOTES ON DWG. 1495 SHT. 2.

REVISIONS

REV	DESCRIPTION	DATE	CHECKED	PM	Q.A.
8	INCORPORATED ECO 1024-1	S.GEE 2-10-00	B.G. 3-16-00	B.G.U. 3-16-00	S.S. 3-17-00
9	INCORPORATED ECO 1024-34	T.F.O. 10-11-01	K.L. 10-11-01	B.G.U. 10-11-01	VIR#: 334652

REV.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP. BY:	APPROVAL DATE:	VIR#:
10	INCORPORATED ECO 1024-44	T.F.O.	2/6/02	39781
11	INCORPORATED ECO 1024-47	S.L.C	2/27/02	30763
12	INCORPORATED ECO 1024-47, REV. 1	S.L.C	3/11/02	83036



CUT-OUT DETAIL ITEM 56 BOLT CUT-OUT

HOLTEC INTERNATIONAL

EQUIPMENT DESIGN
ANALYSIS
CONSULTING

DESCRIPTION: SECTION "Y" - "Y" OF HI-STORM

CLIENT: N/A

COMPANION DRAWINGS: 1561, B/M 1575

PROJECT No:	SCALE:	DRAWING No:	REV:
1024	.09375 = 1	1495 (E.I.D. 2902)	12
P.I. No: N/A			SHEET: 3 of 6

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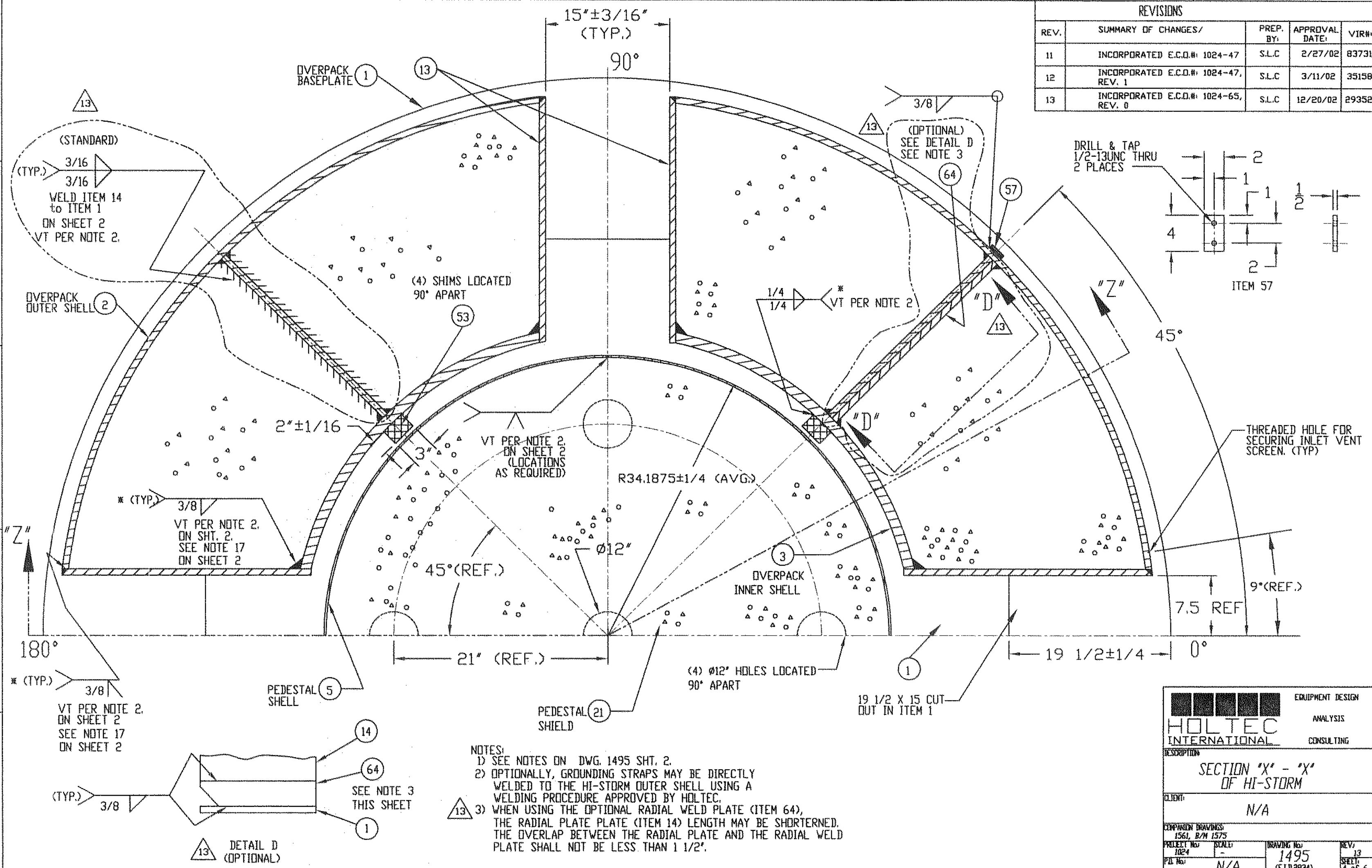


REVISIONS

REV.	SUMMARY OF CHANGES/	PREP. BY:	APPROVAL DATE:	VIR#:
11	INCORPORATED E.C.O.#: 1024-47	S.L.C	2/27/02	83731
12	INCORPORATED E.C.O.#: 1024-47, REV. 1	S.L.C	3/11/02	35158
13	INCORPORATED E.C.O.#: 1024-65, REV. 0	S.L.C	12/20/02	29352

NOTES:
1) SEE NOTES ON DWG. 1495 SHT. 2.
2) OPTIONALLY, GROUNDING STRAPS MAY BE DIRECTLY WELDED TO THE HI-STORM OUTER SHELL USING A WELDING PROCEDURE APPROVED BY HOLTEC.
13 3) WHEN USING THE OPTIONAL RADIAL WELD PLATE (ITEM 64), THE RADIAL PLATE PLATE (ITEM 14) LENGTH MAY BE SHORTERNED. THE OVERLAP BETWEEN THE RADIAL PLATE AND THE RADIAL WELD PLATE SHALL NOT BE LESS THAN 1 1/2".

HOLTEC INTERNATIONAL
EQUIPMENT DESIGN
ANALYSIS
CONSULTING

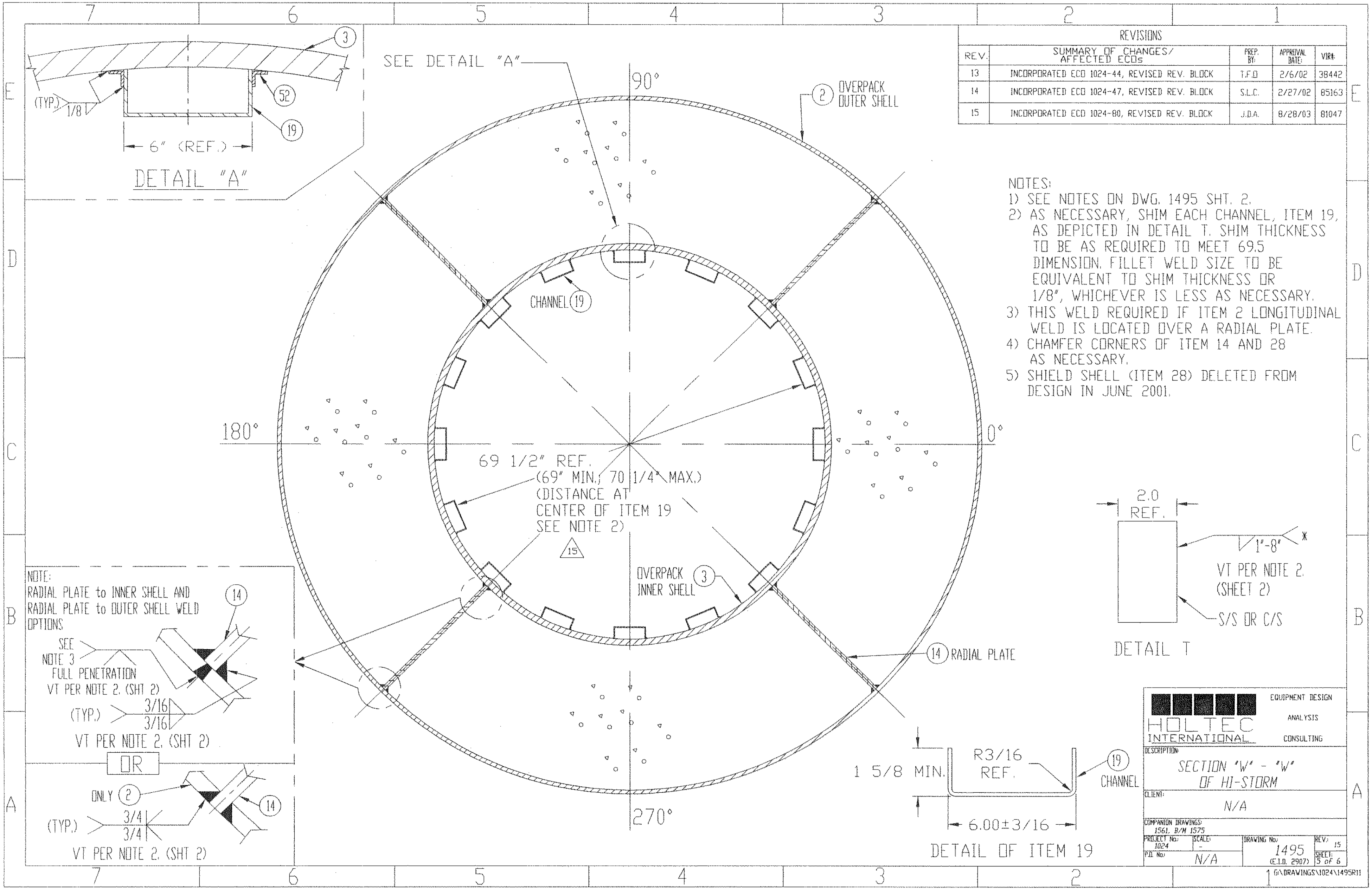
DESCRIPTION: SECTION "X" - "X" OF HI-STORM

CLIENT: N/A

COMPANION DRAWINGS: 1561, B/M 1575

PROJECT No: 1024
SCALE: -
DRAWING No: 1495 (E.I.D.2834)
REV: 13
P.O. No: N/A
SHEET: 4 of 6

G:\DRAWINGS\1024\1495R11



REVISIONS

REV.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP. BY:	APPROVAL DATE:	VIR#:
13	INCORPORATED ECO 1024-44, REVISED REV. BLOCK	T.F.O	2/6/02	38442
14	INCORPORATED ECO 1024-47, REVISED REV. BLOCK	S.L.C.	2/27/02	85163
15	INCORPORATED ECO 1024-80, REVISED REV. BLOCK	J.D.A.	8/28/03	81047

NOTES:
1) SEE NOTES ON DWG. 1495 SHT. 2.
2) AS NECESSARY, SHIM EACH CHANNEL, ITEM 19, AS DEPICTED IN DETAIL T. SHIM THICKNESS TO BE AS REQUIRED TO MEET 69.5 DIMENSION. FILLET WELD SIZE TO BE EQUIVALENT TO SHIM THICKNESS OR 1/8", WHICHEVER IS LESS AS NECESSARY.
3) THIS WELD REQUIRED IF ITEM 2 LONGITUDINAL WELD IS LOCATED OVER A RADIAL PLATE.
4) CHAMFER CORNERS OF ITEM 14 AND 28 AS NECESSARY.
5) SHIELD SHELL (ITEM 28) DELETED FROM DESIGN IN JUNE 2001.

HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION: SECTION "W" - "W" OF HI-STORM

CLIENT: N/A

COMPANION DRAWINGS: 1561, B/M 1575

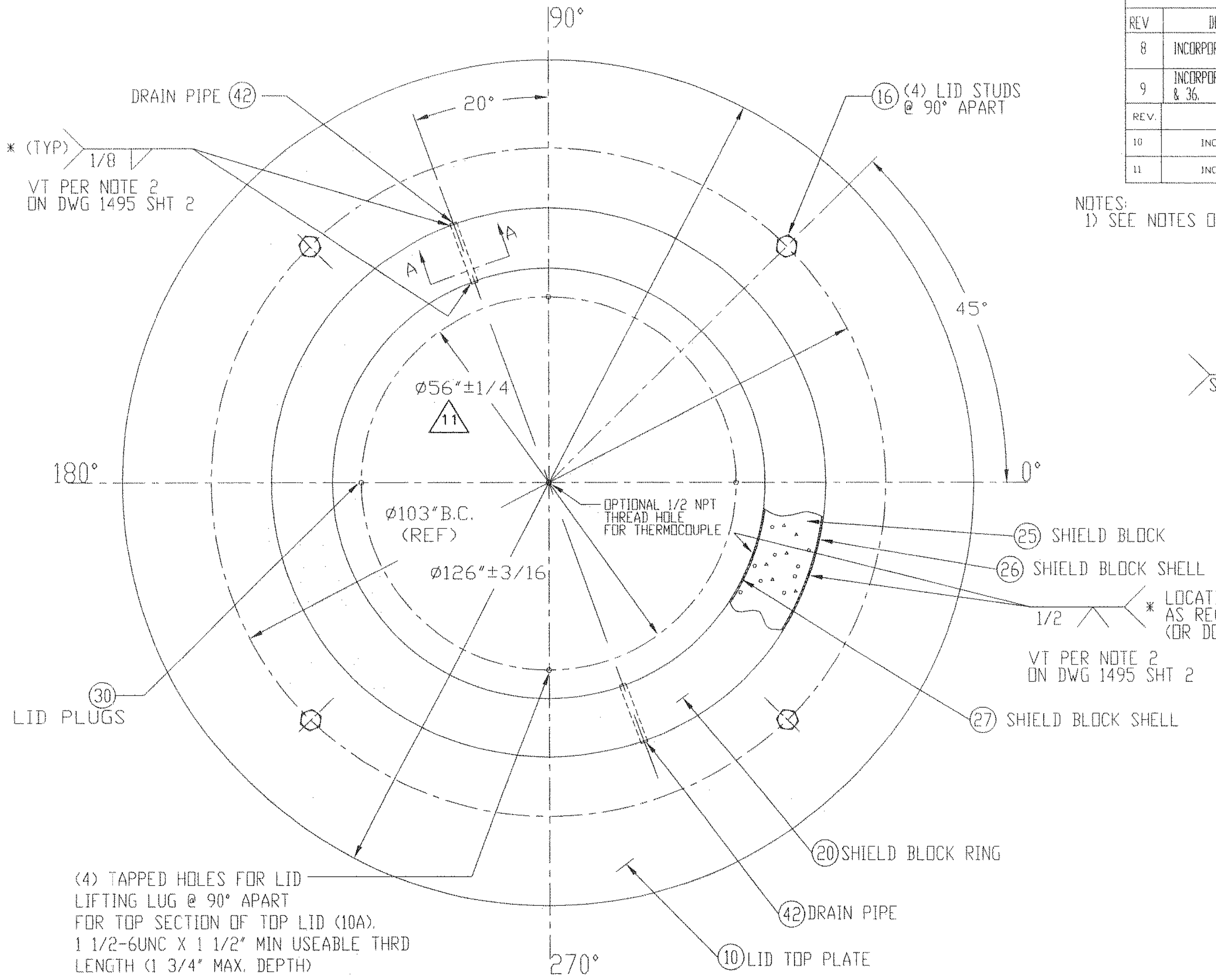
PROJECT No.: 1024 | SCALE: - | DRAWING No.: 1495 (E.I.D. 2907) | REV.: 15 | SHEET: 5 of 6

P.O. No.: N/A

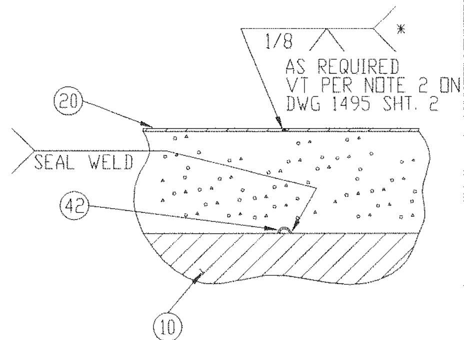
G:\DRAWINGS\1024\1495R11

REVISIONS					
REV	DESCRIPTION	DATE	CHECKED	PM	QA
8	INCORPORATED ECO 1024-1	S.GEE 2-11-2000	B.G. 3-16-2000	B.G.U. 3-16-2000	S.S. 3-16-00
9	INCORPORATED ECO 1024-3, 34, & 36.	T.F.D. 10/11/01	K.L. 10/11/01	B.G.U. 10/11/01	VIR#: 639931

REV.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP. BY:	APPROVAL DATE:	VIR#:
10	INCORPORATED E.C.O.#: 1024-47	S.L.C	2/27/02	59051
11	INCORPORATED E.C.O.#: 1024-68	T.F.D.	5/12/03	75976



NOTES:
1) SEE NOTES ON DWG. 1495 SHT. 2.



SECTION A-A

HOLTEC INTERNATIONAL

EQUIPMENT DESIGN
ANALYSIS
CONSULTING

DESCRIPTION:	VIEW "A" - "A" OF HI-STORM
CLIENT:	N/A
COMPANION DRAWINGS:	1495, B/M 1575
PROJECT No.: 1024	SCALE: .0625 = 1
PII No.:	N/A
DRAWING No.:	1561 (E.I.D. 2904)
REV.:	11
SHEET:	1 OF 6

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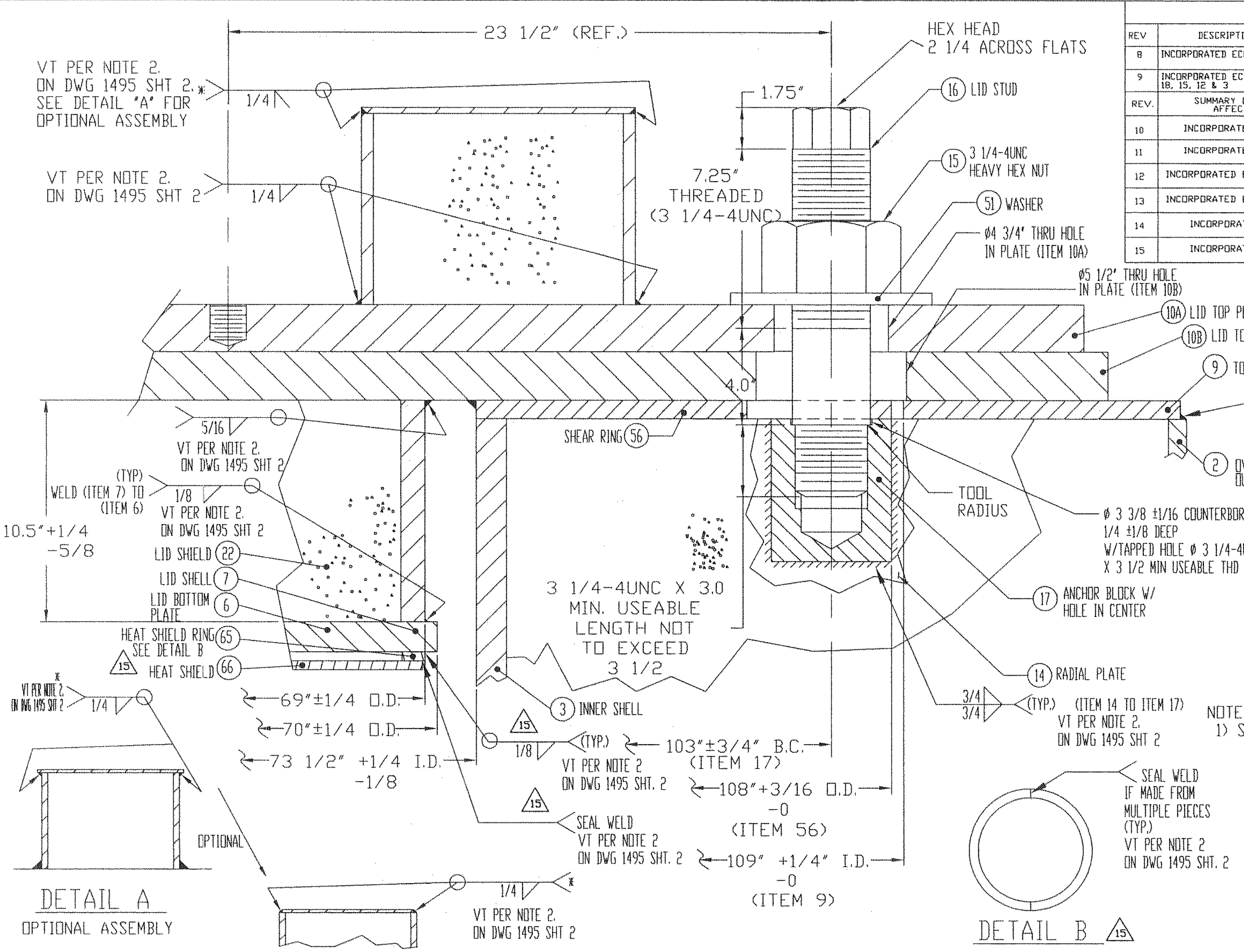


NOTES;
1) SEE NOTES ON DWG. 1495 SHT. 2.

REVISIONS

REV	DESCRIPTION	DATE	CHECKED	PM	Q.A.
8	INCORPORATED ECO 1024-1	S.GEE 2-11-00	B.G. 3-16-00	B.G.U. 3-16-00	S.S. 3-16-00
9	INCORPORATED ECO 1024-34, 21, 18, 15, 12 & 3	T.F.D. 10-11-01	K.L. 10-11-01	B.G.U. 10-11-01	VIR#: 11387

REV.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP. BY:	APPROVAL DATE:	VIR#:
10	INCORPORATED ECO 1024-44	T.F.D.	2/6/02	96812
11	INCORPORATED ECO 1024-47	S.L.C	2/27/02	65653
12	INCORPORATED ECO 1024-47, REV. 1	S.L.C	3/11/02	79208
13	INCORPORATED ECO 1024-55, REV. 0	S.L.C	6/25/02	40118
14	INCORPORATED ECO 1024-61	T.F.D.	9/18/02	74049
15	INCORPORATED ECO 1024-77	S.L.C	8/7/03	91232

HOLTEC INTERNATIONAL
EQUIPMENT DESIGN
ANALYSIS
CONSULTING

DESCRIPTION: DETAIL "B" OF HI-STORM

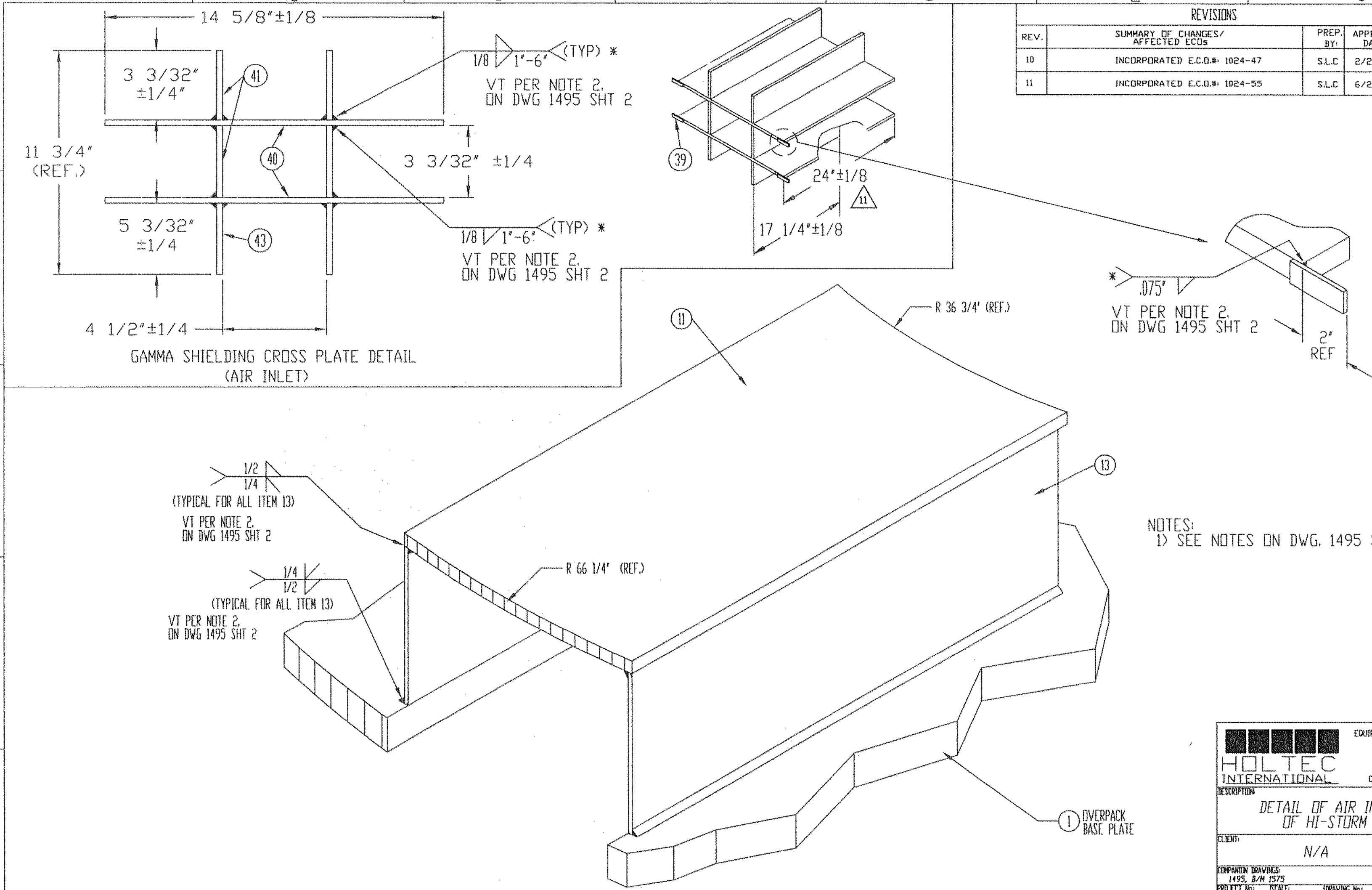
CLIENT: N/A

COMPANION DRAWINGS: 1495, B/N 1575

PROJECT No:	SCALE:	DRAWING No:	REV:
1024	.25 = 1	1561 (E.I.D. 2905)	15
P.O. No: N/A			SHEET: 2 of 6

G:\DRAWINGS\1024\1561-2R15

REVISIONS				
REV.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP. BY:	APPROVAL DATE:	VIR#:
10	INCORPORATED E.C.O.#: 1024-47	S.L.C	2/27/02	14430
11	INCORPORATED E.C.O.#: 1024-55	S.L.C	6/25/02	26651



NOTES:
1) SEE NOTES ON DWG. 1495 SHT. 2.

HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION: DETAIL OF AIR INLET OF HI-STORM

CLIENT: N/A

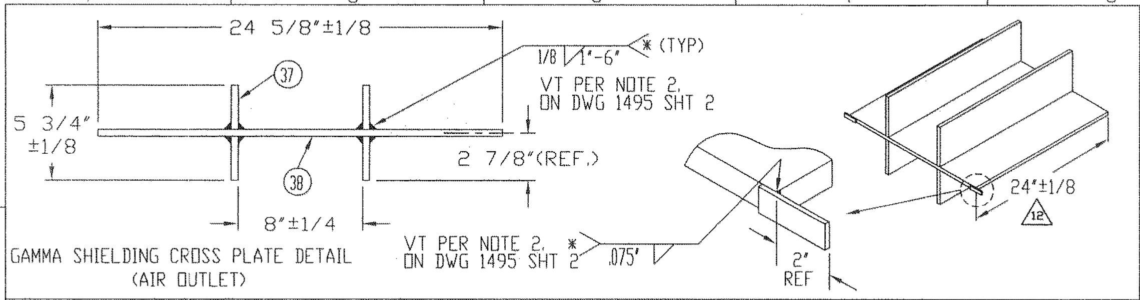
COMPANION DRAWINGS: 1495, B/M 1575

PROJECT No:	SCALE:	DRAWING No:	REV:
1024	NONE	1561 (C.I.D. 3026)	11
P.O. No: N/A			SHEET: 3 of 6

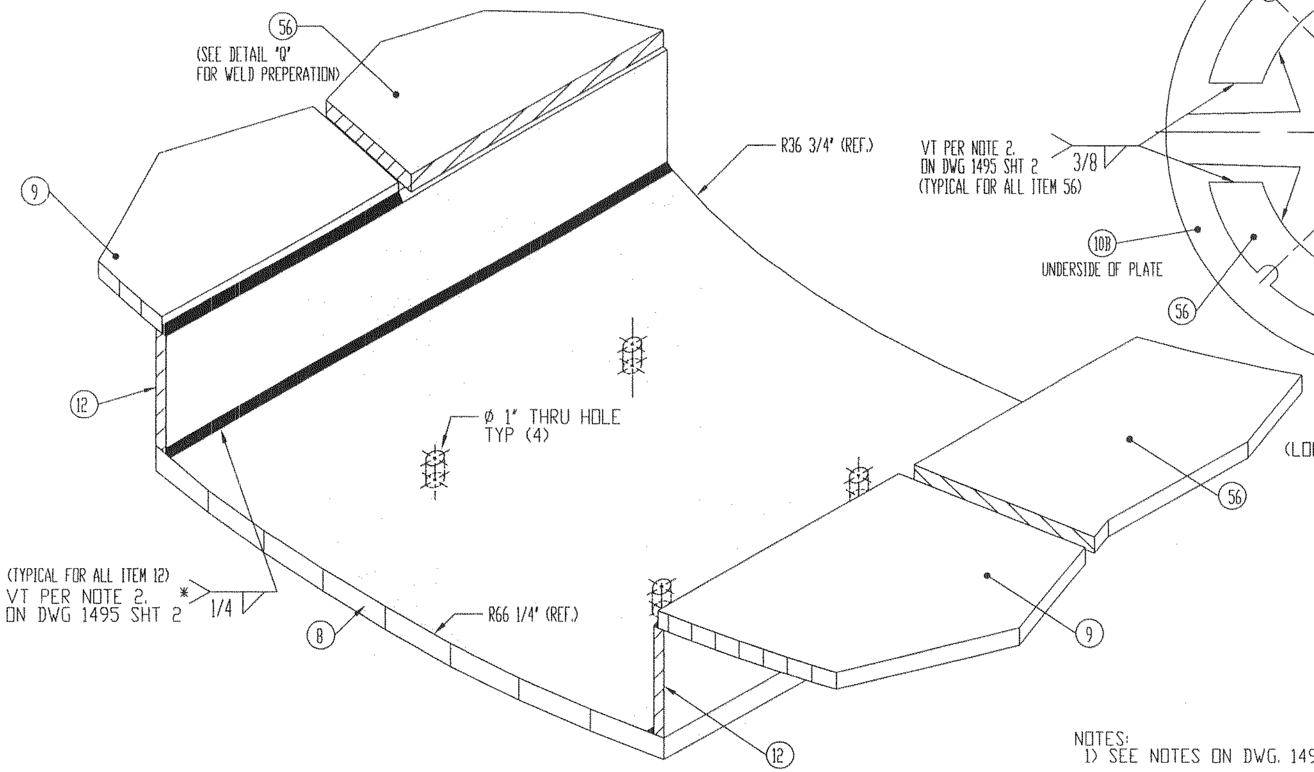
G:\DRAWINGS\1024\1561R10

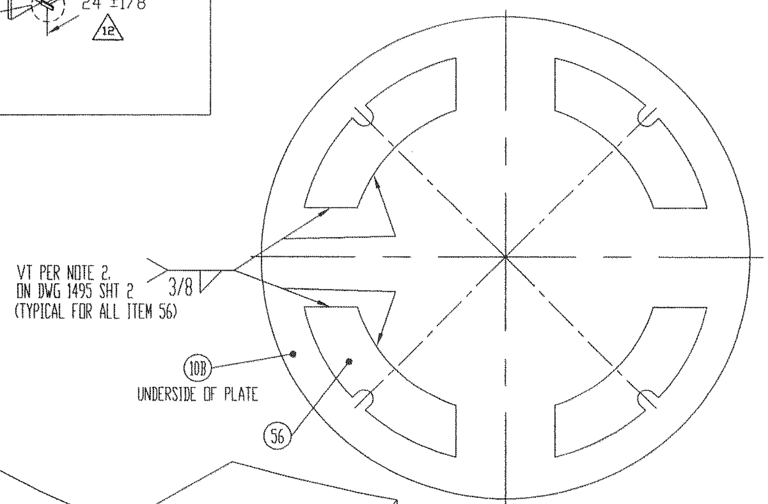
REVISIONS

REV.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP. BY:	APPROVAL DATE:	VIR#:
10	INCORPORATED ECO 1024-44	T.F.Q.	2/6/02	89454
11	INCORPORATED ECO 1024-47	S.L.C	2/27/02	28685
12	INCORPORATED ECO 1024-55	S.L.C	6/25/02	26662



GAMMA SHIELDING CROSS PLATE DETAIL (AIR OUTLET)





DETAIL "Q"
(LOOKING AT UNDERSIDE OF ITEM 10B)

NOTES:
1) SEE NOTES ON DWG. 1495 SHT. 2.

HOLTEC INTERNATIONAL
EQUIPMENT DESIGN
ANALYSIS
CONSULTING

DESCRIPTION: DETAIL OF AIR OUTLET OF HI-STORM

CLIENT: N/A

COMPANION DRAWINGS: 1495, B/M 1575

PROJECT No:	SCALE:	DRAWING No:	REV.:
1024	NONE	1561 (E.I.D. 2966)	12
P.O. No: N/A			SHEET: 4 of 6

G:\DRAWINGS\1024\1561R10

LICENSING DRAWING PACKAGE COVER SHEET

CLIENT GENERAL

PROJECT NO. 1024 | P.O. NO. N/A

DRAWING PACKAGE I.D. 3669 | TOTAL SHEETS 12

LICENSING DRAWING PACKAGE CONTENTS:

SHEET	DESCRIPTION
1	COVER SHEET
2	ASSEMBLY DRAWING , NOTES AND BILL OF MATERIALS
3	OVERALL DIMENSIONS
4	INNER SHELL ASSEMBLY
5	OVERPACK BODY INNER SHELL PART DETAILS
6	OVERPACK BODY ASSEMBLY
7	PEDESTAL ASSEMBLY
8	LID ASSEMBLY
9	LID STUD AND NUT
10	VENT SCREEN ASSEMBLIES
11	GAMMA SHIELD CROSS PLATES (INLET & OUTLET)
12	OPTIONAL GAMMA SHIELD CROSS PLATES (INLET & OUTLET)

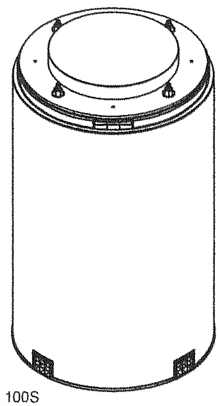
REVISION LOG

REV	AFFECTED DRAWING	AFFECTED ECOs	PREP. BY	APPROVAL DATE	VIR# †
10	SHEETS 2, 4, 5, & 6	1024-108, R0	David Butler	02/28/06	30563
11	SHEETS 2, 4, 5, & 6	1024-108, R0 & QPV 454	SLC	04/13/06	22605
12	SHEETS 2, 4, 5, & 6	1024-120, R0	D. Butler	04/26/06	11220
13	SHEET 6	1024-122, R0	D. Butler	05/04/06	36052
14	SHEET 8	1024-124, R0	JJB	05/17/06	16513
15	SHEET 2	1024-126, R0	MAP	08/18/06	32414
16	SHEETS 2, 4, 5, 6, 7 & 8	1024-137, R0	D. Butler	06/21/07	31340

† THE VALIDATION IDENTIFICATION RECORD (VIR) NUMBER IS A COMPUTER GENERATED RANDOM NUMBER WHICH CONFIRMS THAT ALL APPROPRIATE REVIEWS OF THIS DRAWING ARE DOCUMENTED IN COMPANY'S NETWORK.

NOTES:

1. THE EQUIPMENT DOCUMENTED IN THIS DRAWING PACKAGE HAS BEEN CONFIRMED BY HOLTEC INTERNATIONAL TO COMPLY WITH THE SAFETY ANALYSES DESCRIBED IN THE HI-STORM FSAR.
2. DIMENSIONAL TOLERANCES ON THIS DRAWING ARE PROVIDED SOLELY FOR LICENSING PURPOSES TO DEFINE REASONABLE LIMITS ON THE NOMINAL DIMENSIONS USED IN LICENSING WORK. HARDWARE IS FABRICATED IN ACCORDANCE WITH THE DESIGN DRAWINGS, WHICH HAVE MORE RESTRICTIVE TOLERANCES, TO ENSURE COMPONENT FIT-UP. DO NOT USE WORST-CASE TOLERANCE STACK-UP FROM THIS DRAWING TO DETERMINE COMPONENT FIT-UP.
3. THE REVISION LEVEL OF EACH INDIVIDUAL SHEET IN THE PACKAGE IS THE SAME AS THE REVISION LEVEL OF THIS COVER SHEET. A REVISION TO ANY SHEET(S) IN THIS PACKAGE REQUIRES UPDATING OF REVISION NUMBERS OF ALL SHEETS TO THE NEXT REVISION NUMBER.
4. APPLICABLE CODES AND STANDARDS ARE DELINEATED IN SECTION 2.2.4 OF THE FSAR.
5. ALL WELDS REQUIRE VISUAL EXAMINATION. ADDITIONAL NDE INSPECTIONS ARE NOTED ON THE DRAWING IF REQUIRED. NDE TECHNIQUES AND ACCEPTANCE CRITERIA ARE PROVIDED IN TABLE 9.1.4 OF THE FSAR.
6. UNLESS OTHEWISE NOTED, FULL PENETRATION WELDS MAY BE MADE FROM EITHER SIDE OF A COMPONENT.
7. THIS COMPONENT IS IMPORTANT-TO-SAFETY, CATEGORY A, BASED ON THE HIGHEST CLASSIFICATION OF ANY SUBCOMPONENT. SUBCOMPONENT CLASSIFICATIONS ARE PROVIDED ON THE DESIGN DRAWING.
8. ALL WELD SIZES ARE MINIMUMS EXCEPT AS ALLOW BY APPLICABLE CODES AS CLARIFIED IN THE FSAR. FABRICATORS MAY ADD WELDS WITH HOLTEC APPROVAL.



HI-STORM 100S ISOMETRIC VIEW

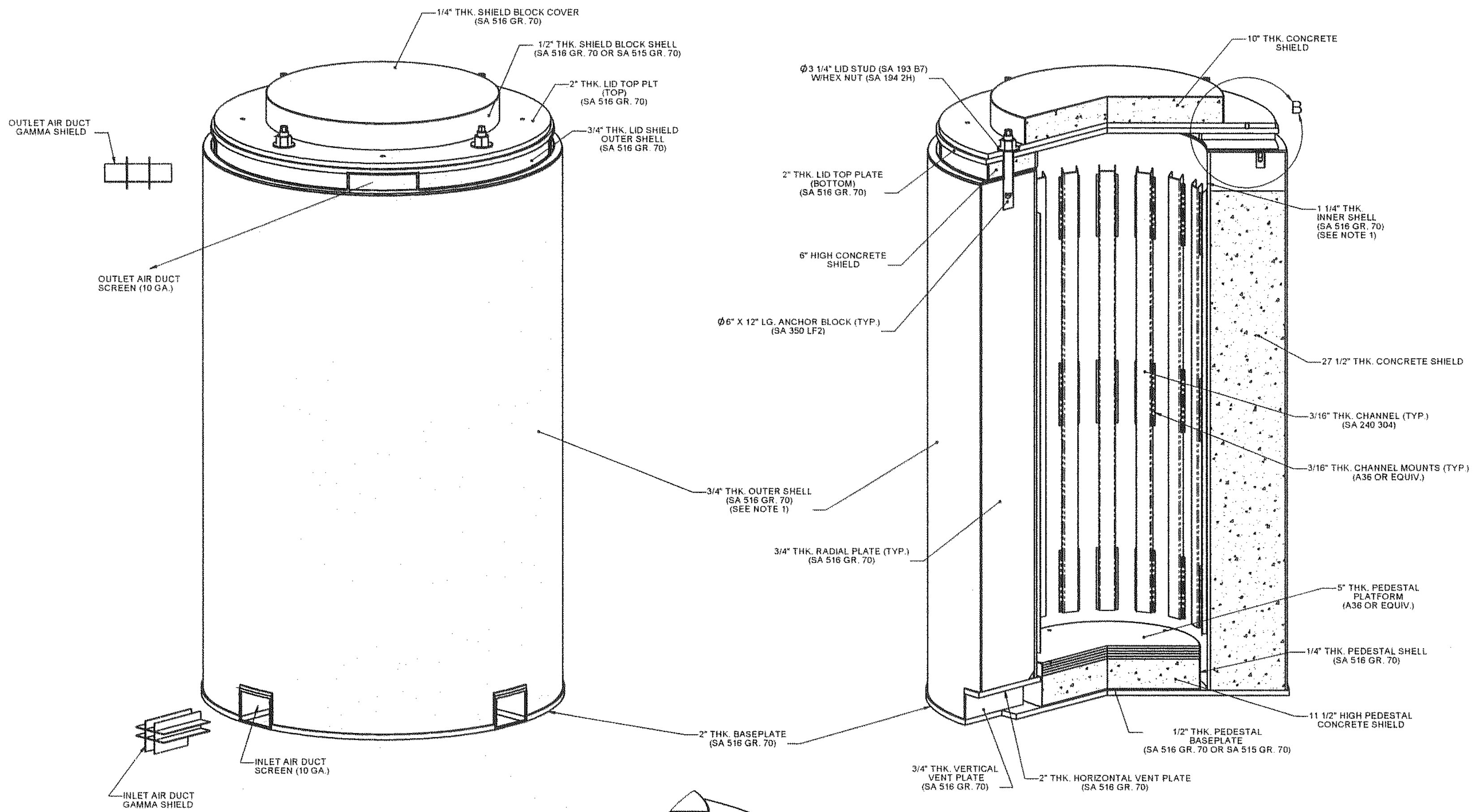
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN CENTER
MARLTON, NJ 08053

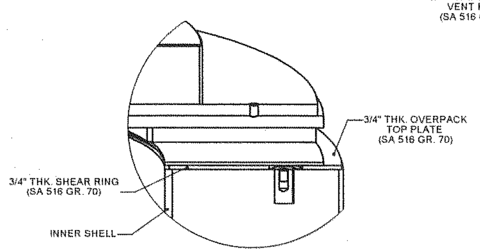
GENERAL

HI-STORM 100S ASSEMBLY

PROJECT NO.	DRAWING NO.	SHEET	TOTAL SHEETS
1024	3669	1	12

P.O. NO. N/A





DETAIL B
SCALE 1 : 10

NOTES.

1) INNER AND OUTER SHELL THICKNESSES MAY BOTH BE CHANGED TO 1-INCH THICK IN LIEU OF 1 1/4" AND 3/4" RESPECTIVELY. IF EITHER THE INNER OR OUTER SHELL THICKNESS IS CHANGED TO 1-INCH, THEN BOTH SHALL BE 1-INCH THICK. CORRESPONDINGLY, THE OUTER SHELL INNER DIAMETER WILL CHANGE FROM 131" TO 130 1/2".

16 2) THE LONG RADIAL PLATE CAN BE CHANGED FROM A SINGLE PIECE TO A TWO-PIECE CONFIGURATION SUCH THAT ONE PIECE IS LOCATED NEAR THE TOP OVERPACK AND THE OTHER NEAR THE BOTTOM. THE TOP EDGE OF THE TOP RADIAL PLATE AND THE BOTTOM EDGE OF THE BOTTOM RADIAL PLATE SHALL BE LOCATED IN THE SAME LOCATION AS THE TOP AND BOTTOM EDGES OF THE SINGLE PIECE RADIAL PLATE. THE THICKNESS OF THE SHORTER RADIAL PLATES SHALL BE 1" AS OPPOSED TO 3/4" FOR THE SINGLE PIECE RADIAL PLATE AND THEIR DIMENSIONS SHALL BE BE 27 1/2" X 38" FOR THE TOP PLATE AND 27 1/2" X 30" FOR THE BOTTOM PLATE. THE SHORTER RIB PLATES SHALL HAVE A MIN. OF 24" OF WELD CONNECTING THEM TO THE INNER AND OUTER SHELLS AND TO THE VENT PLATE.

3) MULTIPLE HOLES MAY BE DRILLED AND TAPPED INTO THE HI-STORM BODY / LID FOR THE PURPOSE OF ATTACHING TEMPERATURE MONITORING EQUIPMENT. HOLES SHALL BE 3/8" DIAMETER (MAX.) X 5/8" (MAX.) DEPTH. AFTER INSTALLATION OF THE TEMPERATURE MONITORING EQUIPMENT ALL HOLES SHALL BE PLUGGED.

TOLERANCES

INCHES [MILLIMETERS]		ANGULAR
.X ± .2	[5.0]	±2°
.XX ± .1	[2.54]	
.XXX ± .50	[.50]	

FRACTIONAL

0 TO LESS THAN 2 IN.	±1/8 IN.
2 IN. TO LESS THAN 3 FT	±1/4 IN.
3 FT. AND GREATER	±3/8 IN.

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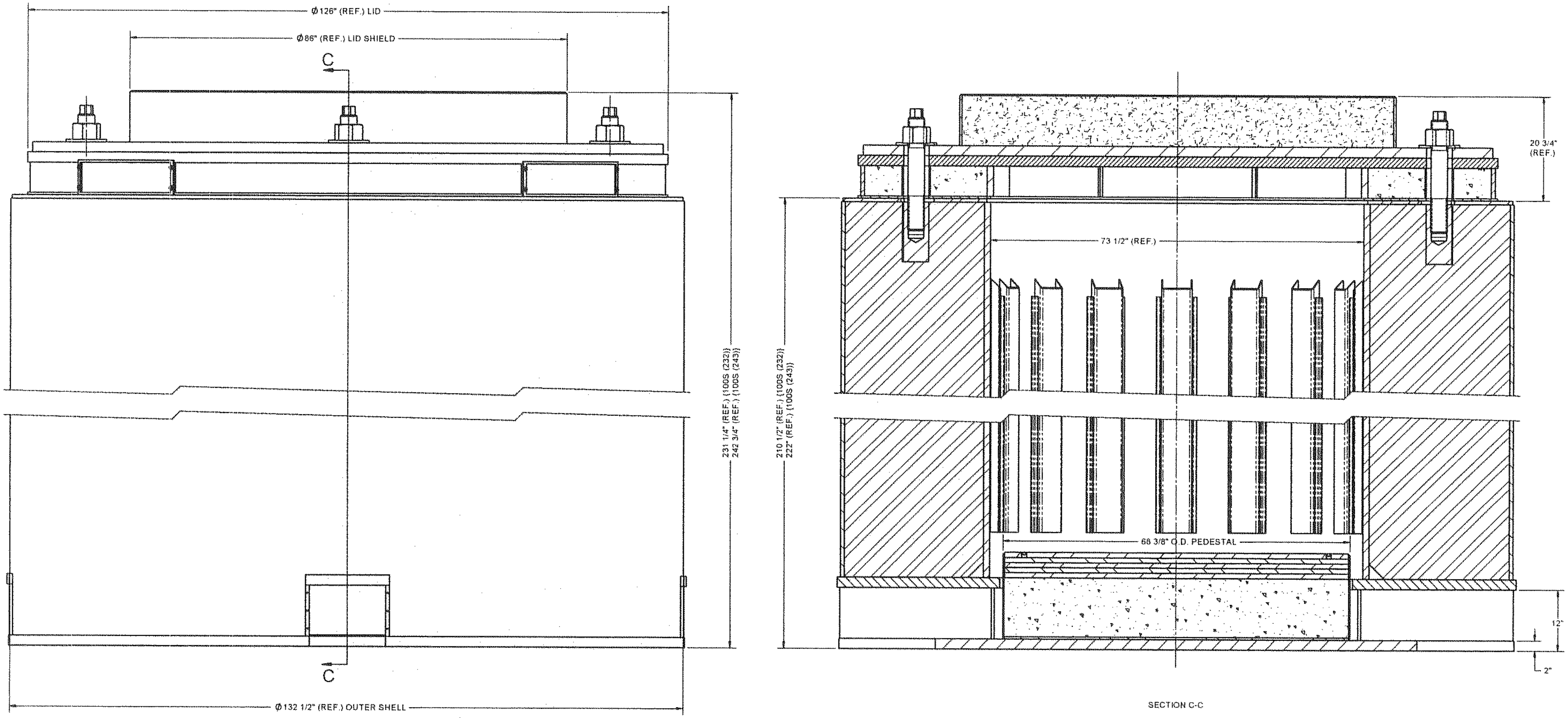
GENERAL

HI-STORM 100S ASSEMBLY

PROJECT NO.	1024
	N/A
SIZE	D
DRAWING NO.	3669
SHEET	2
REV.	16
SCALE	NONE
FILE PATH	G:\DRAWINGS\1024\3669



TOLERANCES

INCHES (MILLIMETERS)
.X ± .2 [5.0]
.XX ± .1 [2.54]
.XXX ± .02 [.50]

ANGULAR ±2°

FRACTIONAL
0 TO LESS THAN 2 IN. ±1/8 IN.
2 IN. TO LESS THAN 3 FT. ±1/4 IN.
3 FT. AND GREATER ±3/8 IN.

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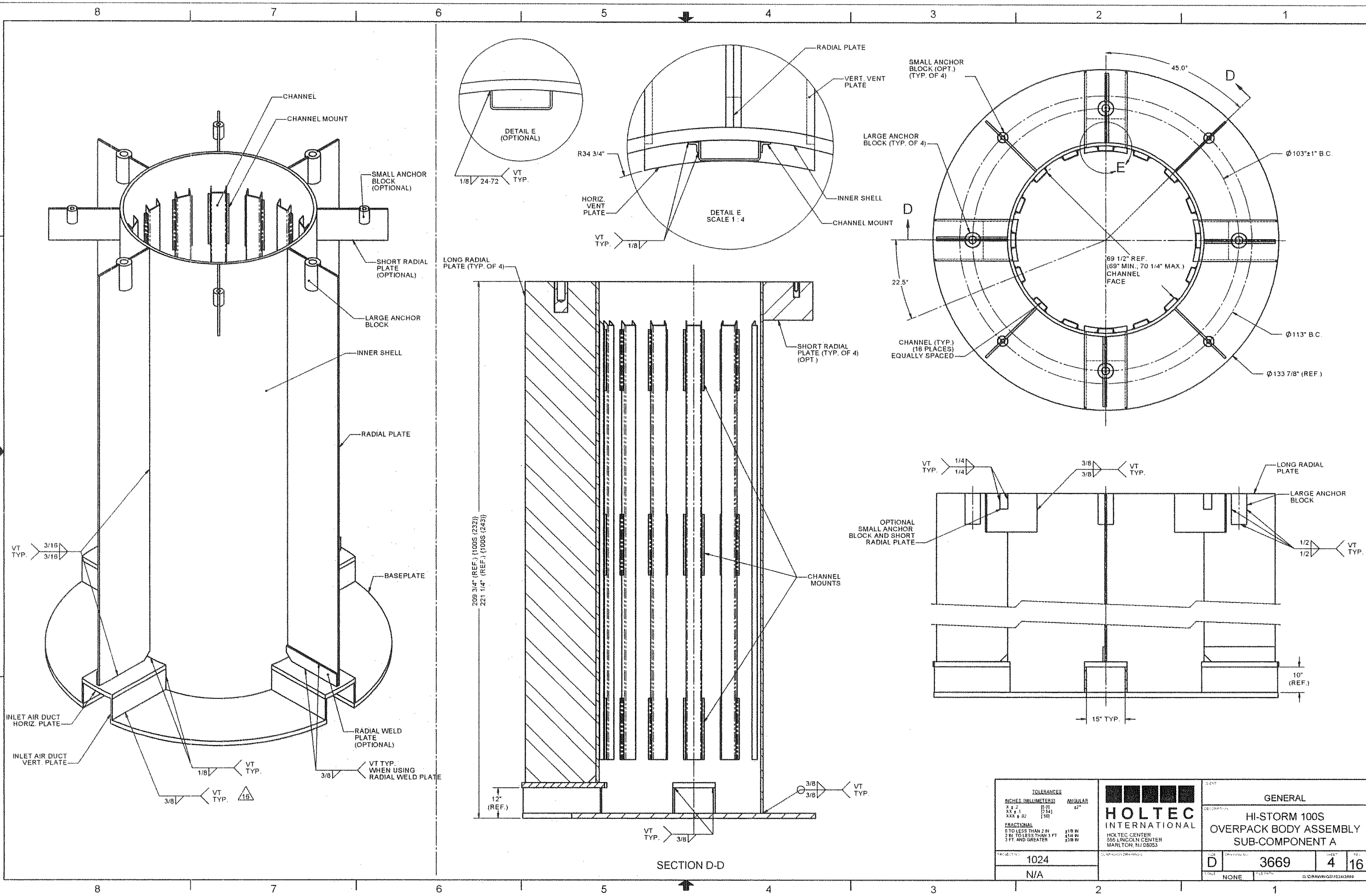
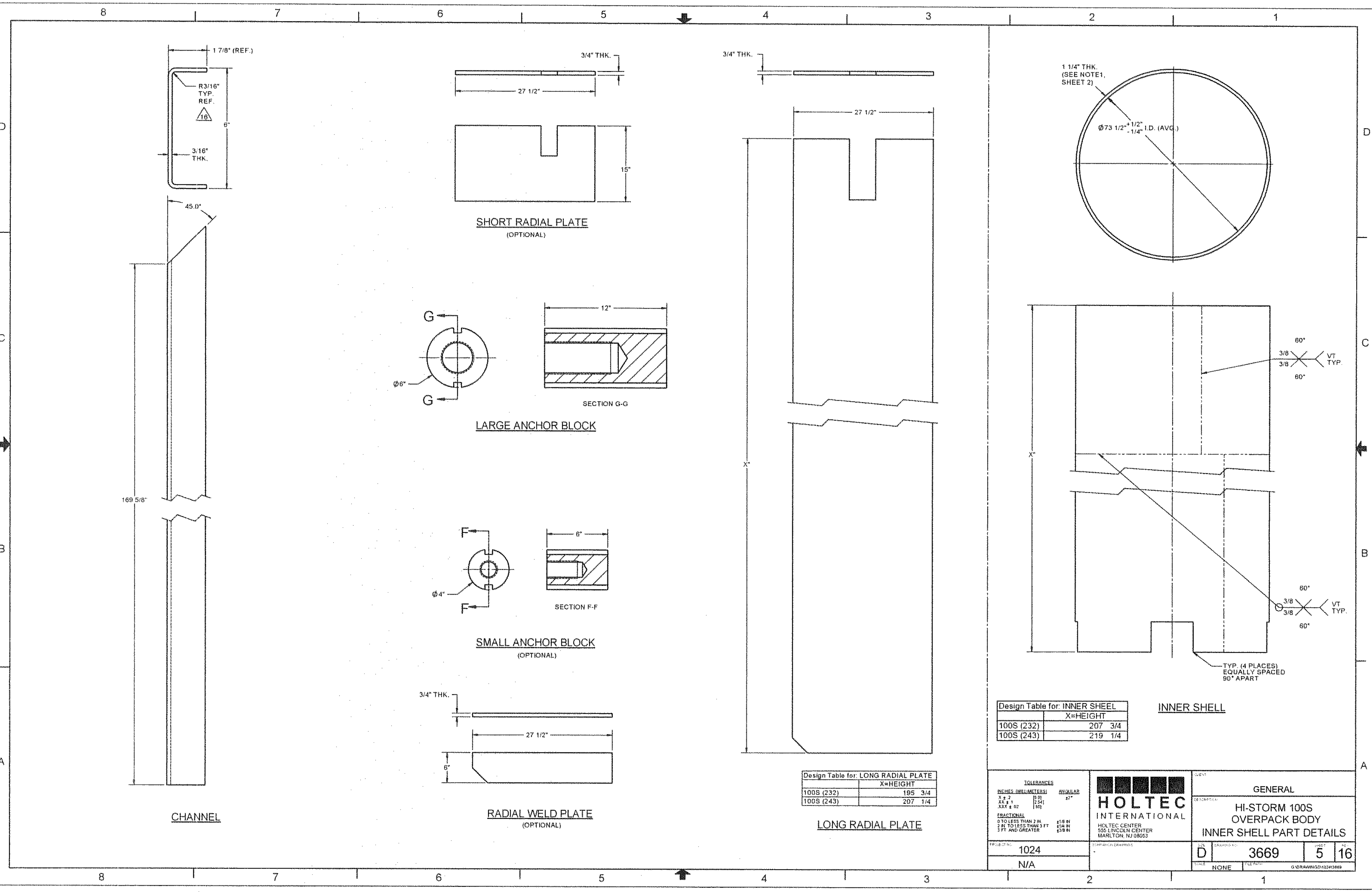
GENERAL

HI-STORM 100S ASSEMBLY

1024		D	3669	3	16
N/A		NONE	G:\DRAWINGS\1024\3669		


CHANNEL
CHANNEL MOUNT
SMALL ANCHOR BLOCK (OPTIONAL)
SHORT RADIAL PLATE (OPTIONAL)
LARGE ANCHOR BLOCK
INNER SHELL
RADIAL PLATE
BASEPLATE
VT TYP. 3/16 3/16
INLET AIR DUCT HORIZ. PLATE
INLET AIR DUCT VERT. PLATE
RADIAL WELD PLATE (OPTIONAL)
VT TYP. WHEN USING RADIAL WELD PLATE
1/8 VT TYP.
3/8 VT TYP. 16
DETAIL E (OPTIONAL)
1/8 24-72 VT TYP.
RADIAL PLATE
VERT. VENT PLATE
R34 3/4"
HORIZ. VENT PLATE
INNER SHELL
CHANNEL MOUNT
DETAIL E SCALE 1 : 4
VT TYP. 1/8
LONG RADIAL PLATE (TYP. OF 4)
209 3/4" (REF.) (100S (232))
221 1/4" (REF.) (100S (243))
SHORT RADIAL PLATE (TYP. OF 4) (OPT.)
CHANNEL MOUNTS
12" (REF.)
3/8 3/8 VT TYP.
VT TYP. 3/8
SECTION D-D
SMALL ANCHOR BLOCK (OPT.) (TYP. OF 4)
45.0°
D
LARGE ANCHOR BLOCK (TYP. OF 4)
E
Ø103"±1" B.C.
D
22.5°
69 1/2" REF. (69" MIN.; 70 1/4" MAX.) CHANNEL FACE
CHANNEL (TYP.) (16 PLACES) EQUALLY SPACED
Ø113" B.C.
Ø133 7/8" (REF.)
VT TYP. 1/4 1/4
3/8 3/8 VT TYP.
LONG RADIAL PLATE
LARGE ANCHOR BLOCK
OPTIONAL SMALL ANCHOR BLOCK AND SHORT RADIAL PLATE
1/2 1/2 VT TYP.
10" (REF.)
15" TYP.
TOLERANCES
INCHES [MILLIMETERS] ANGULAR
X ±.2 [5.0] ±2°
XX ±.1 [2.54]
XXX ±.02 [.50]
FRACTIONAL
0 TO LESS THAN 2 IN ±1/8 IN
2 IN. TO LESS THAN 3 FT ±1/4 IN
3 FT. AND GREATER ±3/8 IN
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN CENTER
MARLTON, NJ 08053
GENERAL
HI-STORM 100S
OVERPACK BODY ASSEMBLY
SUB-COMPONENT A
1024
N/A
D
3669
4
16
NONE



Design Table for: INNER SHEEL	
	X=HEIGHT
100S (232)	207 3/4
100S (243)	219 1/4

Design Table for: LONG RADIAL PLATE	
	X=HEIGHT
100S (232)	195 3/4
100S (243)	207 1/4

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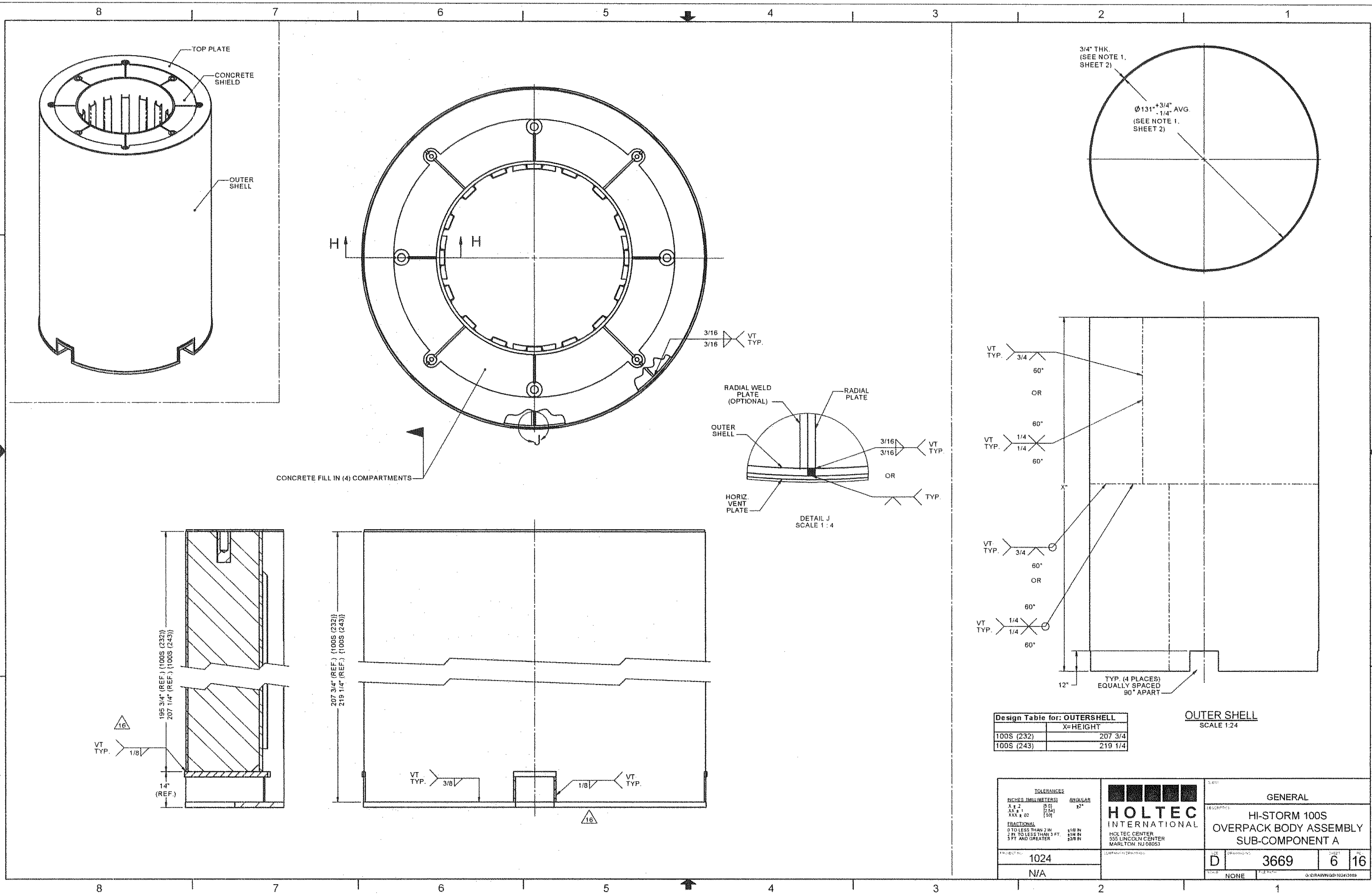
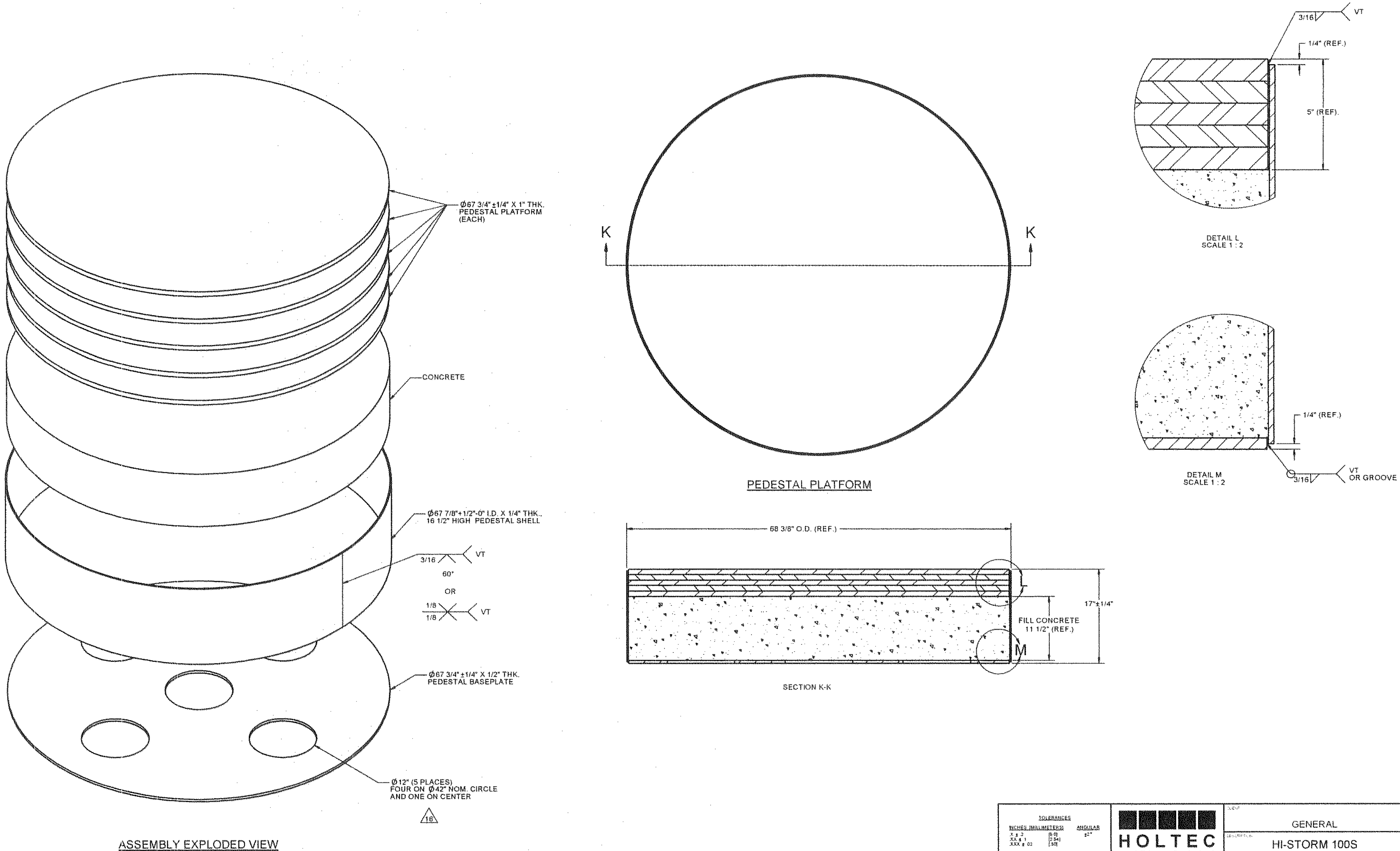
GENERAL

HI-STORM 100S
OVERPACK BODY
INNER SHELL PART DETAILS

Project No.	Size	Drawing No.	Sheet	Rev.
1024	D	3669	5	16
N/A	Scale: NONE			



Design Table for: OUTERSHELL	
	X=HEIGHT
100S (232)	207 3/4
100S (243)	219 1/4



TOLERANCES

INCHES	[MILLIMETERS]	ANGULAR
.X ± .2	[5.0]	±2°
.XX ± .1	[2.54]	
.XXX ± .02	[.50]	

FRACTIONAL

0 TO LESS THAN 2 IN	±1/8 IN
2 IN. TO LESS THAN 3 FT.	±1/4 IN
3 FT. AND GREATER	±3/8 IN

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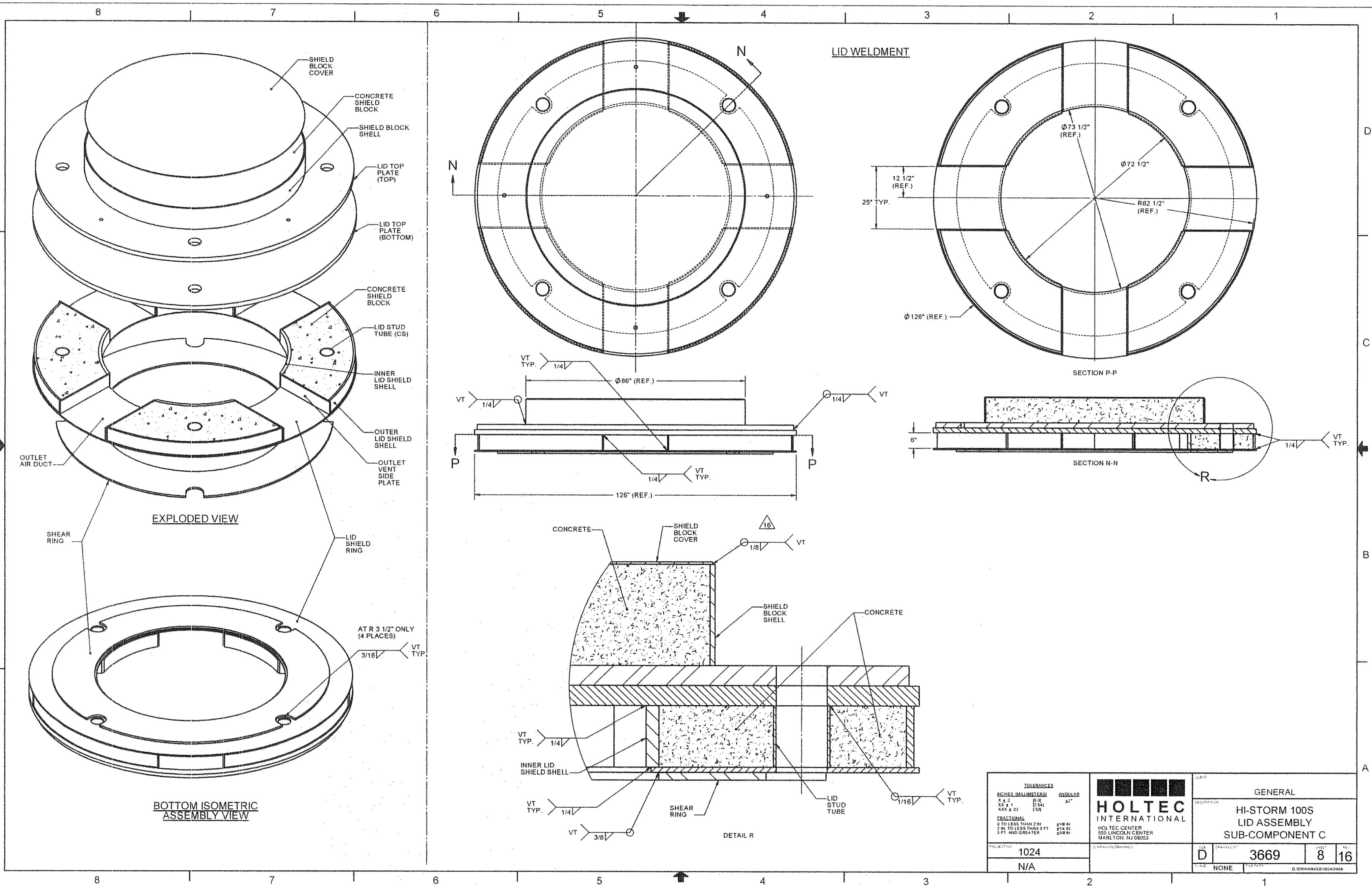
GENERAL

HI-STORM 100S
PEDESTAL ASSEMBLY
SUB-COMPONENT B

	1024
	N/A
	-
SIZE	D
DRAWING NO.	3669
SHEET	7
REV.	16
SCALE	NONE
	G:\DRAWINGS\1024\3669


SHIELD BLOCK COVER
CONCRETE SHIELD BLOCK
SHIELD BLOCK SHELL
LID TOP PLATE (TOP)
LID TOP PLATE (BOTTOM)
CONCRETE SHIELD BLOCK
LID STUD TUBE (CS)
INNER LID SHIELD SHELL
OUTER LID SHIELD SHELL
OUTLET VENT SIDE PLATE
OUTLET AIR DUCT
EXPLODED VIEW
SHEAR RING
LID SHIELD RING
AT R 3 1/2" ONLY (4 PLACES)
3/16
VT TYP.
BOTTOM ISOMETRIC ASSEMBLY VIEW
LID WELDMENT
N
N
Ø73 1/2" (REF.)
Ø72 1/2"
12 1/2" (REF.)
25" TYP.
R62 1/2" (REF.)
Ø126" (REF.)
SECTION P-P
VT TYP.
1/4
Ø86" (REF.)
VT
1/4
1/4
VT
P
P
1/4
VT TYP.
126" (REF.)
6"
1/4
VT TYP.
SECTION N-N
R
CONCRETE
SHIELD BLOCK COVER
16
1/8
VT
SHIELD BLOCK SHELL
CONCRETE
VT TYP.
1/4
INNER LID SHIELD SHELL
VT TYP.
1/4
VT
3/8
SHEAR RING
LID STUD TUBE
1/16
VT TYP.
DETAIL R
TOLERANCES
INCHES (MILLIMETERS) ANGULAR
X ± .2 [5.0] ±2°
.XX ± .1 [2.54]
.XXX ± .02 [.50]
FRACTIONAL
0 TO LESS THAN 2 IN ±1/8 IN.
2 IN. TO LESS THAN 3 FT ±1/4 IN.
3 FT. AND GREATER ±3/8 IN.
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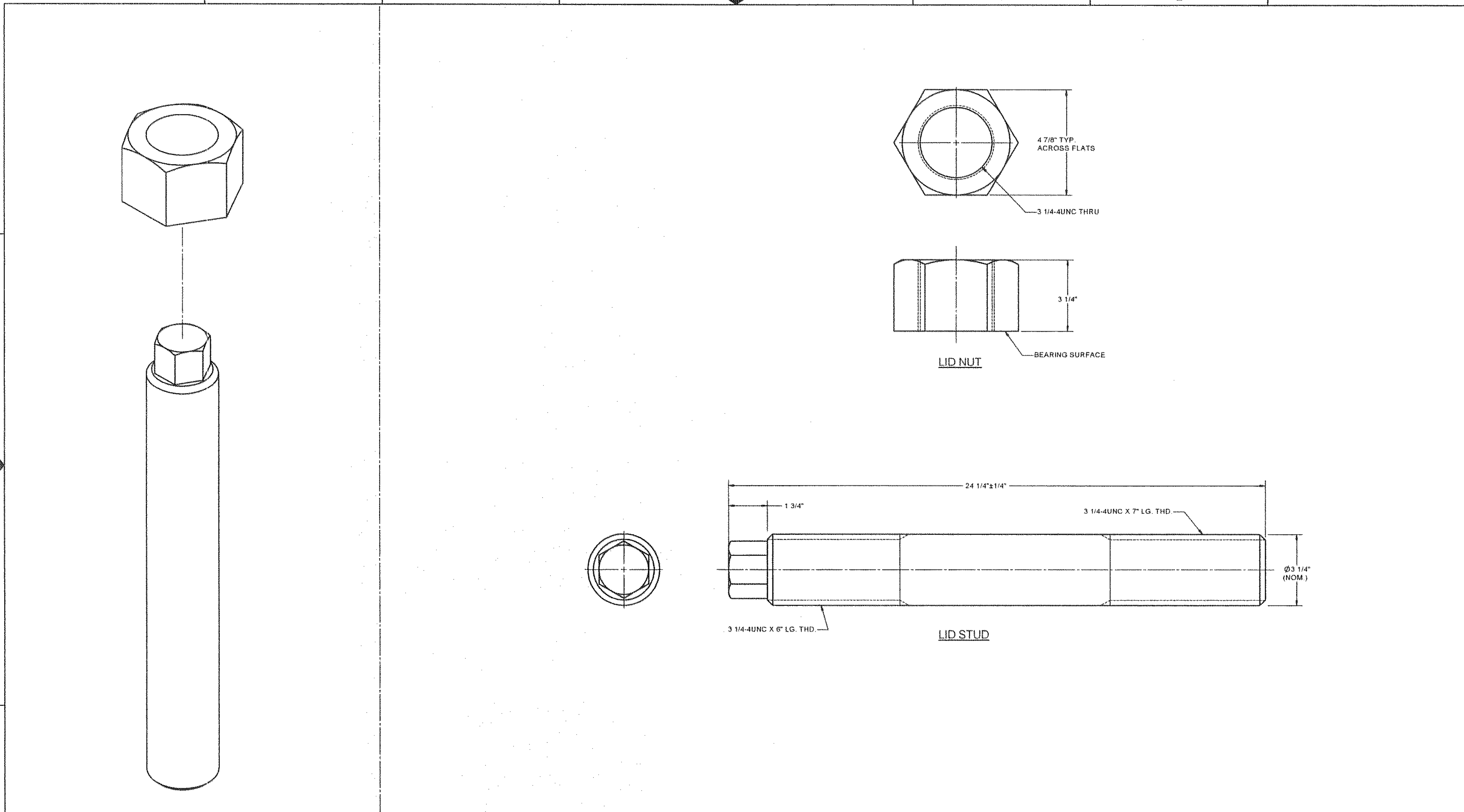
MARLTON, NJ 08053
GENERAL
HI-STORM 100S
LID ASSEMBLY
SUB-COMPONENT C
1024
N/A
D
3669
8
16
NONE
G:\DRAWINGS\1024\3669



TOLERANCES

INCHES [MILLIMETERS] ANGULAR
.X ± .2 [5.0] ±2°
.XX ± .1 [2.54]
.XXX ± .02 [.50]

FRACTIONAL
0 TO LESS THAN 2 IN. ±1/8 IN.
2 IN. TO LESS THAN 3 FT ±1/4 IN.
3 FT AND GREATER ±3/8 IN.

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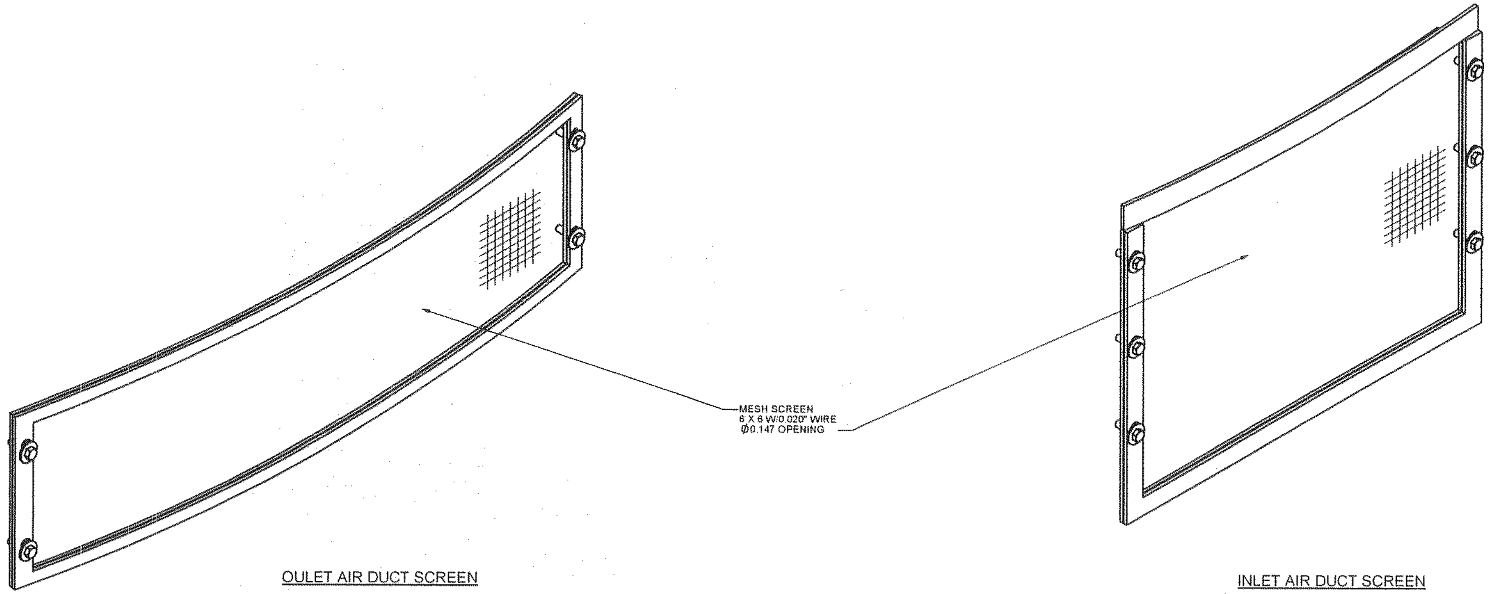
GENERAL

HI-STORM 100S
LID STUD AND NUT
SUB-COMPONENTS

1024	-	D	3669	9	16
N/A		NONE	G:\DRAWINGS\1024\3669		

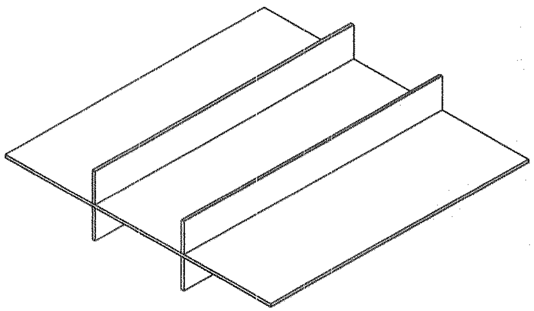


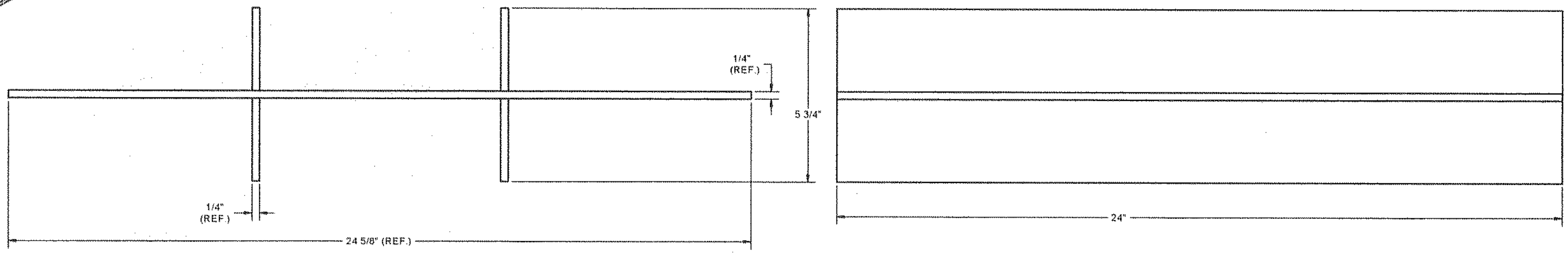
OULET AIR DUCT SCREEN

INLET AIR DUCT SCREEN

TOLERANCES			HOLTEC INTERNATIONAL	GENERAL
INCHES (MILLIMETERS)		ANGULAR	HOLTEC CENTER 555 LINCOLN CENTER MARLTON NJ 08053	HI-STORM 100S VENT SCREEN ASSEMBLIES SUB-COMPONENTS F & G
X ± .2	[5.0]	±2°		
.XX ± .1	[2.54]			
.XXX ± .02	[.50]			
FRACTIONAL				
0 TO LESS THAN 2 IN.	±1/8 IN.			
2 IN. TO LESS THAN 3 FT	±1/4 IN.			
3 FT AND GREATER	±3/8 IN.			
1024			-	D 3669 SHEET 10 REV. 16
N/A				NONE G:\DRAWINGS\1024\3669

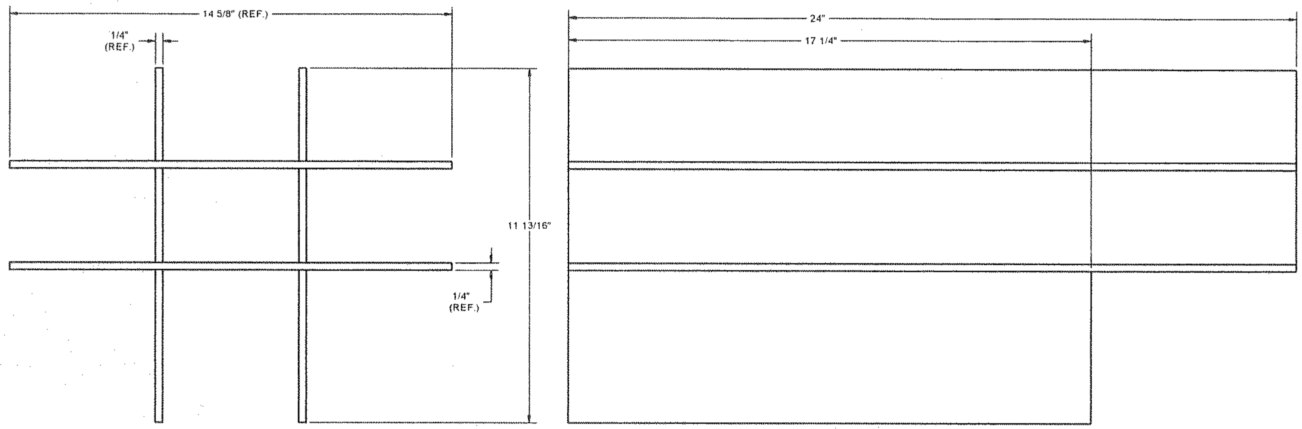
NOTE:
FOR OPTIONAL OUTLET VENT GAMMA SHIELD CROSS PLATES, SEE SHEET 12.

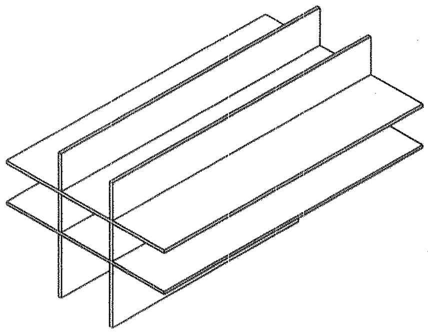




MANDATORY OUTLET AIR DUCT GAMMA SHIELD CROSS PLATES
(STAINLESS STEEL)

NOTE:
FOR OPTIONAL INLET VENT GAMMA SHIELD CROSS PLATES, SEE SHEET 12.





MANDATORY INLET AIR DUCT GAMMA SHIELD CROSS PLATES
(STAINLESS STEEL)

TOLERANCES		
INCHES [MILLIMETERS]		ANGULAR
.X ± .2	[5.0]	±2°
.XX ± .1	[2.54]	
.XXX ± .02	[.50]	
FRACTIONAL		
0 TO LESS THAN 2 IN.	±1/8 IN.	
2 IN. TO LESS THAN 3 FT.	±1/4 IN.	
3 FT. AND GREATER	±3/8 IN.	

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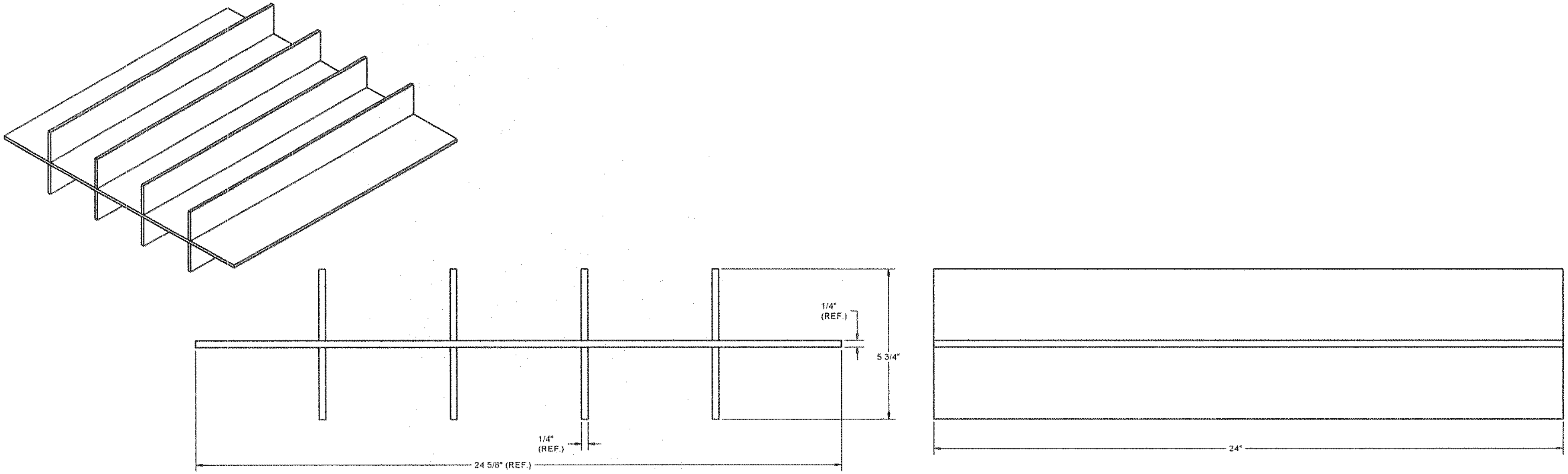
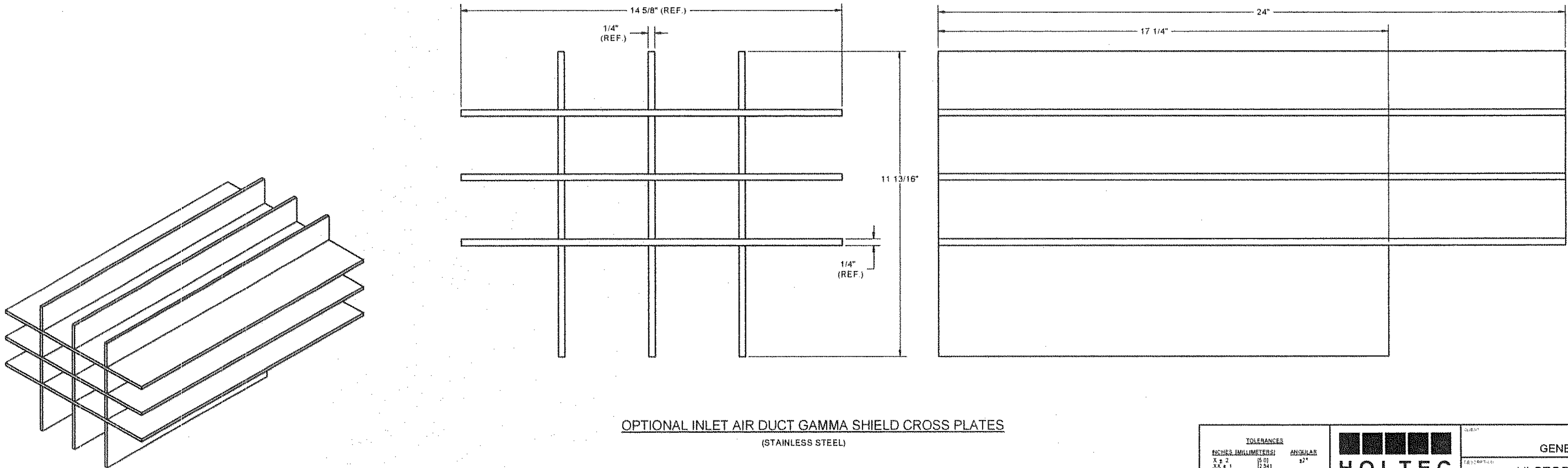
CLIENT: GENERAL
DESCRIPTION: HI-STORM 100S GAMMA SHIELDING ASSEMBLY SUB-COMPONENTS H & I

PROJECT NO.	COMPANION DRAWINGS	SIZE	DRAWING NO.	SHEET	REV.
1024	-	D	3669	11	16
N/A		SCALE: NONE	FILE PATH: G:\DRAWINGS\1024\3669		



OPTIONAL OUTLET AIR DUCT GAMMA SHIELD CROSS PLATES
(STAINLESS STEEL)



OPTIONAL INLET AIR DUCT GAMMA SHIELD CROSS PLATES
(STAINLESS STEEL)

TOLERANCES

INCHES [MILLIMETERS]		ANGULAR
.X ± .2	[5.0]	±2°
.XX ± .1	[2.54]	
.XXX ± .02	[.50]	

FRACTIONAL

0 TO LESS THAN 2 IN	±1/8 IN
2 IN. TO LESS THAN 3 FT	±1/4 IN.
3 FT. AND GREATER	±3/8 IN

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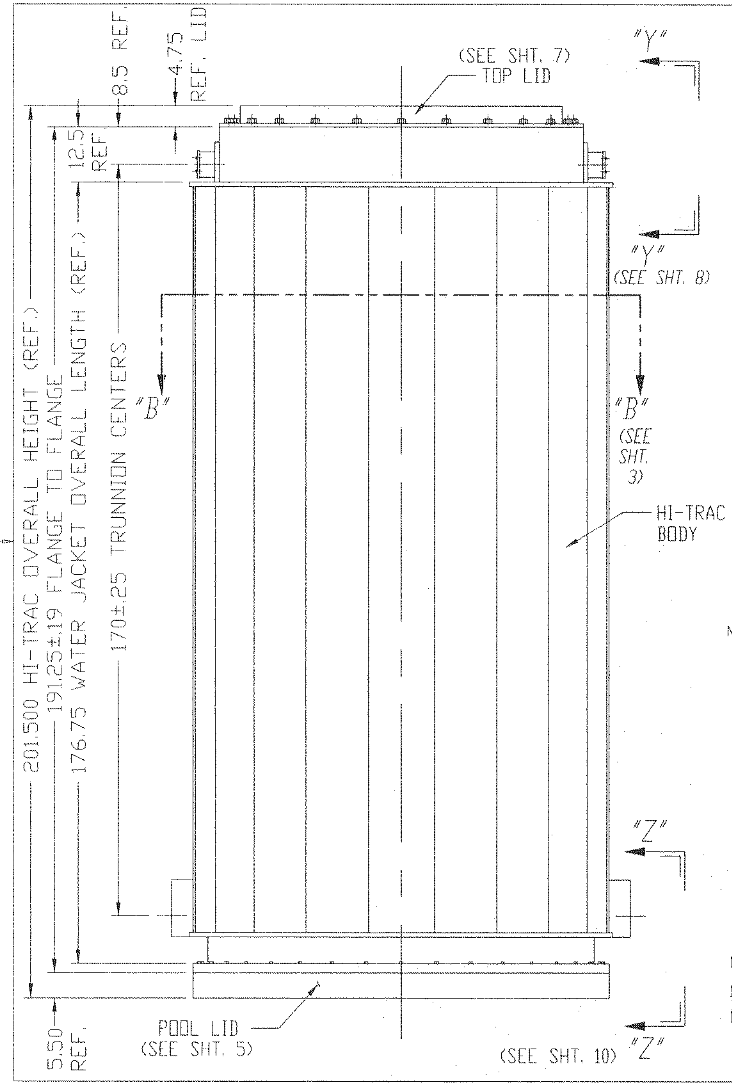
555 LINCOLN CENTER
MARLTON, NJ 08053

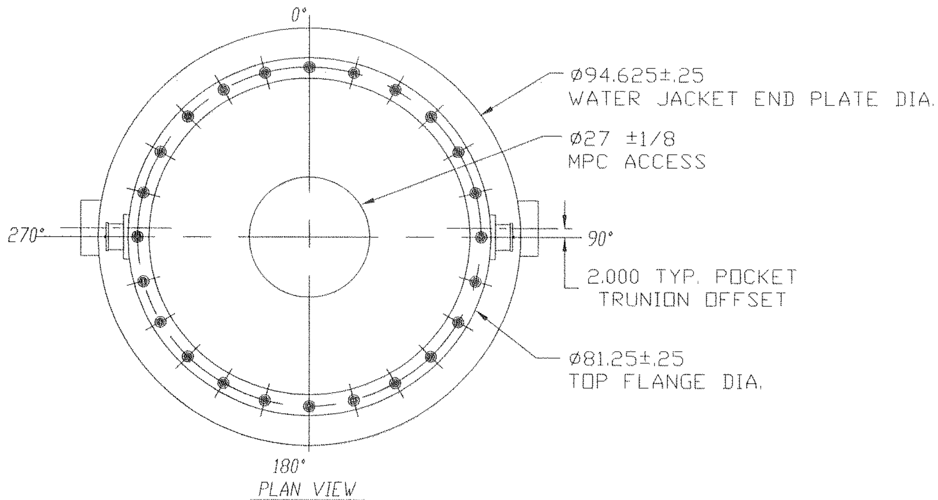
GENERAL

HI-STORM 100S
OPTIONAL GAMMA SHIELDING
SUB-COMPONENTS J & K

1024	-	D	3669	12	16
N/A		NONE	G:\DRAWINGS\1024\3669		

REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
9	INCORPORATED ECO#: 1025-35	T.F.O.	11/30/01	61197





PLAN VIEW

NOTES:

1) SERIAL NUMBERS ARE TO BE PLACED ON ALL LOOSE COMPONENTS ASSEMBLED IN THE FIELD OR COMPONENTS WHICH MAY BE REMOVED TO PROVIDE TRACEABILITY.
2) DELETED
3) ALL WELDS REQUIRE VISUAL EXAMINATION (VT).
4) EXCEPT WHERE STATED OTHERWISE, TOLERANCE ON FINISHED DIMENSIONS ±1/4.
5) ALL LINEAR DIMENSIONS ARE IN INCHES.
6) NONDESTRUCTIVE EXAMINATIONS AS FOLLOWS:
   a) LIQUID PENETRANT PER ASME SECTION V, ARTICLE 6. ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5350.
   b) VISUAL EXAMINATION PER ASME SECTION V, ARTICLE 9. ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5360.
   c) MAGNETIC PARTICLE PER ASME SECTION V, ARTICLE 7 ACCEPTANCE CRITERIA PER ASME SECTION III, SECTION NF, ARTICLE NF-5340.
7) DELETED
8) FABRICATOR TO MAKE FINAL DETERMINATION OF THE LOCATION AND TOTAL NUMBER OF CIRCUMFERENTIAL AND LONGITUDINAL WELDS REQUIRED.
9) DELETED
10) THE EXTERNAL SURFACE OF THE CASK SHALL BE PAINTED WITH CARBOLINE 890. THE INSIDE SURFACES OF THE CASK (EXCLUDING SEALING AREAS) TO BE PAINTED WITH THERMALINE 450 OR EQUIVALENT. THREADED HOLES, PLUGS, SEALS ETC. SHALL NOT BE PAINTED.
11) STEEL USED IN FABRICATION SHALL MEET THE REQUIREMENTS OF ASME SECTION II.
12) WELDING PROCEDURES AND WELDER QUALIFICATIONS SHALL BE PER ASME SECTION IX AND ASME SECTION III, SUBSECTION NF.
13) ALL ANGLES ARE FOR REFERENCE ONLY UNLESS OTHERWISE NOTED.
14) ALL BASE METAL THICKNESS IN DRAWINGS ARE DEFINED AS REFERENCE DIMENSIONS.
15) WELDS IDENTIFIED WITH AN '*' ARE CONSIDERED NON-NF WELDS AND MAY BE WELDED USING PREQUALIFIED WELD PROCEDURES FROM AWS D1.1.

HOLTEC INTERNATIONAL — EQUIPMENT DESIGN / ANALYSIS / CONSULTING

DESCRIPTION: 125TON HI-TRAC OUTLINE WITH POOL LID

CLIENT: N/A

COMPANION DRAWINGS: B/M 1880

PROJECT No: 1025	SCALE: .04 = 1	DRAWING No: 1880 (E.I.D. 3904)	REV: 9
P.O. No: N/A			SHEET: 1 of 10

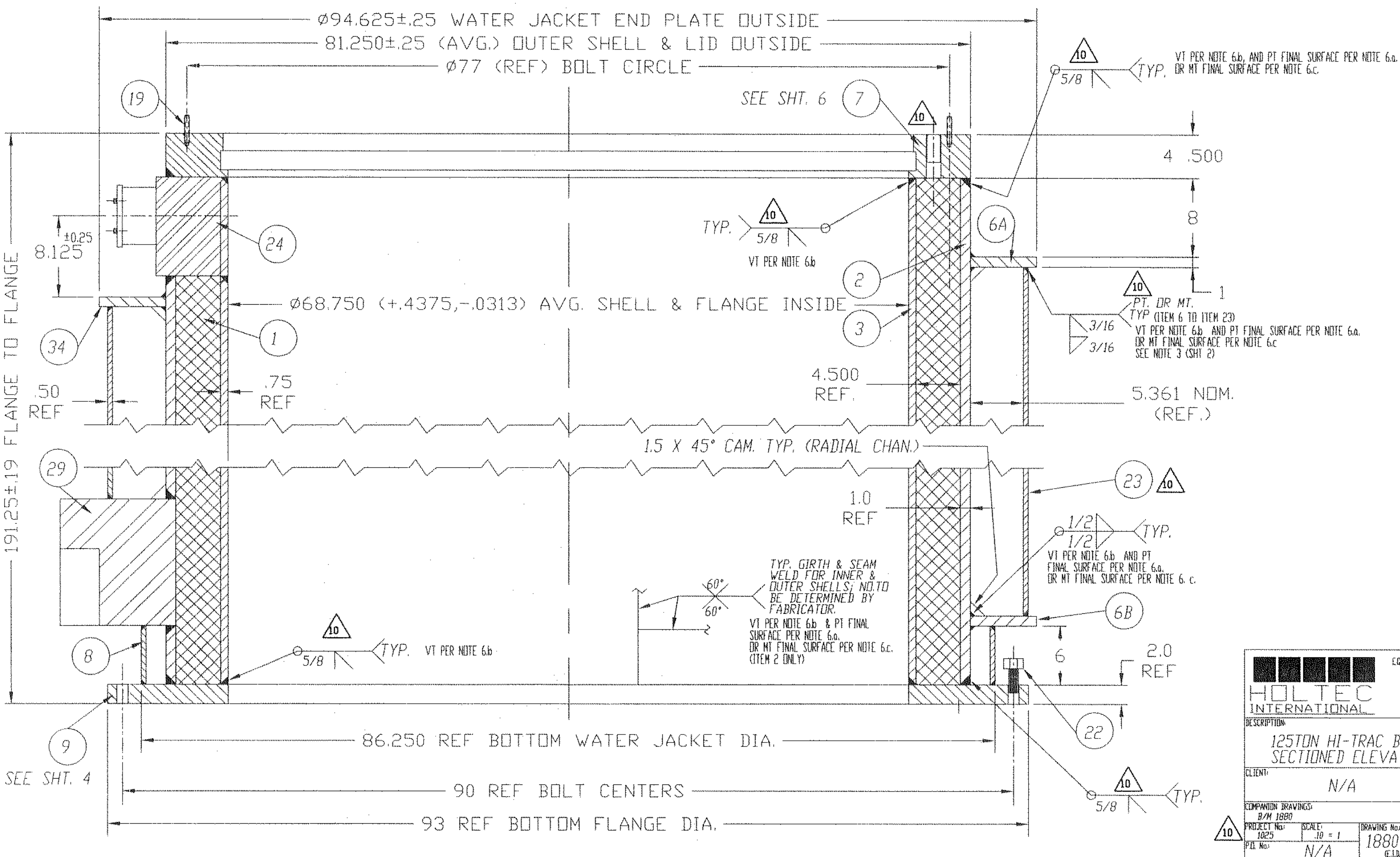
G:\DRAWINGS\1025\TRNSFER\1880-1R8

NOTES:
1) SEE DWG. 1880 SHT. 1 OF 10.
2) DELETED.
3) EXCEPT AS NOTED OTHERWISE, ALL GROOVE WELDS ARE FULL PENETRATION (45° ANGLE MINIMUM). USE OF BACKING, ROOT OPENING SIZE, AND BACK GOUGING (FOR WELDING FROM BOTH SIDES) ARE AT FABRICATOR'S DISCRETION.
10 PARTIAL PENETRATION WELDS ALSO REQUIRE 45 DEGREE ANGLE MINIMUM.

10 4) FABRICATOR MAY ADD ADDITIONAL WELDS PROVIDED APPROVAL IS RECEIVED FROM HOLTEC.

REVISIONS

REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
10	INCORPORATED ECO 1025-35, 13, 8 & 4	T.F.O.	11/30/01	79075



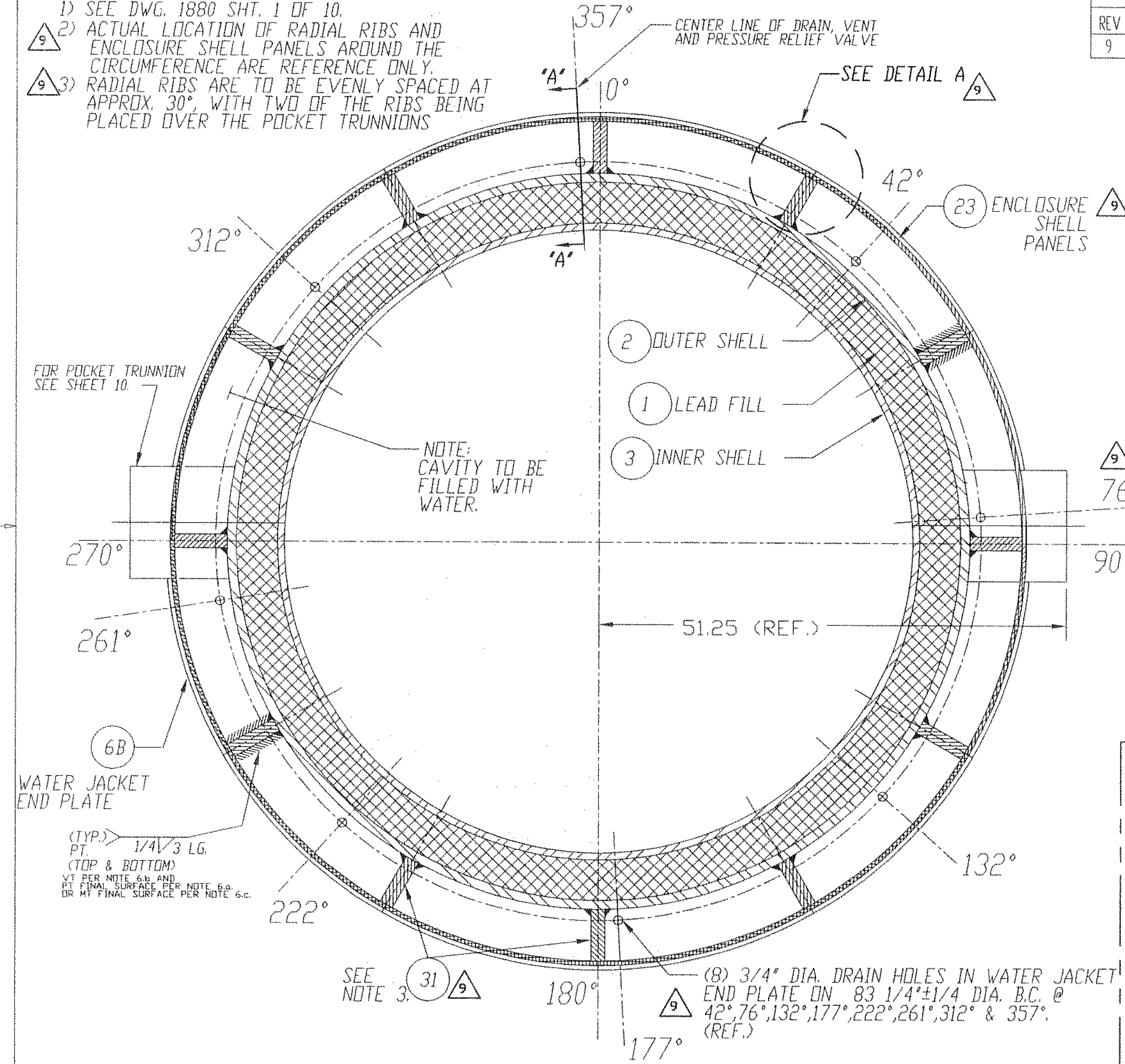
HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

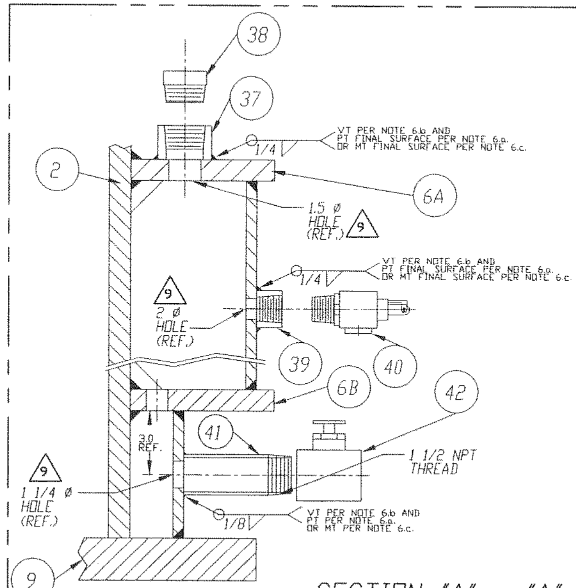
DESCRIPTION:	125TON HI-TRAC BODY SECTIONED ELEVATION
CLIENT:	N/A
COMPANION DRAWINGS:	B/M 1880
PROJECT No:	1025
P.O. No:	N/A
SCALE:	.10 = 1
DRAWING No:	1880 (E.I.D. 3005)
REV:	10
SHEET:	2 of 10

10 G:\DRAWINGS\1025\TRNSFER\1880-2R10

NOTES:
1) SEE DWG. 1880 SHT. 1 OF 10.
9 2) ACTUAL LOCATION OF RADIAL RIBS AND ENCLOSURE SHELL PANELS AROUND THE CIRCUMFERENCE ARE REFERENCE ONLY.
9 3) RADIAL RIBS ARE TO BE EVENLY SPACED AT APPROX. 30°, WITH TWO OF THE RIBS BEING PLACED OVER THE POCKET TRUNNIONS

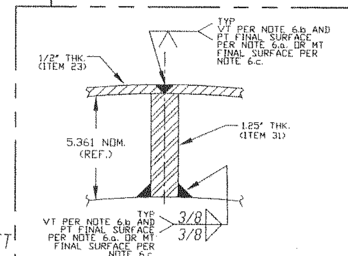
REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
9	INCORPORATED ECO 1025-35, 13, 11 & 5.	T.F.O.	11/30/01	96765





SECTION "A" - "A"

SCALE: .1875 = 1



DETAIL-"A"

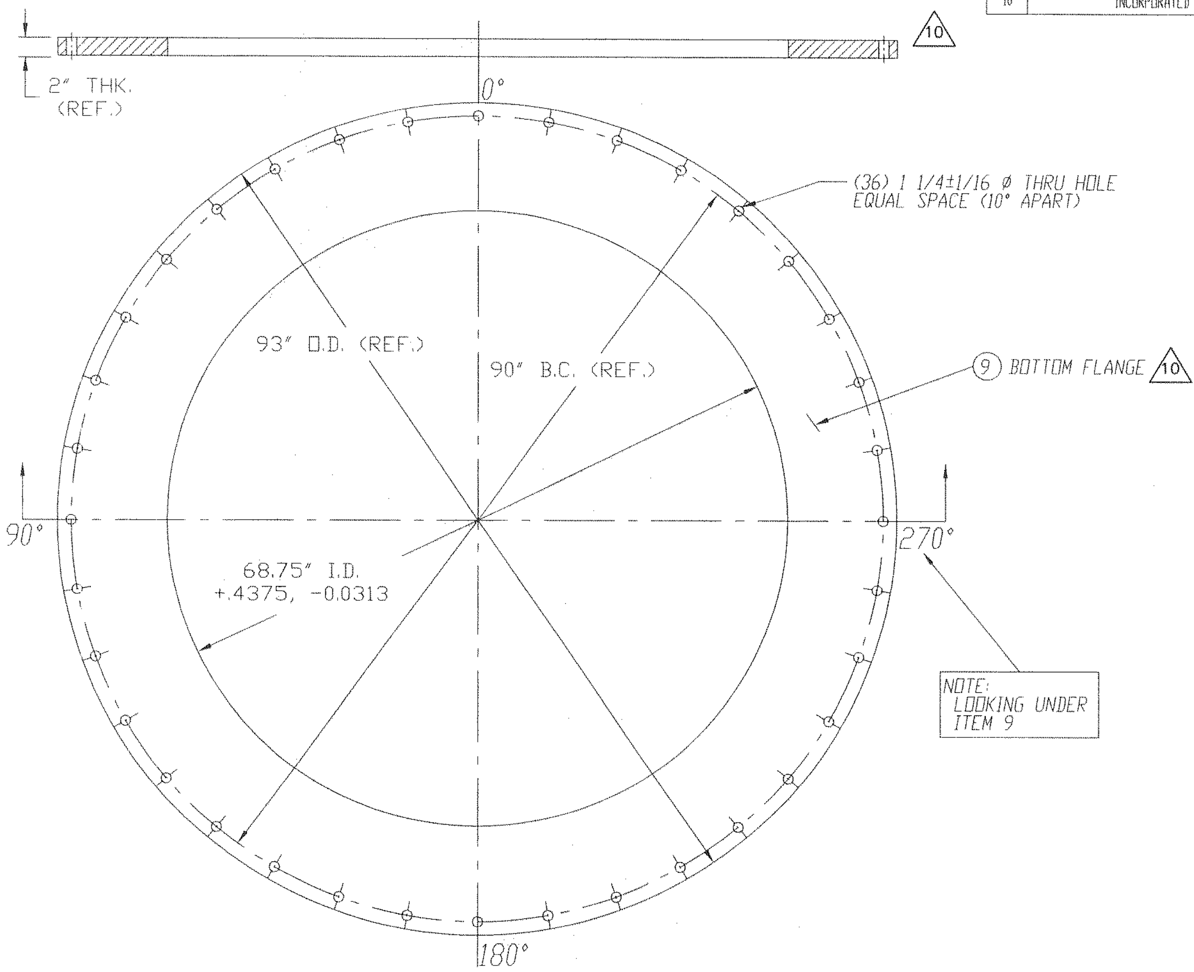
9 RADIAL RIB DETAIL 9

HOLTEC INTERNATIONAL	EQUIPMENT DESIGN ANALYSIS CONSULTING
DESCRIPTION: 125TON HI-TRAC BODY SECTIONED ELEVATION 'B'-'B'	
CLIENT:	
COMPANION DRAWINGS: B/M 1880	
PROJECT NO.: 1025 SCALE: .08 = 1 DRAWING No.: 1880 (E.I.D. 3006) REV.: 9	
P.O. No.: N/A SHEET: 3 of 10	

9 G:\DRAWINGS\1025\TRNSFER\1880-3R9

REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
10	INCORPORATED ECO-1025-35 & 12	T.F.O.	11/30/01	68645

NOTES:
1) SEE DWG. 1880 SHT. 1 OF 10.



PLAN VIEW - LOOKING UNDER BOTTOM FLANGE

HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

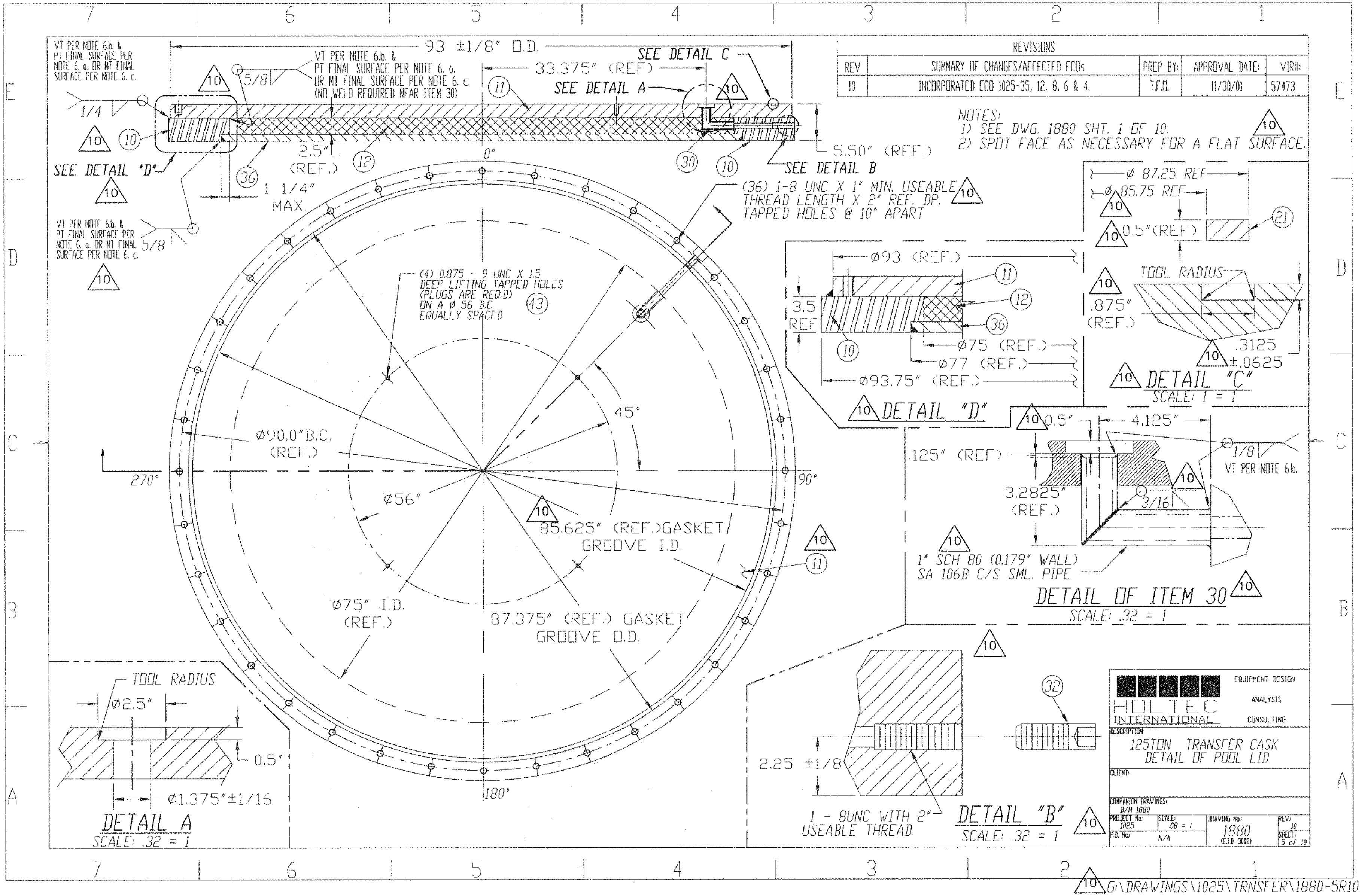
DESCRIPTION: 125TON TRANSFER CASK DETAIL OF BOTTOM FLANGE

CLIENT:

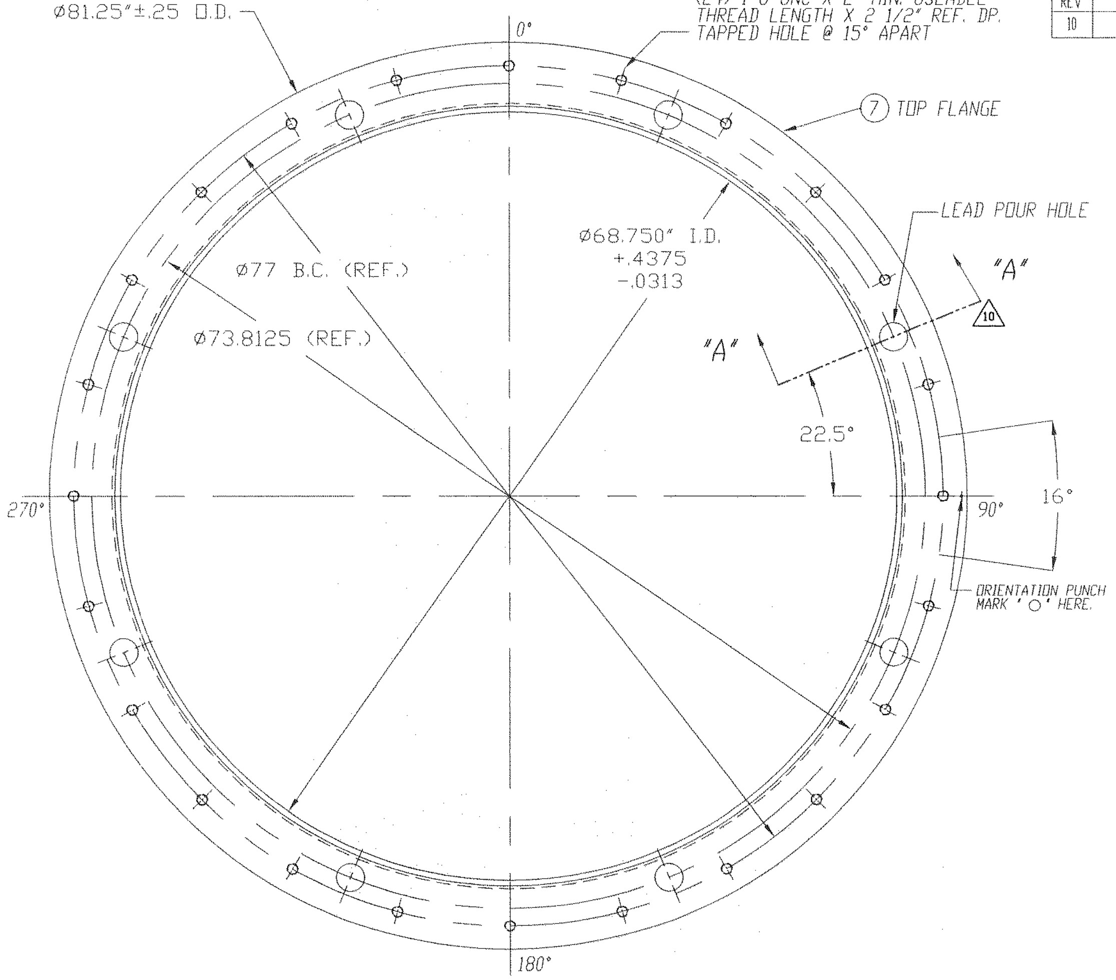
COMPANION DRAWINGS: B/M 1880

PROJECT No.: 1025	SCALE: .08 = 1	DRAWING No.: 1880 (E.I.D. 3007)	REV: 10
P.O. No.: N/A			SHEET: 4 of 10

10 G:\DRAWINGS\1025\TRNSFER\1880-4R10

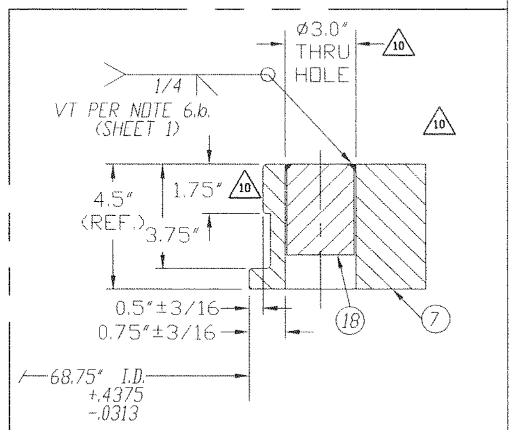

REVISIONS
REV | SUMMARY OF CHANGES/AFFECTED ECOs | PREP BY: | APPROVAL DATE: | VIR#:
10 | INCORPORATED ECO 1025-35, 12, 8, 6 & 4. | T.F.D. | 11/30/01 | 57473
NOTES:
1) SEE DWG. 1880 SHT. 1 OF 10.
2) SPOT FACE AS NECESSARY FOR A FLAT SURFACE.
93 ±1/8" O.D.
33.375" (REF)
SEE DETAIL C
SEE DETAIL A
SEE DETAIL B
SEE DETAIL "D"
5.50" (REF.)
2.5" (REF.)
1 1/4" MAX.
VT PER NOTE 6.b. & PT FINAL SURFACE PER NOTE 6. a. OR MT FINAL SURFACE PER NOTE 6. c.
VT PER NOTE 6.b. & PT FINAL SURFACE PER NOTE 6. a. OR MT FINAL SURFACE PER NOTE 6. c. (NO WELD REQUIRED NEAR ITEM 30)
(36) 1-8 UNC X 1" MIN. USEABLE THREAD LENGTH X 2" REF. DP. TAPPED HOLES @ 10° APART
(4) 0.875 - 9 UNC X 1.5 DEEP LIFTING TAPPED HOLES (PLUGS ARE REQ.D) ON A Ø 56 B.C. EQUALLY SPACED
Ø90.0" B.C. (REF.)
Ø56"
45°
85.625" (REF.) GASKET GROOVE I.D.
87.375" (REF.) GASKET GROOVE O.D.
Ø75" I.D. (REF.)
0°
90°
180°
270°
DETAIL "D"
Ø93 (REF.)
Ø75 (REF.)
Ø77 (REF.)
Ø93.75" (REF.)
3.5 REF
DETAIL "C"
SCALE: 1 = 1
Ø 87.25 REF
Ø 85.75 REF
0.5" (REF)
TOOL RADIUS
.875" (REF.)
.3125 ±.0625
DETAIL OF ITEM 30
SCALE: .32 = 1
0.5"
4.125"
.125" (REF)
3.2825" (REF.)
3/16
1/8
VT PER NOTE 6.b.
1" SCH 80 (0.179" WALL) SA 106B C/S SML. PIPE
DETAIL A
SCALE: .32 = 1
TOOL RADIUS
Ø2.5"
0.5"
Ø1.375" ±1/16
DETAIL "B"
SCALE: .32 = 1
2.25 ±1/8
1 - 8UNC WITH 2" USEABLE THREAD.
HOLTEC INTERNATIONAL
EQUIPMENT DESIGN
ANALYSIS
CONSULTING
DESCRIPTION: 125TON TRANSFER CASK DETAIL OF POOL LID
CLIENT:
COMPANION DRAWINGS: B/M 1880
PROJECT No: 1025
SCALE: .08 = 1
DRAWING No: 1880 (E.I.D. 3008)
REV: 10
SHEET: 5 of 10
P.O. No: N/A
G:\DRAWINGS\1025\TRNSFER\1880-5R10

REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
10	INCORPORATED ECO 1025-35 & 6.	T.F.O.	11/30/01	36553



NOTES:
1) SEE DWG. 1880 SHT. 1 OF 10.

10



10 SECTION "A" - "A"
(SCALE:.25 = 1)

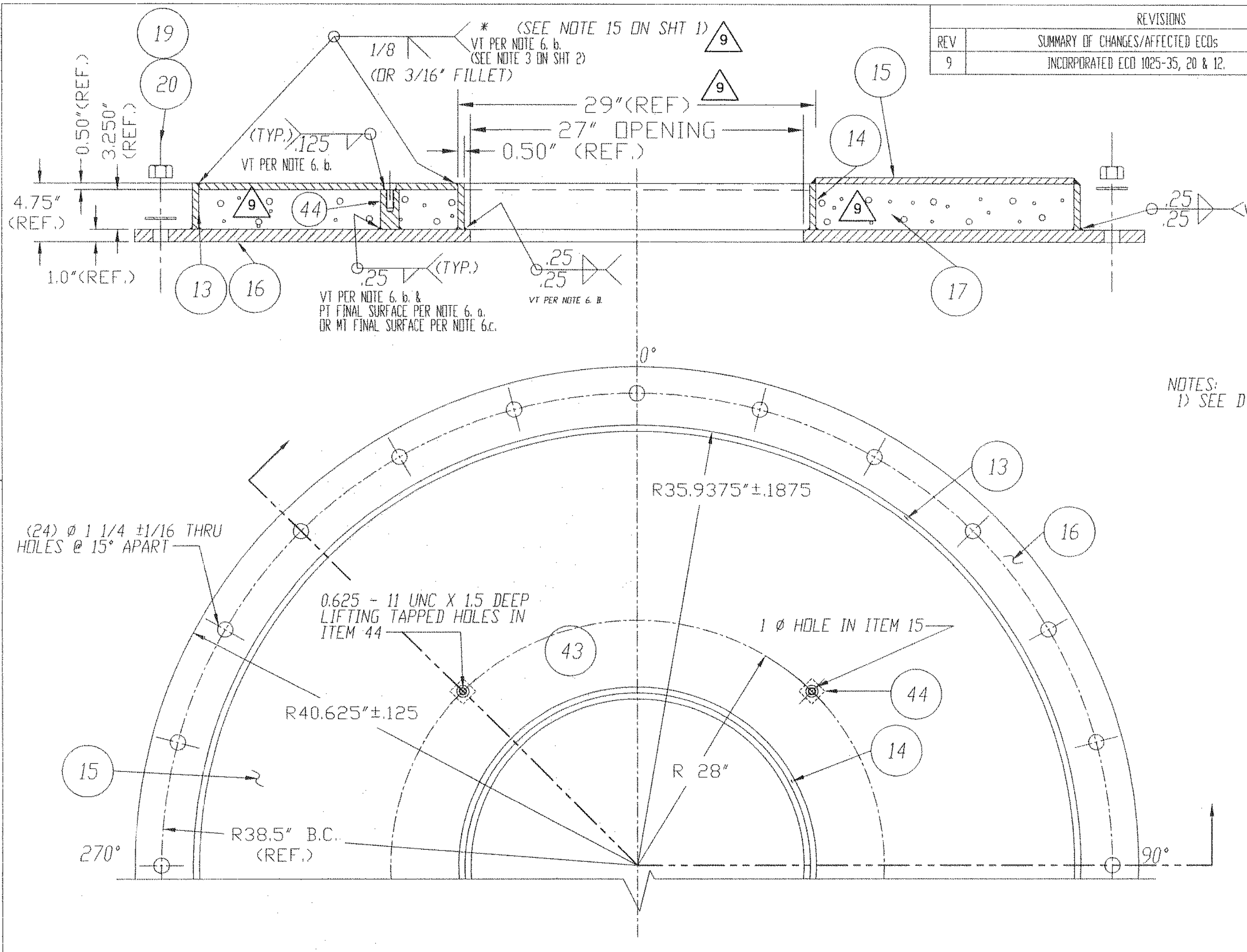
HOLTEC INTERNATIONAL
EQUIPMENT DESIGN
ANALYSIS
CONSULTING

DESCRIPTION: 125TON TRANSFER CASK DETAIL OF TOP FLANGE			
CLIENT:			
COMPANION DRAWINGS: B/M 1880			
PROJECT No: 1025	SCALE: .10 = 1	DRAWING No: 1880 (E.I.D. 3009)	REV: 10
P.O. No: N/A			SHEET: 6 of 10

10

10 G:\DRAWINGS\1025\TRNSFER\1889-6R10

REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
9	INCORPORATED ECO 1025-35, 20 & 12.	T.F.O.	11/30/01	63506



NOTES:
1) SEE DWG. 1880 SHT. 1 OF 10.

HOLTEC INTERNATIONAL

EQUIPMENT DESIGN
ANALYSIS
CONSULTING

DESCRIPTION:
125TON TRANSFER CASK
DETAIL OF TOP LID

CLIENT:

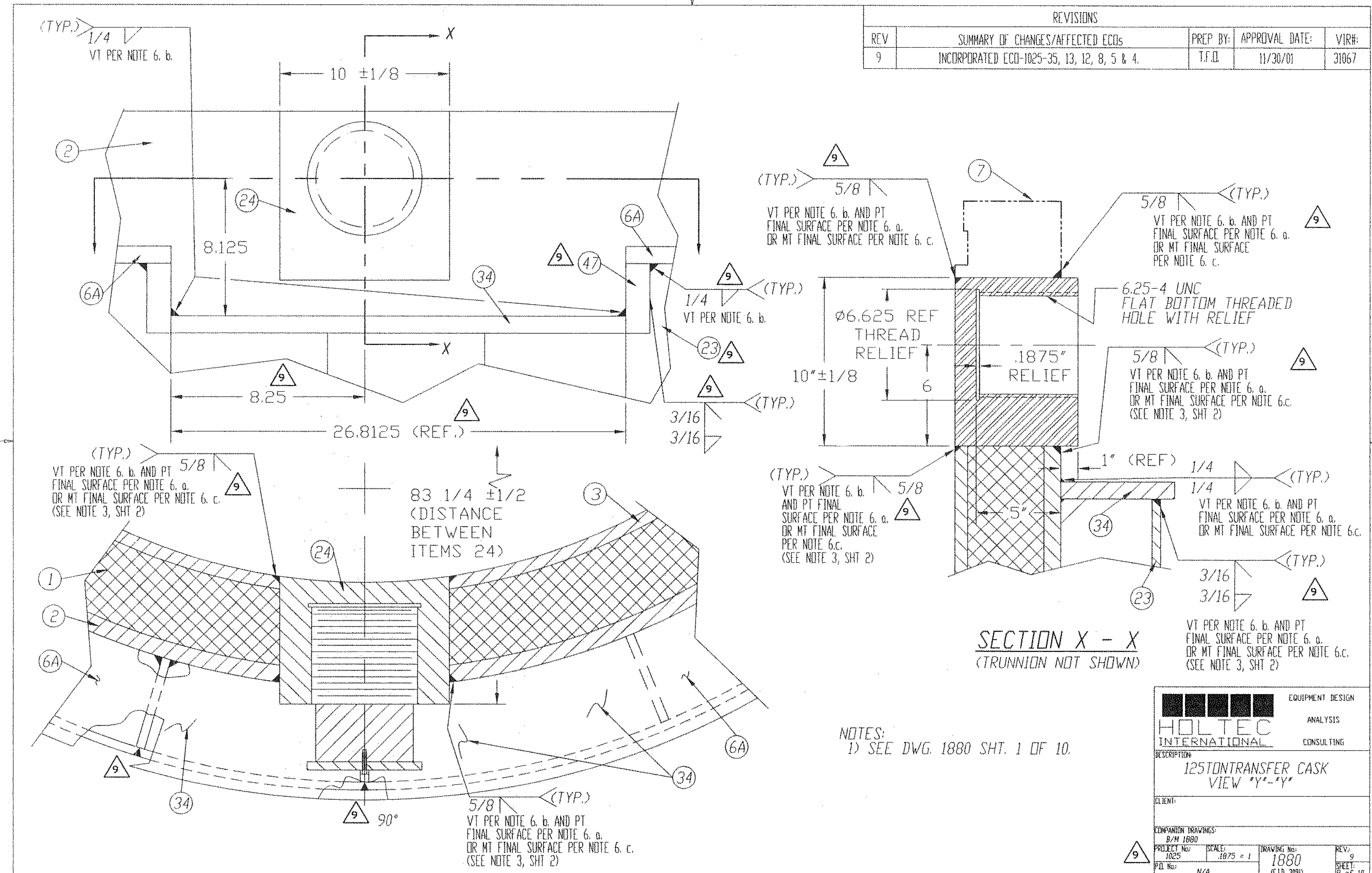
COMPANION DRAWINGS: B/M 1880

PROJECT No.: 1025	SCALE: .125 = 1	DRAWING No.: 1880 (CLD 3010)	REV.: 9
P.O. No.: N/A			SHEET: 7 of 10

G:\DRAWINGS\1025\TRNSFER\1880-7R9

REVISIONS

REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
9	INCORPORATED ECO-1025-35, 13, 12, 8, 5 & 4.	T.F.O.	11/30/01	31067



SECTION X - X
(TRUNNION NOT SHOWN)

NOTES:
1) SEE DWG. 1880 SHT. 1 OF 10.

HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

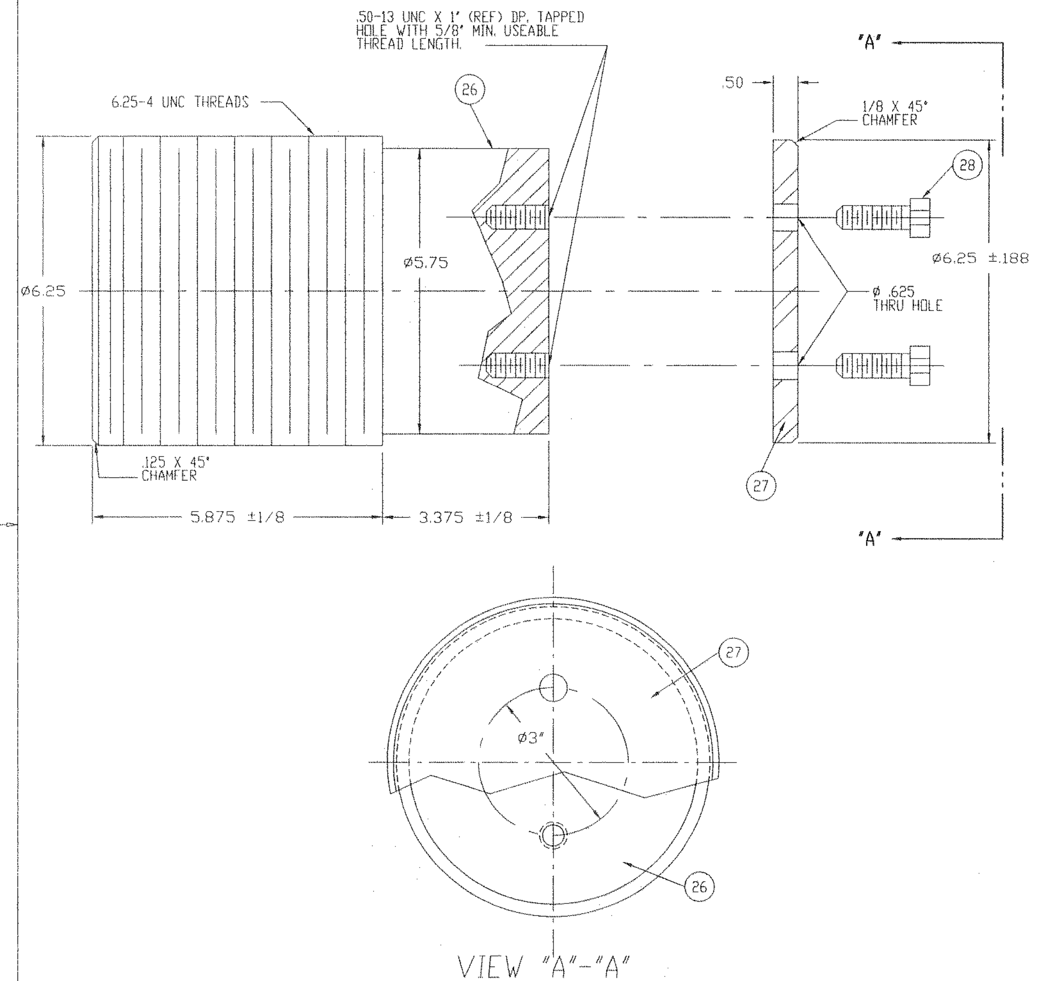
DESCRIPTION: 125TONTRANSFER CASK VIEW "Y"-"Y"

CLIENT:

COMPANION DRAWINGS: B/M 1880

PROJECT No:	SCALE:	DRAWING No:	REV:
1025	.1875 = 1	1880 (C.I.D. 3091)	9
P.O. No: N/A			SHEET: 8 of 10

G:\DRAWINGS\1025\TRNSFER\1880-8R9



DETAIL OF LIFTING TRUNNION

REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
7	INCORPORATED ECO #: 1025-35	T.F.D.	11/30/01	37433

NOTES:
1) SEE DWG. 1880 SHT. 1 OF 10.

HOLTEC INTERNATIONAL
EQUIPMENT DESIGN
ANALYSIS
CONSULTING

DESCRIPTION:
125TON TRANSFER CASK LIFTING TRUNNION AND LOCKING PAD

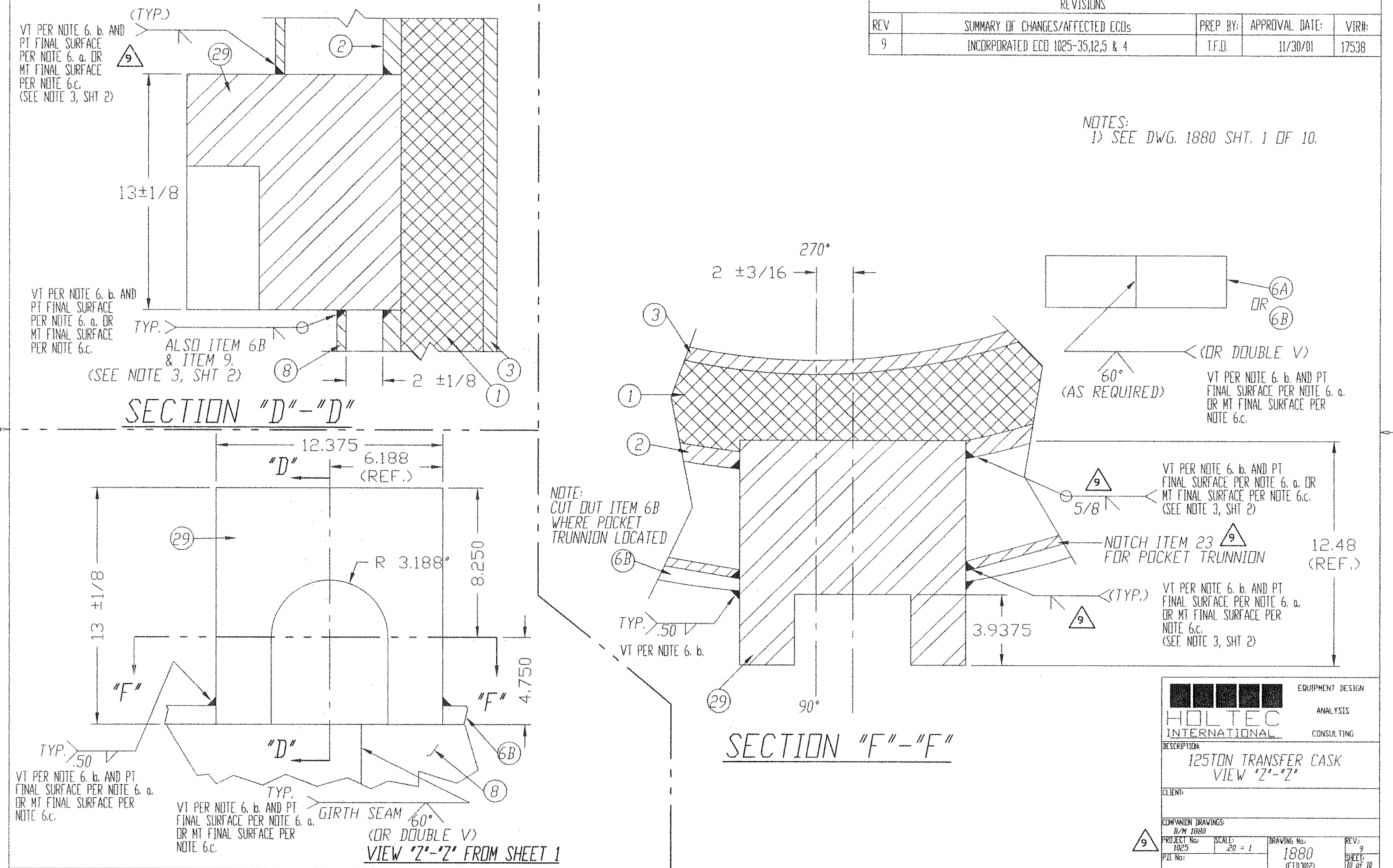
CLIENT:

COMPANION DRAWINGS: B/M 1880
PROJECT No: 1025 | SCALE: NONE | DRAWING No: 1880 (C.I.D. 3011) | REV: 7
PO No: N/A | SHEET: 9 of 10

G:\DRAWINGS\1025\TRNSFER\1880-9R7

REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
9	INCORPORATED ECO 1025-35,12,5 & 4	T.F.D.	11/30/01	17538

NOTES:
1) SEE DWG. 1880 SHT. 1 OF 10.



HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION: 125TON TRANSFER CASK VIEW "Z"-"Z"

CLIENT:

COMPANION DRAWINGS: B/M 1880

PROJECT No: 1025	SCALE: 20 = 1	DRAWING No: 1880 (C.I.D.3012)	REV: 9
P.O. No:			SHEET: 10 of 10

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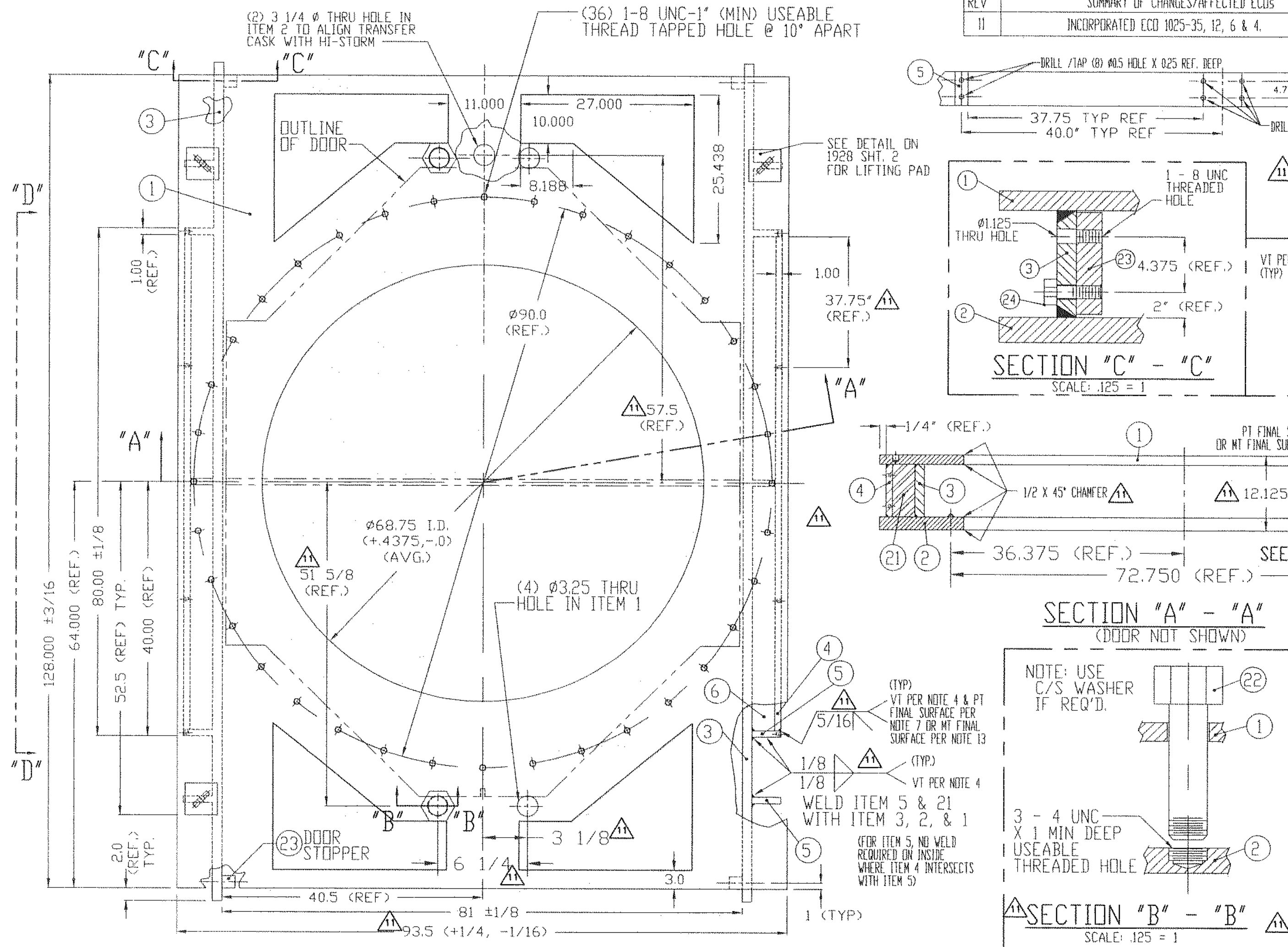
NOTES:
1) SEE DWG. 1928 SHT. 2

REVISIONS

REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
11	INCORPORATED ECO 1025-35, 12, 6 & 4.	T.S.D.	11/30/01	24016



HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION:	125TON HI-TRAC TRANSFER LID HOUSING DETAIL
CLIENT:	N/A
COMPANION DRAWINGS:	B/M 1928
PROJECT No:	1025
SCALE:	.0625 = 1
DRAWING No:	1928 (C.I.D. 2999)
REV:	11
SHEET:	1 of 2
P.O. No:	N/A

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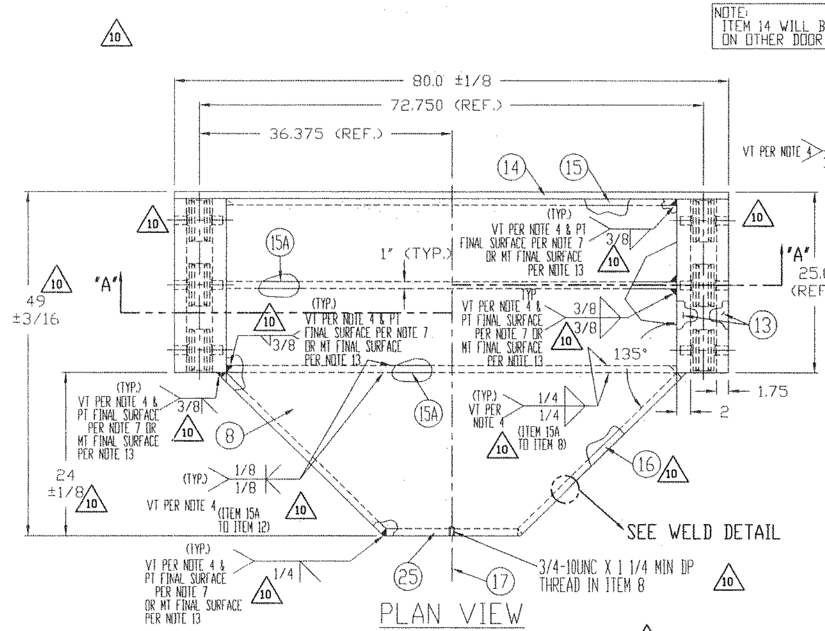
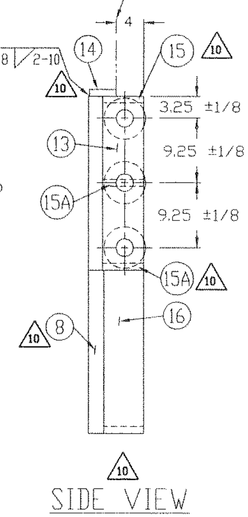
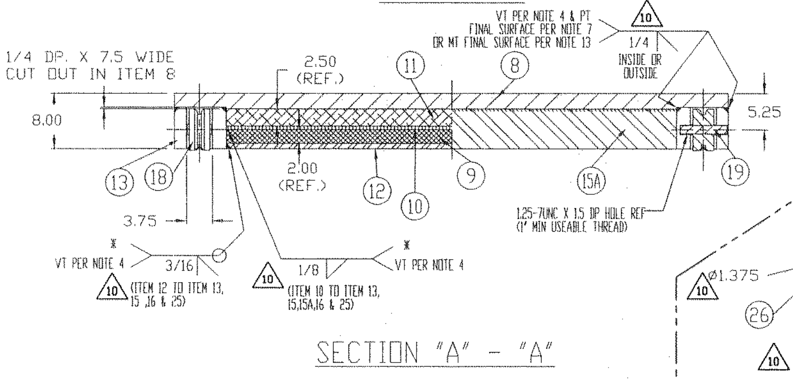
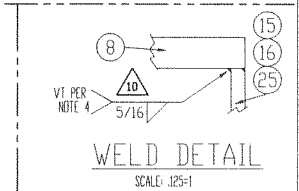
REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
10	INCORPORATED ECO 1025-35, 16, 12, 8 & 1.	T.F.O.	11/30/01	39983

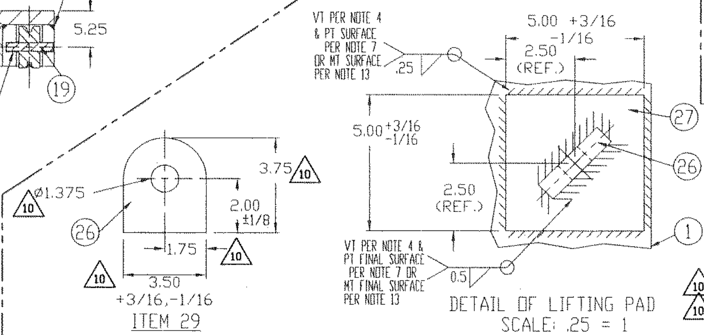




NOTES:
1) DIMENSIONAL TOLERANCE ±1/8, EXCEPT NOTED.
2) TWO DOORS REQ.
3) PAINT THE TOP SURFACE OF THE DOORS WITH THERMALINE 450 OR EQUIVALENT AND ALL OTHER EXTERIOR SURFACES WITH CARBOLINE 890.
4) ALL WELDS REQUIRE VISUAL EXAMINATION PER ASME SECTION V, ARTICLE 9, ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5360.
5) ALL LINEAR DIMENSIONS ARE IN INCHES.
6) SERIAL NUMBERS ARE TO BE PLACED ON ALL LOOSE COMPONENTS TO PROVIDE TRACEABILITY.
7) LIQUID PENETRANT EXAMINATIONS AS FOLLOWS:
-LIQUID PENETRANT PER ASME SECTION V, ARTICLE 6. ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5350.
8) STEEL USED IN FABRICATION SHALL MEET THE REQUIREMENTS OF ASME SECTION II, PART A.
9) WELDING PROCEDURES AND WELDER QUALIFICATIONS SHALL BE PER SECTION IX AND ASME SECTION III, SUBSECTION NF.
10) ALL ANGLES ARE REFERENCE ONLY UNLESS OTHERWISE STATED.
11) DELETED
12) EXCEPT AS NOTED OTHERWISE, FULL AND PARTIAL PENETRATION WELDS SHALL BE 45° MINIMUM. SIZE OF ROOT OPENING (IF REQUIRED), USE OF BACKING AND BACK GOUGING (AND WELDING FROM BOTH SIDES) ARE AT FABRICATOR'S DISCRETION.
13) MAGNETIC PARTICLE EXAMINATIONS AS FOLLOWS:
MAGNETIC PARTICLE PER ASME SECTION V, ARTICLE 7. ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5340.
14) FABRICATOR MAY ADD ADDITIONAL WELDS PROVIDED APPROVAL IS RECEIVED FROM HOLTEC.
15) WELDS IDENTIFIED WITH AN '*' ARE CONSIDERED NON-NF WELDS AND MAY BE WELDED USING PRE- QUALIFIED WELD PROCEDURES FROM AWS D1.1.







HOLTEC INTERNATIONAL

EQUIPMENT DESIGN
ANALYSIS
CONSULTING

DESCRIPTION: 125TON HI-TRAC TRANSFER LID DOOR DETAIL

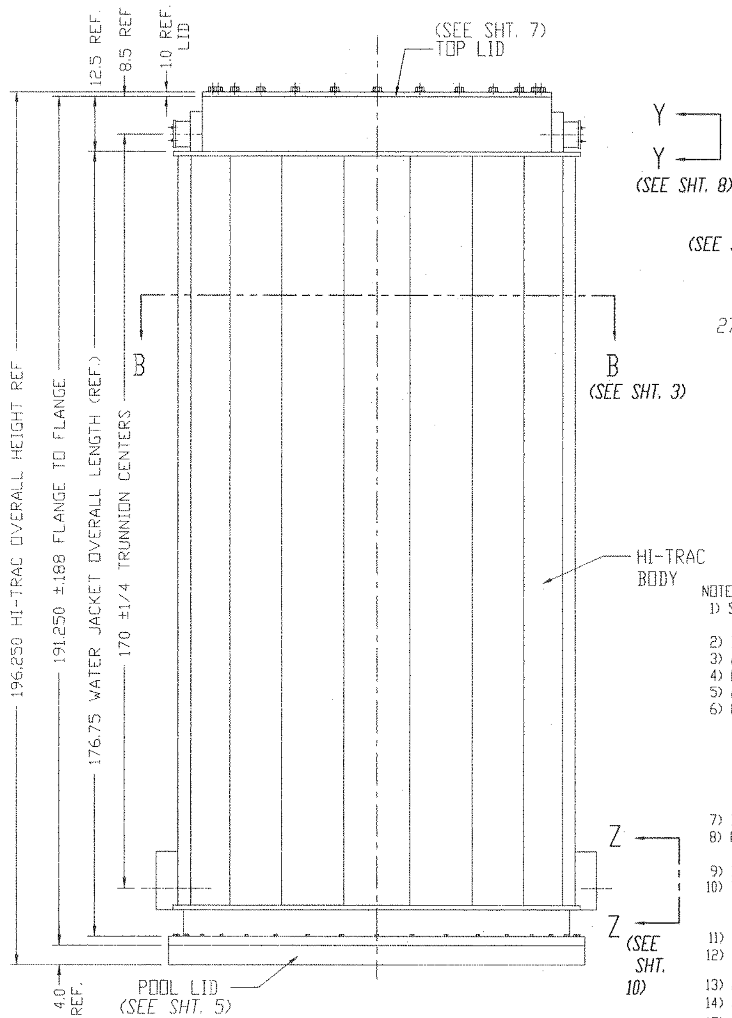
CLIENT: N/A

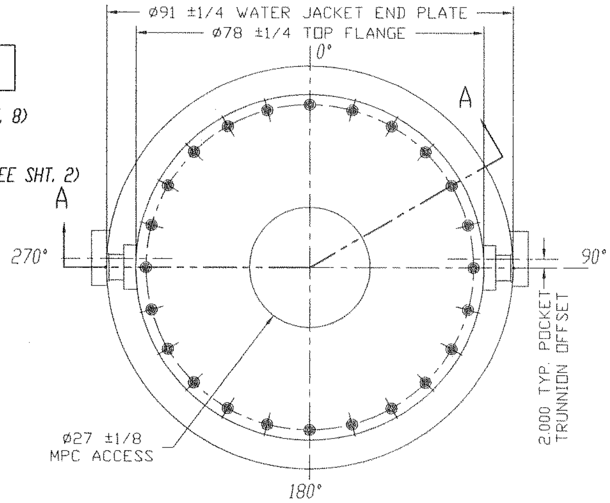
COMPANION DRAWINGS: B/M 1928

PROJECT No:	SCALE:	DRAWING No:	REV:
1025	.0625 = 1	1928 (E.I.D. 3000)	10
P.O. No: N/A			SHEET: 2 of 2

G:\DRAWINGS\1025\TRNSFER\1928-2R10

REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
8	INCORPORATED ECO#: 1026-28	T.F.O.	11/30/01	92346





PLAN VIEW

NOTES:

1) SERIAL NUMBERS ARE TO BE PLACED ON ALL LOOSE COMPONENTS ASSEMBLED IN THE FIELD OR COMPONENTS WHICH MAY BE REMOVED TO PROVIDE TRACEABILITY.
2) DELETED.
3) ALL WELDS REQUIRE VISUAL EXAMINATION (VT).
4) EXCEPT WHERE STATED OTHERWISE, TOLERANCE ON FINISHED DIMENSIONS ±1/4.
5) ALL LINEAR DIMENSIONS ARE IN INCHES.
6) NONDESTRUCTIVE EXAMINATIONS AS FOLLOWS:
   a) LIQUID PENETRANT PER ASME SECTION V, ARTICLE 6. ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5350.
   b) VISUAL EXAMINATION PER ASME SECTION V, ARTICLE 9. ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5360.
   c) MAGNETIC PARTICLE PER ASME SECTION V, ARTICLE 7. ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5340.
7) DELETED.
8) FABRICATOR TO MAKE FINAL DETERMINATION OF THE LOCATION AND TOTAL NUMBER OF CIRCUMFERENTIAL AND LONGITUDINAL WELDS REQUIRED.
9) DELETED
10) THE EXTERNAL SURFACE OF THE CASK SHALL BE PAINTED WITH CARBOLINE 890. THE INSIDE SURFACES OF THE CASK (EXCLUDING SEALING AREAS) TO BE PAINTED WITH THERMALINE 450 OR EQUIVALENT THREADED HOLES, PLUGS, SEALS ETC. SHALL NOT BE PAINTED. 8
11) STEEL USED IN FABRICATION SHALL MEET THE REQUIREMENTS OF ASME SECTION II.
12) WELDING PROCEDURES AND WELDER QUALIFICATIONS SHALL BE PER ASME SECTION IX AND ASME SECTION III, SUBSECTION NF.
13) ALL ANGLES ARE FOR REFERENCE ONLY UNLESS OTHERWISE NOTED.
14) ALL BASE METAL THICKNESSES IN DRAWINGS ARE DEFINED AS REFERENCE DIMENSIONS.
15) WELDS IDENTIFIED WITH AN '*' ARE CONSIDERED NON-NF WELDS AND MAY BE WELDED USING PREQUALIFIED WELD PROCEDURES FROM AWS D1.1. 8

HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION: 100 TON HI-TRAC OUTLINE WITH POOL LID

CLIENT: N/A

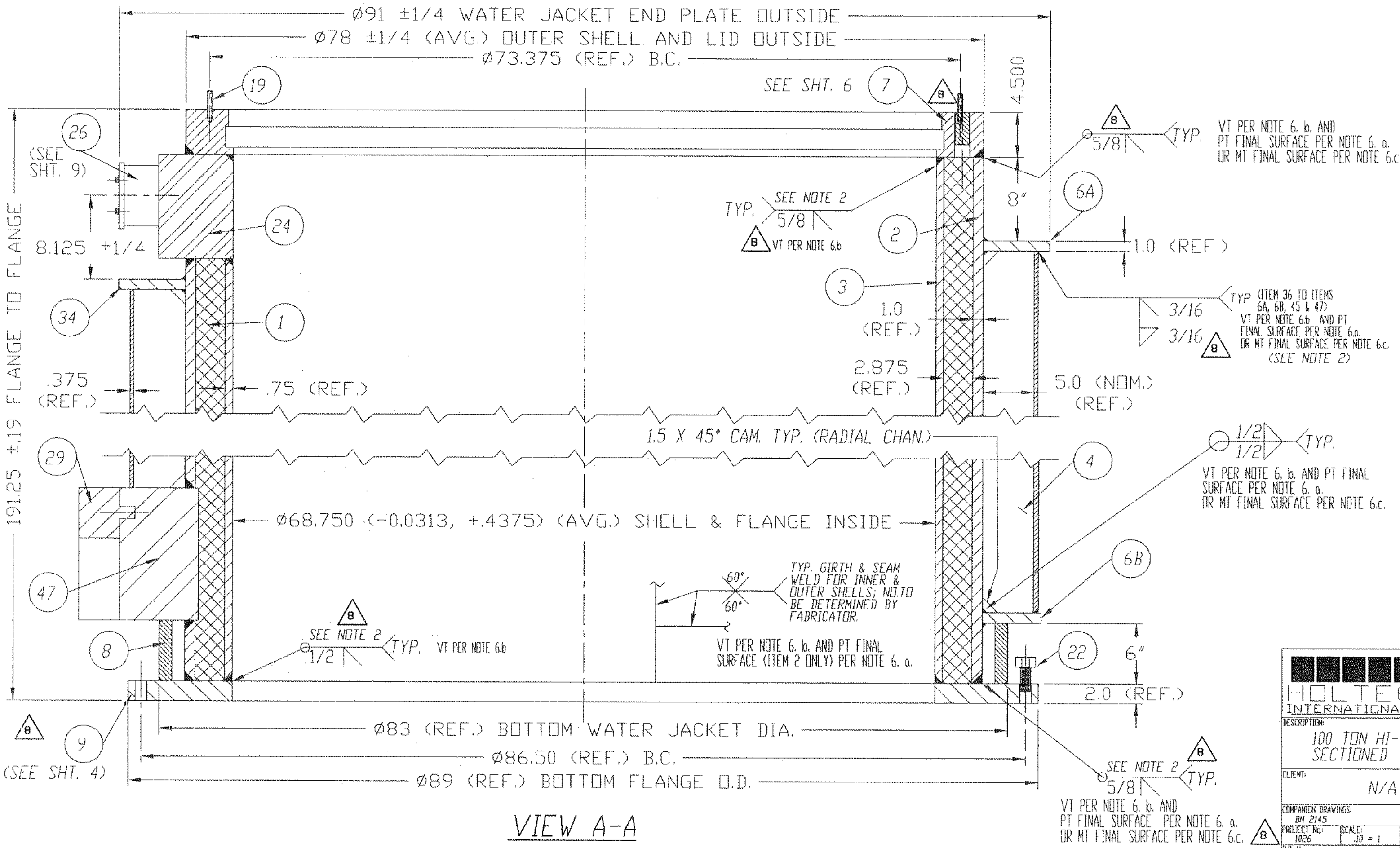
COMPANION DRAWINGS: BM 2145

PROJECT No:	SCALE:	DRAWING No:	REV:
1026	.04 = 1	2145 (C.I.D. 3051)	8
P.O. No: N/A			SHEET: 1 of 10

8 G:\DRAWINGS\1026\HI-TRAC\2145-1R8

NOTES:
1) SEE DWG. 2145 SHT. 1 OF 10.
2) EXCEPT AS NOTED OTHERWISE, ALL GROOVE WELDS ARE FULL PENETRATION (45° ANGLE MINIMUM). USE OF BACKING, ROOT OPENING SIZE, AND BACK GOUGING (FOR WELDING FROM BOTH SIDES) ARE AT FABRICATOR'S DISCRETION. PARTIAL PENTRATION WELDS ALSO REQUIRE 45° ANGLE MINIMUM.

REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
8	INCORPORATED ECO-1026-28, 13, 9, & 4.	T.F.D.	11/30/01	35696



VIEW A-A

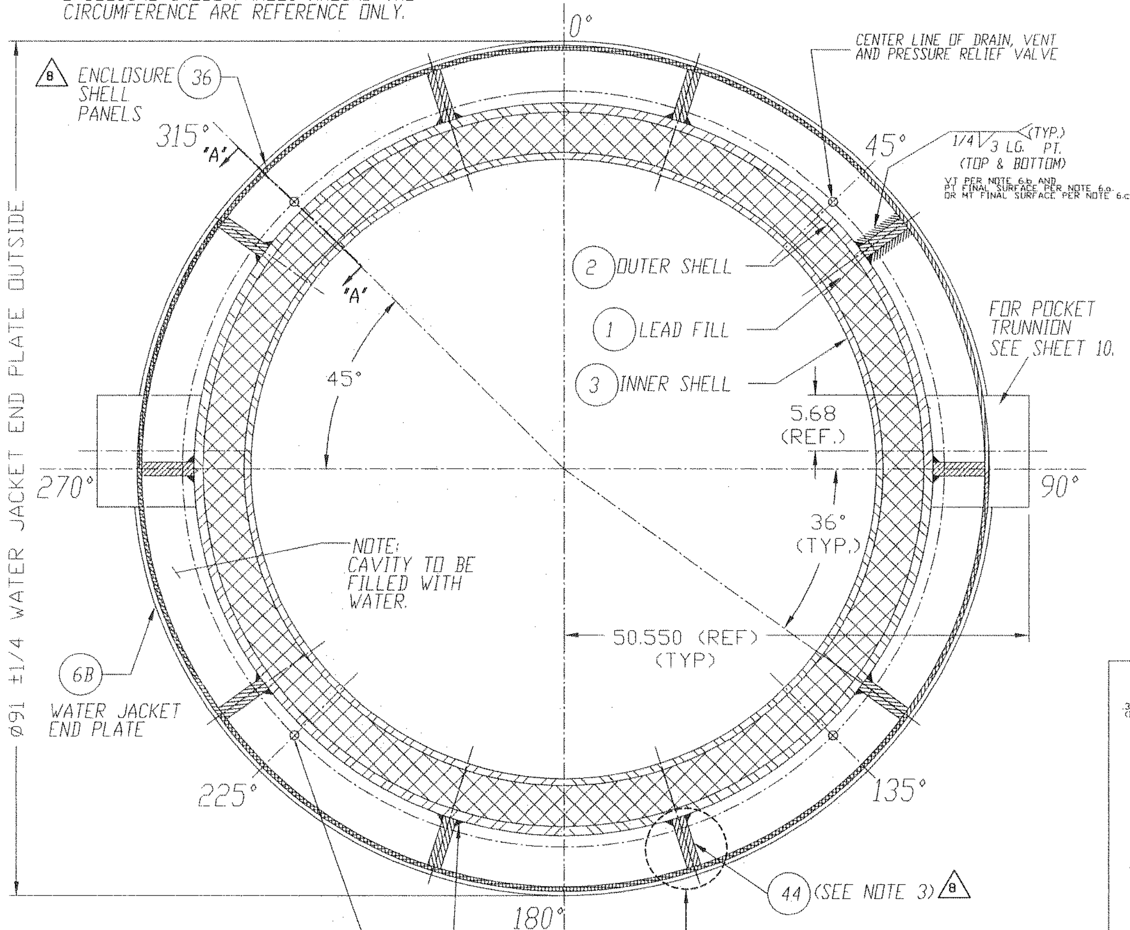
HOLTEC INTERNATIONAL — EQUIPMENT DESIGN · ANALYSIS · CONSULTING

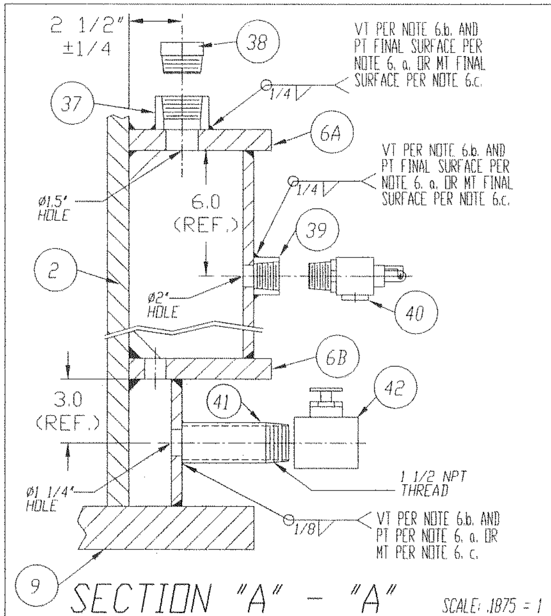
DESCRIPTION:	100 TON HI-TRAC BODY SECTIONED ELEVATION
CLIENT:	N/A
COMPANION DRAWINGS:	BM 2145
PROJECT No.: 1026	SCALE: .10 = 1
P.O. No.: N/A	DRAWING No.: 2145 (C.I.D. 3052)
REV.: 8	SHEET: 2 of 10

G:\DRAWINGS\1026\HI-TRAC\2145-2R8

NOTES:
1) SEE DWG. 2145 SHT. 1 OF 10.
2) ACTUAL LOCATION OF RADIAL RIBS AND ENCLOSURE SHELL PANELS AROUND THE CIRCUMFERENCE ARE REFERENCE ONLY.
3) RADIAL RIBS ARE TO BE EVENLY SPACED AT APPROX. 36° WITH TWO OF THE RIBS BEING PLACED OVER THE POCKET TRUNIONS.

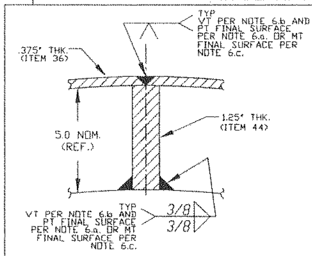
REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
8	INCORPORATED ECO-1026-28, 10, & 7.	T.F.O.	11/30/01	68481





SECTION "A" - "A"

SCALE: .1875 = 1



DETAIL-"A"

RADIAL RIB DETAIL

HOLTEC INTERNATIONAL

EQUIPMENT DESIGN
ANALYSIS
CONSULTING

DESCRIPTION: 100 TON HI-TRAC BODY SECTIONED ELEVATION 'B-B'

CLIENT: N/A

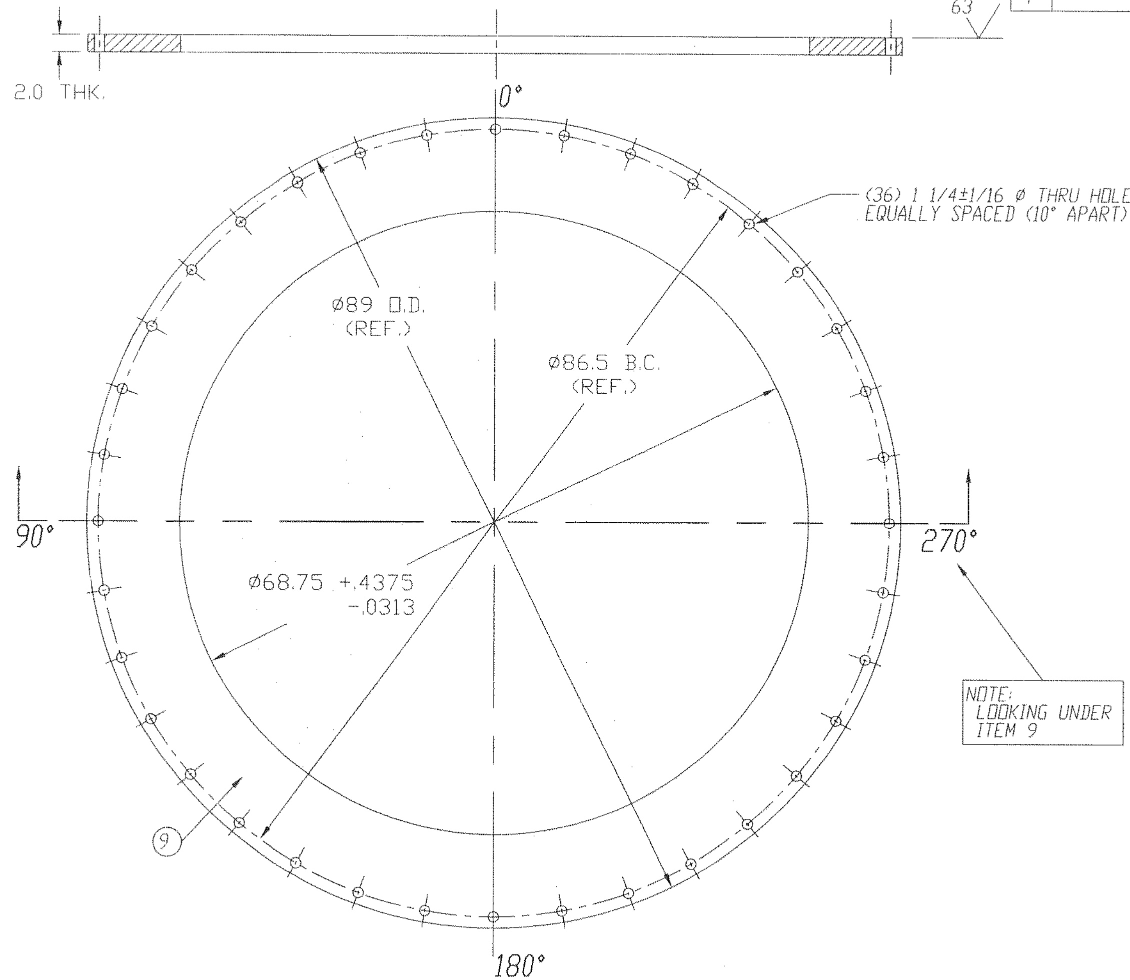
COMPANION DRAWINGS: BM 2145

PROJECT No: 1026	SCALE: .08 = 1	DRAWING No: 2145 (E.I.D.3053)	REV: 8
PI No: N/A			SHEET: 3 of 10

G:\DRAWINGS\1026\HI-TRAC\2145-3R8

REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
7	INCORPORATED ECO#: 1026-28	T.F.D.	11/30/01	50862

NOTES:
1) SEE DWG. 2145 SHT. 1 OF 10.



BOTTOM VIEW OF BOTTOM FLANGE

HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION: 100 TON HI-TRAC DETAIL OF BOTTOM FLANGE

CLIENT: N/A

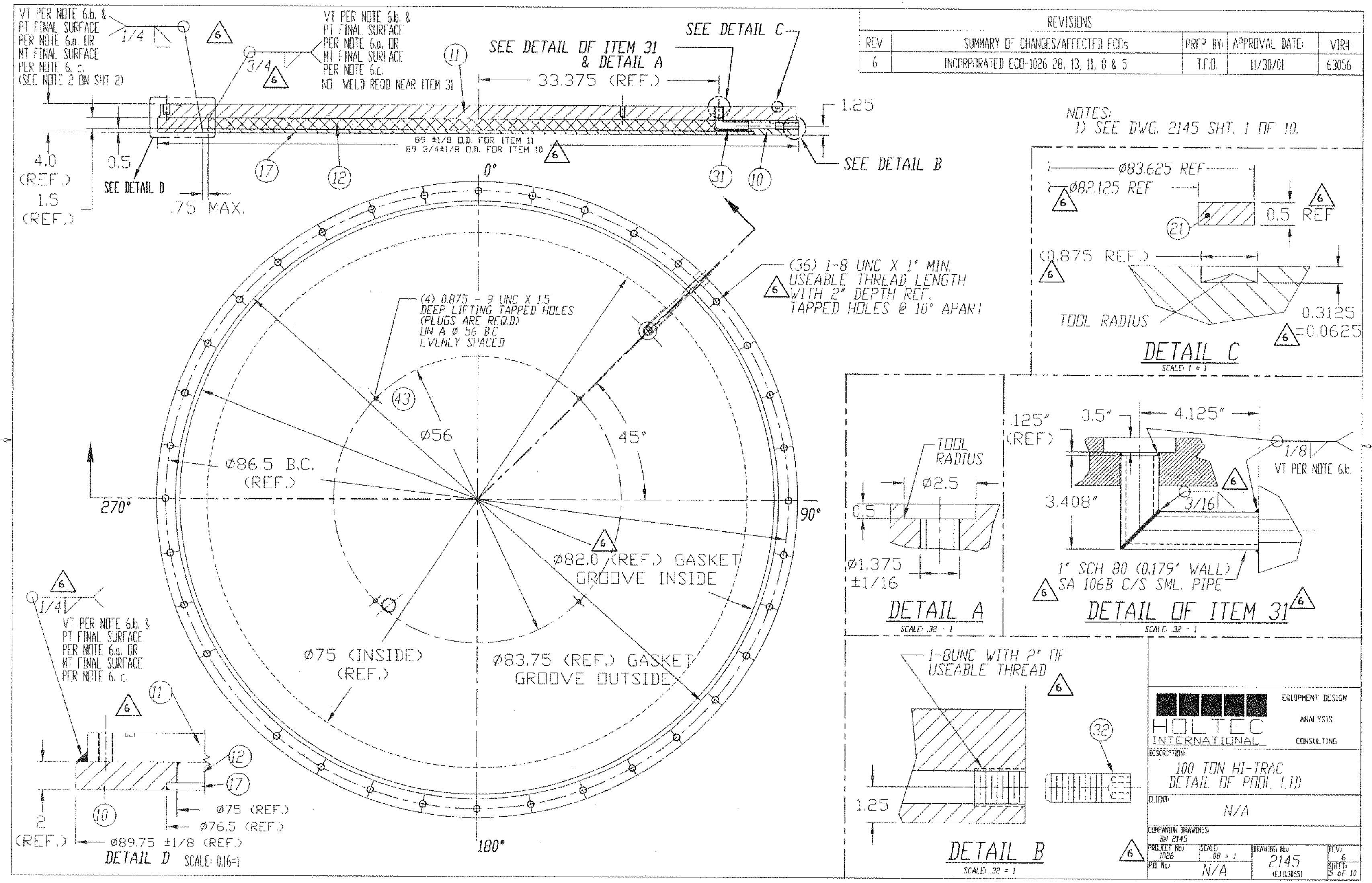
COMPANION DRAWINGS: BM 2145

PROJECT No:	SCALE:	DRAWING No:	REV:
1026	.08 = 1	2145 (C.I.D. 3054)	7
PI No: N/A			SHEET: 4 of 10

G:\DRAWINGS\1026\HI-TRAC\2145-4R7

REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
6	INCORPORATED ECO-1026-28, 13, 11, 8 & 5	T.F.O.	11/30/01	63056

NOTES:
1) SEE DWG. 2145 SHT. 1 OF 10.



HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION: 100 TON HI-TRAC DETAIL OF POOL LID

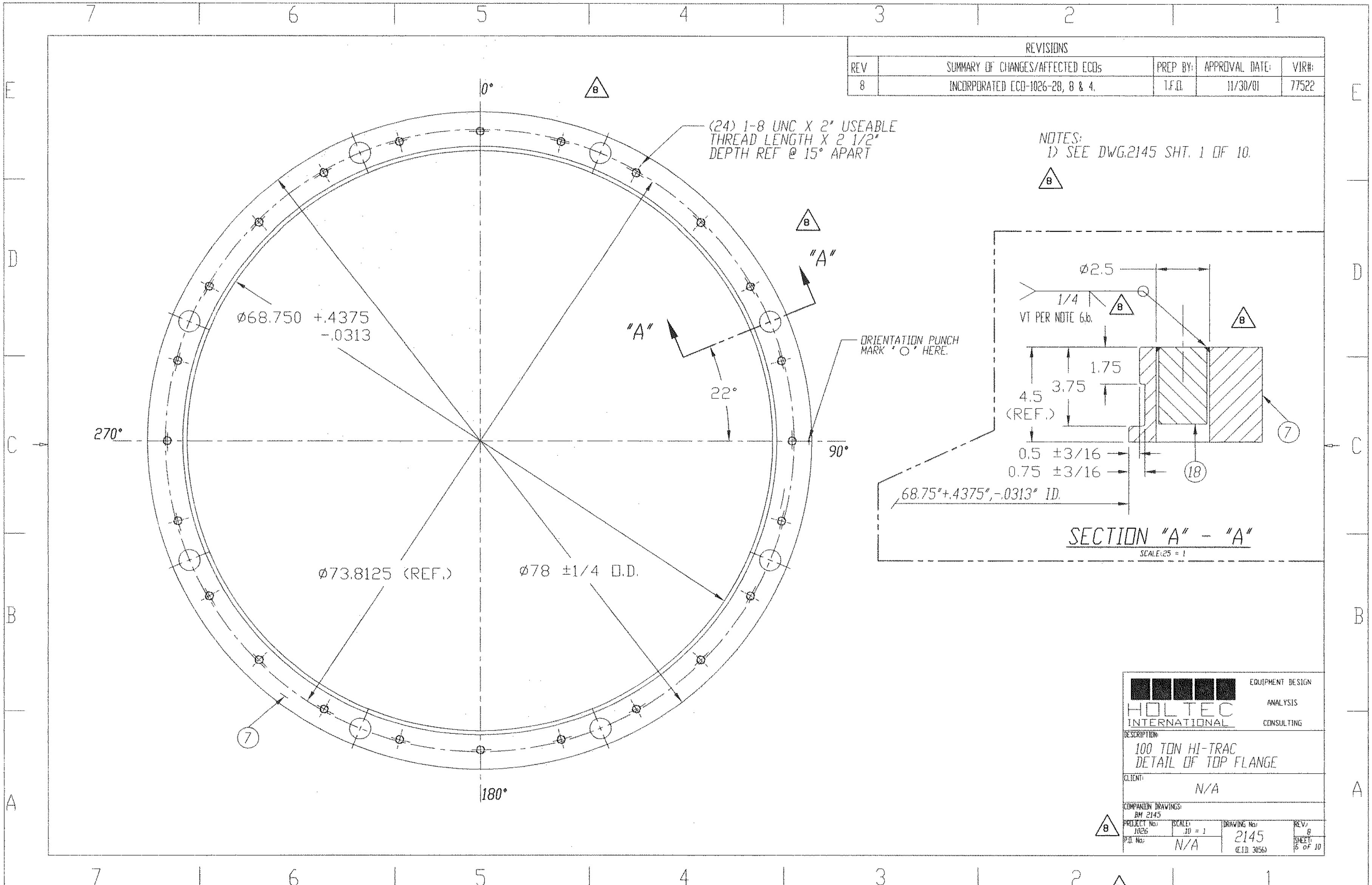
CLIENT: N/A

COMPANION DRAWINGS: BM 2145

PROJECT No: 1026 | SCALE: 88 = 1 | DRAWING No: 2145 | REV: 6

PO No: N/A | SHEET: 5 OF 10

G:\DRAWINGS\1026\HI-TRAC\2145-5R6



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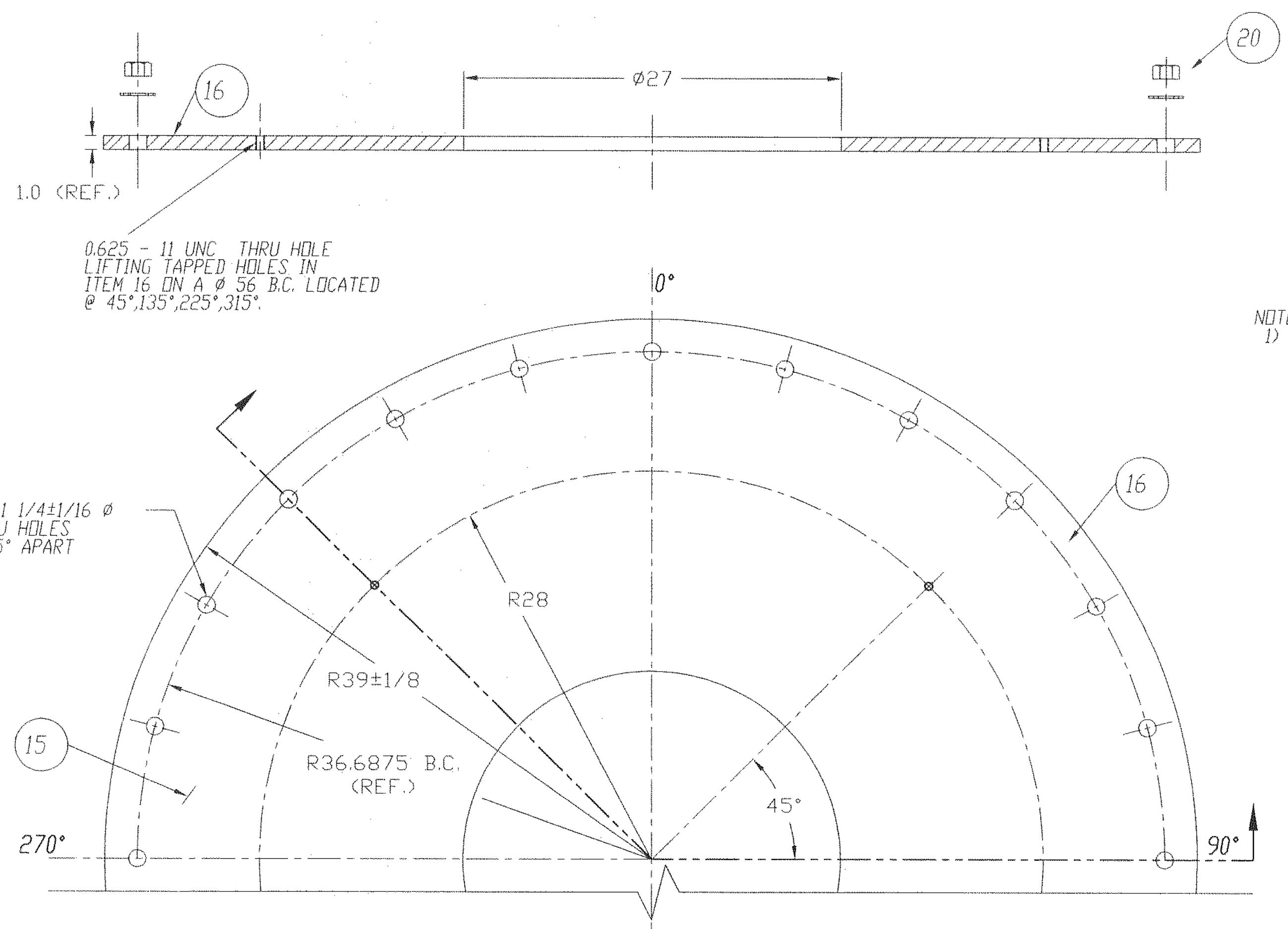
REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
8	INCORPORATED ECO#: 1026-28	T.F.D.	11/30/01	85278



NOTES:
1) SEE DWG. 2145 SHT. 1 OF 10.

HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION: 100 TON HI-TRAC DETAIL OF TOP LID

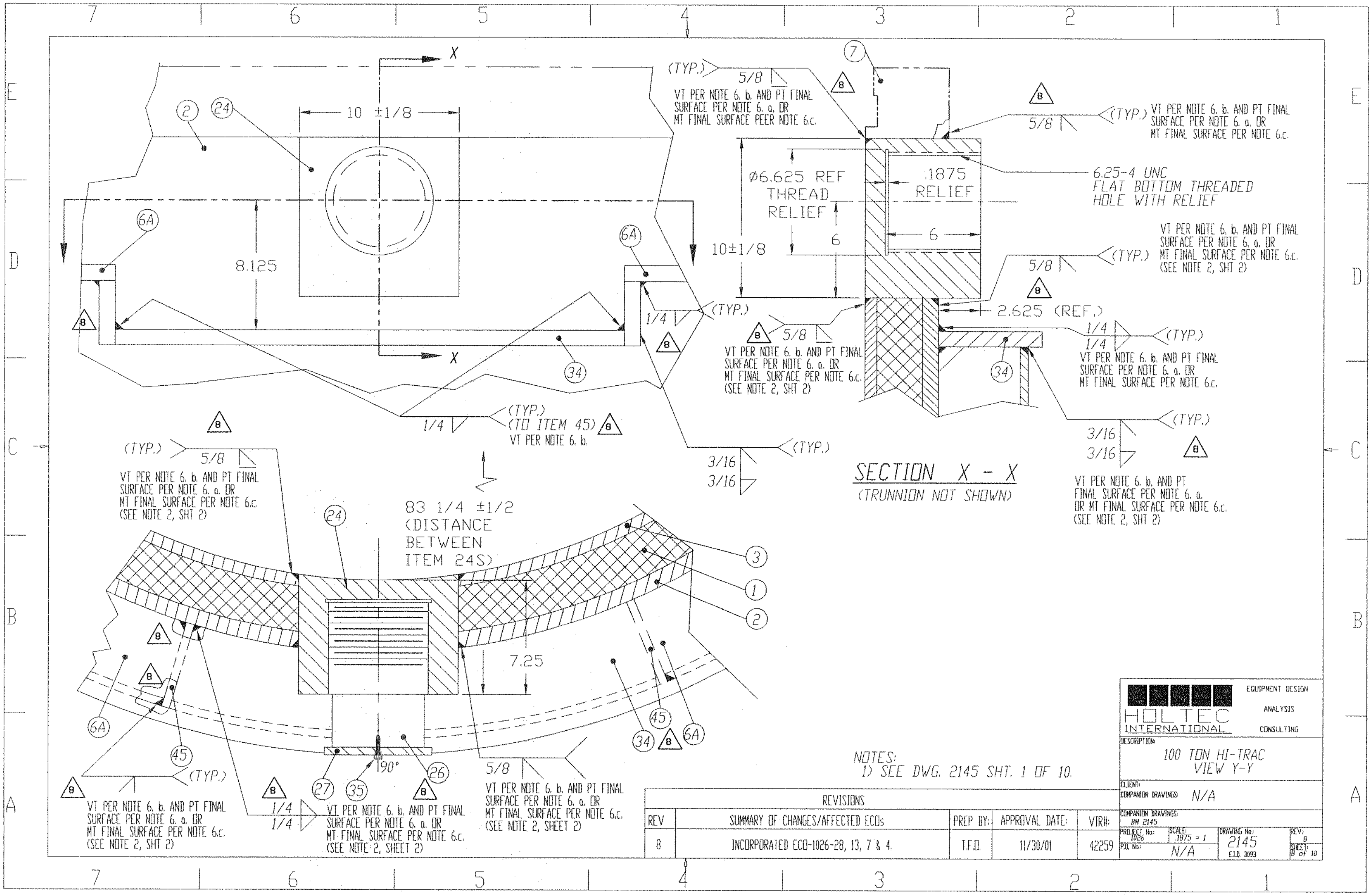
CLIENT: N/A

COMPANION DRAWINGS: BM 2145

PROJECT No.: 1026 | SCALE: .125 = 1 | DRAWING No.: 2145 (E.I.D. 3092) | REV.: 8

P.O. No.: N/A | SHEET: 7 of 10

G:\DRAWINGS\1026\HI-TRAC\2145-7R8



NOTES:
1) SEE DWG. 2145 SHT. 1 OF 10.

REVISIONS

REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
8	INCORPORATED ECO-1026-28, 13, 7 & 4.	T.F.D.	11/30/01	42259

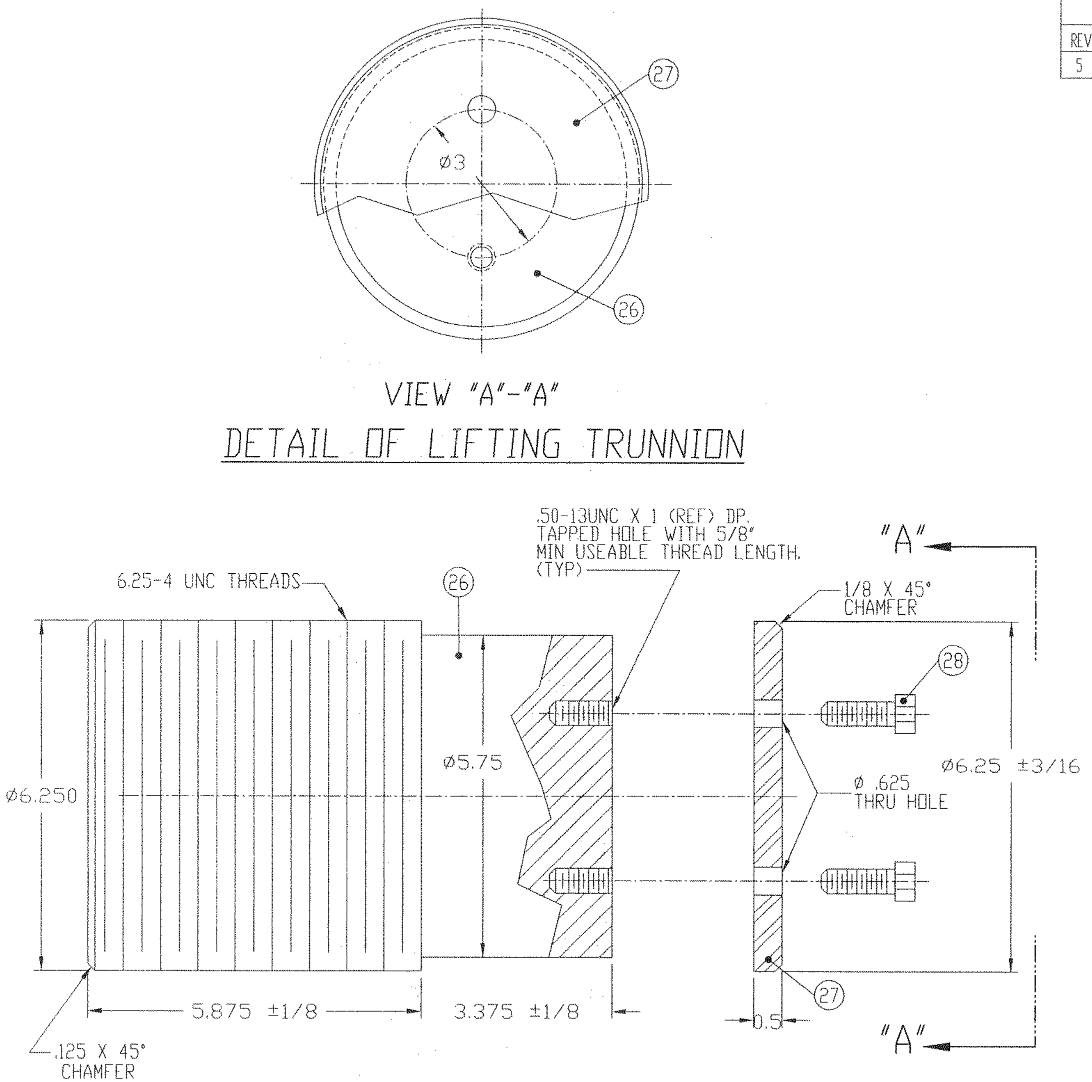
HOLTEC INTERNATIONAL
EQUIPMENT DESIGN
ANALYSIS
CONSULTING

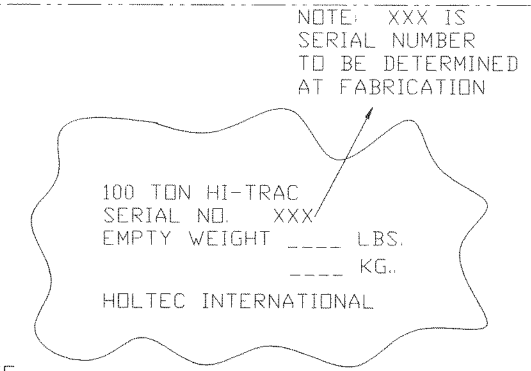
DESCRIPTION: 100 TON HI-TRAC VIEW Y-Y
CLIENT:
COMPANION DRAWINGS: N/A
COMPANION DRAWINGS: BM 2145
PROJECT No: 1026
SCALE: .1875 = 1
DRAWING No: 2145
REV: 8
P.O. No: N/A
E.I.D. 3093
SHEET: 8 of 10

G:\DRAWINGS\1026\HI-TRAC\2145-8R8

REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
5	INCORPORATED ECO-1026-28 & 16	T.F.O.	11/30/01	59616

NOTES:
1) SEE DWG. 2145 SHT. 1 OF 10.





NOTE:
LETTERS AND NUMBERS 1/2" HIGH MINIMUM.

STAMP DETAIL 5

(ON TOP FLANGE AT 0° REF.)

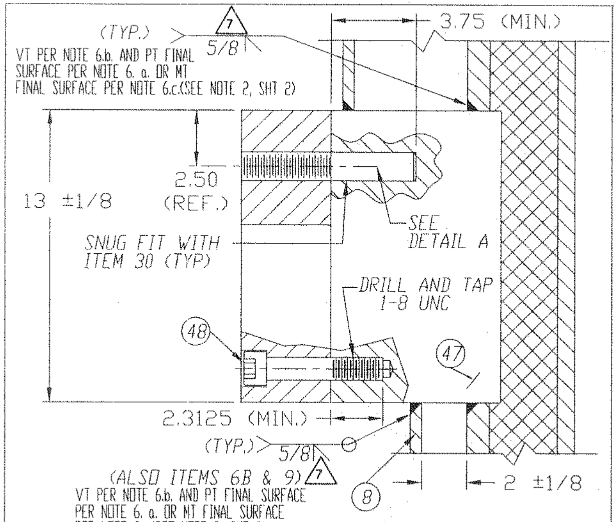
HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION: 100 TON HI-TRAC LIFTING TRUNNION AND LOCKING PAD			
CLIENT: N/A			
COMPANION DRAWINGS: BM 2145			
PROJECT No: 1026	SCALE: NONE	DRAWING No: 2145 (C.I.D. 3057)	REV: 5
P.O. No: N/A			SHEET: 9 of 10

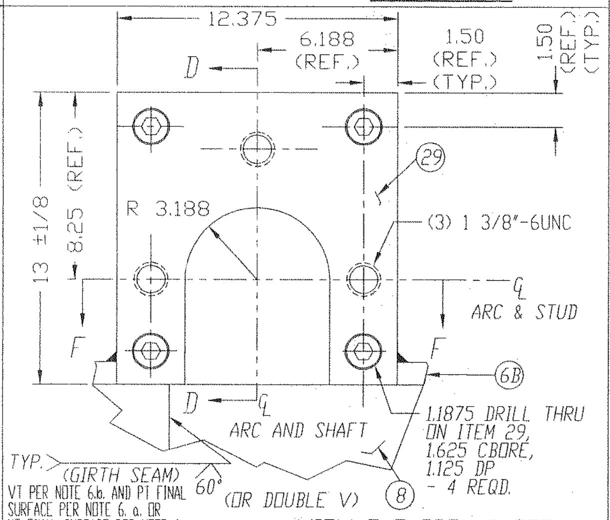
5 G:\DRAWINGS\1026\HI-TRAC\2145-9R5

REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
7	INCORPORATED ECO-1026-28, 6 & 4	T.F.D.	11/30/01	25532

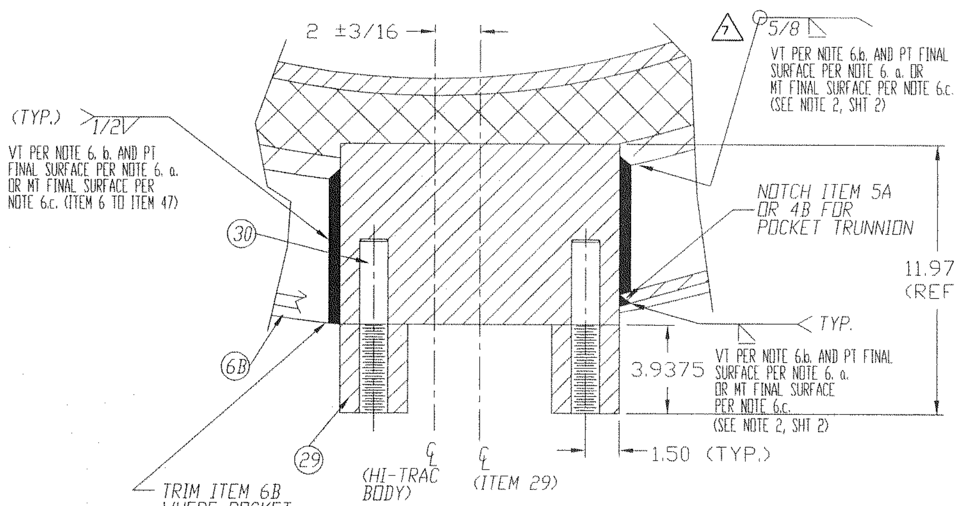
REVISIONS



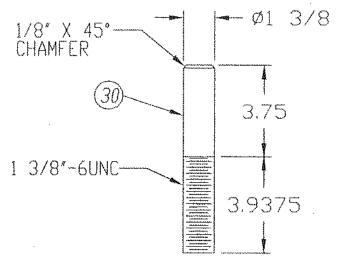
SECTION D-D



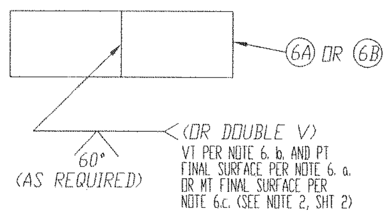
VIEW Z-Z FROM SHEET 1



SECTION F-F



DETAIL A



NOTES:
1) SEE DWG. 2145 SHT. 1 OF 10.
2) IT IS THE RESPONSIBILITY OF THE FABRICATOR TO ASSURE THAT ITEM 29 WILL FIT INTO ITEM 47.
3) AS AN OPTION ITEM 47 AND 29 CAN BE ONE SINGLE PIECE AND ITEMS 30, 48 DELETED.

HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION: 100 TON HI-TRAC VIEW Z-Z

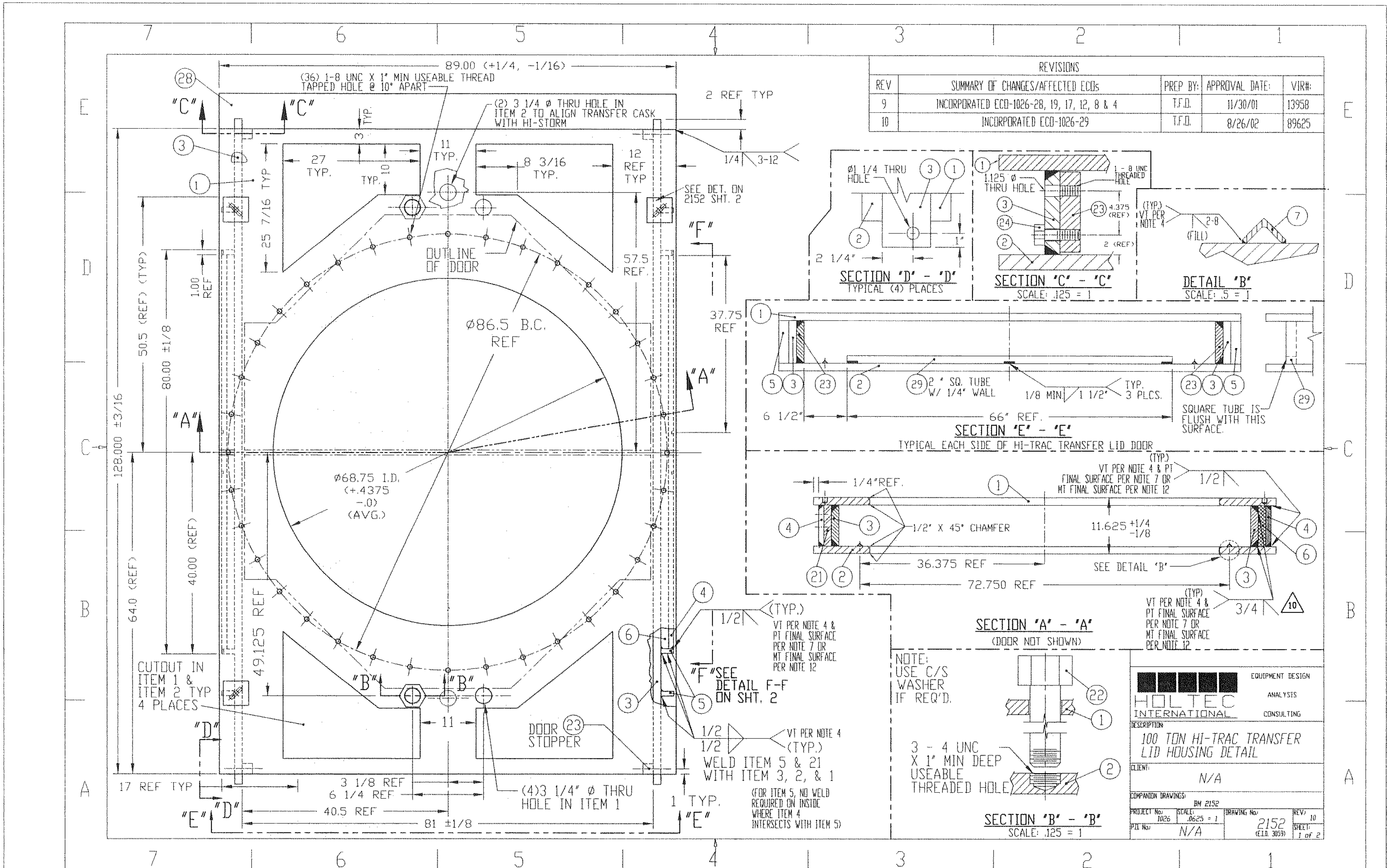
CLIENT: N/A

COMPANION DRAWINGS: BM 2145

PROJECT No: 1026	SCALE: 20 = 1	DRAWING No: 2145 (C.I.D. 3058)	REV: 7
P.O. No: N/A			SHEET: 10 of 10

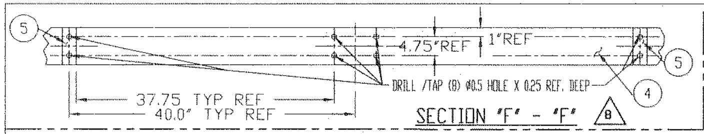
G:\DRAWINGS\1026\HI-TRAC\2145-10.R7

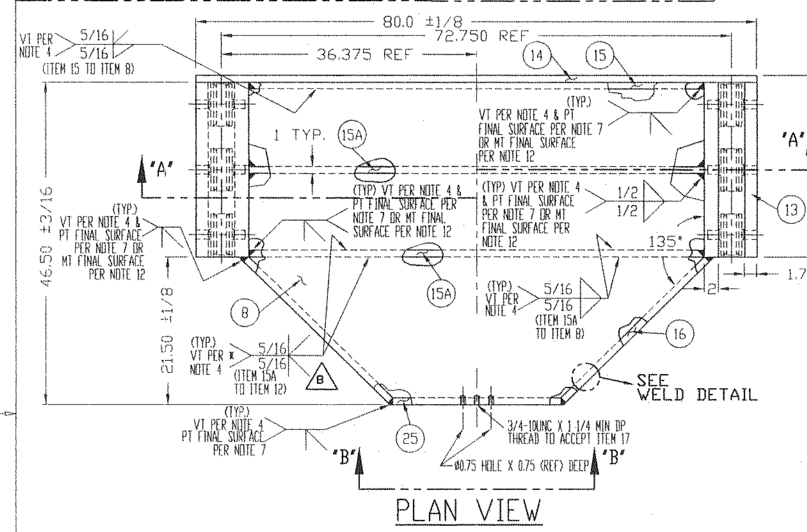
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
9	INCORPORATED ECO-1026-28, 19, 17, 12, 8 & 4	T.F.D.	11/30/01	13958
10	INCORPORATED ECO-1026-29	T.F.D.	8/26/02	89625

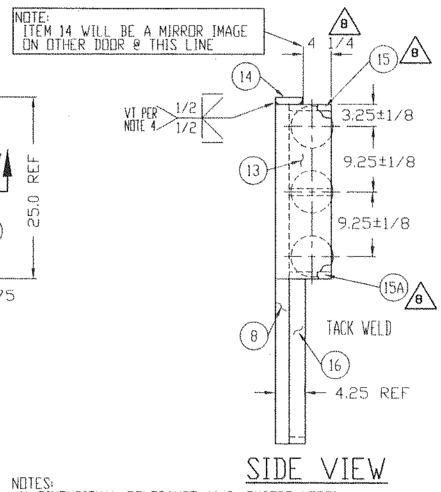


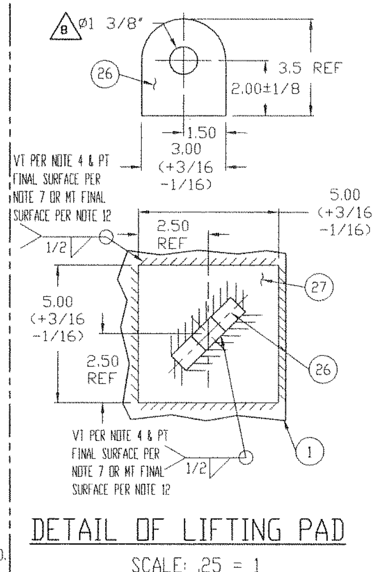
G:\DRAWINGS\1026\HI-TRAC\2152-1R10

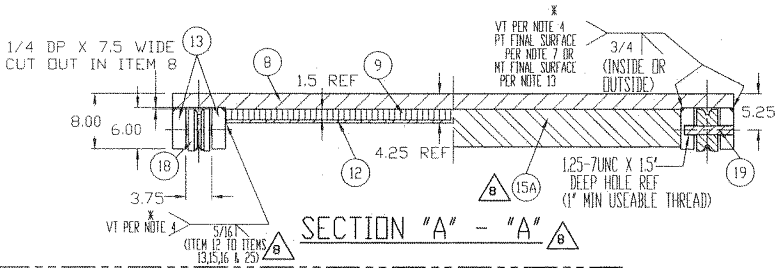
REVISIONS				
REV	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
8	INCORPORATED ECO-1026-28, 19, 17, 14 & 10.	T.F.O.	11/30/01	53364

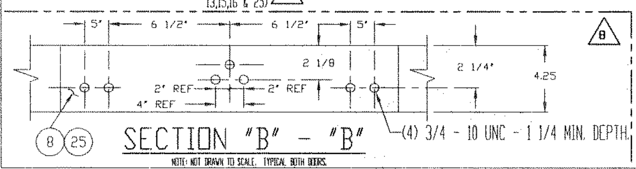




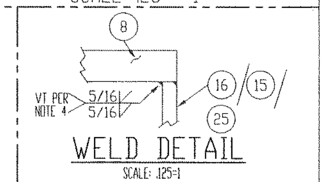








NOTES:
1) DIMENSIONAL TOLERANCE ±1/8, EXCEPT NOTED.
2) TWO DOORS REQ.
3) PAINT THE TOP SURFACE OF THE DOORS WITH THERMALINE 450 OR EQUIVALENT AND ALL OTHER EXTERIOR SURFACES WITH CARBOLINE 890.
4) ALL WELDS REQUIRE VISUAL EXAMINATION PER ASME SECTION V, ARTICLE 9 WITH ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5360.
5) ALL LINEAR DIMENSIONS ARE IN INCHES.
6) SERIAL NUMBERS ARE TO BE PLACED ON ALL LOOSE COMPONENTS TO PROVIDE TRACEABILITY.
7) LIQUID PENETRANT EXAMINATION PER ASME SECTION V, ARTICLE 6. ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5350.
8) STEEL USED IN FABRICATION SHALL MEET THE REQUIREMENTS OF ASME SECTION II, PART A.
9) WELDING PROCEDURES AND WELDER QUALIFICATIONS SHALL BE PER SECTION IX AND ASME SECTION III, SUBSECTION NF.
10) ALL ANGLES ARE REFERENCE ONLY UNLESS OTHERWISE STATED.
11) EXCEPT AS NOTED OTHERWISE, FULL PENETRATION WELDS SHALL BE 45° MINIMUM. SIZE OF ROOT OPENING (IF REQUIRED), USE OF BACKING AND BACK GOUGING (AND WELDING FROM BOTH SIDES) ARE AT FABRICATOR'S DISCRETION.
12) MAGNETIC PARTICLE EXAMINATION PER ASME SECTION V, ARTICLE 7 WITH ACCEPTANCE CRITERIA PER ASME SECTION III, SUBSECTION NF, ARTICLE NF-5340.
13) WELDS IDENTIFIED WITH AN '*' ARE CONSIDERED NON-NF WELDS AND MAY BE WELDED USING PREQUALIFIED WELD PROCEDURES FROM AWS D1.1.
14) FABRICATOR MAY ADD ADDITIONAL WELDS PROVIDED APPROVAL IS RECEIVED FROM HOLTEC.
15) THREADED HOLES USED TO ATTACH THE TRANSFER LID DOOR ACTUATORS SHALL BE LOCATED AS NECESSARY FOR ALIGNMENT.
16) LIFTING PAD IS OPTIONAL. THE ALTERNATIVE IS TO USE AT LEAST (4) OF THE (36) 1-8 UNC THREADED HOLES WITH APPROPRIATE RIGGING EQUIPMENT TO SUPPORT THE TRANSFER LID WEIGHT OF 18,000 LBS.



HOLTEC INTERNATIONAL — EQUIPMENT DESIGN, ANALYSIS, CONSULTING

DESCRIPTION: 100 TON HI-TRAC TRANSFER LID DOOR DETAIL

CLIENT: N/A

COMPANION DRAWINGS: BM 2152

PROJECT No: 1026 | SCALE: .0625 = 1 | DRAWING No: 2152 (E.I.D. 3060) | REV: 8

P.O. No: N/A | SHEET: 2 of 2

G:\DRAWINGS\1026\HI-TRAC\2152-2R8

DESIGN DRAWING PACKAGE COVER SHEET

CLIENT	GENERAL
PROJECT NO. 1024	P.O. NO. N/A
DRAWING PACKAGE I.D. 3187	TOTAL SHEETS 2

DESIGN DRAWING PACKAGE CONTENTS:

SHEET	DESCRIPTION
1	COVER SHEET
2	ASSEMBLY DRAWING, BILL OF MATERIALS AND NOTES

REVISION LOG

IT IS MANDATORY AT EACH REVISION TO COMPLETE THE REVIEW & APPROVAL LOG STORED IN HOLTEC'S DIRECTORY N:\PDOXWIN\WORKING\DBAL BY ALL RELEVANT TECHNICAL DISCIPLINES. PM AND QA PERSONNEL. EACH ATTACHED DRAWING SHEET CONTAINS ANNOTATED TRIANGLES INDICATING THE REVISION TO THE DRAWING.

REV.	AFFECTED DRAWING SHEET NUMBERS	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP. BY	APPROVAL DATE	VIR# †
0	INITIAL ISSUE	INITIAL ISSUE	T.C.	8-7-00	N/A
1	SHEET 1	ADDED GUSSETS & SLOTTED HOLES	S. GEE	8-30-00	N/A
2	SHEETS 1 & 2.	INCORPORATED E.C.O. 1024-43. OTHER EDITORIAL CHANGES MARKED WITH REV. TRIANGLES.	T.F.O.	7/29/02	27911

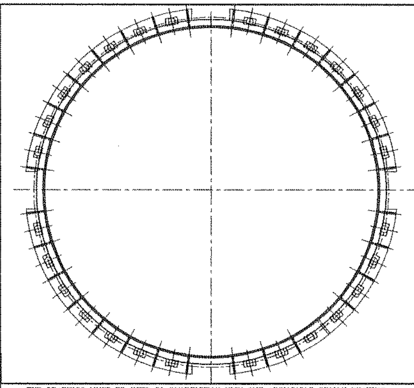
† THE VALIDATION IDENTIFICATION RECORD (VIR) NUMBER IS A COMPUTER GENERATED RANDOM NUMBER WHICH CONFIRMS THAT ALL APPROPRIATE REVIEWS OF THIS DRAWING ARE DOCUMENTED IN COMPANY'S NETWORK.

GENERAL NOTES:

1. THE EQUIPMENT DESIGN DOCUMENTED IN THIS DRAWING PACKAGE HAS BEEN CONFIRMED BY HOLTEC INTERNATIONAL TO COMPLY WITH ALL APPLICABLE CODES AND STANDARDS.
2. THE PURCHASER OF THE EQUIPMENT MUST ENSURE THAT IT WILL INTERFACE WITH THE PURCHASER'S FACILITIES AND DEVICES WITHOUT INTERFERENCE OR EXCESSIVE CLEARANCES.
3. THIS EQUIPMENT MUST BE DEPLOYED IN ACCORDANCE WITH HOLTEC INTERNATIONAL'S INSTRUCTIONS TO ENSURE PERSONNEL SAFETY AND TO MAINTAIN WARRANTY PROTECTION PROVIDED BY THE GOVERNING CONTRACT.
4. THE REVISION LEVEL OF EACH INDIVIDUAL SHEET IN THIS PACKAGE IS THE SAME AS THE REVISION LEVEL OF THIS COVER SHEET. A REVISION TO ANY SHEET(S) IN THIS PACKAGE REQUIRES UPDATING OF REVISION NUMBERS OF ALL SHEETS TO THE NEXT REVISION NUMBER.
5. CRITICAL DIMENSIONS (INDICATED BY AN *) ARE ESSENTIAL TO ASSURE EQUIPMENT FUNCTIONALITY.
6. THE ITS CATEGORY OF A SUB-COMPONENT IS THE HIGHEST ITS LEVEL OF ALL PARTS THAT MAKE UP THE SUB-COMPONENT.

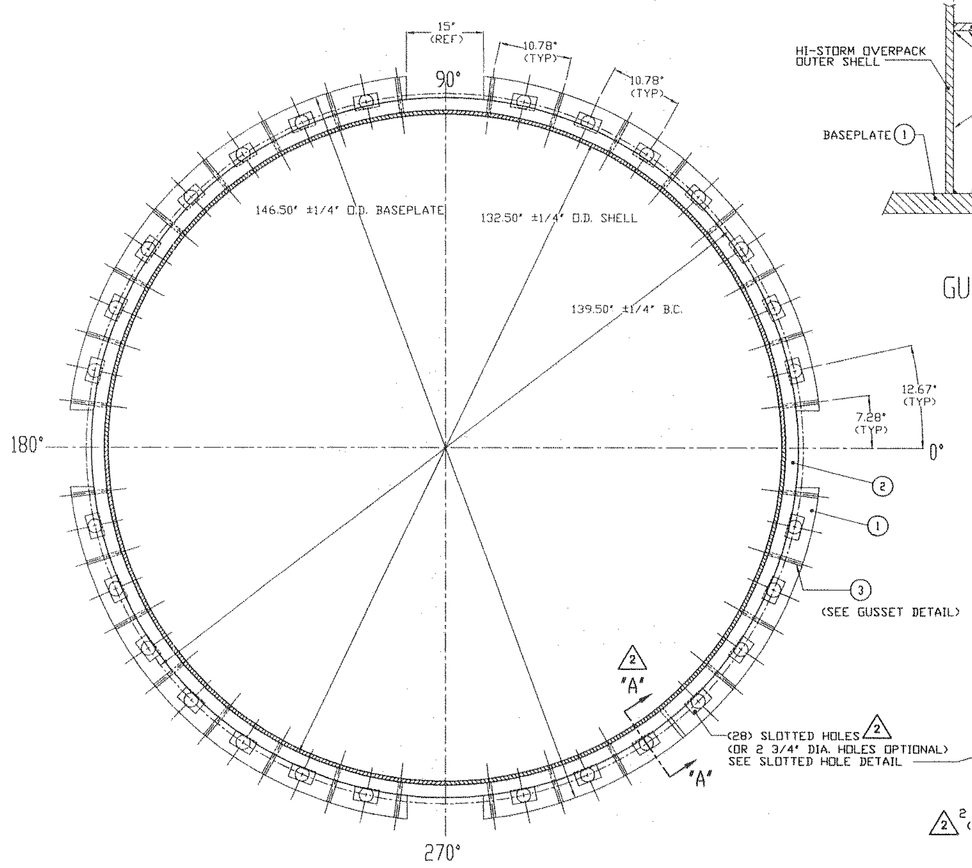
PROPOSED BILL OF LADING

SUB-COMPONENT	QTY.	DESCRIPTION	ITS CATEGORY (SEE NOTE 6)	APPROX. WT./LBS.	SHEET#
A	1	LUG AND ANCHORING ASSEMBLY	ITS-B	11,650	2

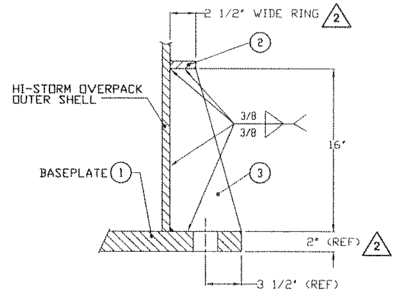


THE DRAWINGS MUST BE USED IN CONJUNCTION WITH THE APPLICABLE DESIGN DRAWING PACKAGE COVER SHEET WHICH CONTAINS THE APPROPRIATE REVIEWS AND APPROVALS.

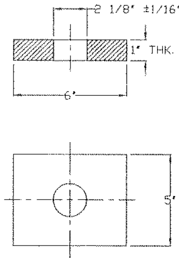
HOLTEC INTERNATIONAL HOLTEC CENTER 555 LINCOLN DRIVE WEST MARLTON, NJ 08053	CLIENT: GENERAL DESCRIPTION: LUG AND ANCHORING DETAIL FOR HI-STORM 100A
PROJECT NO. 1024	DRAWING NO. 3187 · SHEET 1 · TOTAL SHEETS 2
P.O. NO. N/A	FILE PATH: G:\DRAWINGS\1024\HI-STORM\3187R2



PLAN - SECTOR LUG AND ANCHOR BOLT ARRANGEMENT FOR HI-STORM 100A
(ITEMS 4 AND 5 ARE NOT SHOWN)



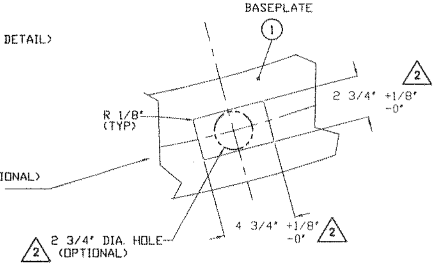
GUSSET DETAIL



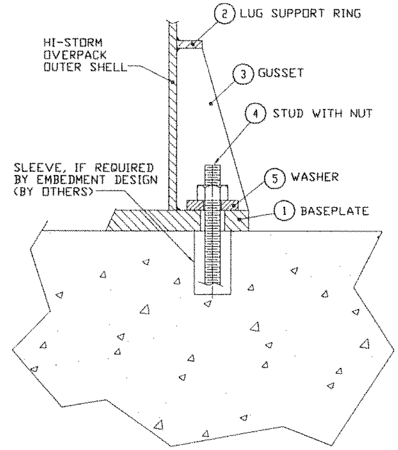
DET. ITEM 5

NOTES:

1. DELETED (2)
2. DELETED (2)
3. ALL ANGULAR DIMENSIONS ARE REFERENCE, UNLESS OTHERWISE NOTED.
4. ALLOY "Z" IS MATERIAL WITH A MINIMUM YIELD AND ULTIMATE STRENGTHS PER FSAR TABLE 2.0.4. FSAR TABLE 1.2.7 PROVIDES SEVERAL ACCEPTABLE MATERIALS. (2)
5. THE HI-STORM 100A DESIGN IS ALSO APPLICABLE TO THE HI-STORM 100S OVERPACK, IN WHICH CASE THE ASSEMBLY WOULD BE NAMED HI-STORM 100SA. (2)



SLOTTED HOLE DETAIL



SECTION A-A

BILL OF MATERIAL

ITEM NO.	QTY.	MATERIAL	PART DESCRIPTION	REMARKS	PART NAME	ITS CATEGORY	
1	1	SA 516 GRADE 70	2" THK. X 146 1/2" O.D.	BASEPLATE REPLACES ITEM 1 ON B.M. 1575 OF HI-STORM 100.	BASEPLATE	ITS-B	2
2	1	SA 516 GRADE 70	3/4" THK. X 132 1/2" I.D. X 137 1/2" O.D.	RING MAY BE MADE FROM MORE THAN ONE PIECE.	LUG SUPPORT RING	ITS-B	2
3	32	SA 516 GRADE 70	3/4" THK. X 7" WIDE X 16" LG.	PLATE	GUSSET	ITS-B	2
4	28	ALLOY "Z"	ø2",16" LG. MIN., 42" LG. MAX. (BELOW THE NUT).	STUD WITH HEAVY HEX NUT (SEE NOTE 4)	STUD WITH NUT	ITS-B	2
5	28	SA 516 GRADE 70	1" THK. X 5" WIDE X 6" LG.	PLATE	WASHER	NITS	2

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS ARE IN INCHES
DIMENSIONS IN [ ] ARE IN MILLIMETERS

TOLERANCES

INCHES [MILLIMETERS]		ANGULAR
X±.1	[2.5]	±3°
.XX±.05	[1.27]	
.XXX±.010	[.25]	

FRACTIONAL

0 TO LESS THAN 2 IN.	±1/16 IN.
2 IN. TO LESS THAN 3 FT.	±1/8 IN.
3 FT. AND GREATER	±3/16 IN.

REMOVE ALL BURRS AND BREAK SHARP EDGES

- DO NOT SCALE OFF OF DRAWING -

THE DRAWINGS MUST BE USED IN CONJUNCTION WITH THE APPLICABLE DESIGN DRAWING PACKAGE COVER SHEET WHICH CONTAINS THE APPROPRIATE REVIEWS AND APPROVALS.

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

CLIENT: GENERAL

DESCRIPTION: LUG AND ANCHORING DETAIL FOR HI-STORM 100A

PROJECT NO. 1024
P.O. NO. N/A
COMPANION DRAWINGS
SIZE D
DRAWING NO. 3187
SHEET 2
REV 2
SCALE N/A
FILE PATH: G:\DRAWINGS\1024\HI-STORM\3187R2

BM-1575 (E.I.D. 2839) BILL OF MATERIAL FOR HI-STORM (DWG. 1495, 1561) SHT 1 OF 2

REV.	SUMMARY OF CHANGES/ AFFECTED E.C.O.s	PREP. BY:	APPROVAL DATE	VIR#:
19	INCORPORATED E.C.O.# 1024-67	T.F.O.	4/14/03	68570
18	INCORPORATED E.C.O.# 1024-66	T.F.O.	3/28/03	80754
17	INCORPORATED E.C.O.# 1024-62	S.L.C	9/30/02	35699
16	INCORPORATED E.C.O.# 1024-61	T.F.O.	9/18/02	16734
15	INCORPORATED E.C.O.# 1024-54	S.L.C	6/20/02	32848
14	INCORPORATED E.C.O.# 1024-50	S.L.C	5/7/02	46085
13	INCORPORATED E.C.O.# 1024-44., CHANGED REVISION BLOCK TO NEW FORMAT	T.F.O.	2/6/02	34436

	ITEM	QTY.	SPECIFICATION	NOMENCLATURE	DESCRIPTION
	1	1	SA 516 GR. 70	BASEPLATE	2 THK. X 133 7/8ø BASEPLATE
△19	2	1	SA 516 GR. 70	OUTER SHELL	3/4 THK. X 224 1/2 LG. X 132 1/2 O.D. CYLINDER (MAY BE MADE IN SECTIONS, SEE DWG 1495 SHT 5) (SEE NOTE 5)
△19	3	1	SA 516 GR. 70	INNER SHELL	1 1/4 THK. X 224 1/2 LG. X 76 O.D. CYLINDER (SEE NOTE 5)
	4	1	CONCRETE	RADIAL SHIELD	26 3/4 THK. RADIAL SHIELD
	5	1	SA 516 GR. 70	PEDESTAL SHELL	1/4 THK. X 68 3/8 O.D. X 21 5/8 LG. CYLINDER
	6	1	SA 516 GR. 70	LID BOTTOM PLATE	1 1/4 THK. X 70" ø PLATE.
	7	1	SA 516 GR. 70	LID SHELL	1 THK. X 10 1/2" WIDE X 69 O.D.
	8	4	SA 516 GR. 70	EXIT VENT HORIZONTAL PLATE	1 1/4 THK. X 26 WIDE X 31 7/8 LG. PLATE (SEE DET. DWG. 1561 SHT. 4)
	9	1	SA 516 GR. 70	TOP PLATE	3/4 THK. X 132 O.D. X 109 I.D RING (CUT IN 4 PIECES)
	10A	1	SA-516-70	LID TOP PLATE	2 THK. X 124 ø PLATE (SEE NOTE 4)
	10B	1	SA-516-70	LID TOP PLATE	2 THK. X 126 ø PLATE (SEE NOTE 4)
	11	4	SA-516-70	INLET VENT HORIZONTAL PLATE	2 THK. X 16 1/2 WIDE X 30 7/16 LG. PLATE (SEE DET. DWG. 1561 SHT. 3)
	12	8	SA 516 GR. 70 OR SA 515 GR. 70	EXIT VENT VERTICAL PLATE	1/2 THK. X 5 1/4 WIDE X 30 7/16 APPROX. LG. PLATE
	13	8	SA 516 GR. 70	INLET VENT VERTICAL PLATE	3/4 THK. X 10 WIDE X 29 3/4 APPROX. LG. PLATE
	14	4	SA 516 GR. 70	RADIAL PLATE	3/4 THK. X 27 1/2 WIDE X 224 1/2 LG. PLATE
	15	4	SA 194 2H	TOP LID NUT	3 1/4 - 4 UNC HEAVY HEX NUT
	16	4	SA-564-630 AGE HARDENED AT 1075°F OR SA193-B7	LID STUD	3 1/4- 4 UNC X 16 LG. (SEE DWG. 1561, SHT 2)
	17	4	SA 350 LF3 OR SA 203 E OR SA 350 LF 2	BOLT ANCHOR BLOCK	5 X 5 X 6 ANCHOR BLOCK W/ 3 1/4 - 4 UNC X 5 LG HOLE IN CENTER; (ø5" ROUND BAR MAY BE USED IN LIEU OF 5 X 5 SQUARE BAR)
*	18	4	SS	PEDESTAL PLUGS	1-8UNC X LENGTH AS REQUIRED SET SCREW
	19	16	SA 516 GR. 70 OR SA240 TYPE 304	CHANNEL	3/16 THK. X 6 WIDE X 170 7/8 LG. CHANNEL (SEE DETAIL 1495 SH. 5) (GALVANIZE FOR C/S)
	20	1	SA 516 GR. 70	SHIELD BLOCK RING	1/4 THK. X 63 1/2 I.D. X 85 1/2 O.D. (MAY BE MADE FROM MORE THAN 1 PIECE.)
	21	1	CONCRETE	PEDESTAL SHIELD	17" THK. PLATFORM
	22	1	CONCRETE	LID SHIELD	10 1/2 THK. TOP SHIELD
	23	1	SA 516 GR. 70 OR SA 515 GR. 70	PEDESTAL PLATE	1/2 THK X 67 7/8 ø
	24	1	A36 OR EQUAL	PEDESTAL PLATFORM	5 THK. X 67 7/8 ø PLATE (MAY USE MULTIPLE PLATES OF LESSER THICKNESS - NUMBER OF PLATES AND THICKNESS OF PLATES OPTIONAL)
	25	1	CONCRETE	SHIELD BLOCK	8" THK.
	26	1	SA 516 GR. 70 OR SA 515 GR. 70	SHIELD BLOCK SHELL	1/2 THK X 86 O.D. CYLINDER X 8" HIGH (MAY MAKE OUT OF MORE THAN 1 PIECE)
	27	1	SA 516 GR. 70 OR SA 515 GR. 70	SHIELD BLOCK SHELL	1/2 THK X 64 O.D. CYLINDER X 8" HIGH (MAY MAKE OUT OF MORE THAN 1 PIECE)
	28	-	---	DELETED	----
*	29	1	SA 240 304	STORAGE MARKING NAME PLATE	14 GAGE (0.0751 THK.) X 4 WIDE X 10 LG. SHEET
*	30	4	C/S OR S/S	LID PLUGS	1 1/2"-6UNC X 1 1/2" DP BOLT OR 1 1/2"-6UNC X 2" LG SET SCREW

NOTES:

1) THE CONCRETE MATERIAL IS TO MEET THE REQUIREMENTS SPECIFIED IN APPENDIX 1.D OF THE HI-STORM 100 FSAR DOCKET NUMBER 72-1014 (LATEST REVISION).
2) ALL DIMENSIONS IDENTIFIED ON BM-1575 ARE APPROXIMATE DIMENSIONS EXCEPT THICKNESSES OF STEEL PLATES WHICH IN THE RAW MATERIAL FORM MUST HAVE TOLERANCES MEETING THE APPLICABLE SPECIFICATION.
3) ITEMS WITH A * CONDIDERED NOT TO BE NF CLASS 3 (NON STRUCTURAL).
4) AS AN OPTION, ITEMS 10A & 10B CAN BE COMBINED AS A SINGLE 4" THICK PLATE AT 126" ø WITH SAME SIZE THRU HOLES FOR LID STUDS AS ITEM 10A.
△19 5) INNER AND OUTER SHELL THICKNESSES MAY BOTH BE CHANGED TO 1-INCH THICK IN LIEU OF 1 1/4" AND 3/4" RESPECTIVELY. IF EITHER THE INNER OR OUTER SHELL THICKNESS IS CHANGED TO 1-INCH, THEN BOTH SHALL BE 1-INCH THICK.

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BM-1575 (E.I.D. 2836) BILL OF MATERIAL FOR HI-STORM (DWG. 1495, 1561) SHT 2 OF 2

REV.	SUMMARY OF CHANGES/ AFFECTED E.C.O.s	PREP. BY:	APPROVAL DATE:	VIR #
13	INCORPORATED E.C.O.#: 1024-47	S.L.C	2/27/02	72710
14	INCORPORATED E.C.O.#: 1024-50	S.L.C	5/7/02	19678
15	INCORPORATED E.C.O.#: 1024-54	S.L.C	6/20/02	89834
16	INCORPORATED E.C.O.#: 1024-56	S.L.C	6/21/02	14060
17	INCORPORATED E.C.O.#: 1024-55	S.L.C	6/25/02	96106
18	INCORPORATED E.C.O.#: 1024-65	S.L.C	12/20/02	14428
19	INCORPORATED E.C.O.#: 1024-77	S.L.C	8/7/03	69857

	ITEM	QTY.	SPECIFICATION	NOMENCLATURE	DESCRIPTION
	31	--	---	DELETED	---
*	32	4	SA 240 304	EXIT VENT SCREEN SHEET	16 GAGE (0.0595 THK.) X 6 1/4 WIDE X 40 LG. SHEET
*	33	4	SA 240 304	EXIT VENT SCREEN FRAME	16 GAGE (0.0595 THK.)
*	34	1	COMMERCIAL	SCREEN	16 WIDE X 212 LG. 6 X 6 MESH 0.020 WIRE ø 0.147 WIDTH OPEN FROM McMASTER-CARR 101 PAGE# 2521 ITEM# 9220T67 CUT AS NECESSARY OR EQUIVALENT
*	35	4	SA 240 304	INLET VENT SCREEN FRAME	16 GAGE (0.0595 THK.)
*	36	2	COMMERCIAL	THERMOCOUPLE OR RTD	1/8 ø SHEATH WITH TEMPERATURE ELEMENT (BY USER).
*	37	16	SA240-304	GAMMA SHIELD CROSS PLATE	1/4 THK X 2.75 X 24
*	38	4	SA240-304	GAMMA SHIELD CROSS PLATE	1/4 THK X 24 X 24 5/8
*	39	24	SA240-304	CROSS PLATE TABS	.075 THK X 1/4 X 2 1/2
*	40	8	SA240-304	GAMMA SHIELD CROSS PLATE	1/4 THK X 14 5/8 X 24
*	41	16	SA240-304	GAMMA SHIELD CROSS PLATE	1/4 THK X 3.09 X 24
*	42	2	C/S OR S/S	DRAIN PIPE	3/4 SCH 160 PIPE X 11 1/2 LG
*	43	8	SA240-304	GAMMA SHIELD CROSS PLATE	1/4 THK X 5.09 X 17 1/4
*	44	2	316 SS	COMPRESSION FITTING	1/8" X 1/4 NPT MALE PASS THRU COMPRESSION FITTING (OPTIONAL)
*	45	2	CAST IRON	PROTECTION HEAD	1/2 NPT X 1/2 NPT (OPTIONAL)
*	46	2	304 SS	BUSHING	1/4 X 1/2 NPT (OPTIONAL)
*	47	2	304 SS	COUPLING	1/2 NPT COUPLING W/ MOUNTING STUD 1/2 DIA X 3" LG. (OPTIONAL)
*	48	2	304 SS	HEX NIPPLE	1/2 X 1/2 NPT HEX NIPPLE (OPTIONAL)
*	49	2	304 SS	CONNECTION	1/2 NPT CONDUIT CONNECTION (OPTIONAL)
*	50	28	S/S	SCREW	ø1/4" X LENGTH AS REQUIRED
	51	4	S/S	WASHER	1/2" MIN. THK. X 3 1/2" I.D X 8" MIN. O.D.
	52	96	A36	CHANNEL MOUNTS	3/16" X 1" X 1" X 24" LONG
	53	4	C/S	SHIMS	2" THK X 3" LONG X 2" HIGH
	54	4	S/S	BAR INLET SCREEN BASE	1/2" X 1" X 24 3/32" LG. BAR
	55	8	S/S	BAR INLET SCREEN BASE	1/2" X 1" X 15" LG. BAR.
	56	1	SA516 GR. 70	SHEAR RING	3/4" THK. X 73 1/2" I.D. X 108" O.D. PLATE (CUT IN FOUR PIECES)
	57	2	SA516 GR. 70 OR SA515 GR. 70	GROUNDING BLOCK	1/2" THK. X 2" WIDE X 4" LONG
	58	16	SA516 GR. 70	EXITVENT FRAME LEG	3/8" THK. X 1" WIDE X 6 1/2" LG. (CUT AS REQUIRED)
	59	8	SA516 GR. 70	EXITVENT FRAME TOP	3/8" THK. X 1" WIDE X 28 1/4" LG. (CUT AS REQUIRED)
	60	16	SA516 GR. 70	INLETVENT FRAME LEG	3/8" THK. X 1" WIDE X 12" LG. (CUT AS REQUIRED)
	61	8	SA516 GR. 70	INLETVENT FRAME TOP	3/8" THK. X 1" WIDE X 18 3/4" LG. (CUT AS REQUIRED)
	62	4	S/S	EXIT SCREEN BASE	3/8" THK. X 1/2" WIDE X 32 5/16" LG.
	63	8	S/S	EXIT SCREEN BASE	3/8" THK. X 1/2" WIDE X 10" LG.
	64	4	SA516 GR. 70	RADIAL WELD PLATE	3/4" THK. X 6" WIDE X 27 1/2" LG. (OPTIONAL)
19	65	1	C/S	HEAT SHIELD RING	3/8" THK. X 1" WIDE X 69" O.D. (CAN BE MADE FROM MULTIPLE PIECES)
19	66	1	C/S	HEAT SHIELD	14 GAGE (.0747 THK.) X 68" O.D.

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BM-1880 (E.I.D. 3002) BILL OF MATERIAL FOR 125 TON HI-TRAC (DWG. 1880) SHT. 1 OF 2

REV. NO.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP. BY	APPROVAL DATE:	VIR#:
9	INCORPORATED ECO 1025-35, 15, 12, 8, 6 & 5.	T.F.O.	11/30/01	70889

ITEM	QTY.	SPECIFICATION	NOMENCLATURE	DESCRIPTION
1	1	ASTM B 29	RADIAL LEAD SHIELD	113 CU. FT. COMMON LEAD APPROX.
2	1	SA 516 GR. 70	OUTER SHELL	1 THK. X 81.25 O.D. X 184.75 LG. CYLINDER
3	1	SA 516 GR. 70	INNER SHELL	0.75 THK. X 68.75 I.D. X 184.75 LG. CYLINDER
4	-	-	DELETED	-
4A	-	-	DELETED	-
4B	-	-	DELETED	-
5	-	-	DELETED	-
5A	-	-	DELETED	-
6A	2	SA 516 GR. 70	WATER JACKET END PLATE	1 THK. X 94.625 O.D. X 81.25 I.D. X 141° (APP) (MAY BE MADE FROM MORE THAN 1 PIECE)
6B	1	SA 516 GR. 70	WATER JACKET END PLATE	1 THK. X 94.625 O.D. X 81.25 I.D. RING (MAY BE MADE FROM MORE THAN 1 PIECE)
7	1	SA 350 LF3	TOP FLANGE	4.5 THK. X 81.25 O.D. X 68.75 I.D. RING
8	1	SA 516 GR. 70	LOWER WATER JACKET SHELL	0.5 THK. X 86.25 O.D. X 6 LG. CYLINDER
9	1	SA 516 GR. 70 OR SA 350 LF3	BOTTOM FLANGE	2 THK. X 93 O.D. X 68.75 I.D.
10	1	SA 516 GR. 70 OR SA 203-E OR SA 350 LF3	POOL LID OUTER RING	3.5 THK. X 93.75 O.D. X 75 I.D. RING
11	1	SA 516 GR. 70	POOL LID TOP PLATE	2 THK. X 93 ø PLATE
12	1	ASTM B 29	POOL LID LEAD SHIELD	6.39 CU. FT. COMMON LEAD APPROX.
13	1	SA 516 GR. 70	TOP LID OUTER RING	0.5 THK. X 71.875 O.D. X 3.25 LG. CYLINDER
14	1	SA 516 GR. 70	TOP LID INNER RING	0.5 THK. X 29 O.D. X 3.25 LG. CYLINDER
15	1	SA 516 GR. 70	TOP LID TOP PLATE	0.5 THK. X 71.375 O.D. X 28.5 I.D. RING
16	1	SA 516 GR. 70	TOP LID BOTTOM PLATE	1.0 THK. X 81.25 O.D. X 27 I.D. RING
17	1	HOLTITE	TOP LID SHIELDING	5.41 CU. FT. APPROX.
18	8	SA 516 GR. 70	FILL PORT PLUGS	3 1/4"LG. X 2 7/8" ø CYLINDER (MAYBE MADE OF MULTIPLE, UNATTACHED PIECES)
19	24	SA 193 B7	TOP LID STUD	1-8 UNC X 4 3/8 LG. STUDS (4 3/8 FULL LENGTH THREAD WITH WRENCH FLAT AT ONE END)
20	24	SA 194 2H	TOP LID NUT	1-8 UNC HEAVY HEX WITH WASHER
21	1	ELASTOMER	POOL LID GASKET	0.5 THK. X 87.25 O.D. X 85.75 I.D. COMMERCIAL
22	36	SA 193 B7	POOL LID BOLT	1 - 8 UNC X 3.125 LG. HEX. BOLTS X 1.25 MIN THREAD LENGTH W/WASHER

NOTE: 1) ALL SA-350-LF3 MATERIAL MAY BE REPLACED BY SA-203-E.
2) ALL DIMENSIONS ARE FOR REFERENCE ONLY.
9 3) FOR ITEM 18, SA 516 GR.70 MAY BE REPLACED WITH SA-203-E OR SA-350-LF 3 OR EQUIVALENT.

9 G:\DRAWINGS\1025\TRNSFER\BM1880-1.R9

BM-1880 (E.I.D 3003) BILL OF MATERIAL FOR 125 TON HI-TRAC (DWG. 1880) SHT. 2 OF 2

REV. NO.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
7	INCORPORATED ECO 1025-35, 20, 13, 8 & 5.	T.F.O.	11/30/01	22562

	ITEM	QTY.	SPECIFICATION	NOMENCLATURE	DESCRIPTION
△7	23	12	SA 516 GR.70	ENCLOSURE SHELL PANEL	0.5 THK. X 93.00 O.D. X 168.75 LG. 30DEG. SHELL SEGMENTS
	24	2	SA 350 LF3	LIFTING TRUNNION BLOCK	7.625 (APPROX) X 10 X 10
	25	--	---	DELETED	---
	26	2	SB 637 N07718	LIFTING TRUNNION	6.25 Ø X 9.25 LG. BAR
	27	2	SA 516 GR. 70	LIFTING TRUNNION END CAP	0.5 THK. X 6.25 Ø PLATE
	28	4	SA 193 B7	END CAP BOLTS	0.5 - 13 UNC X 1 LG. WITH 5/8 LG THREAD
	29	2	SA 350 LF3	POCKET TRUNNION	12.375 X 13 X 12.5 BLOCK
	30	1	SA 106	DRAIN PIPE	1 SHC. 80 X 7 (APPROX.) LG. PIPE
△7	31	12	SA 516 GR.70	RADIAL RIB	1.25 THK. X 5.361 W X 168.75 LG.
	32	1	SA 193 B7	DRAIN BOLT	1 - 8UNC X 1.75 LG. SOCKET SET SCREW
	33	--	---	DELETED	---
	34	2	SA 516 GR. 70	WATER JACKET END PLATE	1 THK. X 94.625 O.D. X 81.25 I.D. X 39° (APP)
	35	--	---	DELETED	---
	36	1	SA 516 GR. 70	POOL LID BOTTOM PLATE	1 THK. X 77 Ø PLATE
	37	1	COMMERCIAL	VENT COUPLING	1 1/2-3000 lb. SCREWED HALF COUPLING (OR SIMILAR)
	38	1	COMMERCIAL	VENT PLUG	1 1/2-3000 lb. SCREWED HEXAGON HEAD PLUG (OR SIMILAR)
△7	39	2	COMMERCIAL	PRESSURE RELIEF COUPLING	2-3000 lb. SCREWED HALF COUPLING (OR SIMILAR)
△7	40	2	COMMERCIAL	PRESSURE RELIEF VALVE	MEDIUM PRESSURE POP VALVE (OR SIMILAR)
	41	1	SA 106	JACKET DRAIN PIPE	1 1/2 SCH. 40 X 5 LG. PIPE
△7	42	1	COMMERCIAL	JACKET DRAIN VALVE	1 1/2 NONRISING STEM GATE VALVE (OR SIMILAR)
	43	4	C/S OR S/S	HOLE PLUGS	N/A
	44	4	SA 516 GR. 70	TOP LID LIFTING BLOCK	1.5 SQ. X 3.25 LG. BLOCK
△7	45	--	--	DELETED	--
	46	--	---	DELETED	---
△7	47	4	SA 516 GR.70	SHORT RIB	0.5 THK. X 6.688" W X 4.125 LG.

△7 G:\DRAWINGS\1025\TRNSFER\BM1880-2.R7

BM-1928 (E.I.D. 3001) BILL OF MATERIAL FOR 125 TON HI-TRAC TRANSFER LID (DWG. 1928)

REV. NO.	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
10	INCORPORATED ECO 1025-35, 10, 8, 6, & 4.	T.F.O.	11/30/01	87422

	ITEM	QTY.	SPECIFICATION	NOMENCLATURE	DESCRIPTION
10	1	1	SA 516 GR. 70	LID TOP PLATE	1.5 THK. X 93.5 WIDE X 128 LG. PLATE
10	2	1	SA 516 GR. 70	LID BOTTOM PLATE	2 THK. X 93.5 WIDE X 128 LG. PLATE
10	3	2	SA 516 GR. 70	LID INTERMEDIATE PLATE	1.5 THK. X 8.625 WIDE X 132 LG. PLATE
10	4	2	SA 516 GR. 70	LEAD COVER PLATE	1 THK. X 8.625 WIDE X 78 LG. PLATE
10	5	8	SA 516 GR. 70	LEAD COVER SIDE PLATE	1 THK. X 4.5 WIDE X 8.625 LG. PLATE
	6	1	ASTM B 29	SIDE LEAD SHIELD	2.65 (APPROX.) CU. FT.
10	7	2	SA 36	WHEEL TRACK	0.25 THK. X 1 X 1 X 128 LG. ANGLE
	8	2	SA 516 GR. 70	DOOR TOP PLATE	2 1/4 THK. X 47 WIDE X 80 LG. PLATE (CUT AS NECESSARY)
	9	2	ASTM B 29	DOOR LEAD SHIELD	2.9 (APPROX.) CU. FT.
	10	2	SA 516 GR. 70	DOOR MIDDLE PLATE	1/2 THK. X 47 WIDE X 65 LG. PLATE (CUT AS NECESSARY)
	11	2	HOLTITE	DOOR SHIELDING	3.65 (APPROX.) CU. FT.
	12	2	SA 516 GR. 70	DOOR BOTTOM PLATE	3/4 THK. X 47 WIDE X 65 LG. PLATE (CUT AS NECESSARY)
	13	4	SA 516-70	DOOR WHEEL HOUSING	1 7/8 THK. X 6 WIDE X 25 LG. PLATE
	14	2	SA 516 GR. 70	DOOR INTERFACE PLATE	1 THK. X 3 7/8 WIDE X 80 LG. PLATE
	15	2	SA 516 GR. 70	DOOR SIDE PLATE	1 THK. X 5.75 WIDE X 65 LG. PLATE
	15A	4	SA 516 GR. 70	DOOR SIDE PLATE	1 THK. X 5.75 WIDE X 65 LG. PLATE
	16	4	SA 516 GR. 70	DOOR SIDE PLATE	1 THK. X 5.75 WIDE X 32.625 APPROX. LG. PLATE
	17	2	C/S OR S/S	DOOR HANDLE	3/4-10UNC EYE BOLT
	18	12	COMMERCIAL	DOOR WHEEL	6 X 3 V-GROOVE WHEEL.
	19	12	SA 193-B7	WHEEL SHAFT	1.25-7UNC (1.25" THREAD LENGTH) X 6.625 LG. BAR WITH SCREWDRIVER SLOT FOR INSTALLATION AT UNTHREADED END.
	20	---	---	DELETED	---
10	21	2	SA 516 GR. 70	LID HOUSING STIFFENER	1 THK. X 3.5 WIDE X 8.625 LG. PLATE
10	22	4	SA 193 B7	DOOR LOCK BOLT	3 - 4 UNC X 11.25" LG. HEX. BOLTS W/ 1.5 LG. THREADED AT END
	23	4	SA 516 GR. 70	DOOR STOP BLOCK	2 THK. X 2 WIDE X 8 LG. BLOCK
	24	8	SA 193 B7	DOOR STOP BLOCK BOLT	1 - 8 UNC X 3 LG. BOLT W/ 2.5 LG. THREADED AT END
	25	2	SA 516 GR. 70	DOOR END PLATE	1 THK. X 5.75 WIDE X 19 LG. PLATE
	26	4	SA 516 GR. 70	LIFTING LUG	0.75 THK. X 3 WIDE X 3.5 LG. PLATE
	27	4	SA 516 GR. 70	LIFTING LUG PAD	0.5 THK. X 5 SQ. PLATE

NOTE:
1) ALL DIMENSIONS ARE APPROXIMATE.

10 G:\DRAWINGS\1025\TRNSFER\BM-1928R10

BM-2145 (E.I.D. 3049) BILL OF MATERIAL FOR 100 TON HI-TRAC (DWG. 2145) SHT. 1 OF 2

REV. NO.	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
6	INCORPORATED ECO-1026-28, 18, 8, 7 & 5	T.F.O.	11/30/01	70563

	ITEM	QTY.	SPECIFICATION	NOMENCLATURE	DESCRIPTION
	1	1	ASTM B 29	RADIAL LEAD SHIELD	71.15 CU. FT. COMMON LEAD APPROX.
	2	1	SA 516 GR. 70	OUTER SHELL	1 THK. X 78 O.D. X 184.75 LG. CYLINDER
	3	1	SA 516 GR. 70	INNER SHELL	0.75 THK. X 68.75 I.D. X 184.75 LG. CYLINDER
6	4	-	-	DELETED	-
6	4A	-	-	DELETED	-
6	4B	-	-	DELETED	-
6	5	-	-	DELETED	-
6	5A	-	-	DELETED	-
	6A	2	SA 516 GR. 70	WATER JACKET END PLATE	1 THK. X 91 O.D. X 78 I.D. RING X 132° REF (MAY BE MADE FROM MORE THAN 1 PIECE)
	6B	1	SA 516 GR. 70	WATER JACKET END PLATE	1 THK. X 91 O.D. X 78 I.D. RING (MAY BE MADE FROM MORE THAN 1 PIECE)
	7	1	SA 350 LF3	TOP FLANGE	4.5 THK. X 78.00 O.D. X 68.75 I.D. RING
	8	1	SA 516 GR. 70	LOWER WATER JACKET SHELL	1.25 THK. X 83.00 O.D. X 6 LG. CYLINDER
	9	1	SA 350 LF3, OR SA 516 GR. 70	BOTTOM FLANGE	2 THK. X 89 O.D. X 68.75 I.D.
	10	1	SA516 GR 70 OR SA 203-E OR SA350 LF3	POOL LID OUTER RING	2.0 THK X 89-3/4 O.D. X 75 I.D.
	11	1	SA 516 GR. 70	POOL LID TOP PLATE	2 THK. X 89 ø
	12	1	ASTM B 29	POOL LID LEAD SHIELD	3.84 CU FT APPROX. COMMON LEAD
	13	--	---	DELETED	---
	14	--	---	DELETED	---
	15	--	---	DELETED	---
	16	1	SA 516 GR. 70	TOP LID BOTTOM PLATE	1.0 THK. X 78.00 O.D. X 27 I.D. RING
	17	1	SA 516 GR 70	POOL LID BOTTOM PLATE	.5 THK X 76.5 ø
6	18	8	SA 516 GR. 70	FILL PORT PLUGS	3 1/4 LG. X ø2 3/8 CYLINDER (MAYBE MADE OF MULTIPLE UNATTACHED PIECES)
6	19	24	SA 193 B7	TOP LID STUD	1-8 UNC X 5 LG. STUD (FULL LENGTH THREAD WITH WRENCH FLAT AT ONE END)
6	20	24	SA 194 2H	TOP LID NUT	1-8 UNC HEAVY HEX WITH WASHER (3/16" MAX; OPTIONAL)
6	21	1	ELASTOMER	POOL LID GASKET	0.5" THK. X 83.625 O.D. X 82.125 I.D. COMMERCIAL
6	22	36	SA 193 B7	POOL LID BOLT	1-8UNC X 3.125 LG. HEX BOLTS WITH 1.25" MIN THRD LENGTH W/WASHER (3/16" MAX; OPTIONAL)
	23	--	---	DELETED	---
	24	2	SA 350 LF3	LIFTING TRUNNION BLOCK	7.25 (APP) X 10 X 10
	25	--	---	DELETED	---

NOTES: 1. ALL SA-350-LF3 MATERIAL MAY BE REPLACED BY SA-203-E.
2. ALL DIMENSIONS ARE FOR REFERENCE ONLY.

BM-2145 (E.I.D. 3050) BILL OF MATERIAL FOR 100 TON HI-TRAC (DWG. 2145) SHT. 2 OF 2

REV. NO.	SUMMARY OF CHANGES/AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
5	INCORPORATED ECO-1026-10, 7 & 5.	T.F.O.	11/30/01	66474

	ITEM	QTY.	SPECIFICATION	NOMENCLATURE	DESCRIPTION
	26	2	SB 637 N07718	LIFTING TRUNNION	6.25 Ø X 9.25 LG. BAR
	27	2	SA 516 GR. 70	LIFTING TRUNNION END CAP	0.5 THK. X 6.25 Ø PLATE
	28	4	SA 193 B7	END CAP BOLTS	0.5 - 13 UNC X 1 LG. WITH 5/8 MIN THREAD.
	29	2	SA 350 LF3	REMOVABLE POCKET TRUNNION	3.9375 X 13 X 12.375 BLOCK
	30	6	SA564-630 (H1100)	DOWEL PINS	1 3/8" Ø BAR
	31	1	SA 106	DRAIN PIPE	1 SCH 80 X 6 LG APPROX (CUT TO SUIT)
5	32	1	SA 193 B7	DRAIN BOLT	1 - 8UNC X 1.75 LG. SET SCREW
	33	--	---	DELETED	---
	34	2	SA 516 GR. 70	WATER JACKET END PLATE	1 THK. X 91 O.D. X 78 I.D. X 48° APP
	35	--	---	DELETED	---
5	36	10	SA 516 GR. 70	ENCLOSURE SHELL PANEL	0.375 THK. X 88.75 O.D. X 168.75 LG. 36 DEG. SHELL SEGMENT
	37	1	COMMERCIAL	VENT COUPLING	1 1/2-3000 lb. SCREWED HALF COUPLING (OR SIMILAR)
	38	1	COMMERCIAL	VENT PLUG	1 1/2-3000 lb. SCREWED HEXAGON HEAD PLUG (OR SIMILAR)
5	39	2	COMMERCIAL	PRESSURE RELIEF COUPLING	2"-3000 lb. SCREWED HALF COUPLING (OR SIMILAR)
5	40	2	COMMERCIAL	PRESSURE RELIEF VALVE	MEDIUM PRESSURE POP VALVE (OR SIMILAR)
	41	1	SA 106	JACKET DRAIN PIPE	1 1/2 SCH. 40 X 5 LG. PIPE
5	42	1	COMMERCIAL	JACKET DRAIN VALVE	1 1/2 NONRISING STEM GATE VALVE (OR SIMILAR)
	43	4	C/S OR S/S	HOLE PLUGS	N/A
5	44	10	SA 516 GR. 70	RADIAL RIB	1.25 THK. X 168.75 LG. X 5 WIDE
5	45	4	SA 516 GR. 70	SHORT RIB	0.5 THK. X 4.125 LG. X 5.375 WIDE
	46	--	---	DELETED	---
	47	2	SA 350 LF3	POCKET TRUNNION BASE	8.03 X 13 X 12.375
	48	4	SA564-630 (H1100)	POCKET TRUNNION BOLTS	1-8 UNC X 6.25 WITH 2.3125" MIN LG THREAD
5	49	--	---	DELETED	---

5 G:\DRAWINGS\1026\HI-TRAC\BM2145-2R5

BM-2152 BILL OF MATERIAL FOR 100 TON HI-TRAC TRANSFER LID (DWG. 2152)

REV. NO.	SUMMARY OF CHANGES/ AFFECTED ECOs	PREP BY:	APPROVAL DATE:	VIR#:
8	INCORPORATED ECO-1026-28, 19, 15, 14, 10, 8 & 4.	T.F.O.	11/30/01	71621

ITEM	QTY.	SPECIFICATION	NOMENCLATURE	DESCRIPTION
1	1	SA 516 GR. 70	LID TOP PLATE	1.5 THK. X 89.5 WIDE X 128 LG. PLATE
2	1	SA 516 GR. 70	LID BOTTOM PLATE	1 1/2 THK. X 89.5 WIDE X 128 LG. PLATE
3	2	SA 516 GR. 70	LID INTERMEDIATE PLATE	1.5 THK. X 8.625 WIDE X 132 LG. PLATE
4	2	SA 516 GR. 70	LEAD COVER PLATE	1 THK. X 8.625 WIDE X 78 LG. PLATE
5	8	SA 516 GR. 70	LEAD COVER SIDE PLATE	1 THK. X 2.5 WIDE X 8.625 LG. PLATE
6	1	ASTM B 29	SIDE LEAD SHIELD	1.136 APPROX. CU. FT.
7	2	SA 36	WHEEL TRACK	0.25 THK. X 1.0 X 1.0 X 128 LG. ANGLE
8	2	SA 516 GR. 70	DOOR TOP PLATE	2.25 THK. X 47 WIDE X 80 LG. (CUT AS NECESSARY)
9	2	ASTM B 29	DOOR LEAD SHIELD	2.04 APPROX CU. FT.
10	--	DELETED	- - -	- - -
11	--	DELETED	- - -	- - -
12	2	SA 516 GR. 70	DOOR BOTTOM PLATE	1/2 THK. X 44.5 WIDE X 65 LG. PLATE (CUT AS NECESSARY)
13	4	SA 516 GR 70,	DOOR WHEEL HOUSING	1 7/8 THK. X 6 WIDE X 25 LG.
14	2	SA 516 GR. 70	DOOR INTERFACE PLATE	1 THK. X 3 3/4 WIDE X 80 LG. PLATE
15	2	SA 516 GR. 70	DOOR SIDE PLATE	1 THK. X 5.75 WIDE X 65 LG. PLATE
15A	4	SA 516 GR. 70	DOOR SIDE PLATE	1 THK. X 5.75 WIDE X 65 LG. PLATE
16	4	SA 516 GR. 70	DOOR SIDE PLATE	1 THK. X 2 WIDE X 29 APPROX. LG. PLATE
17	2	C/SOR S/S	DOOR HANDLE	3/4-10UNC EYE BOLT
18	12	COMMERCIAL	DOOR WHEEL	6 X 3 V-GROOVE WHEEL
19	12	SA 193 B7	WHEEL SHAFT	1.25-7UNC (1.25 THREAD LENGTH) X 6.625 LG. BAR WITH SCREWDRIVER SLOT FOR INSTALLATION AT UNTHREADED END.
20	--	DELETED	- - -	- - -
21	2	SA 516 GR. 70	LID HOUSING STIFFENER	1 THK. X 1.5 WIDE X 8.625 LG. PLATE
22	4	SA 193 B7	DOOR LOCK BOLT	3 - 4 UNC X 11.25 LG. HEX. BOLTS W/ 1.5 LG. THREADED AT END
23	4	SA 516 GR. 70	DOOR STOP BLOCK	2 THK. X 2 WIDE X 8 LG. BLOCK
24	8	SA 193 B7	DOOR STOP BLOCK BOLT	1 - 8 UNC X 3 LG. BOLT W/ 2.5 LG. THREADED AT END
25	2	SA 516 GR. 70	DOOR END PLATE	1 THK. X 2 WIDE X 24 LG. PLATE
26	4	SA 516 GR. 70	LIFTING LUG	0.75 THK. X 3 WIDE X 3.5 LG. PLATE
27	4	SA 516 GR. 70	LIFTING LUG PAD	0.5 THK. X 5 SQ. PLATE
28	1	CARBON STEEL	TOP PLATE EXTENSION	1 1/2" THK. X 5.75" WIDE X 89 LG. PLATE
29	2	CARBON STEEL	AIR HOSE GUIDE	2" X 2" SQ. TUBE W/ 1/4" THK. WALL

NOTES:
1) ALL DIMENSIONS ARE APPROXIMATE.

@\DRAWIINGS\1026\HI-TRAC\BM2152R8

CLIENT GENERAL

PROJECT NO. 1025 | P.O. NO. N/A

DRAWING PACKAGE I.D. 3768 | TOTAL SHEETS 12

LICENSING DRAWING PACKAGE COVER SHEET

LICENSING DRAWING PACKAGE CONTENTS:

SHEET	DESCRIPTION
1	COVER SHEET
2	ASSEMBLY DRAWING AND BILL OF MATERIALS
3	OVERALL DIMENSIONS
4	POOL LID ASSEMBLY
5	BASE PLATE ASSEMBLY
6	OUTER SHELL ASSMBLY
7	TOP FLANGE ASSEMBLY
8	TRUNNION AND INNER SHELL ASSEMBLY
9	WATER JACKET SHELL ASSEMBLY
10	TOP LID ASSEMBLY
11	OPTIONAL RADIAL RIB DESIGN
12	OPTIONAL BOTTOM FLANGE DESIGN

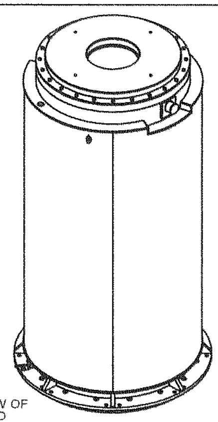
REVISION LOG

REV	AFFECTED DRAWING SHEET NUMBERS	SUMMARY OF CHANGES/ AFFECTED ECOs	PREPARED BY	APPROVAL DATE	VIR# †
0	INITIAL ISSUE	1025-36	S.CAIN	11/15/01	37568
1	ALL	1025-36, REV. 1	S.CAIN	8/26/02	47339
2	SHEETS 9 & 11	1025-40, REV. 0	S.CAIN	10/21/02	81264
3	SHEET 4	1025-42, REV. 0	S.CAIN	12/11/02	40539
4	SHEETS 4 & 9	1025-44, REV. 0, 1025-45, REV. 0	S.CAIN	5/16/03	65098
5	SHEETS 1, 10 & 12	1025-46	S.CAIN	6/20/03	59183
6	SHEETS 6 & 8	1025-51, Rev. 0	D. Butler	10/05/04	28534
7	SHEET 6	1025-54, Rev. 0	D. Butler	03/11/05	35646

† THE VALIDATION IDENTIFICATION RECORD (VIR) NUMBER IS A COMPUTER GENERATED RANDOM NUMBER WHICH CONFIRMS THAT ALL APPROPRIATE REVIEWS OF THIS DRAWING ARE DOCUMENTED IN COMPANY'S NETWORK.

NOTES:

1. THE EQUIPMENT DOCUMENTED IN THIS DRAWING PACKAGE HAS BEEN CONFIRMED BY HOLTEC INTERNATIONAL TO COMPLY WITH THE SAFETY ANALYSES DESCRIBED IN THE HI-STORM FSAR.
2. DIMENSIONAL TOLERANCES ON THIS DRAWING ARE PROVIDED SOLELY FOR LICENSING PURPOSES TO DEFINE REASONABLE LIMITS ON THE NOMINAL DIMENSIONS USED IN LICENSING WORK. HARDWARE IS FABRICATED IN ACCORDANCE WITH THE DESIGN DRAWINGS, WHICH HAVE MORE RESTRICTIVE TOLERANCES, TO ENSURE COMPONENT FIT-UP. DO NOT USE WORST-CASE TOLERANCE STACK-UP FROM THIS DRAWING TO DETERMINE COMPONENT FIT-UP.
3. THE REVISION LEVEL OF EACH INDIVIDUAL SHEET IN THE PACKAGE IS THE SAME AS THE REVISION LEVEL OF THIS COVER SHEET. A REVISION TO ANY SHEET(S) IN THIS PACKAGE REQUIRES UPDATING OF REVISION NUMBERS OF ALL SHEETS TO THE NEXT REVISION NUMBER.
4. APPLICABLE CODES AND STANDARDS ARE DELINEATED IN FSAR SECTION 2.2.4.
5. ALL WELDS REQUIRE VISUAL EXAMINATION. ADDITIONAL NDE INSPECTIONS ARE NOTED ON THE DRAWING. NDE TECHNIQUES AND ACCEPTANCE CRITERIA ARE PROVIDED IN FSAR TABLE 9.1.4.
6. UNLESS OTHEWISE NOTED, FULL PENETRATION WELDS MAY BE MADE FROM EITHER SIDE OF A COMPONENT.
7. THIS COMPONENT IS IMPORTANT-TO-SAFETY, CATEGORY A, BASED ON THE HIGHEST CLASSIFICATION OF ANY SUBCOMPONENT. SUBCOMPONENT CLASSIFICATIONS ARE PROVIDED ON THE DESIGN DRAWING.
8. ALL WELD SIZES ARE MINIMUMS EXCEPT AS ALLOWED BY APPLICABLE CODES AS CLARIFIED IN THE FSAR. FABRICATOR MAY ADD WELDS WITH HOLTEC APPROVAL.



ISOMETRIC VIEW OF HI-TRAC 125D TRANSFER CASK

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

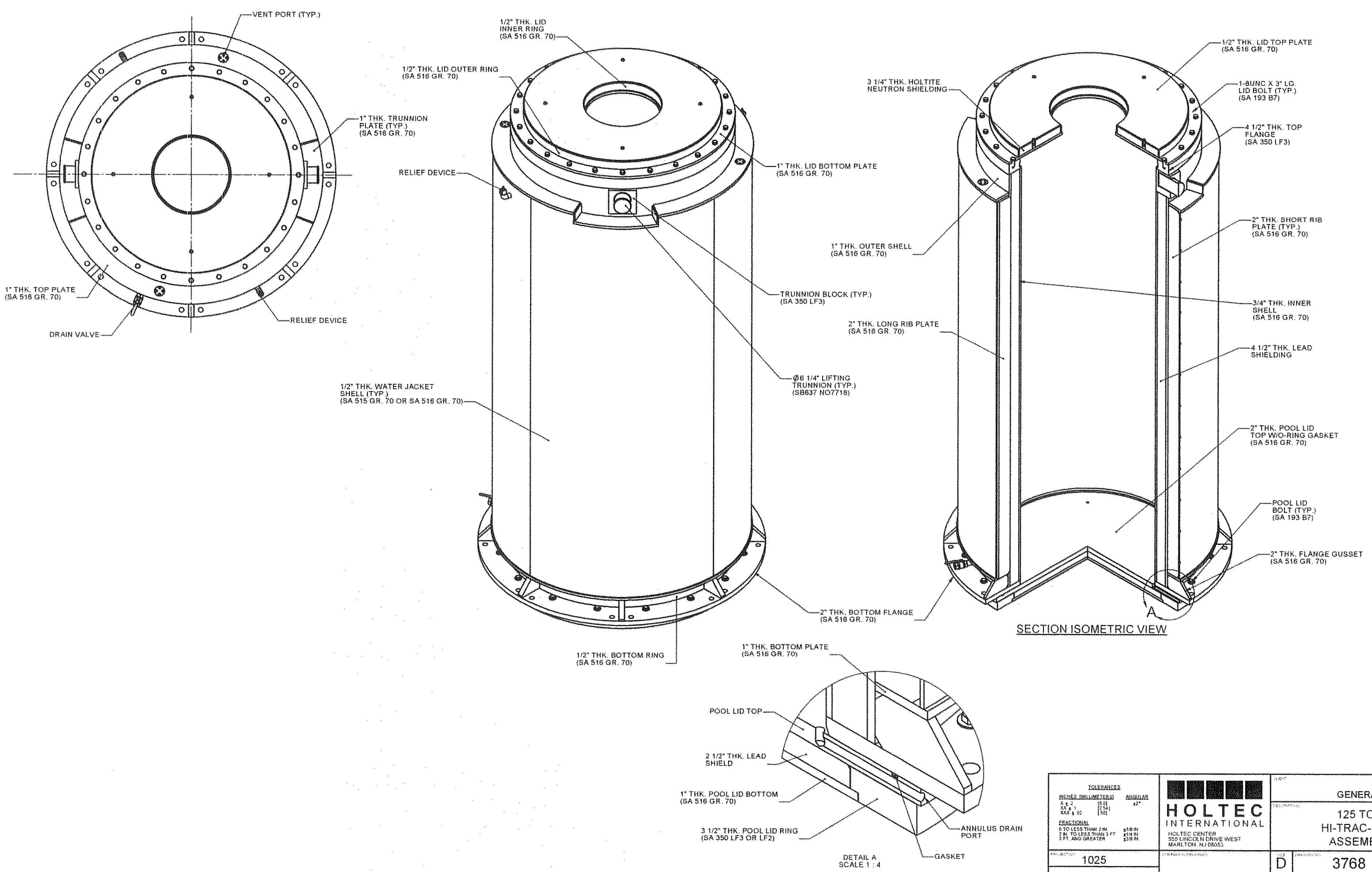
CLIENT: GENERAL

DESCRIPTION: 125 TON HI-TRAC-125D ASSEMBLY

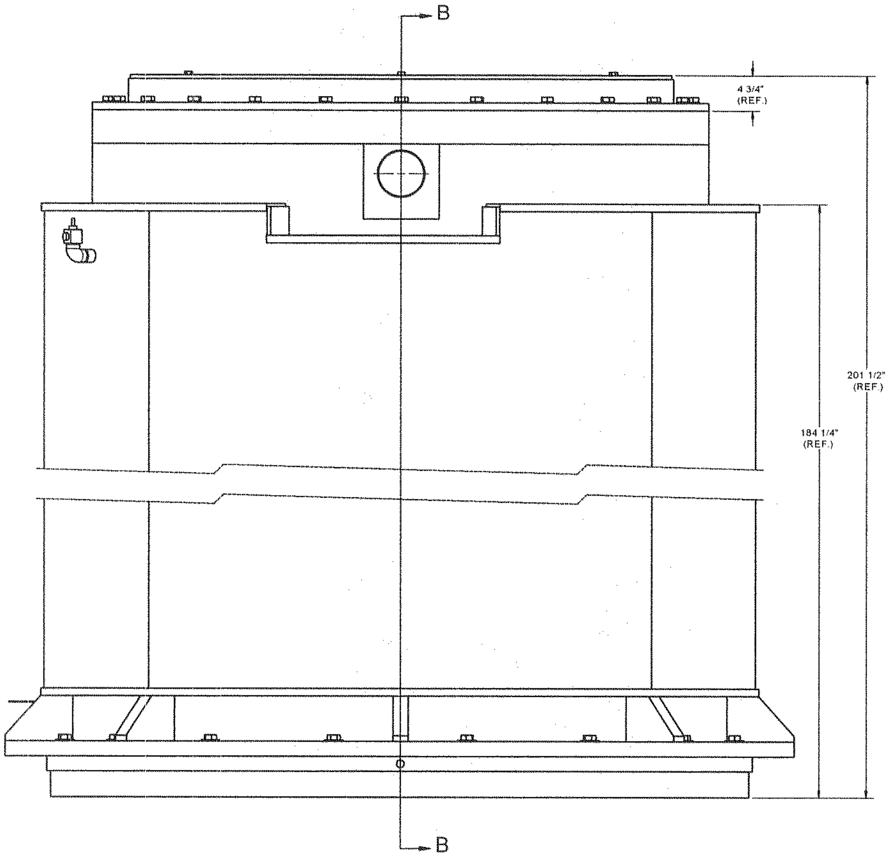
PROJECT NO. 1025 | DRAWING NO. 3768 | SHEET 1 | TOTAL SHEETS 12

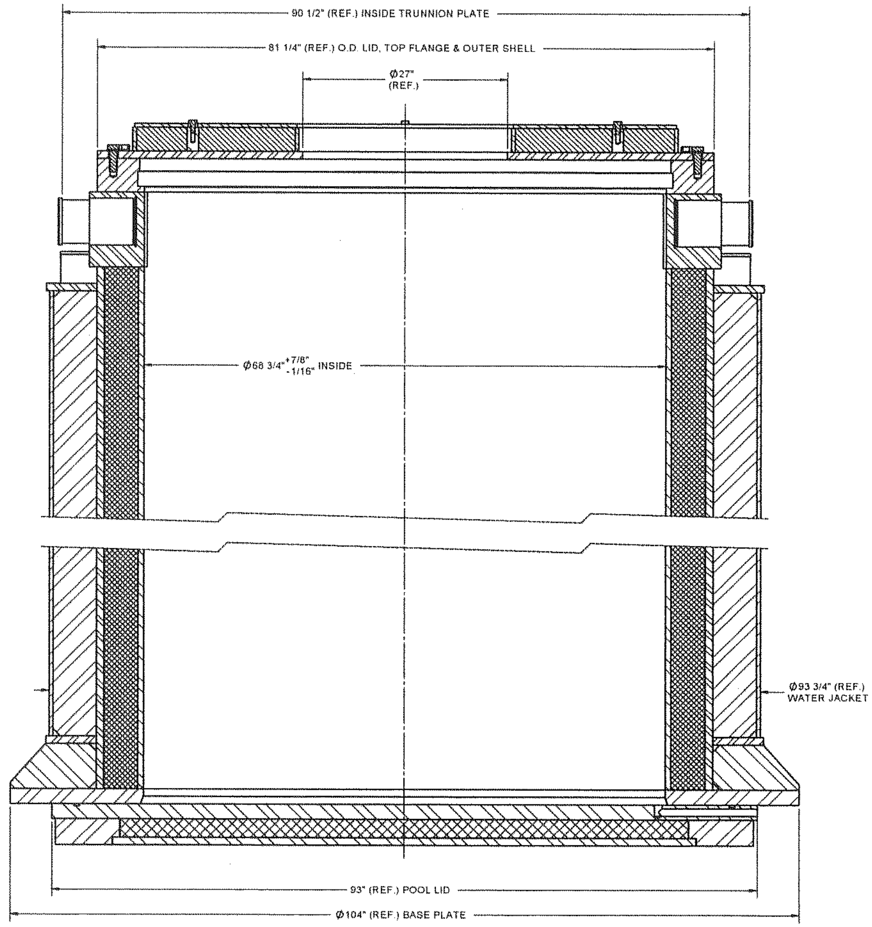
P.O. NO. N/A

G:\DRAWINGS\1025\3768



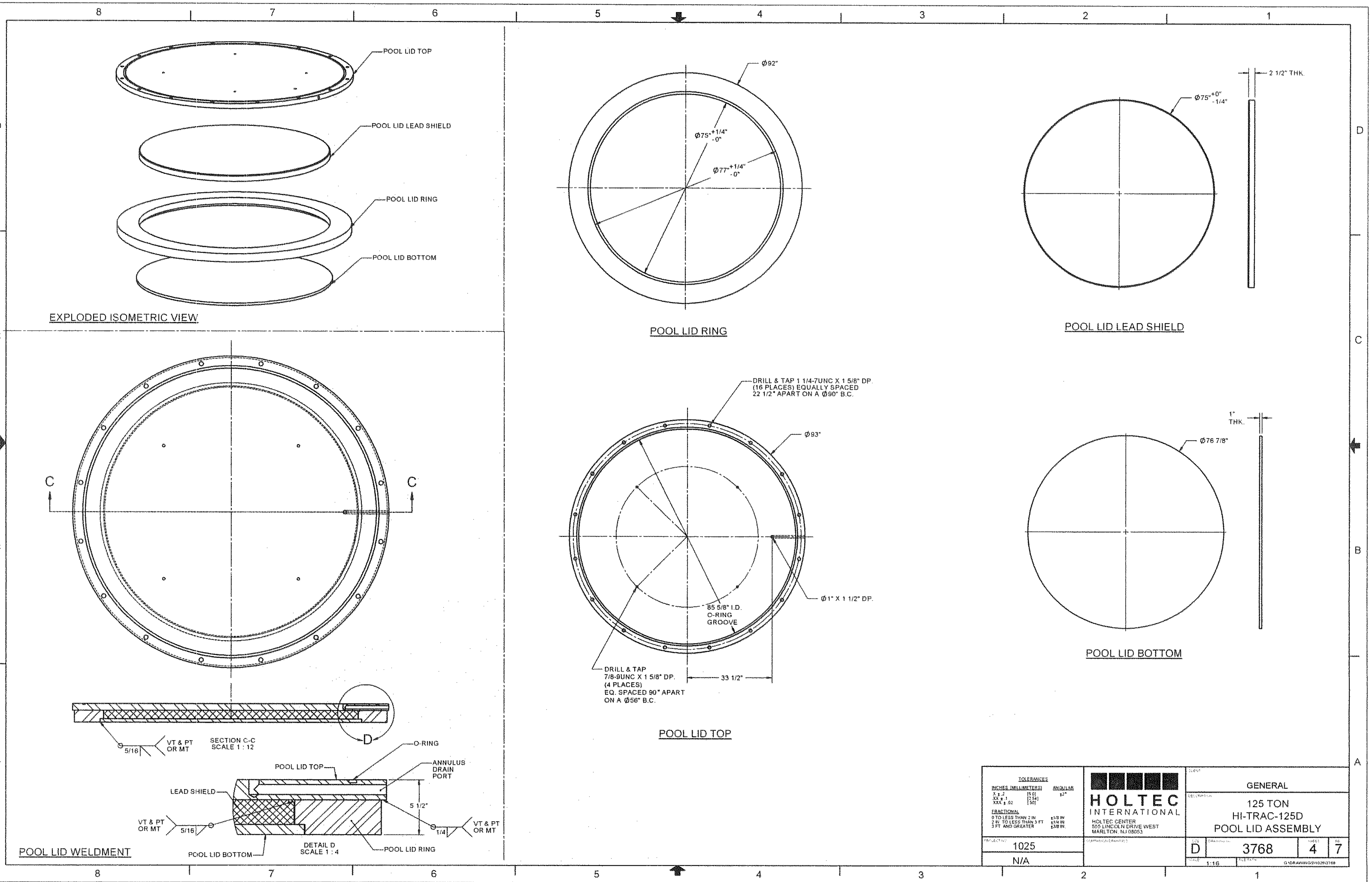
TOLERANCES INCHES [MILLIMETERS] X ± .2 [5.0], XX ± .1 [2.54], XXX ± .02 [.50] ANGULAR ±2° FRACTIONAL 0 TO LESS THAN 2 IN. ±1/8 IN 2 IN. TO LESS THAN 3 FT ±1/4 IN 3 FT. AND GREATER ±3/8 IN	HOLTEC INTERNATIONAL HOLTEC CENTER 555 LINCOLN DRIVE WEST MARLTON, NJ 08053	GENERAL 125 TON HI-TRAC-125D ASSEMBLY
1025 N/A		D 3768 2 7 1:16 G:\DRAWINGS\1025\3768



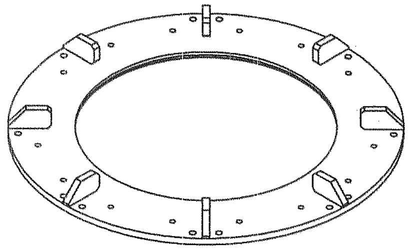


SECTION B-B

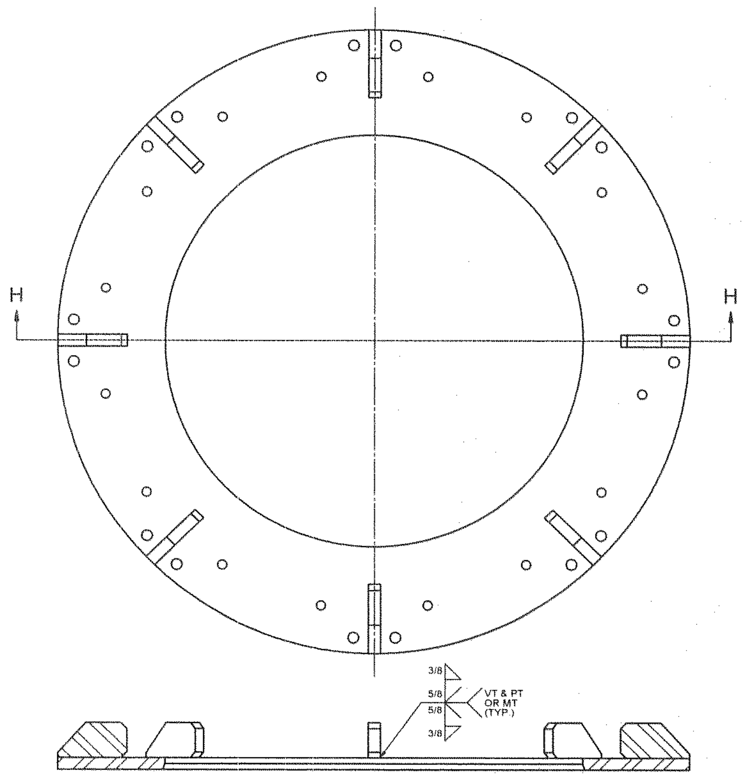
TOLERANCES	HOLTEC INTERNATIONAL	GENERAL
INCHES (MILLIMETERS): .X ± .2 [5.0]; .XX ± .1 [2.54]; .XXX ± .02 [.50]. ANGULAR: ±2°. FRACTIONAL: 0 TO LESS THAN 2 IN ±1/8 IN; 2 IN. TO LESS THAN 3 FT ±1/4 IN; 3 FT. AND GREATER ±3/8 IN	HOLTEC CENTER 555 LINCOLN DRIVE WEST MARLTON, NJ 08053	125 TON HI-TRAC-125D ASSEMBLY
1025		D — 3768 — 3 — 7
N/A		1:8 — G:\DRAWINGS\1025\3768



POOL LID TOP
POOL LID LEAD SHIELD
POOL LID RING
POOL LID BOTTOM
EXPLODED ISOMETRIC VIEW
Ø92"
Ø75" +1/4" -0"
Ø77" +1/4" -0"
POOL LID RING
2 1/2" THK.
Ø75" +0" -1/4"
POOL LID LEAD SHIELD
DRILL & TAP 1 1/4-7UNC X 1 5/8" DP. (16 PLACES) EQUALLY SPACED 22 1/2° APART ON A Ø90" B.C.
Ø93"
Ø1" X 1 1/2" DP.
85 5/8" I.D. O-RING GROOVE
DRILL & TAP 7/8-9UNC X 1 5/8" DP. (4 PLACES) EQ. SPACED 90° APART ON A Ø56" B.C.
33 1/2"
POOL LID TOP
1" THK.
Ø76 7/8"
POOL LID BOTTOM
C
C
D
5/16
VT & PT OR MT
SECTION C-C SCALE 1 : 12
O-RING
POOL LID TOP
ANNULUS DRAIN PORT
LEAD SHIELD
5 1/2"
VT & PT OR MT
5/16
1/4
VT & PT OR MT
DETAIL D SCALE 1 : 4
POOL LID BOTTOM
POOL LID RING
POOL LID WELDMENT
TOLERANCES
INCHES (MILLIMETERS) ANGULAR
X ±.2 [5.0] ±2°
.XX ±.1 [2.54]
.XXX ±.02 [.50]
FRACTIONAL
0 TO LESS THAN 2 IN ±1/8 IN
2 IN. TO LESS THAN 3 FT ±1/4 IN
3 FT AND GREATER ±3/8 IN.
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053
GENERAL
125 TON
HI-TRAC-125D
POOL LID ASSEMBLY
1025
N/A
D
3768
4
7
1:16
G:\DRAWINGS\1025\3768

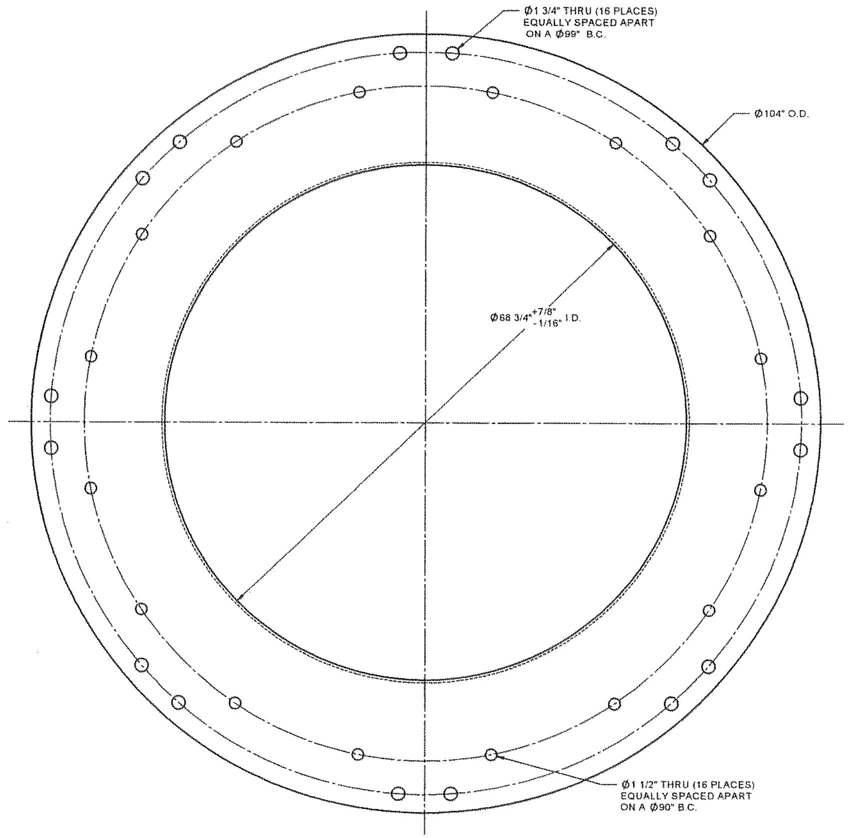


ISOMETRIC ASSEMBLY VIEW



SECTION H-H
SCALE 1 : 10

BASE PLATE WELDMENT



BOTTOM FLANGE

TOLERANCES

INCHES [MILLIMETERS]		ANGULAR
.X ± .2	[5.0]	±2°
.XX ± .1	[2.54]	
.XXX ± .02	[.50]	

FRACTIONAL

0 TO LESS THAN 2 IN	±1/8 IN
2 IN. TO LESS THAN 3 FT	±1/4 IN
3 FT AND GREATER	±3/8 IN

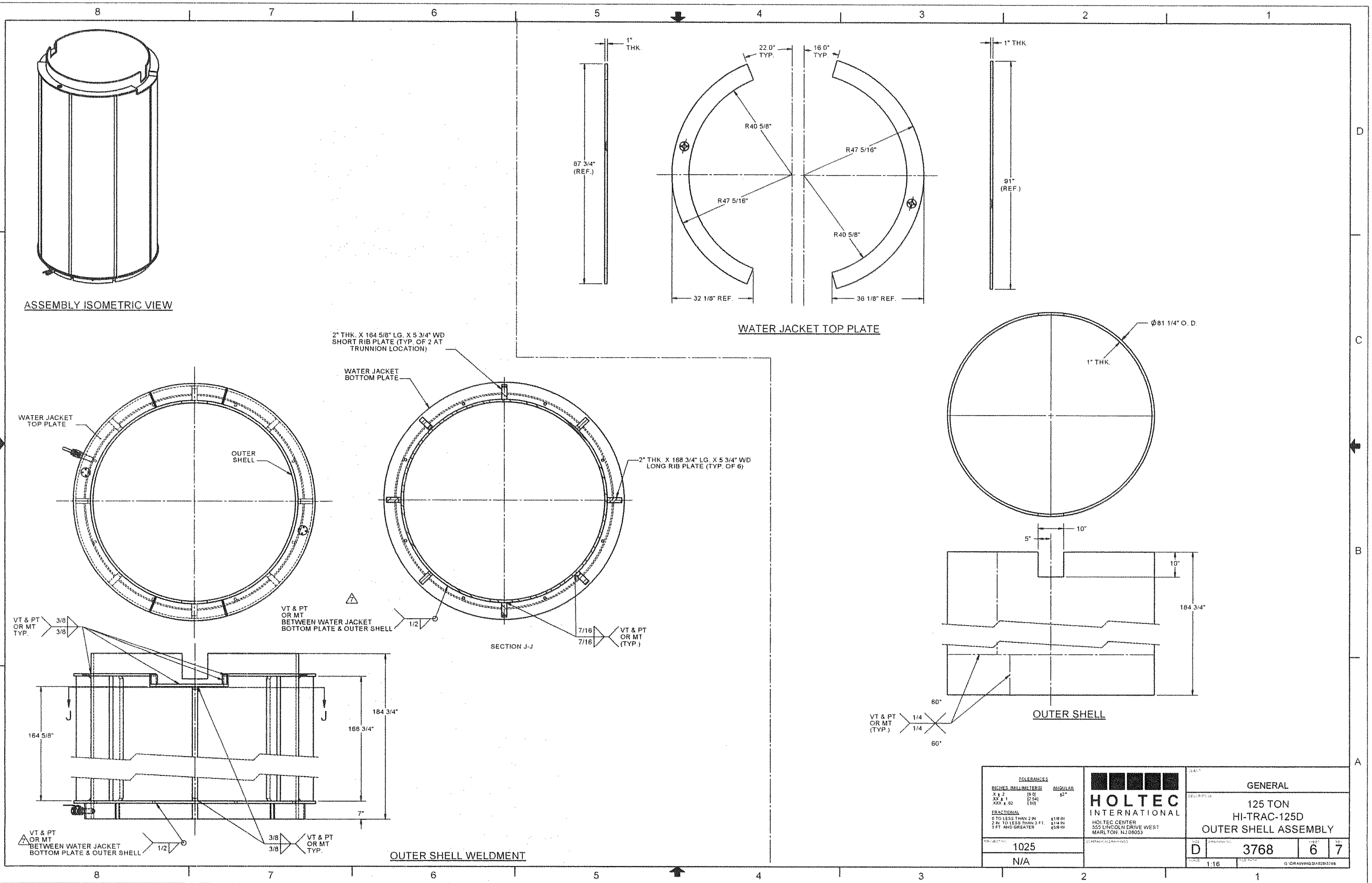
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

GENERAL

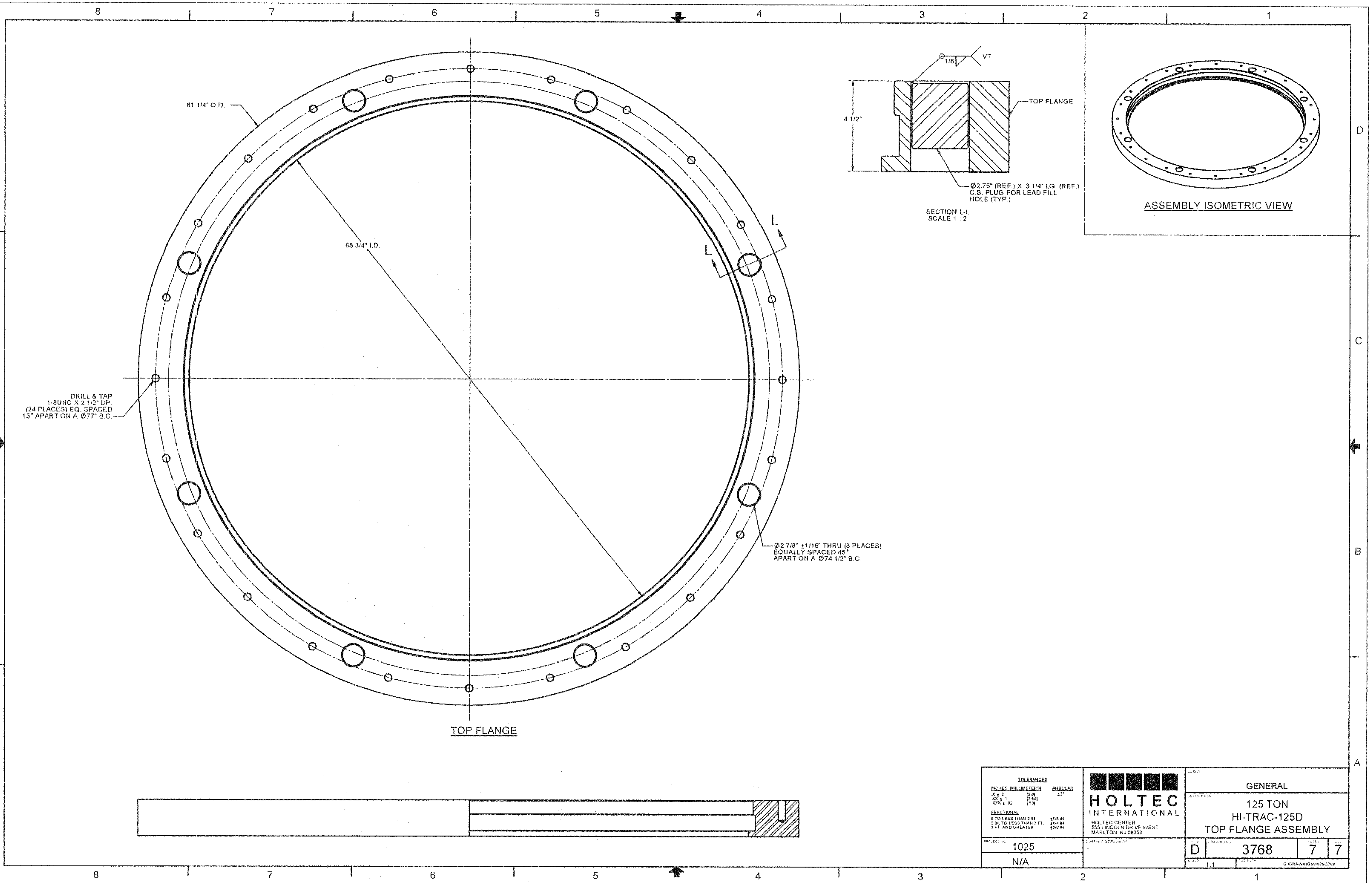
125 TON
HI-TRAC-125D
BASE PLATE ASSEMBLY

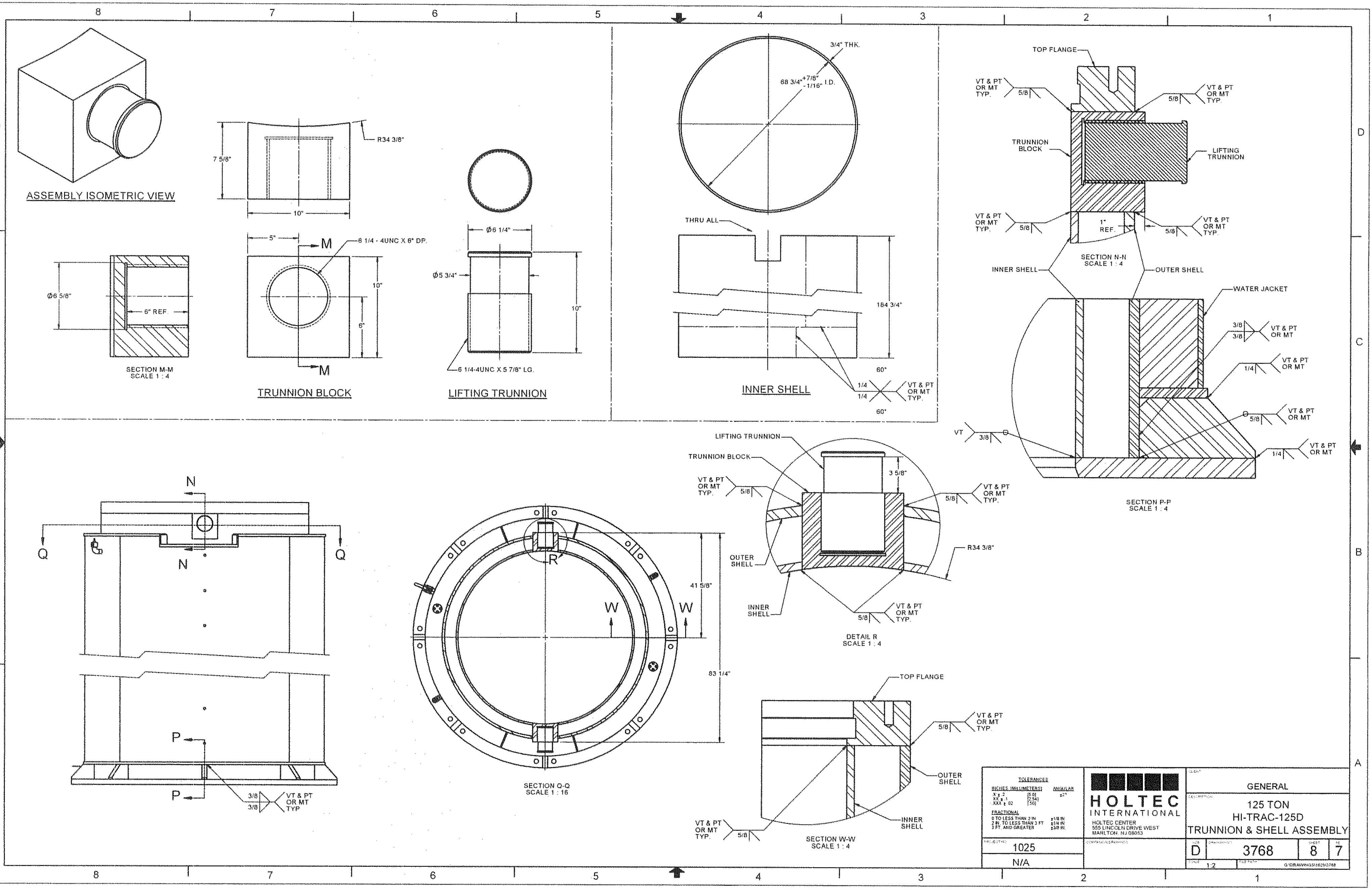
1025	
N/A	

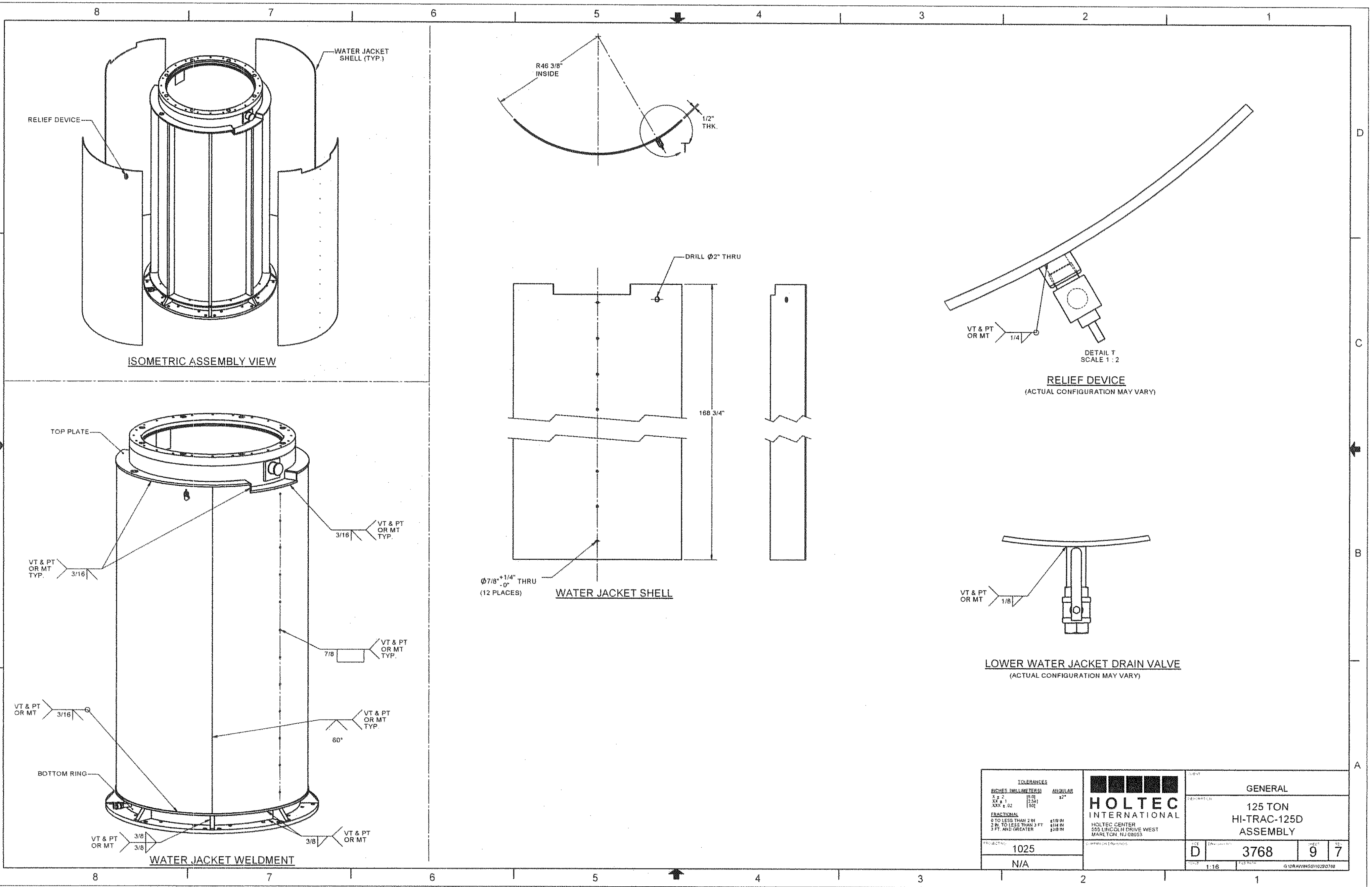
D	3768	5	7
1:1	G:\DRAWINGS\1025\3768		

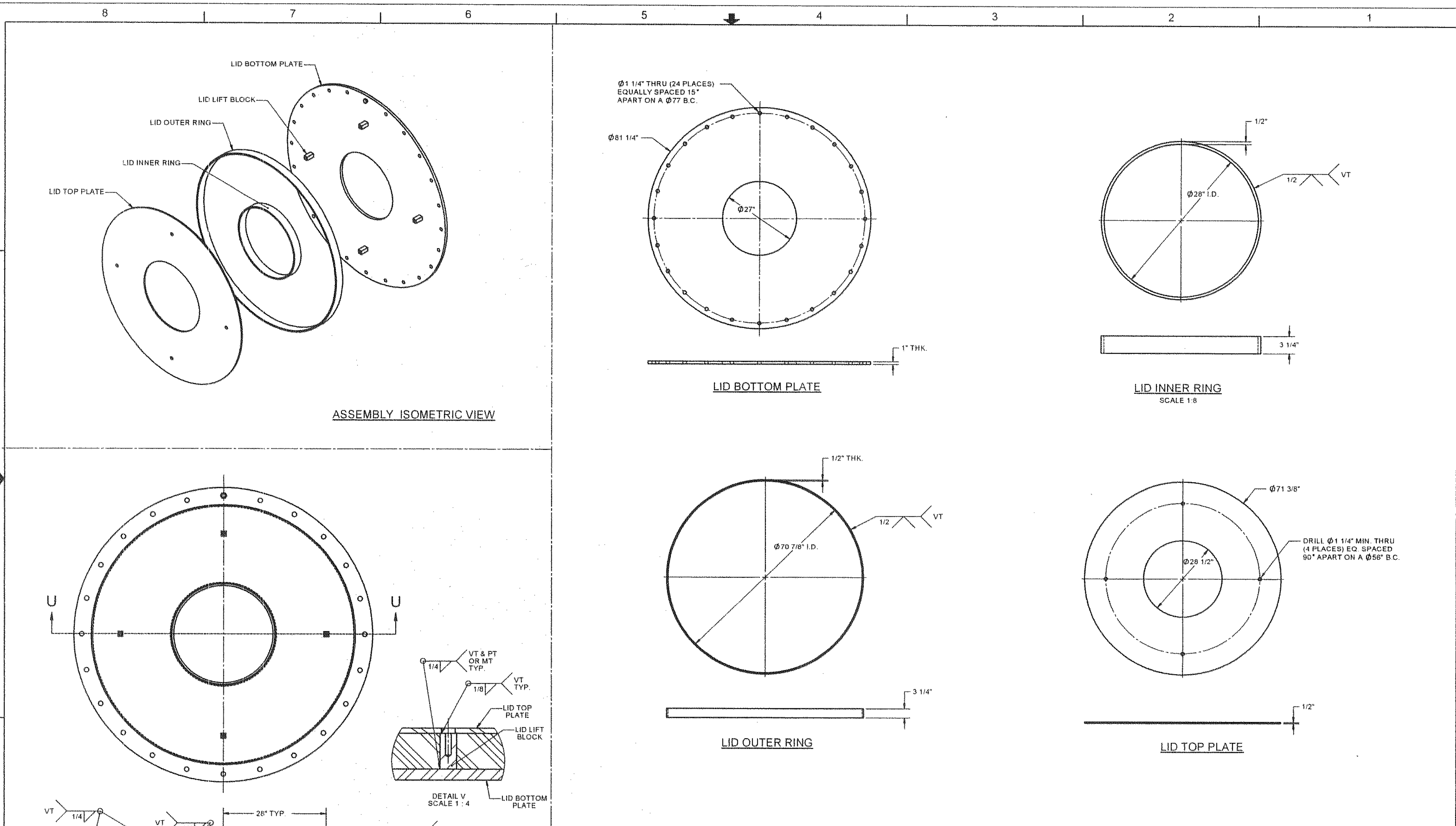


ASSEMBLY ISOMETRIC VIEW
WATER JACKET TOP PLATE
1" THK.
87 3/4" (REF.)
22.0° TYP.
16.0° TYP.
R40 5/8"
R47 5/16"
32 1/8" REF.
36 1/8" REF.
91" (REF.)
2" THK. X 164 5/8" LG. X 5 3/4" WD SHORT RIB PLATE (TYP. OF 2 AT TRUNNION LOCATION)
WATER JACKET BOTTOM PLATE
WATER JACKET TOP PLATE
OUTER SHELL
2" THK. X 168 3/4" LG. X 5 3/4" WD LONG RIB PLATE (TYP. OF 6)
VT & PT OR MT BETWEEN WATER JACKET BOTTOM PLATE & OUTER SHELL
1/2
7/16
VT & PT OR MT (TYP.)
SECTION J-J
VT & PT OR MT TYP.
3/8
J
164 5/8"
168 3/4"
184 3/4"
7"
OUTER SHELL WELDMENT
Ø81 1/4" O. D.
5"
10"
184 3/4"
60°
VT & PT OR MT (TYP.)
1/4
OUTER SHELL
TOLERANCES
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053
GENERAL
125 TON
HI-TRAC-125D
OUTER SHELL ASSEMBLY
1025
N/A
D
3768
6
7
1:16

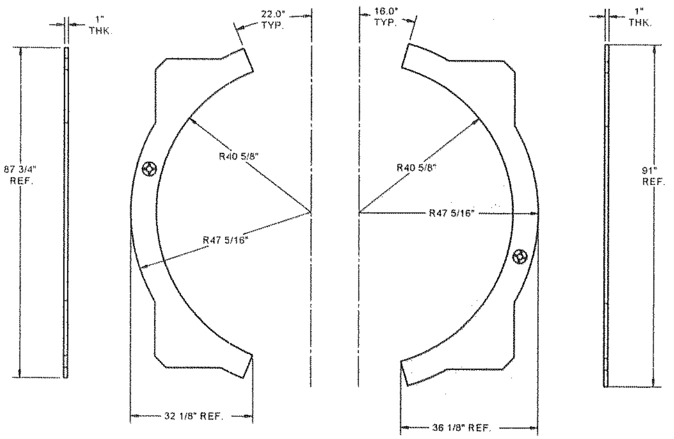

81 1/4" O.D.
68 3/4" I.D.
DRILL & TAP
1-8UNC X 2 1/2" DP.
(24 PLACES) EQ. SPACED
15° APART ON A Ø77" B.C.
Ø2 7/8" ±1/16" THRU (8 PLACES)
EQUALLY SPACED 45°
APART ON A Ø74 1/2" B.C.
L
L
TOP FLANGE
1/8
VT
4 1/2"
TOP FLANGE
Ø2.75" (REF.) X 3 1/4" LG. (REF.)
C.S. PLUG FOR LEAD FILL
HOLE (TYP.)
SECTION L-L
SCALE 1 : 2
ASSEMBLY ISOMETRIC VIEW
TOLERANCES
INCHES (MILLIMETERS) ANGULAR
.X ± .2 [5.0] ±2°
.XX ± .1 [2.54]
.XXX ± .02 [.50]
FRACTIONAL
0 TO LESS THAN 2 IN ±1/8 IN
2 IN. TO LESS THAN 3 FT. ±1/4 IN
3 FT. AND GREATER ±3/8 IN
HOLTEC
INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON NJ 08053
1025
N/A
-
GENERAL
125 TON
HI-TRAC-125D
TOP FLANGE ASSEMBLY
D
3768
7
7
1:1


ASSEMBLY ISOMETRIC VIEW
R34 3/8"
7 5/8"
10"
5"
M
6 1/4 - 4UNC X 6" DP.
10"
6"
M
Ø6 5/8"
6" REF.
SECTION M-M
SCALE 1 : 4
TRUNNION BLOCK
Ø6 1/4"
Ø5 3/4"
10"
6 1/4-4UNC X 5 7/8" LG.
LIFTING TRUNNION
3/4" THK.
68 3/4" +7/8" -1/16" I.D.
THRU ALL
184 3/4"
60°
1/4
1/4
VT & PT
OR MT
TYP.
60°
INNER SHELL
TOP FLANGE
VT & PT
OR MT
TYP.
5/8
TRUNNION BLOCK
LIFTING TRUNNION
1" REF.
SECTION N-N
SCALE 1 : 4
INNER SHELL
OUTER SHELL
WATER JACKET
3/8
3/8
VT & PT
OR MT
1/4
VT & PT
OR MT
VT
3/8
5/8
1/4
SECTION P-P
SCALE 1 : 4
N
Q
Q
N
P
P
3/8
3/8
VT & PT
OR MT
TYP
R
W
W
41 5/8"
83 1/4"
SECTION Q-Q
SCALE 1 : 16
LIFTING TRUNNION
TRUNNION BLOCK
3 5/8"
OUTER SHELL
INNER SHELL
R34 3/8"
DETAIL R
SCALE 1 : 4
TOP FLANGE
OUTER SHELL
INNER SHELL
SECTION W-W
SCALE 1 : 4
TOLERANCES
INCHES (MILLIMETERS)
ANGULAR
FRACTIONAL
0 TO LESS THAN 2 IN
2 IN. TO LESS THAN 3 FT
3 FT. AND GREATER
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053
GENERAL
125 TON
HI-TRAC-125D
TRUNNION & SHELL ASSEMBLY
1025
N/A
D
3768
8
7
1:2


WATER JACKET SHELL (TYP.)
RELIEF DEVICE
ISOMETRIC ASSEMBLY VIEW
TOP PLATE
VT & PT OR MT TYP.
3/16
VT & PT OR MT
7/8
60°
BOTTOM RING
3/8
WATER JACKET WELDMENT
R46 3/8" INSIDE
1/2" THK.
DRILL Ø2" THRU
168 3/4"
Ø7/8" +1/4" -0" THRU (12 PLACES)
WATER JACKET SHELL
1/4
DETAIL T SCALE 1 : 2
RELIEF DEVICE
(ACTUAL CONFIGURATION MAY VARY)
1/8
LOWER WATER JACKET DRAIN VALVE
(ACTUAL CONFIGURATION MAY VARY)
TOLERANCES
INCHES (MILLIMETERS) ANGULAR
.X ± .2 [5.0] ±2°
.XX ± .1 [2.54]
.XXX ± .02 [.50]
FRACTIONAL
0 TO LESS THAN 2 IN ±1/8 IN
2 IN. TO LESS THAN 3 FT ±1/4 IN
3 FT. AND GREATER ±3/8 IN
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053
GENERAL
125 TON
HI-TRAC-125D
ASSEMBLY
1025
N/A
D
3768
9
7
1:16

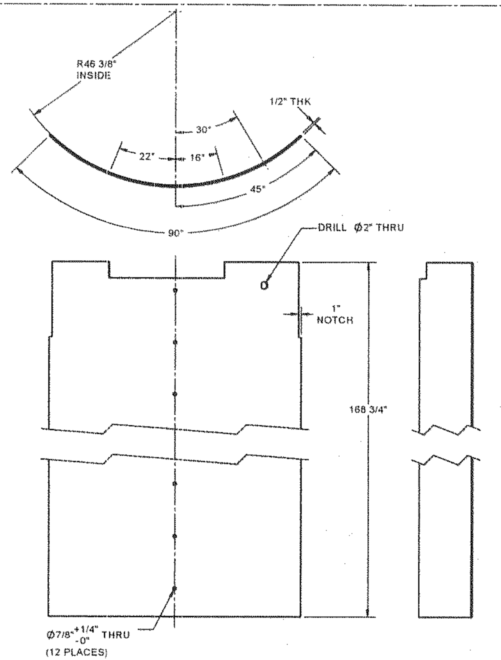


TOLERANCES INCHES [MILLIMETERS] ANGULAR X ± .2 [5.0] ±2° .XX ± .1 [2.54] .XXX ± .02 [.50] FRACTIONAL 0 TO LESS THAN 2 IN ±1/8 IN 2 IN TO LESS THAN 3 FT ±1/4 IN 3 FT AND GREATER ±3/8 IN	HOLTEC INTERNATIONAL HOLTEC CENTER 555 LINCOLN DRIVE WEST MARLTON, NJ 08053	GENERAL 125 TON HI-TRAC-125D TOP LID ASSEMBLY
1025 N/A		D 3768 10 7 1:16 G:\DRAWINGS\1025\3768



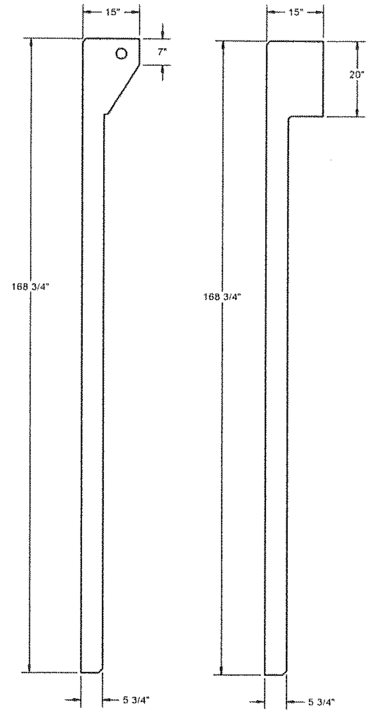
OPTIONAL WATER JACKET TOP PLATE

(SA 516 GR. 70)
(SEE NOTES 3 AND 4 THIS SHEET)



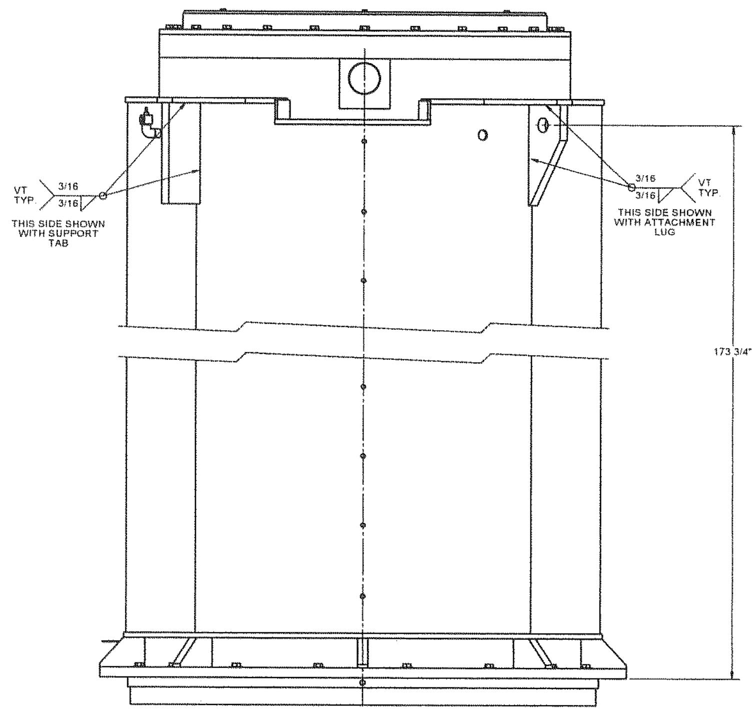
OPTIONAL WATER JACKET SHELL

(SA 515 GR. 70 OR SA 516 GR. 70)
(SEE NOTES 3 AND 4 THIS SHEET)



OPTIONAL ATTACHMENT LUG/SUPPORT TAB

(WITH OR WITHOUT ATTACHMENT HOLE)
(SA 516 GR. 70)
(SEE NOTES 1 AND 2 THIS SHEET)



WATERJACKET WELDMENT

NOTES:

1. OPTIONAL ATTACHMENT LUG/SUPPORT TAB REPLACES LONG RIB PLATE ON SHEET 6, (4) REQUIRED PER HI-TRAC ASSEMBLY.
2. WELDING INSTALLATION, INSPECTIONS AND PAINTING ARE IDENTICAL TO LONG RIB PLATE ON SHEET 6.
3. OPTIONAL WATER JACKET TOP PLATE AND WATER JACKET SHELL REPLACE LIKE ITEMS ON SHEETS 6 AND 9.
4. WELDING INSTALLATION, INSPECTIONS AND PAINTING ARE IDENTICAL TO CALL-OUTS ON SHEETS 6 AND 9.

TOLERANCES

INCHES [MILLIMETERS]		ANGULAR
.X ± .2	[5.0]	±2°
.XX ± .1	[2.54]	
.XXX ± .02	[.50]	

FRACTIONAL

0 TO LESS THAN 2 IN	±1/8 IN
2 IN. TO LESS THAN 3 FT	±1/4 IN
3 FT. AND GREATER	±3/8 IN

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON NJ 08053

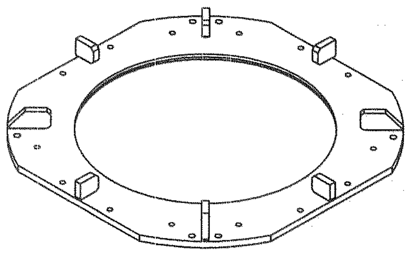
CLIENT: GENERAL

DESCRIPTION: HI-TRAC-125D OPTIONAL RADIAL RIB DESIGN

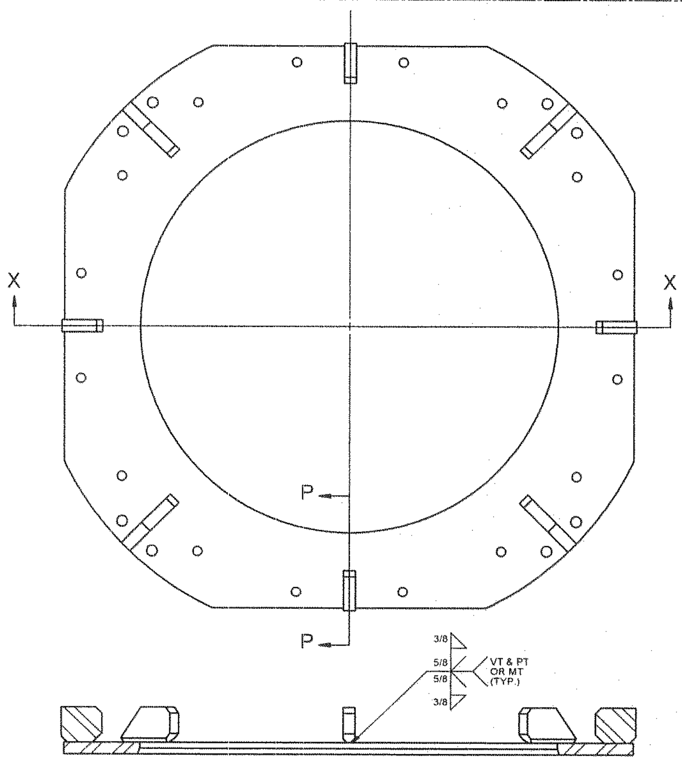
PROJECT NO. 1025
N/A

SIZE: D | DRAWING NO. 3768 | SHEET 11 | REV. 7

SCALE 1:16 | FILE PATH G:\DRAWINGS\1025\3768

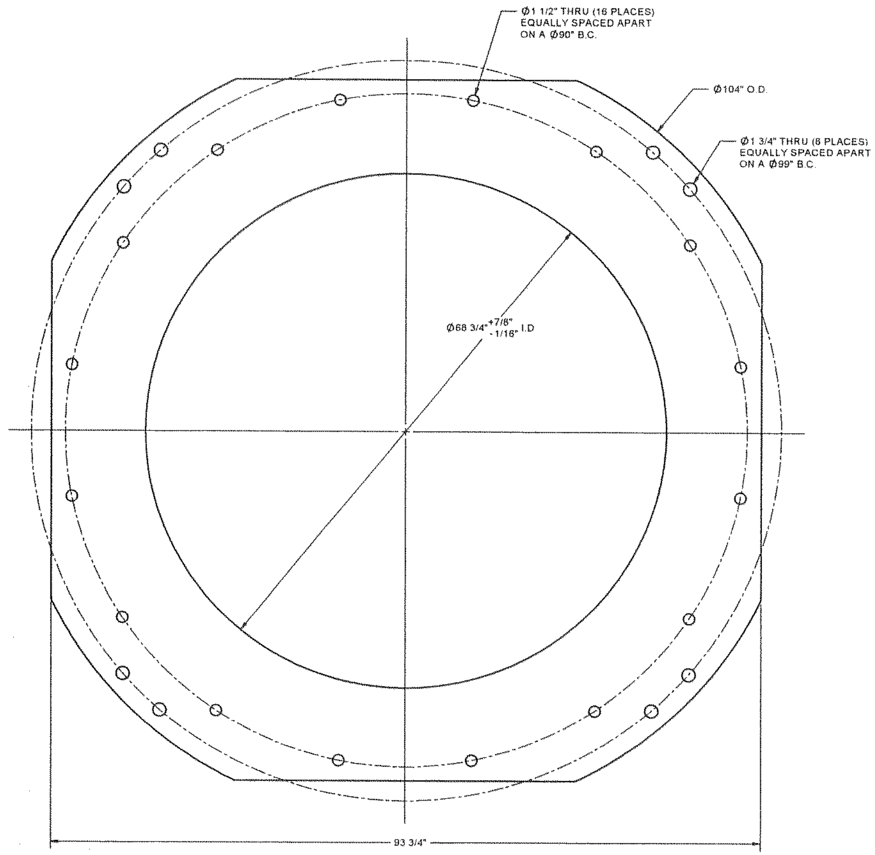


ISOMETRIC ASSEMBLY VIEW

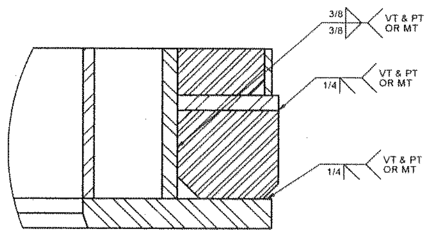


SECTION X-X
SCALE 1 : 10

BASE PLATE WELDMENT



BOTTOM FLANGE



SECTION P-P
SCALE 1 : 4

TOLERANCES INCHES [MILLIMETERS] ANGULAR X ± .2 [5.0] ±2° XX ± .1 [2.54] XXX ± .02 [.50] FRACTIONAL 0 TO LESS THAN 2 IN ±1/8 IN 2 IN TO LESS THAN 3 FT ±1/4 IN 3 FT AND GREATER ±3/8 IN	HOLTEC INTERNATIONAL HOLTEC CENTER 555 LINCOLN DRIVE WEST MARLTON, NJ 08053	GENERAL
		125 TON HI-TRAC-125D BASE PLATE ASSEMBLY
1025		D | 3768 | 12 | 7
N/A		1:1 | G:\DRAWINGS\1025\3768

CLIENT GENERAL

PROJECT NO. 1024 | P.O. NO. N/A

DRAWING PACKAGE I.D. 4116 | TOTAL SHEETS 13

LICENSING DRAWING PACKAGE COVER SHEET

LICENSING DRAWING PACKAGE CONTENTS:

SHEET	DESCRIPTION
1	COVER SHEET
2	ASSEMBLY DRAWING
3	ASSEMBLY
4	BASE INLET ASSEMBLY
5	BASE INLET DETAILS
6	CASK BODY ASSEMBLY
7	CASK BODY DETAILS
8	CLOSURE LID ASSEMBLY
9	CLOSURE LID DETAILS
10	BASE INLET WELDS
11	CASK BODY WELDS
12	CLOSURE LID WELDS
13	GAMMA SHIELD SHIELD INLET & OUTLET ASSEMBLIES

REVISION LOG

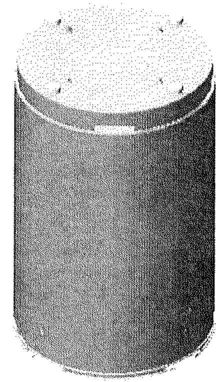
IT IS MANDATORY AT EACH REVISION TO COMPLETE THE REVIEW & APPROVAL LOG STORED IN HOLTEC'S DIRECTORY N:\PDOXWIN\WORKING\DBAL BY ALL RELEVANT TECHNICAL DISCIPLINES, PM AND QA PERSONNEL. EACH ATTACHED DRAWING SHEET CONTAINS ANNOTATED TRIANGLES INDICATING THE REVISION TO THE DRAWING.

REV	AFFECTED DRAWING SHEET NUMBERS	SUMMARY OF CHANGES/ AFFECTED ECOs	PREPARED BY	APPROVAL DATE	VIR# †
12	SHEET 9	1024-119 REV. 0	D.C.B.	04/04/06	60064
13	SHEETS 2, 4, 8, & 9	1024-121, REV. 0, 1024-123, REV. 0	S.L.C	08/15/06	44522
14	SHEETS 2, 9, & 11	1024-126, REV. 0	MAP	08/16/06	30492
15	SHEETS 7,8,9	1024-131, REV. 0	LDV	1/9/07	84320
16	SHEETS 1,8	1024-134, REV. 0	AG	03/19/07	57608
17	SHEET 11	1024-135, REV. 1	SLC	05/17/07	89982
18	SHEETS 1, 3, 6 & 7	1024-141 REV. 0	D.C.B.	01/29/08	31729

† THE VALIDATION IDENTIFICATION RECORD (VIR) NUMBER IS A COMPUTER GENERATED RANDOM NUMBER WHICH CONFIRMS THAT ALL APPROPRIATE REVIEWS OF THIS DRAWING ARE DOCUMENTED IN COMPANY'S NETWORK.

NOTES:

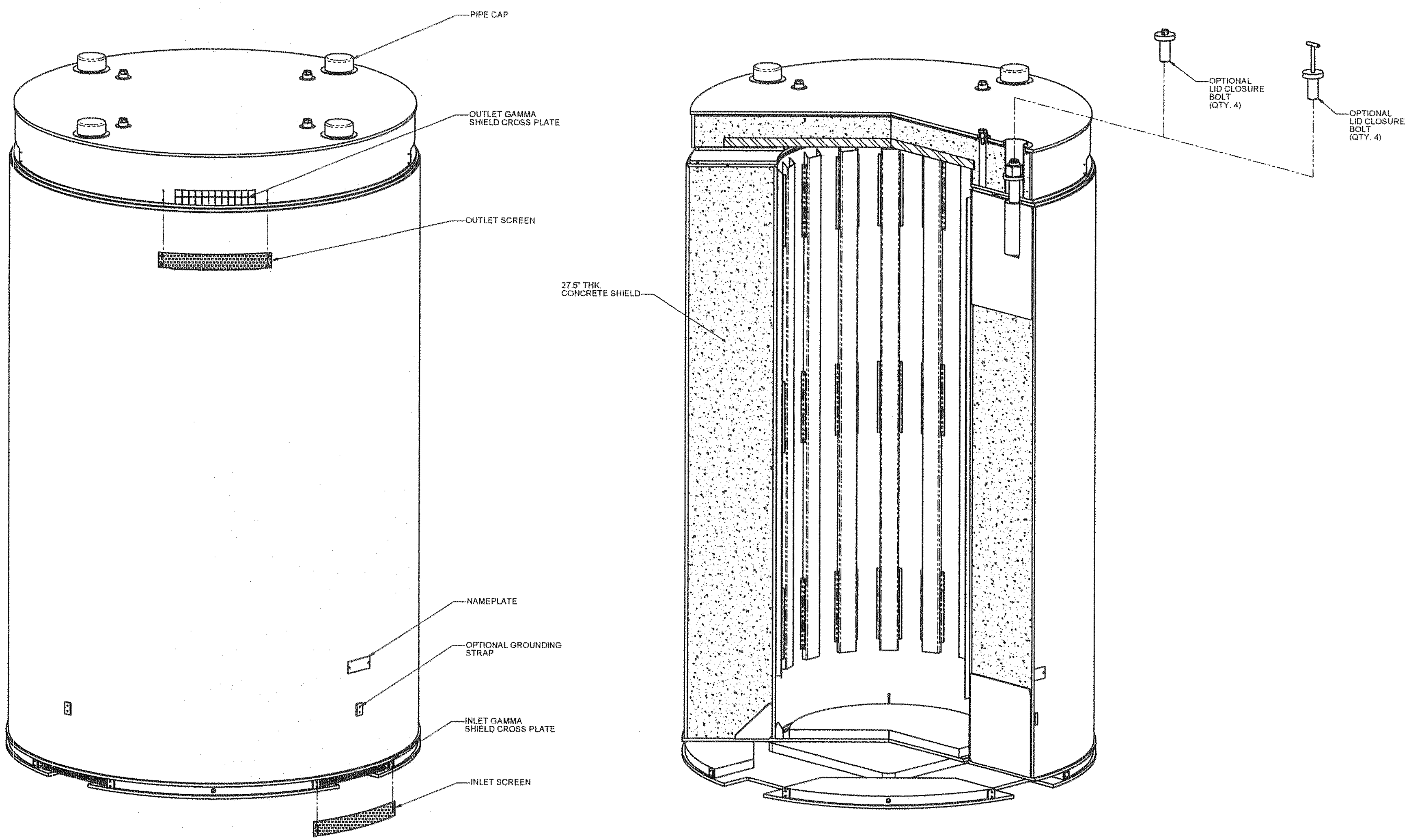
1. THE EQUIPMENT DOCUMENTED IN THIS DRAWING PACKAGE HAS BEEN CONFIRMED BY HOLTEC INTERNATIONAL TO COMPLY WITH THE SAFETY ANALYSES DESCRIBED IN THE HI-STORM FSAR.
2. DIMENSIONAL TOLERANCES ON THIS DRAWING ARE PROVIDED SOLELY FOR LICENSING PURPOSES TO DEFINE REASONABLE LIMITS ON THE NOMINAL DIMENSIONS USED IN LICENSING WORK. HARDWARE IS FABRICATED IN ACCORDANCE WITH THE FABRICATION DRAWINGS, WHICH HAVE MORE RESTRICTIVE TOLERANCES, TO ENSURE COMPONENT FIT-UP. DO NOT USE WORST-CASE TOLERANCE STACK-UP FROM THIS DRAWING TO DETERMINE COMPONENT FIT-UP.
3. THE REVISION LEVEL OF EACH INDIVIDUAL SHEET IN THE PACKAGE IS THE SAME AS THE REVISION LEVEL OF THIS COVER SHEET. A REVISION TO ANY SHEET(S) IN THIS PACKAGE REQUIRES UPDATING OF REVISION NUMBERS OF ALL SHEETS TO THE NEXT REVISION NUMBER.
4. APPLICABLE CODES AND STANDARDS ARE DELINEATED IN SECTION 2.2.4 OF THE FSAR.
5. ALL WELDS REQUIRE VISUAL EXAMINATION. ADDITIONAL NDE INSPECTIONS ARE NOTED ON THE DRAWING IF REQUIRED. NDE TECHNIQUES AND ACCEPTANCE CRITERIA ARE PROVIDED IN TABLE 9.1.4 OF THE FSAR.
6. UNLESS OTHEWISE NOTED, FULL PENETRATION WELDS MAY BE MADE FROM EITHER SIDE OF A COMPONENT.
7. THIS COMPONENT IS IMPORTANT-TO-SAFETY, CATEGORY B, BASED ON THE HIGHEST CLASSIFICATION OF ANY SUBCOMPONENT. SUBCOMPONENT CLASSIFICATIONS ARE PROVIDED ON THE FABRICATION DRAWING.
8. ALL WELD SIZES ARE MINIMUMS EXCEPT AS ALLOWED BY APPLICABLE CODES AS CLARIFIED IN THE FSAR. FABRICATORS MAY ADD WELDS WITH HOLTEC APPROVAL.
9. WELDS IDENTIFIED WITH AN # ARE CONSIDERED NON-NF WELDS. WELDS MAY BE MADE USING PREQUALIFIED WELDS IN ACCORDANCE WITH AWS D1.1 OR PER ASME SECTION IX.
10. THE 3/8" FILLET OR GROOVE WELD MAY BE APPLIED TO THE OUTER OR INNER DIAMETERS OF THE OUTER SHELL. THE WELD MAY BE APPLIED ALTERNATELY BETWEEN THE INNER & OUTER DIAMETER PROVIDED THERE IS AN OVERLAP OF THE INNER AND OUTER WELD.
11. 18 THE HI-STORM 100S VERSION B TYPE 185 IS ONLY APPROVED FOR STORAGE OF INDIAN POINT UNIT 1 FUEL.



HI-STORM 100S VERSION B
ISOMETRIC VIEW

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

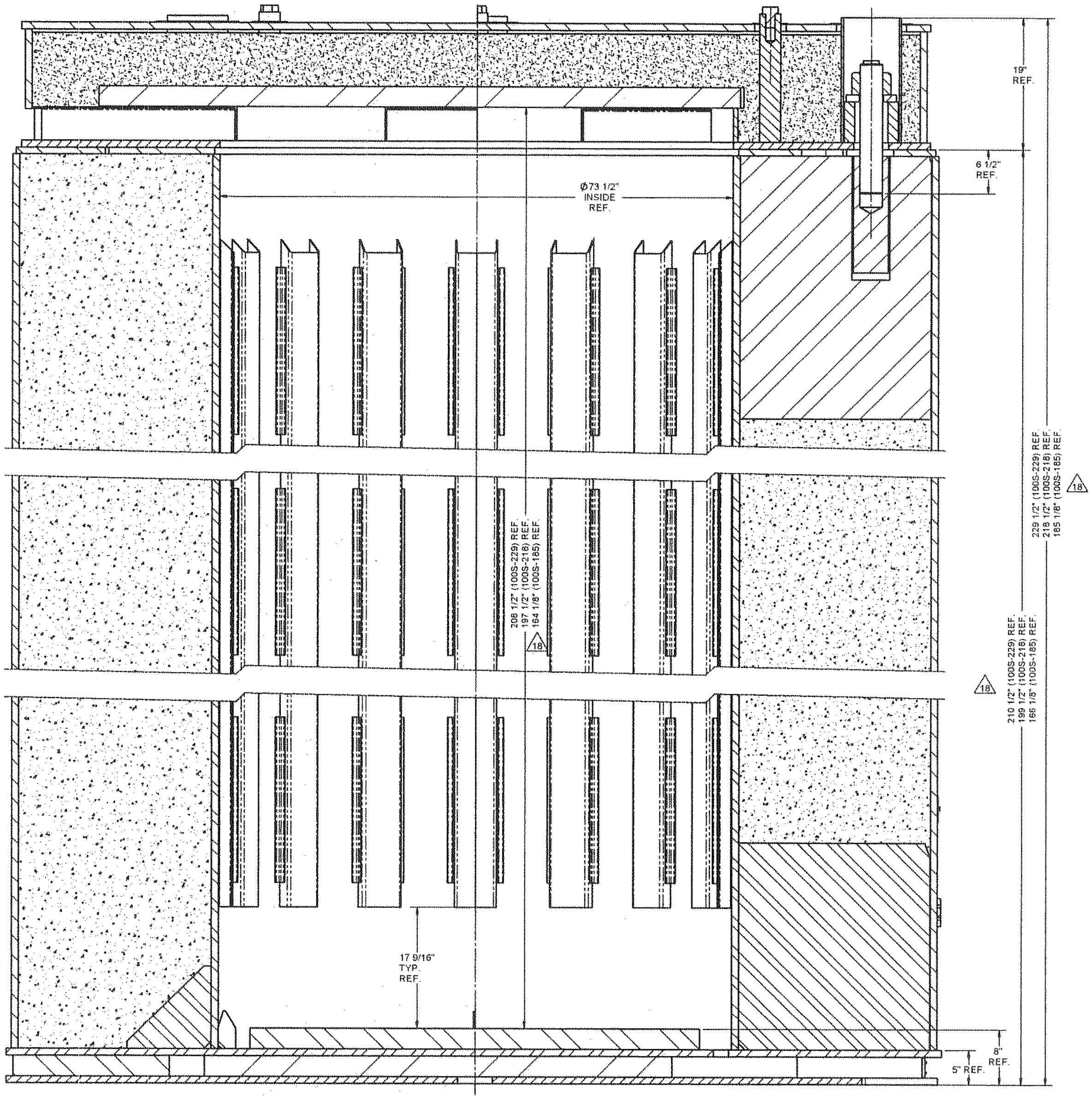
CLIENT	GENERAL
DESCRIPTION	HI-STORM 100S VERSION B COVER SHEET
PROJECT NO.	1024
P.O. NO.	N/A
DRAWING NO.	4116
SHEET	1
TOTAL SHEETS	13
FILE NAME	N:\DRAWINGS\1024\4116



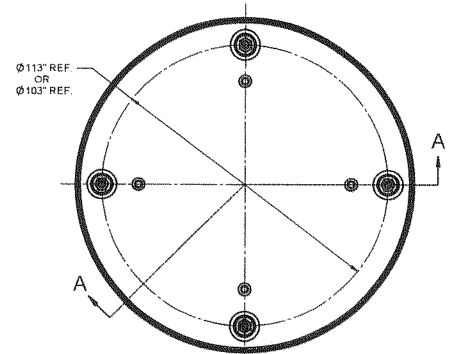
NOTES:

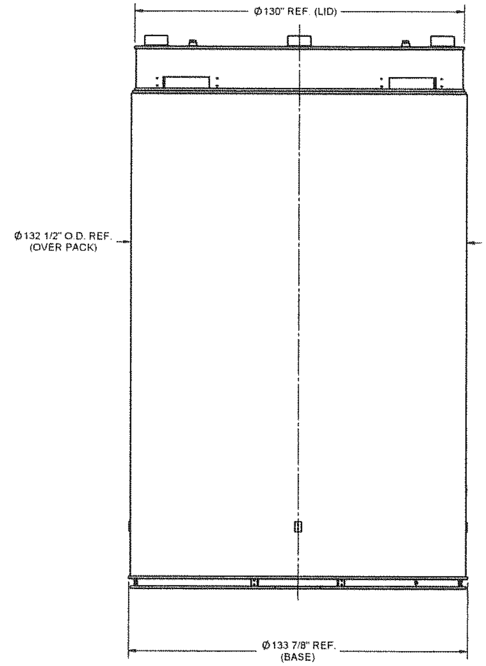
1. MULTIPLE HOLES MAY BE DRILLED AND TAPPED INTO THE HI-STORM BODY / LID FOR THE PURPOSE OF ATTACHING TEMPERATURE MONITERING EQUIPMENT. HOLES SHALL BE 3/8" DIAMETER (MAX.) X 5/8" (MAX.) DEPTH. AFTER INSTALLATION OF THE TEMPERATURE MONITORING EQUIPMENT HOLES SHALL BE PLUGGED.

HOLTEC INTERNATIONAL HOLTEC CENTER 555 LINCOLN DRIVE WEST MARLTON, NJ 08053	GENERAL
	HI-STORM 100S VERSION B ASSEMBLY
1024	D · 4116 · SHEET 2 · REV 18
N/A	SCALE NONE

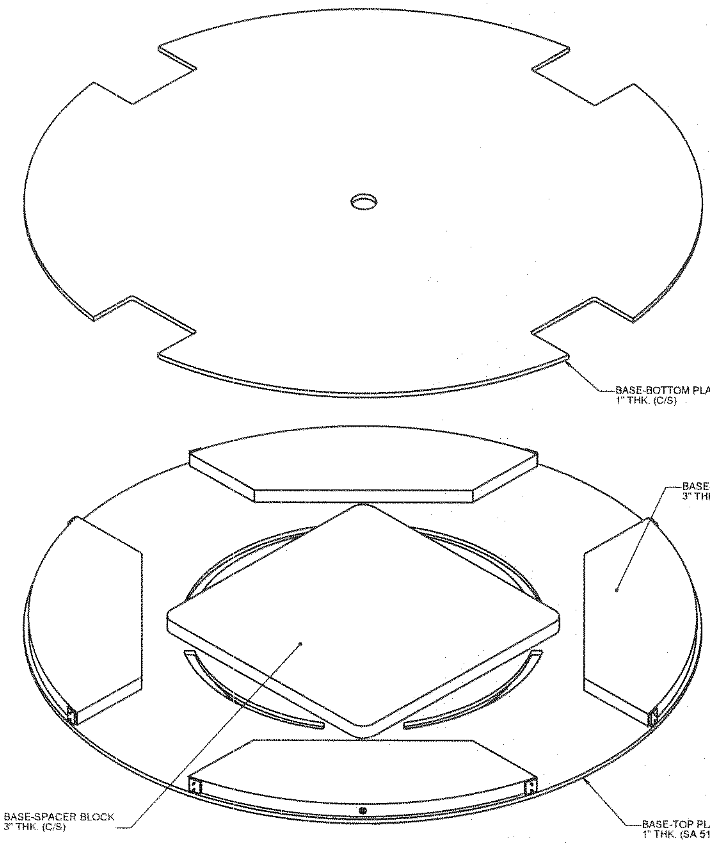


SECTION A-A
SCALE 1 : 8

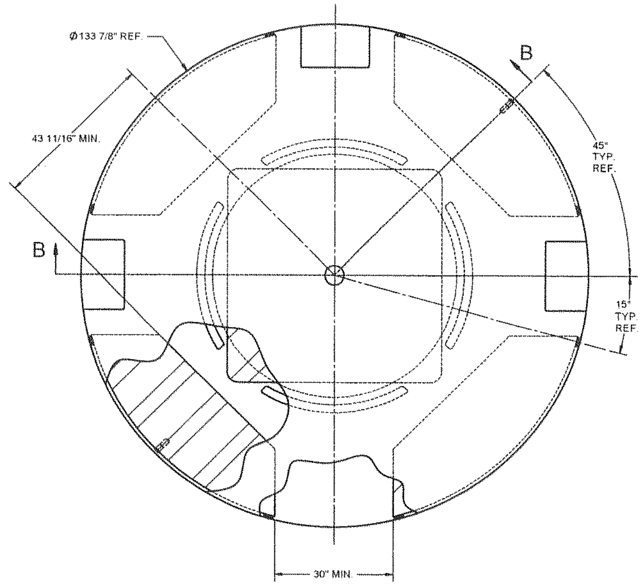




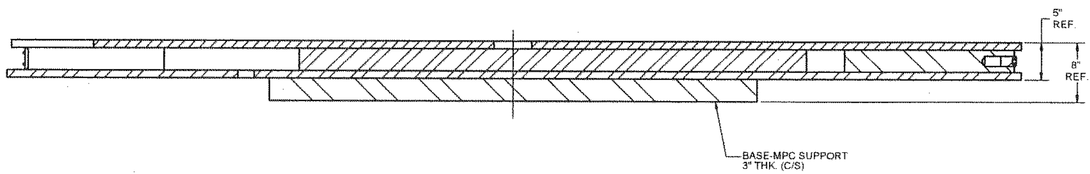
HOLTEC INTERNATIONAL HOLTEC CENTER 555 LINCOLN DRIVE WEST MARLTON, NJ 08053	GENERAL
	HI-STORM 100S VERSION B ASSEMBLY
1024	SIZE: D · DRAWING NO.: 4116 · SHEET: 3 · REV: 18
N/A	SCALE: NONE



EXPLODED ASSEMBLY VIEW
(SHOWN UPSIDE DOWN)

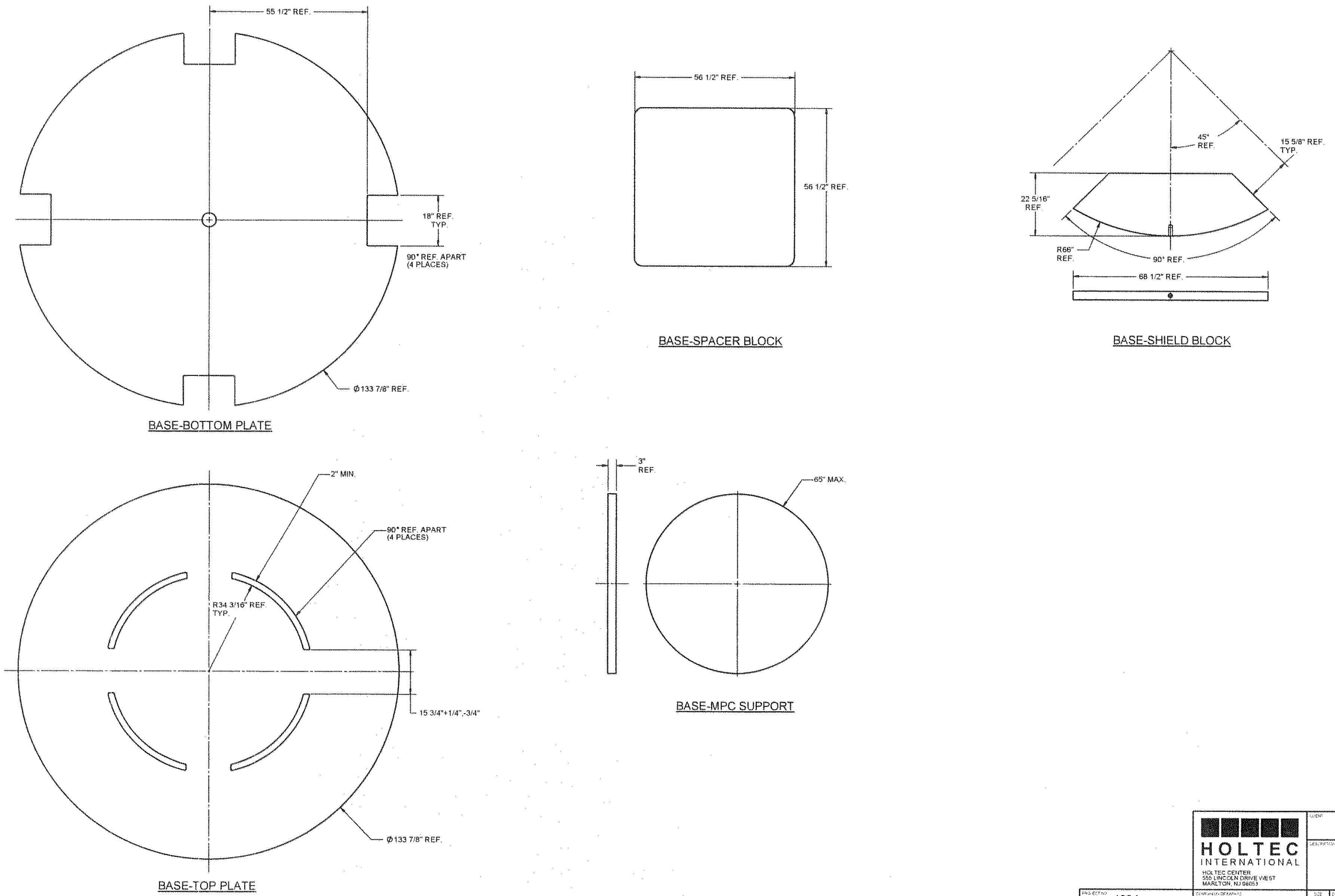


BOTTOM VIEW



SECTION B-B
SCALE 1 : 8

PROJECT NO. 1024		HOLTEC INTERNATIONAL HOLTEC CENTER 555 LINCOLN DRIVE WEST MARLTON, NJ 08053	CLIENT: GENERAL
N/A		COMPANION DRAWINGS: -	DESCRIPTION: HI-STORM 100S VER. B BASE INLET ASSEMBLY
SIZE: D	DRAWING NO. 4116	SHEET 4	REV. 18
SCALE: NONE			

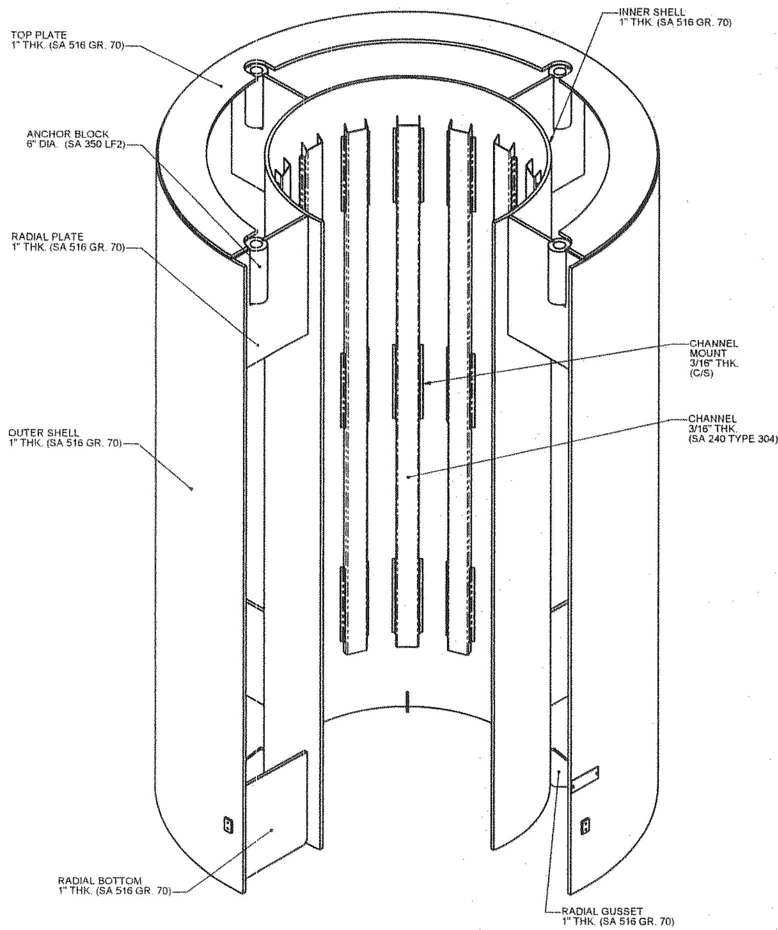


HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

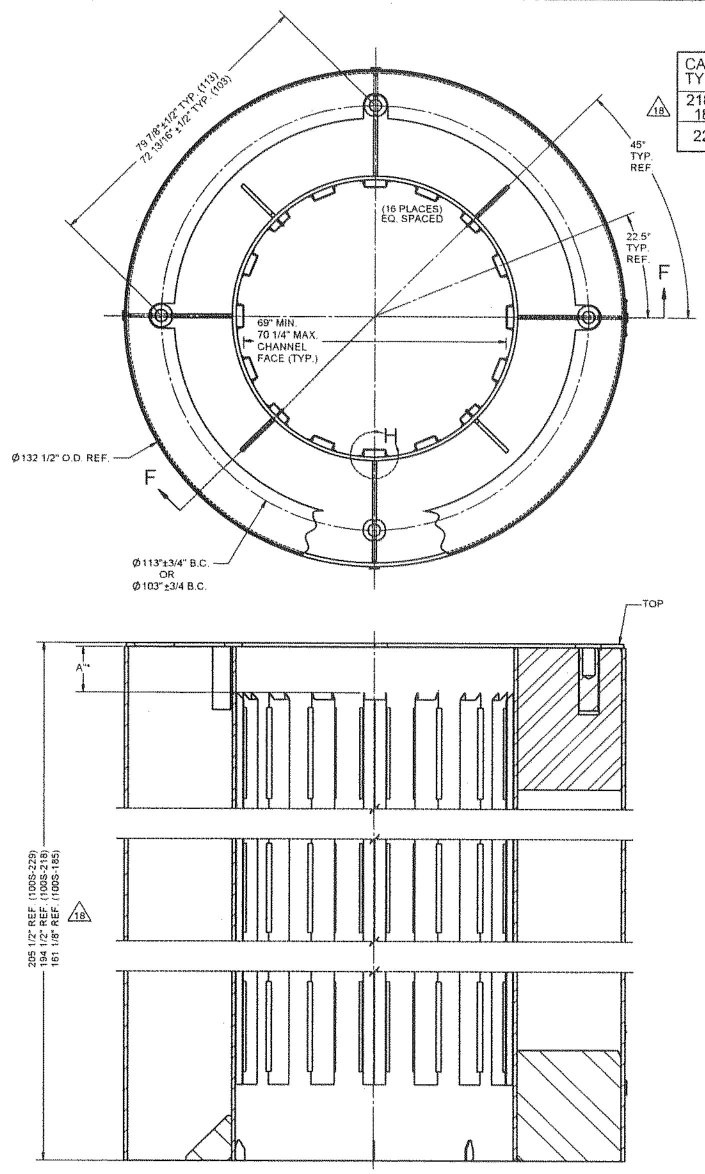
GENERAL

HI-STORM 100S VER. B
BASE INLET
DETAILS

PROJECT NO.	1024
	N/A
SIZE	D
DRAWING NO.	4116
SHEET	5
REV	18
SCALE	NONE

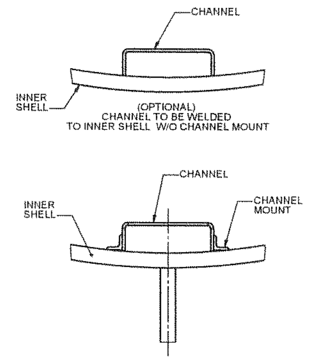


ISOMETRIC SECTION VIEW



SECTION F-F

CASK TYPE	DIMENSION A
218 & 185	1 7/16"±1/4"
229	12 7/16"±1/4"



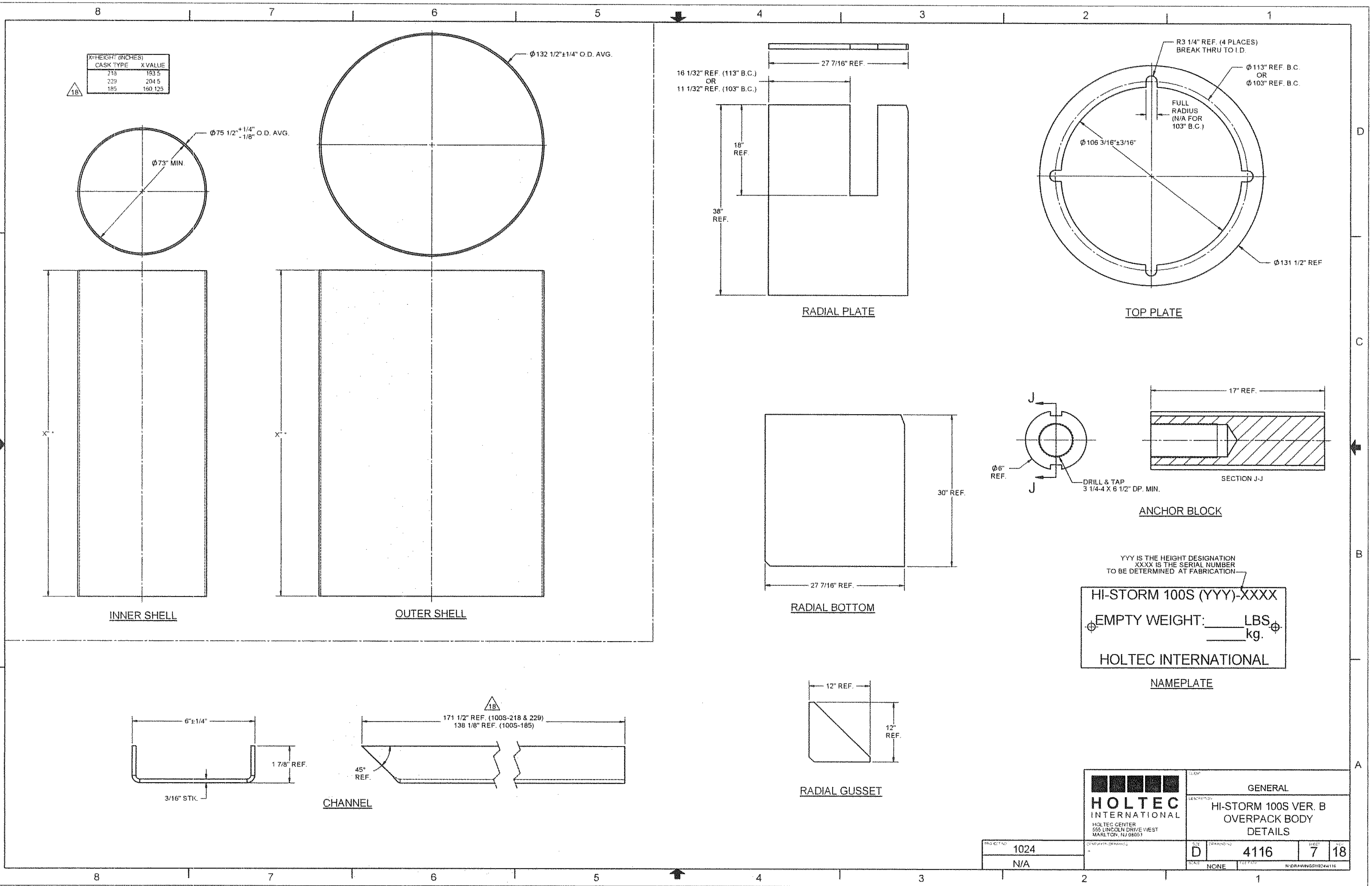
DETAIL H

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

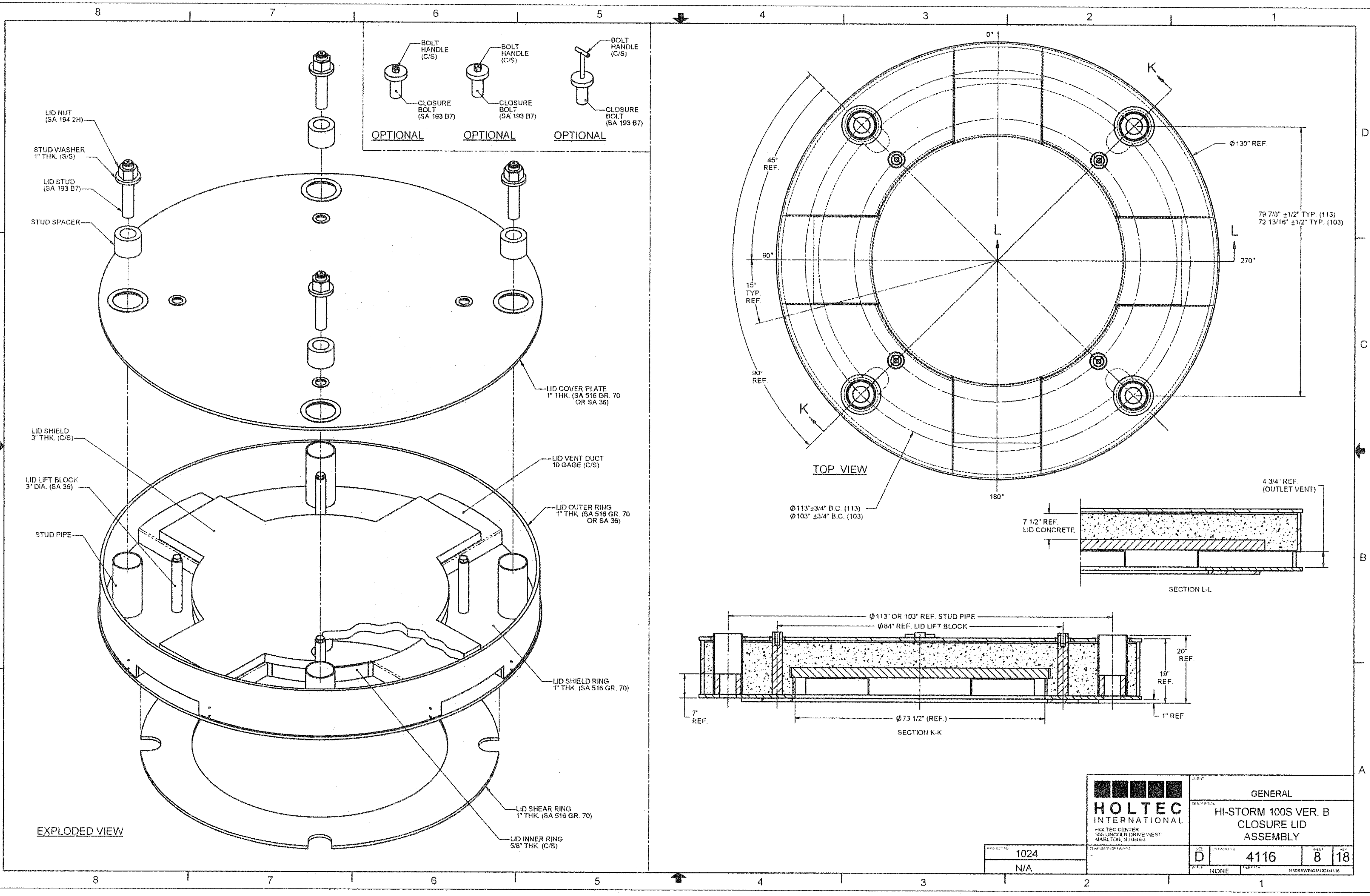
GENERAL

HI-STORM 100S VER. B
CASK BODY
ASSEMBLY

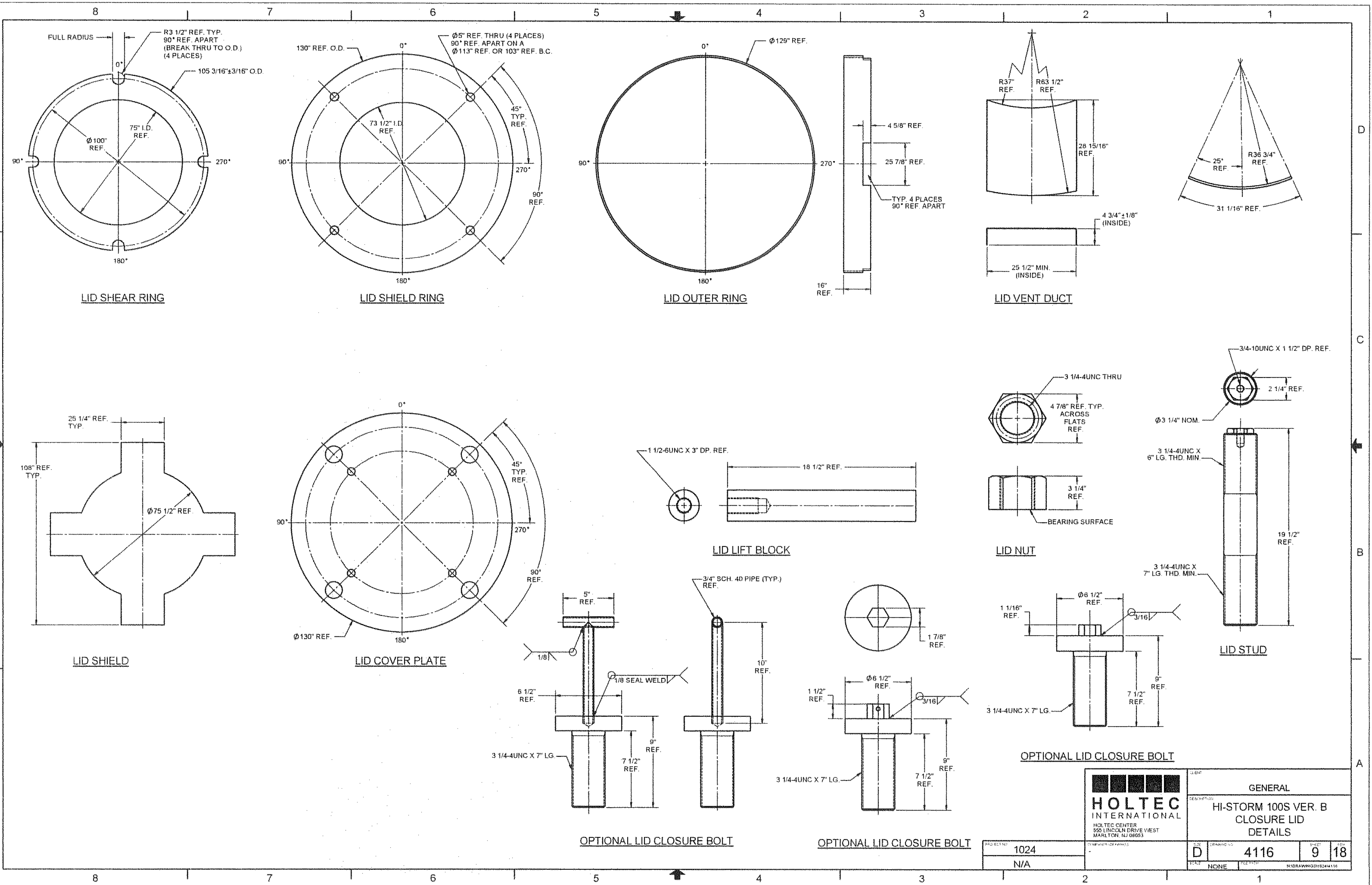
PROJECT NO. 1024
N/A
SIZE D
DRAWING NO. 4116
SHEET 6
REV 18
SCALE NONE



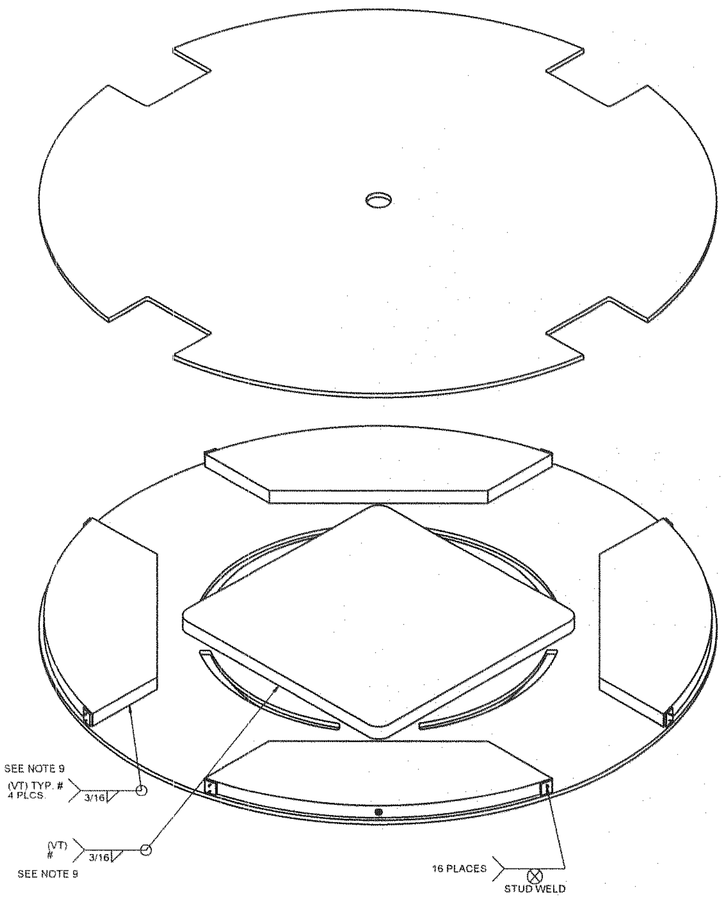
X=HEIGHT (INCHES)
CASK TYPE X VALUE
218 193.5
229 204.5
185 160.125
18
Ø75 1/2" +1/4" -1/8" O.D. AVG.
Ø73" MIN.
Ø132 1/2"±1/4" O.D. AVG.
X" "
INNER SHELL
OUTER SHELL
27 7/16" REF.
16 1/32" REF. (113" B.C.)
OR
11 1/32" REF. (103" B.C.)
18" REF.
38" REF.
RADIAL PLATE
R3 1/4" REF. (4 PLACES)
BREAK THRU TO I.D.
Ø113" REF. B.C.
OR
Ø103" REF. B.C.
FULL RADIUS
(N/A FOR 103" B.C.)
Ø106 3/16"±3/16"
Ø131 1/2" REF
TOP PLATE
30" REF.
27 7/16" REF.
RADIAL BOTTOM
J
Ø6" REF.
DRILL & TAP
3 1/4-4 X 6 1/2" DP. MIN.
17" REF.
SECTION J-J
ANCHOR BLOCK
YYY IS THE HEIGHT DESIGNATION
XXXX IS THE SERIAL NUMBER
TO BE DETERMINED AT FABRICATION
HI-STORM 100S (YYY)-XXXX
EMPTY WEIGHT:_____LBS.
_____kg.
HOLTEC INTERNATIONAL
NAMEPLATE
12" REF.
12" REF.
RADIAL GUSSET
6"±1/4"
1 7/8" REF.
3/16" STK.
18
171 1/2" REF. (100S-218 & 229)
138 1/8" REF. (100S-185)
45° REF.
CHANNEL
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053
GENERAL
HI-STORM 100S VER. B
OVERPACK BODY
DETAILS
1024
N/A
D
4116
7
18
NONE



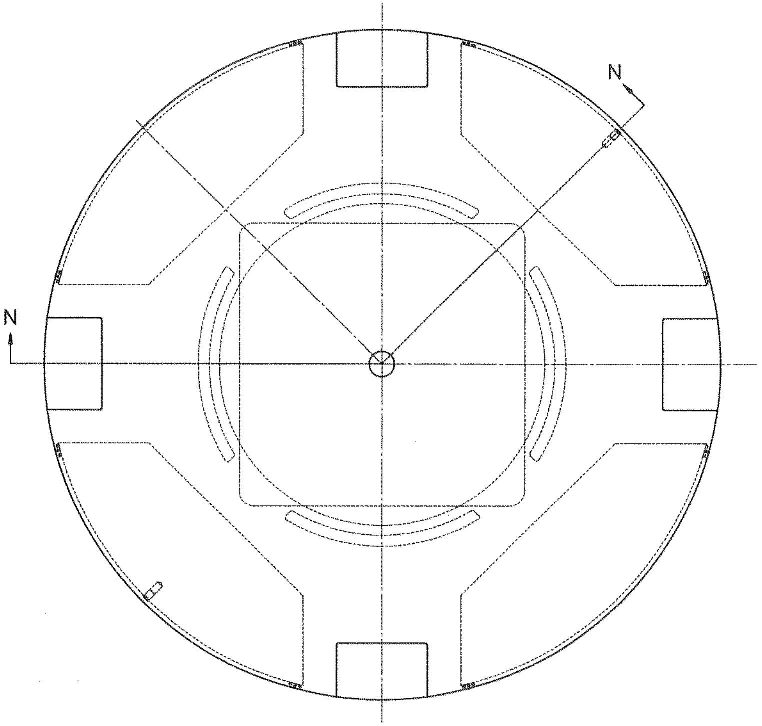
LID NUT (SA 194 2H)
STUD WASHER 1" THK. (S/S)
LID STUD (SA 193 B7)
STUD SPACER
BOLT HANDLE (C/S)
CLOSURE BOLT (SA 193 B7)
OPTIONAL
OPTIONAL
OPTIONAL
LID COVER PLATE 1" THK. (SA 516 GR. 70 OR SA 36)
LID SHIELD 3" THK. (C/S)
LID LIFT BLOCK 3" DIA. (SA 36)
STUD PIPE
LID VENT DUCT 10 GAGE (C/S)
LID OUTER RING 1" THK. (SA 516 GR. 70 OR SA 36)
LID SHIELD RING 1" THK. (SA 516 GR. 70)
LID SHEAR RING 1" THK. (SA 516 GR. 70)
LID INNER RING 5/8" THK. (C/S)
EXPLODED VIEW
0°
45° REF.
90°
15° TYP. REF.
90° REF.
270°
180°
K
L
Ø130" REF.
79 7/8" ±1/2" TYP. (113)
72 13/16" ±1/2" TYP. (103)
Ø113"±3/4" B.C. (113)
Ø103" ±3/4" B.C. (103)
TOP VIEW
4 3/4" REF. (OUTLET VENT)
7 1/2" REF. LID CONCRETE
SECTION L-L
Ø113" OR 103" REF. STUD PIPE
Ø84" REF. LID LIFT BLOCK
20" REF.
19" REF.
7" REF.
1" REF.
Ø73 1/2" (REF.)
SECTION K-K
HOLTEC INTERNATIONAL
HOLTEC CENTER 555 LINCOLN DRIVE WEST MARLTON, NJ 08053
GENERAL
HI-STORM 100S VER. B CLOSURE LID ASSEMBLY
1024
N/A
D
4116
8
18
NONE



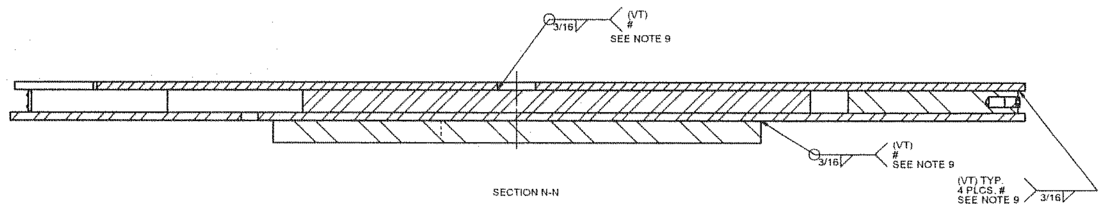
FULL RADIUS
R3 1/2" REF. TYP.
90° REF. APART
(BREAK THRU TO O.D.)
(4 PLACES)
105 3/16"±3/16" O.D.
75" I.D. REF.
Ø100" REF.
LID SHEAR RING
130" REF. O.D.
Ø5" REF. THRU (4 PLACES)
90° REF. APART ON A
Ø113" REF. OR 103" REF. B.C.
73 1/2" I.D. REF.
45° TYP. REF.
90° REF.
LID SHIELD RING
Ø129" REF.
4 5/8" REF.
25 7/8" REF.
TYP. 4 PLACES
90° REF. APART
16" REF.
LID OUTER RING
R37" REF.
R63 1/2" REF.
28 15/16" REF.
4 3/4"±1/8" (INSIDE)
25 1/2" MIN. (INSIDE)
LID VENT DUCT
25° REF.
R36 3/4" REF.
31 1/16" REF.
25 1/4" REF. TYP.
108" REF. TYP.
Ø75 1/2" REF
LID SHIELD
Ø130" REF.
45° TYP. REF.
90° REF.
LID COVER PLATE
1 1/2-6UNC X 3" DP. REF.
18 1/2" REF.
LID LIFT BLOCK
3 1/4-4UNC THRU
4 7/8" REF. TYP. ACROSS FLATS REF.
3 1/4" REF.
BEARING SURFACE
LID NUT
3/4-10UNC X 1 1/2" DP. REF.
2 1/4" REF.
Ø3 1/4" NOM.
3 1/4-4UNC X 6" LG. THD. MIN.
19 1/2" REF.
3 1/4-4UNC X 7" LG. THD. MIN.
LID STUD
5" REF.
1/8
1/8 SEAL WELD
6 1/2" REF.
9" REF.
7 1/2" REF.
3 1/4-4UNC X 7" LG.
3/4" SCH. 40 PIPE (TYP.) REF.
10" REF.
OPTIONAL LID CLOSURE BOLT
1 7/8" REF.
Ø6 1/2" REF.
1 1/2" REF.
3/16
3 1/4-4UNC X 7" LG.
OPTIONAL LID CLOSURE BOLT
1 1/16" REF.
Ø6 1/2" REF.
9" REF.
7 1/2" REF.
3 1/4-4UNC X 7" LG.
OPTIONAL LID CLOSURE BOLT
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053
GENERAL
HI-STORM 100S VER. B
CLOSURE LID
DETAILS
1024
N/A
D
4116
9
18
NONE



EXPLODED ASSEMBLY VIEW
(SHOWN UPSIDE DOWN)

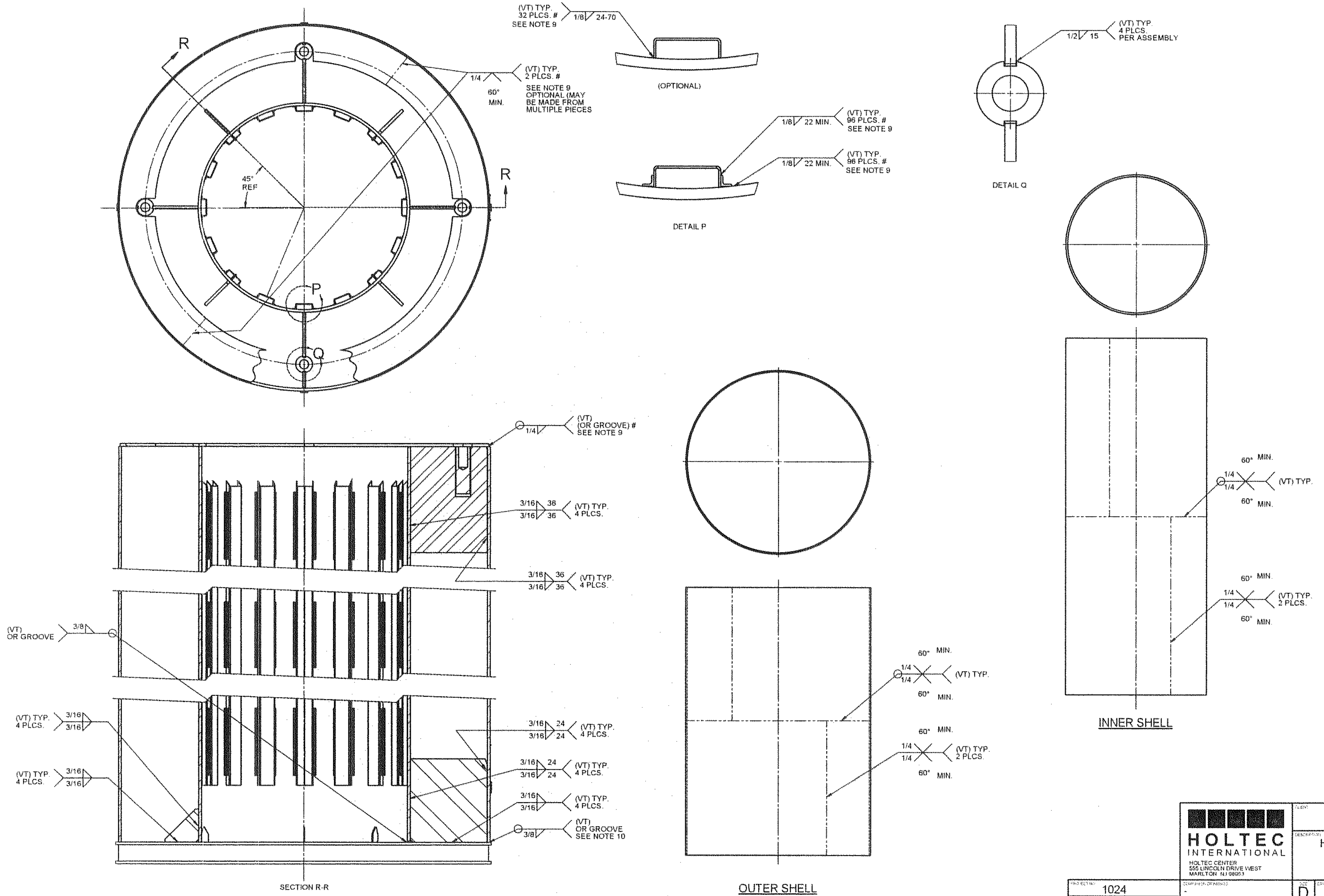


BOTTOM VIEW



SECTION N-N

HOLTEC INTERNATIONAL HOLTEC CENTER 555 LINCOLN DRIVE WEST MARLTON, NJ 08053	GENERAL			
	HI-STORM 100S VER. B BASE INLET WELDS			
PROJECT NO. 1024	D	4116	10	18
N/A	NONE	N:\DRAWINGS\1024\4116		



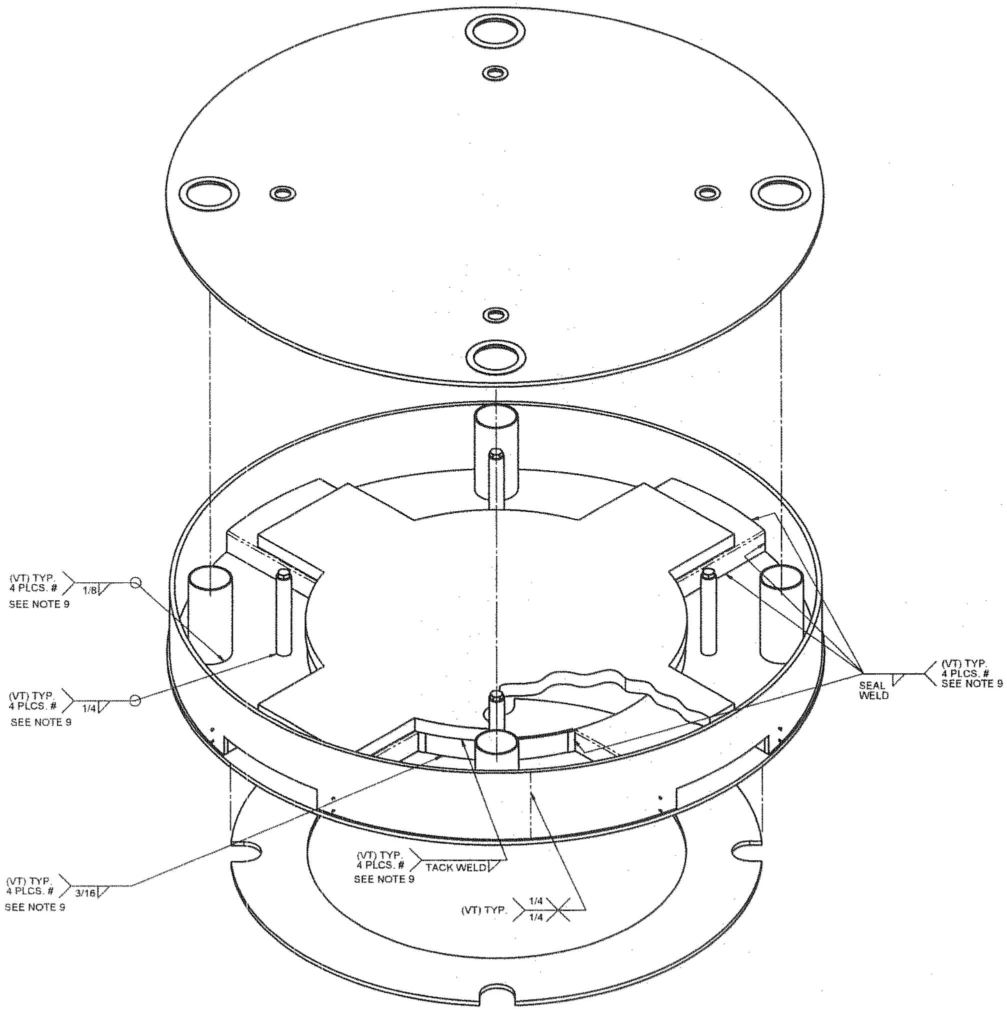
HOLTEC INTERNATIONAL

HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

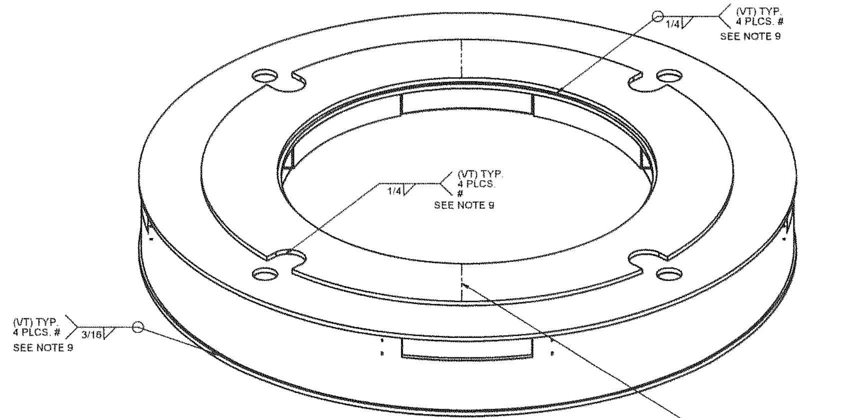
GENERAL

HI-STORM 100S VER. B
CASK BODY
WELDS

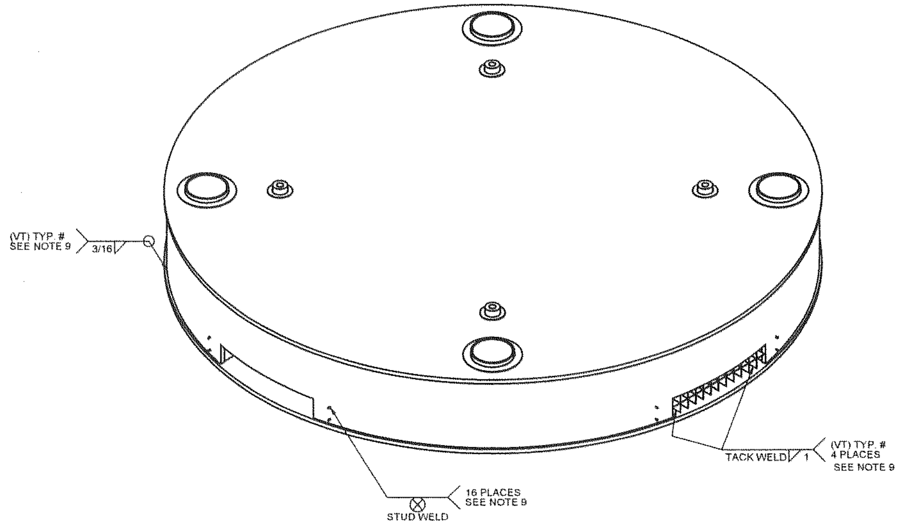
1024	-	D	4116	11	18
N/A		NONE			



EXPLODED VIEW



ISOMETRIC BOTTOM VIEW



ISOMETRIC ASSEMBLY VIEW

HOLTEC
INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

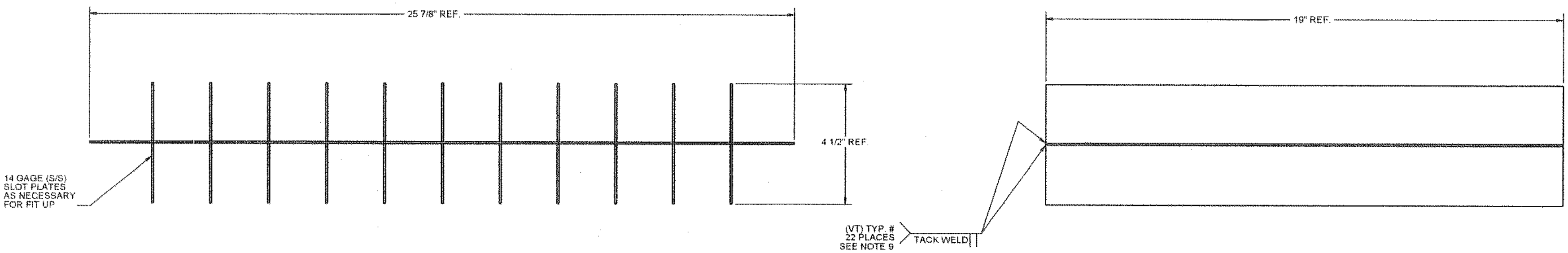
GENERAL

HI-STORM 100S VER. B
CLOSURE LID
WELDS

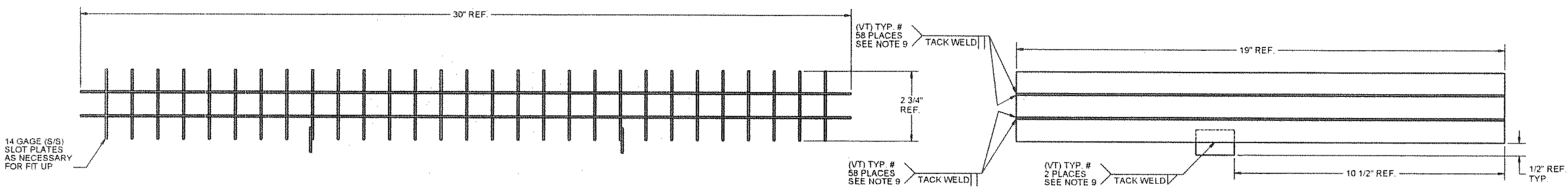
1024	
N/A	-

SIZE	DRAWING NO.	SHEET	REV
D	4116	12	18

SCALE NONE



OUTLET GAMMA SHIELD CROSS ASSEMBLY



INLET GAMMA SHIELD CROSS ASSEMBLY

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

GENERAL

HI-STORM 100S-VER. B
GAMMA CROSS SHIELD
INLET & OUTLET ASSEMBLIES

PROJECT NO. 1024		D	4116	13	18
N/A		NONE			

CLIENT	- GENERAL
PROJECT NO. 1026	P.O. NO. N/A
DRAWING PACKAGE I.D. 4128	TOTAL SHEETS 10

LICENSING DRAWING PACKAGE COVER SHEET

LICENSING DRAWING PACKAGE CONTENTS:

SHEET	DESCRIPTION
1	COVER SHEET
2	ASSEMBLY DRAWING AND BILL OF MATERIALS
3	OVERALL DIMENSIONS
4	POOL LID ASSEMBLY
5	BASE PLATE ASSEMBLY
6	OUTER SHELL ASSEMBLY
7	TOP FLANGE DETAILS
8	TRUNNION AND INNER SHELL ASSEMBLY
9	WATER JACKET SHELL ASSEMBLY
10	TOP LID ASSEMBLY

REVISION LOG

REV	AFFECTED DRAWING SHEET NUMBERS	SUMMARY OF CHANGES/ AFFECTED ECOs	PREPARED BY	APPROVAL DATE	VIR# †
0	INITIAL ISSUE	1026-30	S.CAIN	8/25/03	82748
1	ALL SHEETS	1026-31	T.F.O.	10/27/03	70107
2	SHEET 4	1026-32	LEH	12/17/03	86122
3	SHEET 5 & 8	1026-33	T.F.O.	3/23/04	30678
4	SHEET 6	1026-40	JJB	12/30/05	62382
5	SHEET 4	1026-41	SLC	2/15/06	61656

† THE VALIDATION IDENTIFICATION RECORD (VIR) NUMBER IS A COMPUTER GENERATED RANDOM NUMBER WHICH CONFIRMS THAT ALL APPROPRIATE REVIEWS OF THIS DRAWING ARE DOCUMENTED IN COMPANY'S NETWORK.

NOTES:

1. THE EQUIPMENT DOCUMENTED IN THIS DRAWING PACKAGE HAS BEEN CONFIRMED BY HOLTEC INTERNATIONAL TO COMPLY WITH THE SAFETY ANALYSES DESCRIBED IN THE HI-STORM FSAR.
2. DIMENSIONAL TOLERANCES ON THIS DRAWING ARE PROVIDED SOLELY FOR LICENSING PURPOSES TO DEFINE REASONABLE LIMITS ON THE NOMINAL DIMENSIONS USED IN LICENSING WORK. HARDWARE IS FABRICATED IN ACCORDANCE WITH THE DESIGN DRAWINGS, WHICH HAVE MORE RESTRICTIVE TOLERANCES, TO ENSURE COMPONENT FIT-UP. DO NOT USE WORST-CASE TOLERANCE STACK-UP FROM THIS DRAWING TO DETERMINE COMPONENT FIT-UP.
3. THE REVISION LEVEL OF EACH INDIVIDUAL SHEET IN THE PACKAGE IS THE SAME AS THE REVISION LEVEL OF THIS COVER SHEET. A REVISION TO ANY SHEET(S) IN THIS PACKAGE REQUIRES UPDATING OF REVISION NUMBERS OF ALL SHEETS TO THE NEXT REVISION NUMBER.
4. APPLICABLE CODES AND STANDARDS ARE DELINEATED IN FSAR SECTION 2.2.4.
5. ALL WELDS REQUIRE VISUAL EXAMINATION. ADDITIONAL NDE INSPECTIONS ARE NOTED ON THE DRAWING. NDE TECHNIQUES AND ACCEPTANCE CRITERIA ARE PROVIDED IN FSAR TABLE 9.1.4.
6. UNLESS OTHEWISE NOTED, FULL PENETRATION WELDS MAY BE MADE FROM EITHER SIDE OF A COMPONENT.
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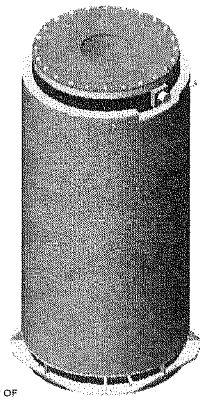
8. ALL WELD SIZES ARE MINIMUMS EXCEPT AS ALLOWED BY APPLICABLE CODES AS CLARIFIED IN THE FSAR. FABRICATOR MAY ADD WELDS WITH HOLTEC APPROVAL.



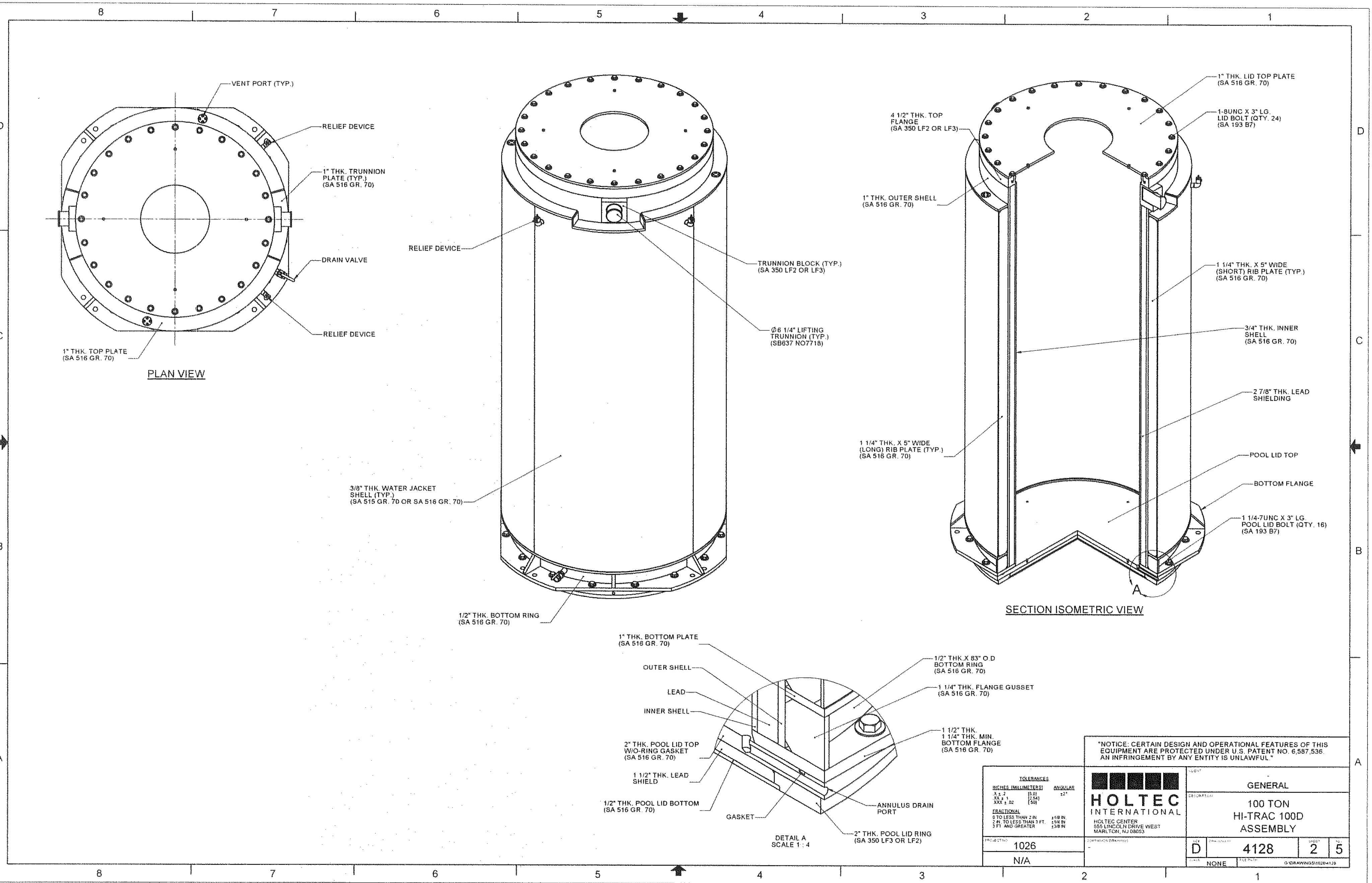
ISOMETRIC VIEW OF HI-TRAC 100D TRANSFER CASK

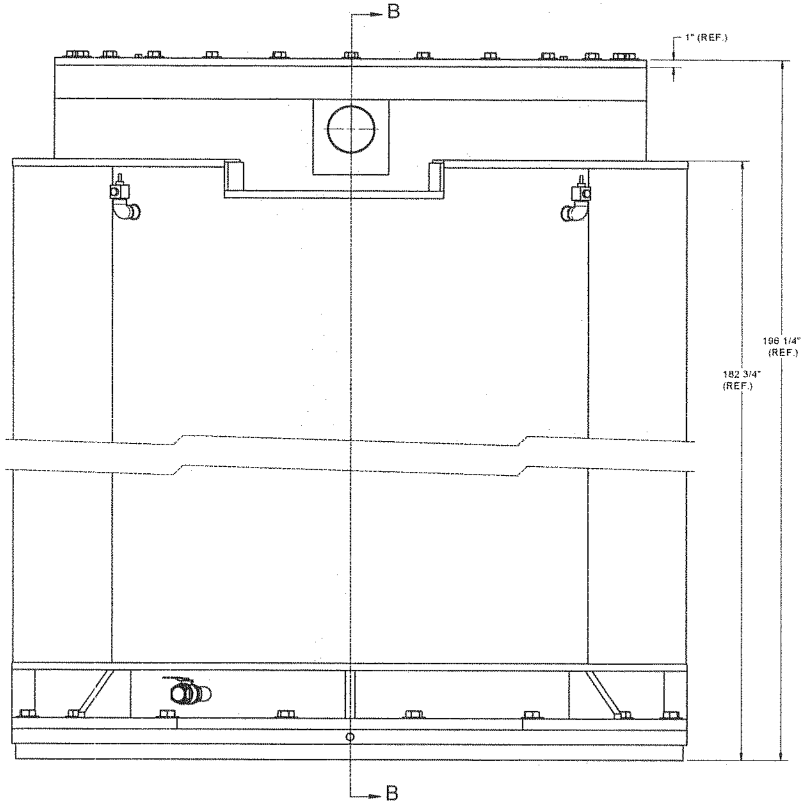
"NOTICE: CERTAIN DESIGN AND OPERATIONAL FEATURES OF THIS EQUIPMENT ARE PROTECTED UNDER U.S. PATENT NO. 6,587,536. AN INFRINGEMENT BY ANY ENTITY IS UNLAWFUL."

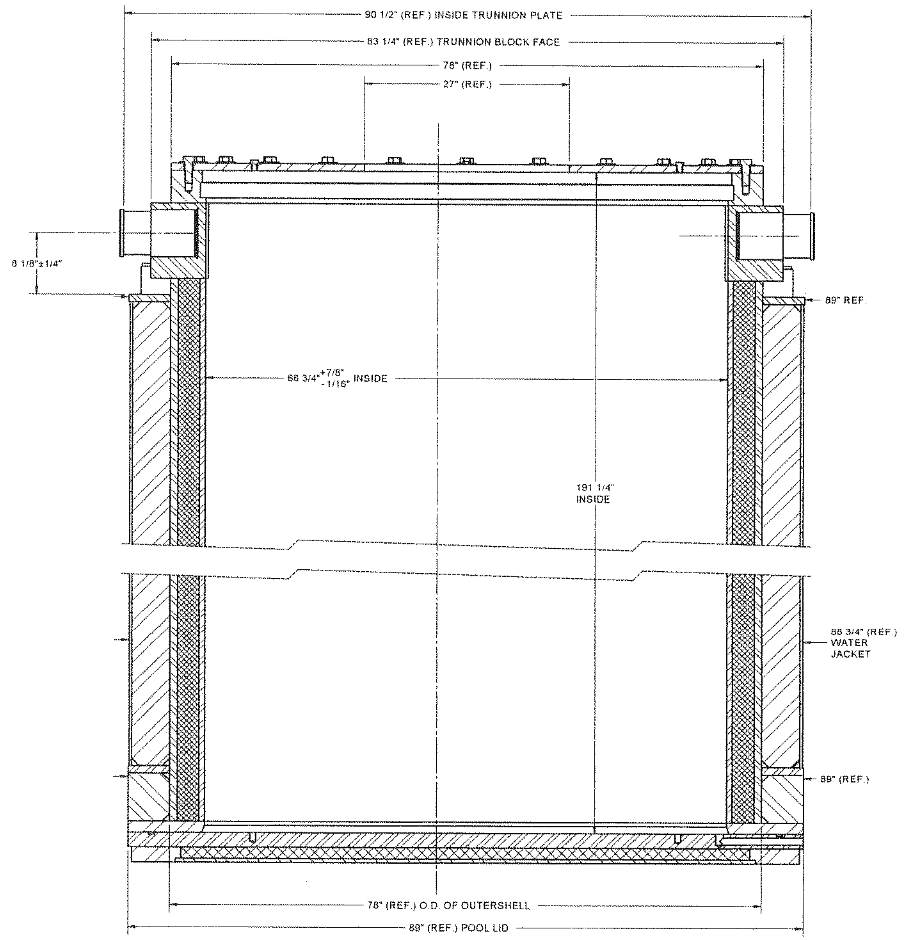
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

CLIENT	- GENERAL
DESCRIPTION	100 TON HI-TRAC 100D ASSEMBLY
PROJECT NO. 1026	DRAWING NO. 4128
P.O. NO. N/A	SHEET 1 / TOTAL SHEETS 10

G:\DRAWINGS\1026\4128


VENT PORT (TYP.)
RELIEF DEVICE
1" THK. TRUNNION PLATE (TYP.) (SA 516 GR. 70)
DRAIN VALVE
RELIEF DEVICE
1" THK. TOP PLATE (SA 516 GR. 70)
PLAN VIEW
RELIEF DEVICE
TRUNNION BLOCK (TYP.) (SA 350 LF2 OR LF3)
Ø6 1/4" LIFTING TRUNNION (TYP.) (SB637 NO7718)
3/8" THK. WATER JACKET SHELL (TYP.) (SA 515 GR. 70 OR SA 516 GR. 70)
1/2" THK. BOTTOM RING (SA 516 GR. 70)
4 1/2" THK. TOP FLANGE (SA 350 LF2 OR LF3)
1" THK. OUTER SHELL (SA 516 GR. 70)
1" THK. LID TOP PLATE (SA 516 GR. 70)
1-8UNC X 3" LG. LID BOLT (QTY. 24) (SA 193 B7)
1 1/4" THK. X 5" WIDE (SHORT) RIB PLATE (TYP.) (SA 516 GR. 70)
3/4" THK. INNER SHELL (SA 516 GR. 70)
2 7/8" THK. LEAD SHIELDING
1 1/4" THK. X 5" WIDE (LONG) RIB PLATE (TYP.) (SA 516 GR. 70)
POOL LID TOP
BOTTOM FLANGE
1 1/4-7UNC X 3" LG. POOL LID BOLT (QTY. 16) (SA 193 B7)
A
SECTION ISOMETRIC VIEW
1" THK. BOTTOM PLATE (SA 516 GR. 70)
OUTER SHELL
LEAD
INNER SHELL
2" THK. POOL LID TOP W/O-RING GASKET (SA 516 GR. 70)
1 1/2" THK. LEAD SHIELD
1/2" THK. POOL LID BOTTOM (SA 516 GR. 70)
GASKET
1/2" THK.X 83" O.D BOTTOM RING (SA 516 GR. 70)
1 1/4" THK. FLANGE GUSSET (SA 516 GR. 70)
1 1/2" THK. 1 1/4" THK. MIN. BOTTOM FLANGE (SA 516 GR. 70)
ANNULUS DRAIN PORT
2" THK. POOL LID RING (SA 350 LF3 OR LF2)
DETAIL A SCALE 1 : 4
"NOTICE: CERTAIN DESIGN AND OPERATIONAL FEATURES OF THIS EQUIPMENT ARE PROTECTED UNDER U.S. PATENT NO. 6,587,536. AN INFRINGEMENT BY ANY ENTITY IS UNLAWFUL."
TOLERANCES
INCHES [MILLIMETERS] ANGULAR
.X ± .2 [5.0] ±2°
.XX ± .1 [2.54]
.XXX ± .02 [.50]
FRACTIONAL
0 TO LESS THAN 2 IN ±1/8 IN.
2 IN. TO LESS THAN 3 FT. ±1/4 IN.
3 FT. AND GREATER ±3/8 IN.
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053
GENERAL
100 TON
HI-TRAC 100D
ASSEMBLY
1026
N/A
D
4128
2
5
NONE





SECTION B-B

TOLERANCES

INCHES [MILLIMETERS]		ANGULAR
X ± .2	[5.0]	±2°
XX ± .1	[2.54]	
XXX ± .02	[.50]	

FRACTIONAL

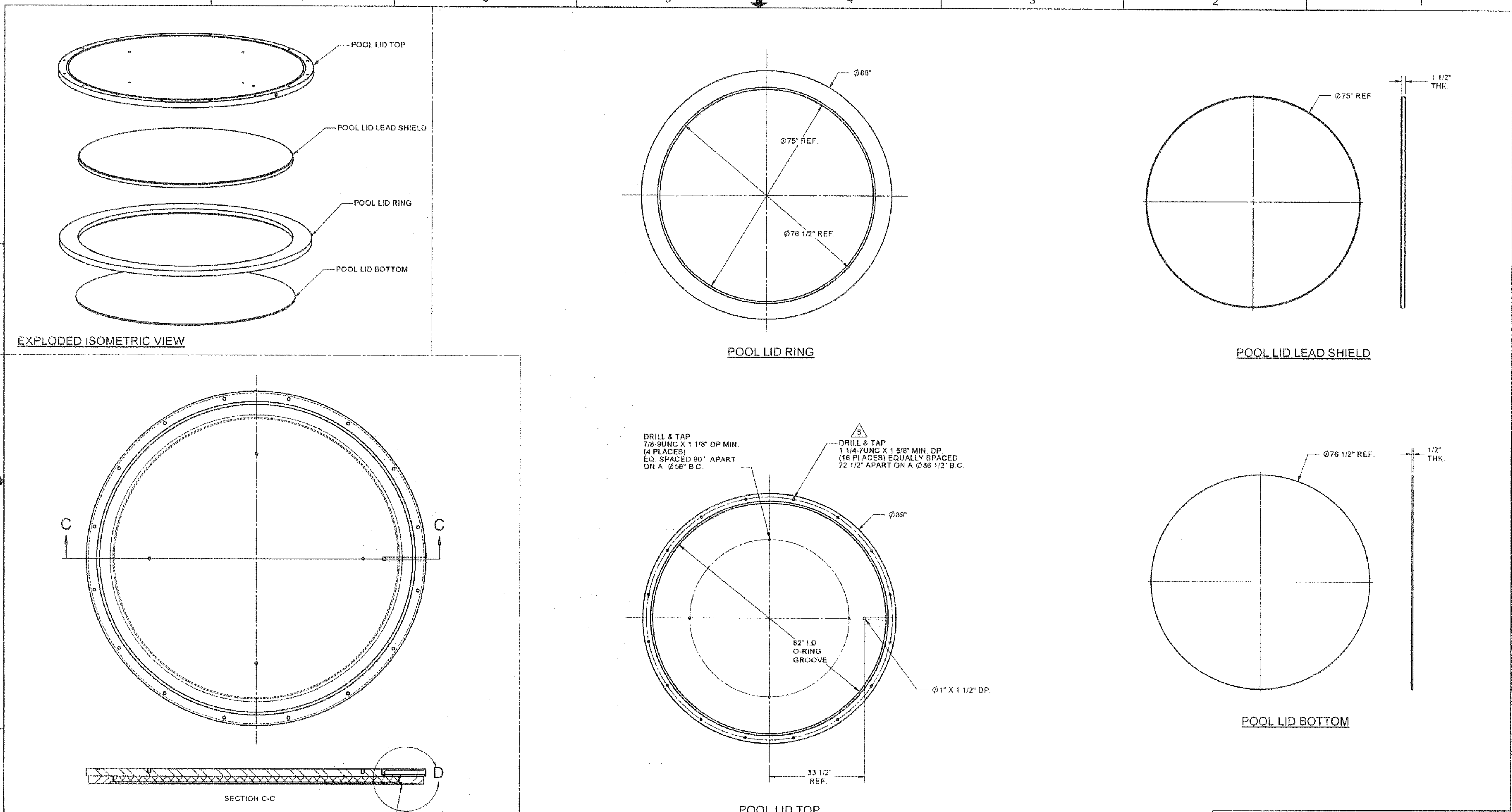
0 TO LESS THAN 2 IN	±1/8 IN
2 IN. TO LESS THAN 3 FT	±1/4 IN
3 FT. AND GREATER	±3/8 IN

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON NJ 08053

GENERAL

100 TON
HI-TRAC 100D
ASSEMBLY

1026	D	4128	3	5	
N/A	NONE	G:\DRAWINGS\1026\4128			



"NOTICE: CERTAIN DESIGN AND OPERATIONAL FEATURES OF THIS EQUIPMENT ARE PROTECTED UNDER U.S. PATENT NO. 6,587,536. AN INFRINGEMENT BY ANY ENTITY IS UNLAWFUL."

TOLERANCES

INCHES (MILLIMETERS) ANGULAR
X ± .2 [5.0] ±2°
XX ± .1 [2.54]
XXX ± .02 [.50]

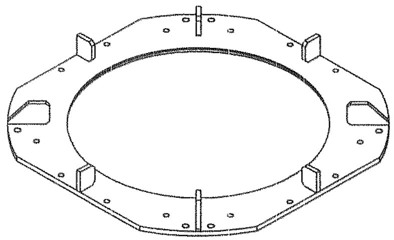
FRACTIONAL
0 TO LESS THAN 2 IN. ±1/8 IN.
2 IN. TO LESS THAN 3 FT ±1/4 IN.
3 FT AND GREATER ±3/8 IN.

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

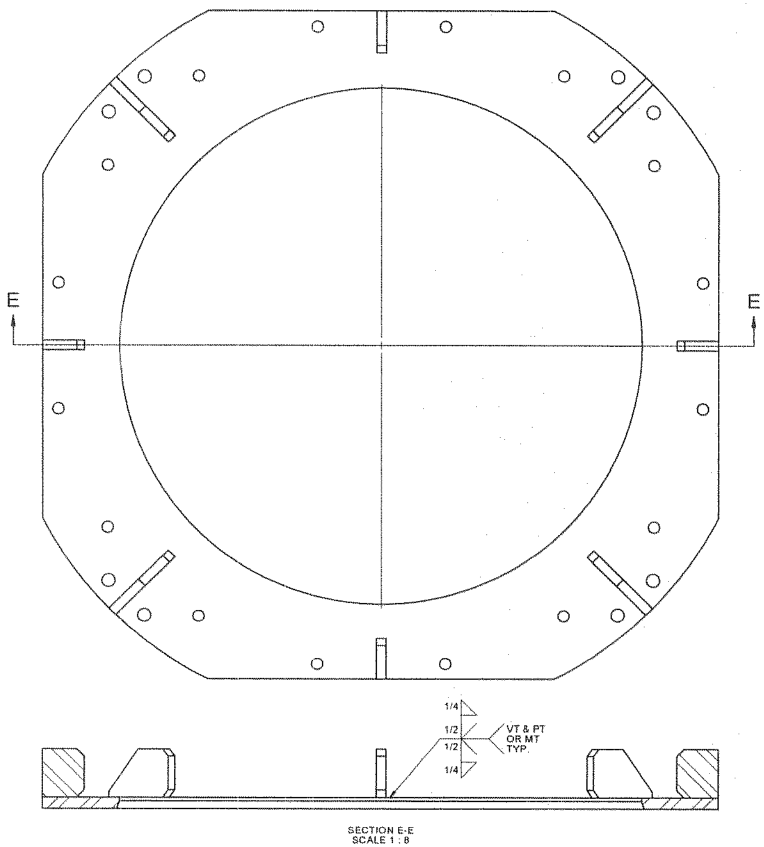
GENERAL

100 TON
HI-TRAC 100D
POOL LID ASSEMBLY

1026
N/A
-
D
4128
4
5
NONE
G:\DRAWINGS\1026\4128

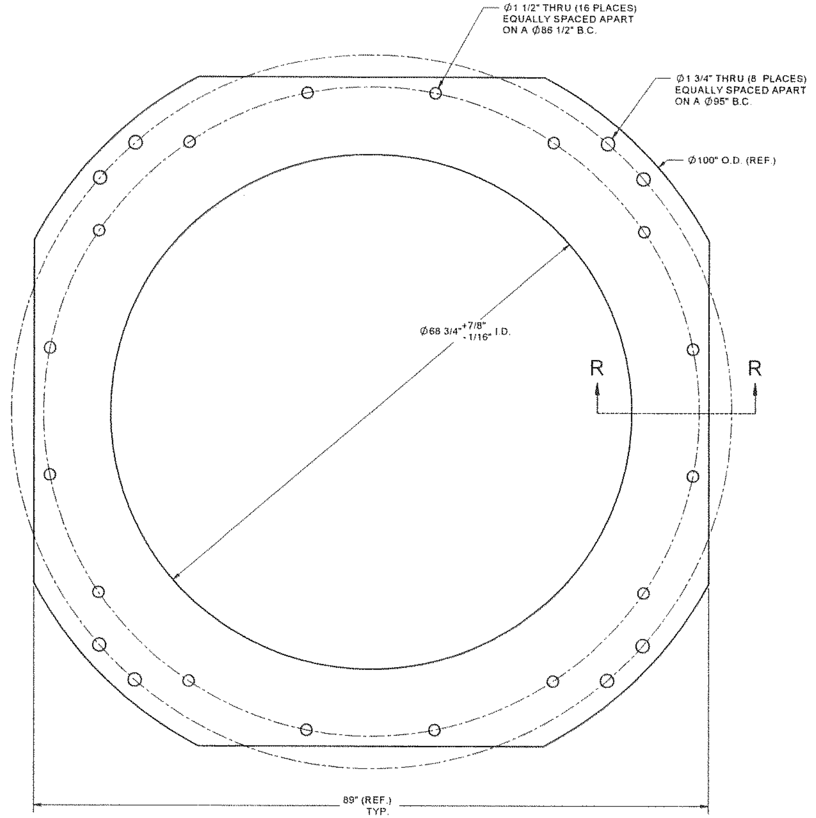


ISOMETRIC ASSEMBLY VIEW

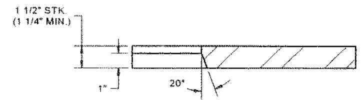


SECTION E-E
SCALE 1 : 8

BASE PLATE WELDMENT



BOTTOM FLANGE



SECTION R-R
SCALE 1 : 4

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TOLERANCES

INCHES (MILLIMETERS)		ANGULAR
X ± .2	[5.0]	±2°
.XX ± .1	[2.54]	
.XXX ± .02	[.50]	

FRACTIONAL

0 TO LESS THAN 2 IN	±1/8 IN
2 IN. TO LESS THAN 3 FT	±1/8 IN
3 FT AND GREATER	±3/8 IN

HOLTEC INTERNATIONAL
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555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

GENERAL

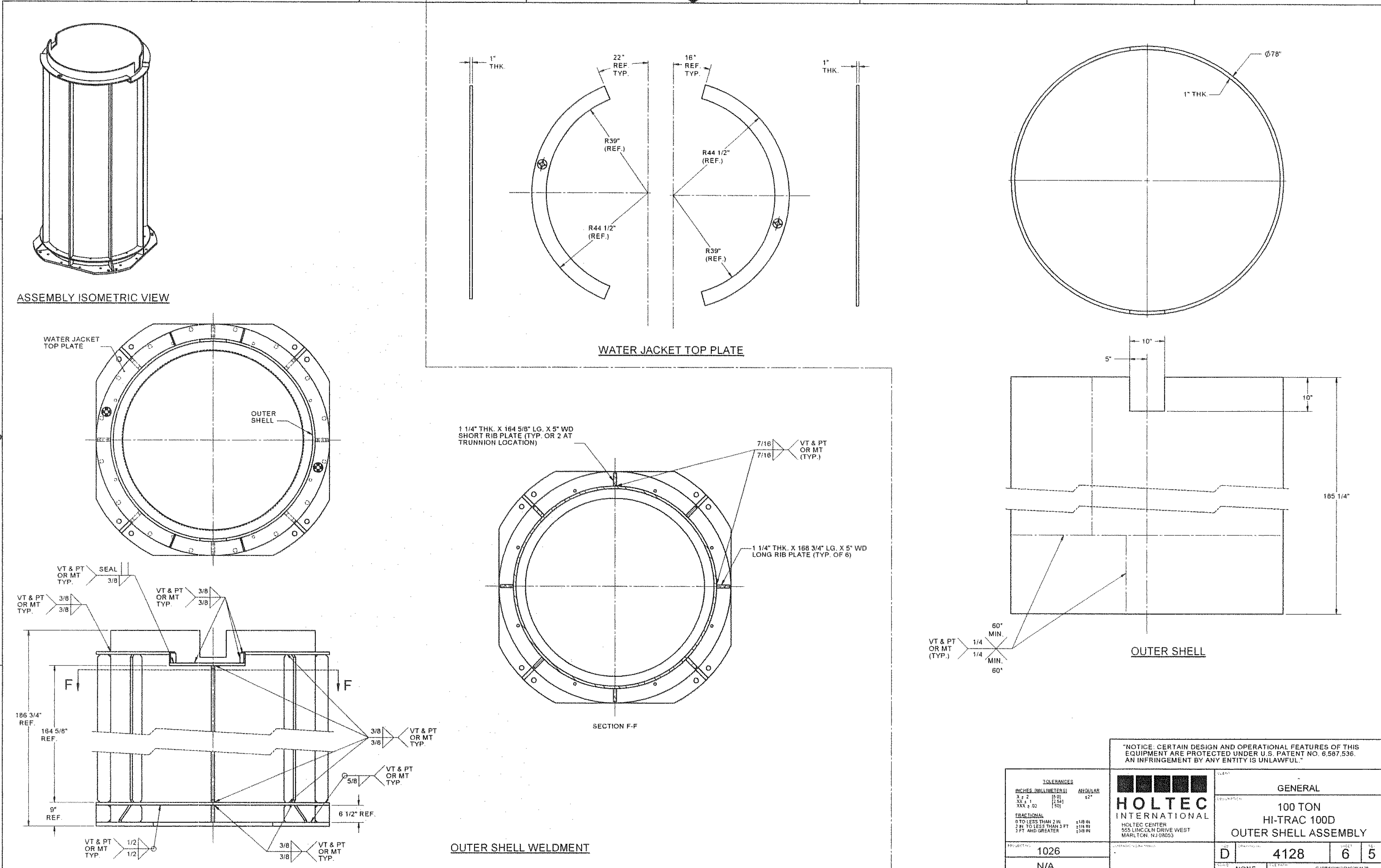
100 TON
HI-TRAC-100D
BASE PLATE ASSEMBLY

1026

N/A

SIZE	DRAWING NO.	SHEET	REV.
D	4128	5	5

SCALE 1:1 G:\DRAWINGS\1026\4128



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TOLERANCES

INCHES [MILLIMETERS]		ANGULAR
.X ± .2	[5.0]	±2°
.XX ± .1	[2.54]	
.XXX ± .02	[.50]	

FRACTIONAL

0 TO LESS THAN 2 IN	±1/8 IN
2 IN. TO LESS THAN 3 FT	±1/4 IN
3 FT AND GREATER	±3/8 IN

HOLTEC INTERNATIONAL
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555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

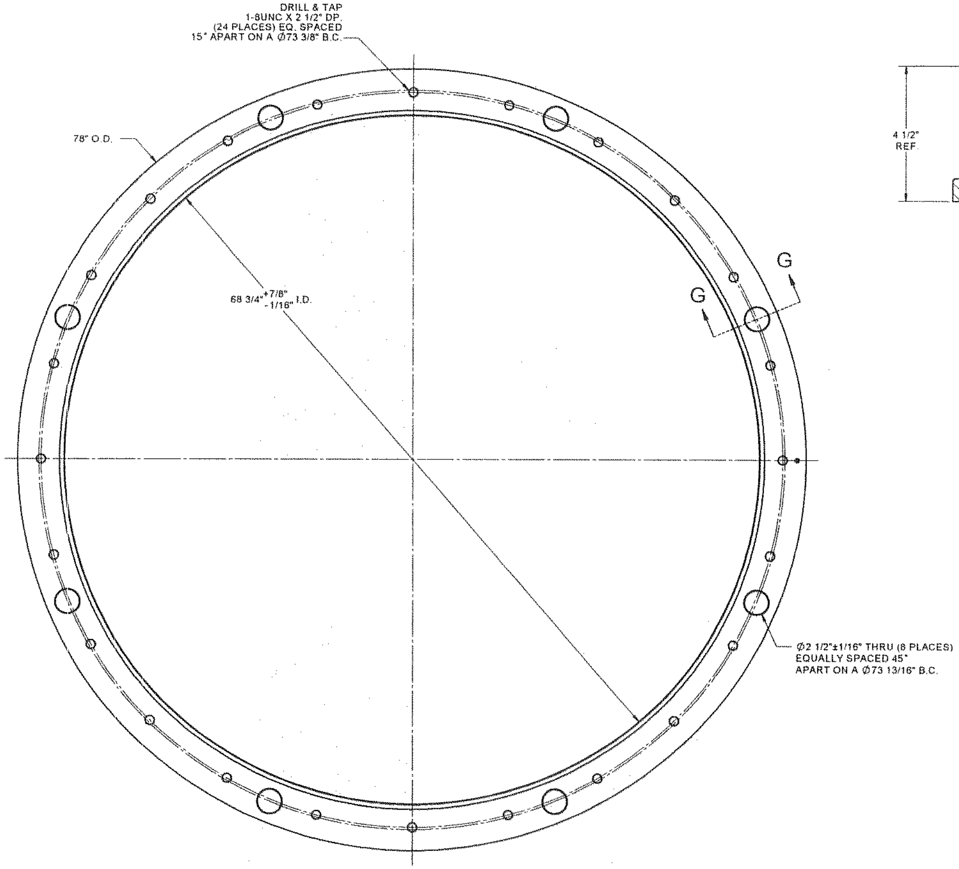
GENERAL

100 TON
HI-TRAC 100D
OUTER SHELL ASSEMBLY

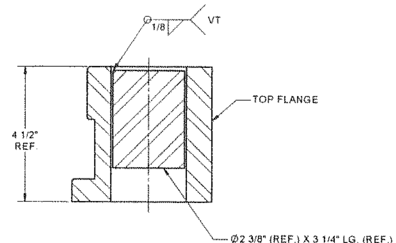
1026
N/A

D | 4128 | 6 | 5

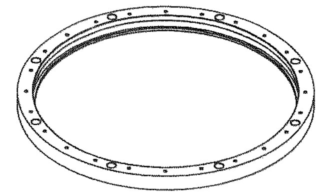
NONE | G:\DRAWINGS\1026\4128



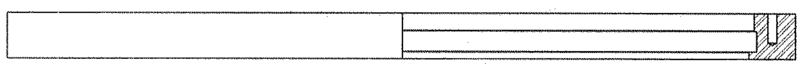
TOP FLANGE



SECTION G-G



ASSEMBLY ISOMETRIC VIEW



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TOLERANCES

INCHES (MILLIMETERS)		ANGULAR
X ± .2	[5.0]	±2°
XX ± .1	[2.54]	
XXX ± .02	[.50]	

FRACTIONAL

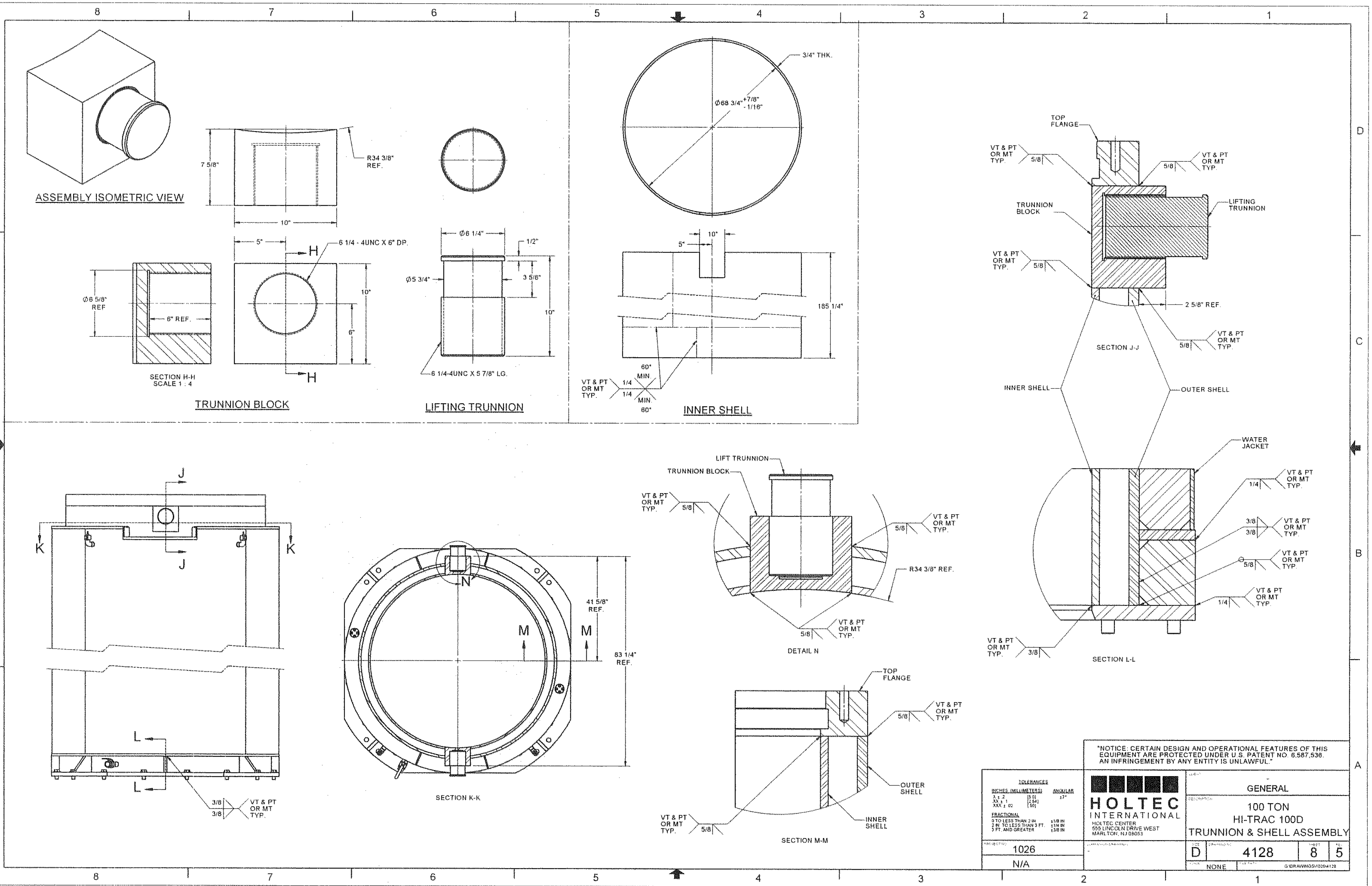
0 TO LESS THAN 2 IN	±1/8 IN
2 IN. TO LESS THAN 3 FT	±1/4 IN
3 FT. AND GREATER	±3/8 IN

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

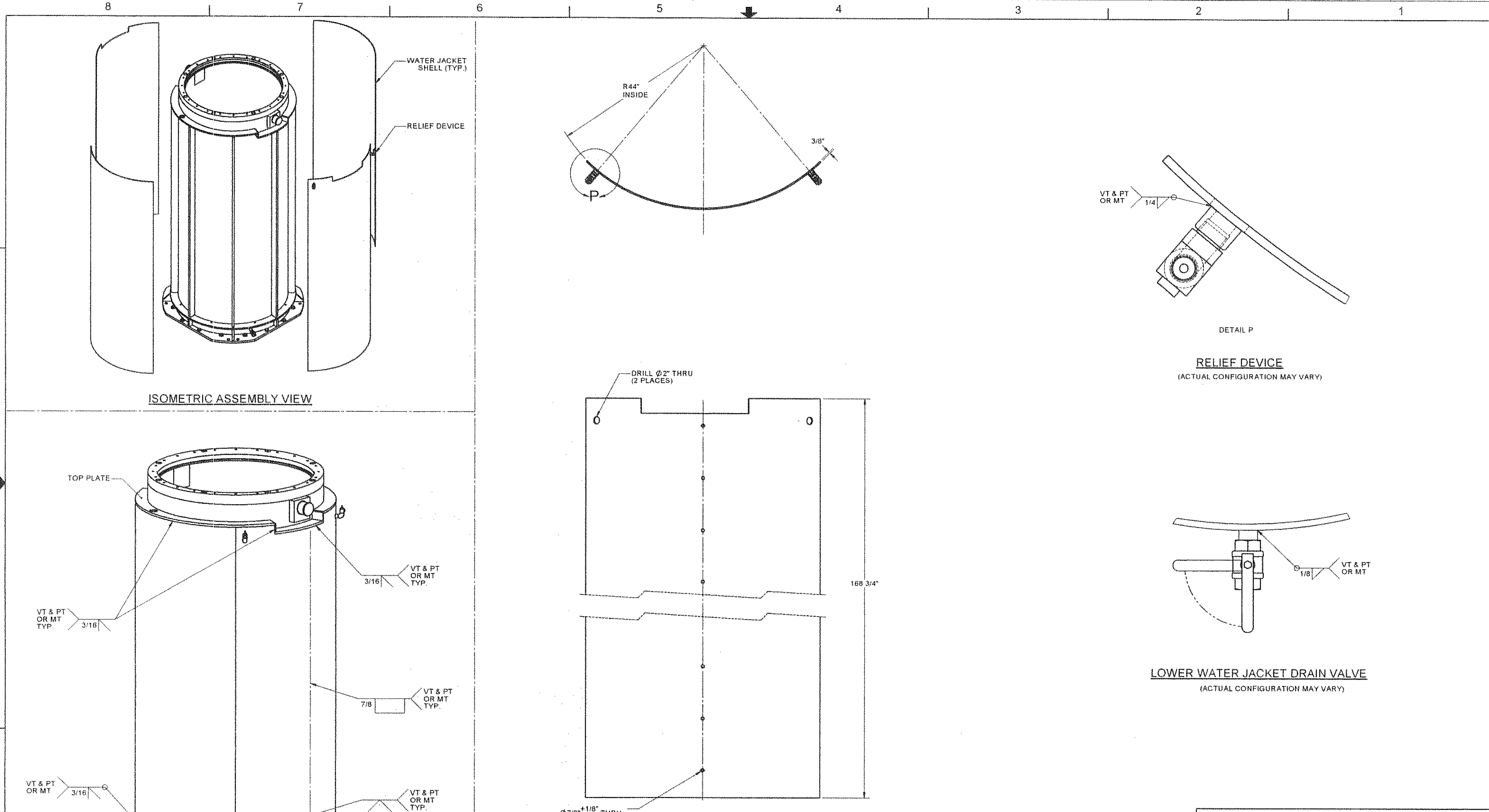
-
GENERAL

100 TON
HI-TRAC 100D
TOP FLANGE ASSEMBLY

1026	-	D	4128	7	5
N/A		NONE	G:\DRAWINGS\1026\4128		



ASSEMBLY ISOMETRIC VIEW
7 5/8"
10"
R34 3/8" REF.
5"
H
6 1/4 - 4UNC X 6" DP.
Ø6 5/8" REF
6" REF.
10"
6"
SECTION H-H SCALE 1 : 4
TRUNNION BLOCK
Ø6 1/4"
1/2"
Ø5 3/4"
3 5/8"
10"
6 1/4-4UNC X 5 7/8" LG.
LIFTING TRUNNION
3/4" THK.
Ø68 3/4" +7/8" -1/16"
10"
5"
185 1/4"
60° MIN
VT & PT OR MT TYP.
1/4
1/4
INNER SHELL
TOP FLANGE
VT & PT OR MT TYP.
5/8
TRUNNION BLOCK
LIFTING TRUNNION
2 5/8" REF.
SECTION J-J
INNER SHELL
OUTER SHELL
WATER JACKET
1/4
3/8
3/8
SECTION L-L
LIFT TRUNNION
R34 3/8" REF.
DETAIL N
J
K
L
M
N
41 5/8" REF.
83 1/4" REF.
SECTION K-K
SECTION M-M
"NOTICE: CERTAIN DESIGN AND OPERATIONAL FEATURES OF THIS EQUIPMENT ARE PROTECTED UNDER U.S. PATENT NO. 6,587,536. AN INFRINGEMENT BY ANY ENTITY IS UNLAWFUL."
TOLERANCES
INCHES (MILLIMETERS)
ANGULAR
FRACTIONAL
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053
GENERAL
100 TON
HI-TRAC 100D
TRUNNION & SHELL ASSEMBLY
1026
N/A
D
4128
8
5
NONE



TOLERANCES

INCHES (MILLIMETERS)		ANGULAR
X ± .2	[5.0]	±2°
XX ± .1	[2.54]	
XXX ± .02	[.50]	

FRACTIONAL

0 TO LESS THAN 2 IN	±1/8 IN
2 IN. TO LESS THAN 3 FT	±1/4 IN.
3 FT AND GREATER	±3/8 IN

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON NJ 08053

GENERAL

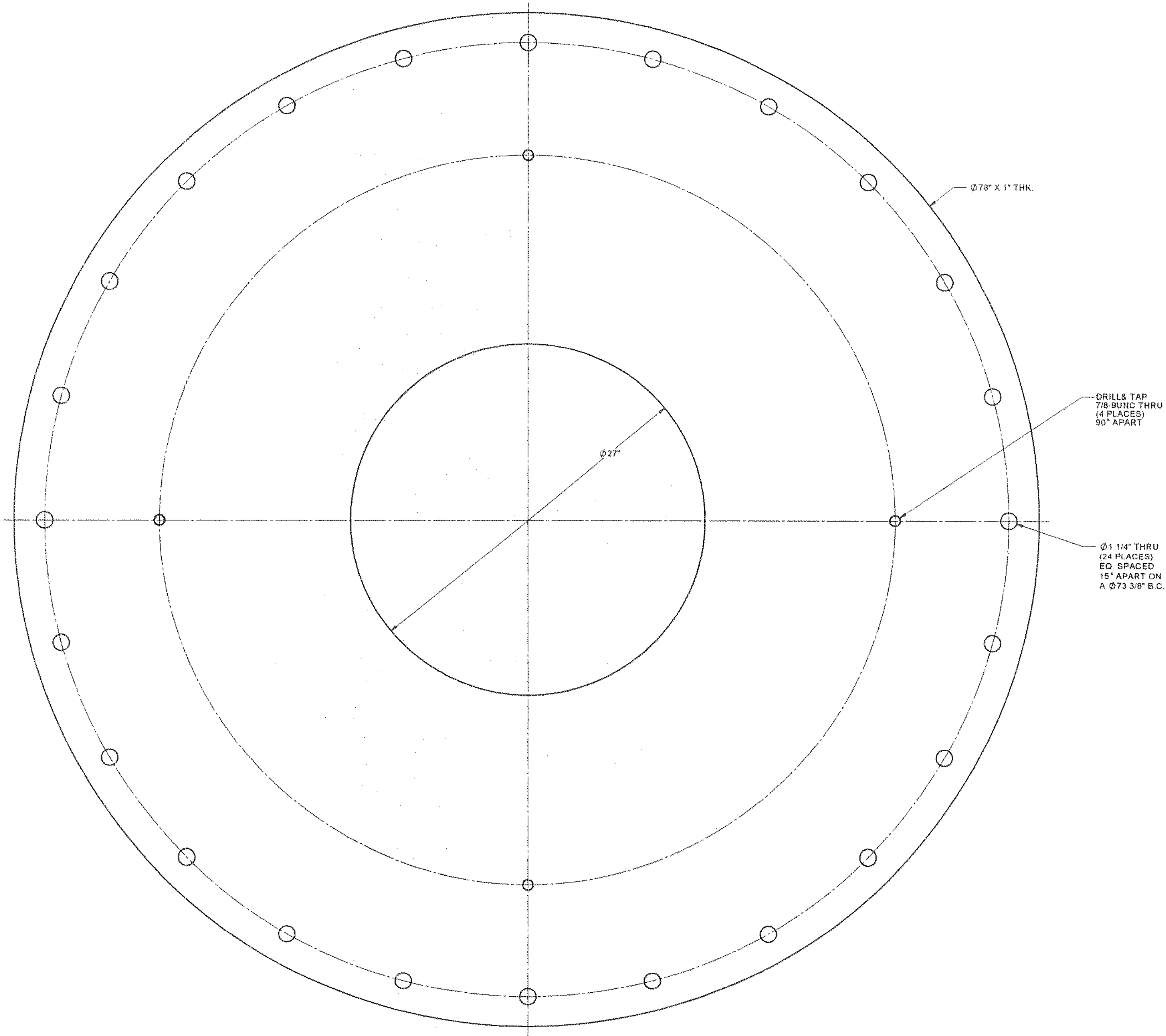
100 TON
HI-TRAC 100D
ASSEMBLY

PROJECT NO.	SIZE	DRAWING NO.	SHEET	REV.
1026	D	4128	9	5

N/A

SCALE: NONE

G:\DRAWINGS\1026\4128



TOP CLOSURE LID

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TOLERANCES

INCHES	[MILLIMETERS]	ANGULAR
.X ± .2	[5.0]	±2°
.XX ± .1	[2.54]	
.XXX ± .02	[.50]	

FRACTIONAL

0 TO LESS THAN 2 IN	±1/8 IN
2 IN. TO LESS THAN 3 FT	±1/4 IN
3 FT. AND GREATER	±3/8 IN

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

GENERAL

100 TON
HI-TRAC 100D
TOP CLOSURE LID

PROJECT NO.	1026
	N/A
COMPANION DRAWINGS	-
SIZE	D
DRAWING NO.	4128
SHEET	10
REV	5
SCALE	NONE

LICENSING DRAWING PACKAGE COVER SHEET

CLIENT	ENTERGY IPEC 1		
PROJECT NO.	1535	P.O. NO.	450054692
DRAWING PACKAGE I.D.	4724	TOTAL SHEETS	10

LICENSING DRAWING PACKAGE CONTENTS:

SHEET	DESCRIPTION
1	COVER SHEET
2	ASSEMBLY DRAWING AND BILL OF MATERIALS
3	OVERALL DIMENSIONS
4	POOL LID ASSEMBLY
5	BASE PLATE ASSEMBLY
6	OUTER SHELL ASSEMBLY
7	TOP FLANGE DETAILS
8	TRUNNION AND INNER SHELL ASSEMBLY
9	WATER JACKET SHELL ASSEMBLY
10	TOP LID ASSEMBLY

REVISION LOG

REV	AFFECTED DRAWING SHEET NUMBERS	SUMMARY OF CHANGES/ AFFECTED ECOs	PREPARED BY	APPROVAL DATE	VIR# †
0	INITIAL ISSUE	N/A	JJB	05/11/07	39820

† THE VALIDATION IDENTIFICATION RECORD (VIR) NUMBER IS A COMPUTER GENERATED RANDOM NUMBER WHICH CONFIRMS THAT ALL APPROPRIATE REVIEWS OF THIS DRAWING ARE DOCUMENTED IN COMPANY'S NETWORK.

NOTES:

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2. DIMENSIONAL TOLERANCES ON THIS DRAWING ARE PROVIDED SOLELY FOR LICENSING PURPOSES TO DEFINE REASONABLE LIMITS ON THE NOMINAL DIMENSIONS USED IN LICENSING WORK. HARDWARE IS FABRICATED IN ACCORDANCE WITH THE DESIGN DRAWINGS, WHICH HAVE MORE RESTRICTIVE TOLERANCES, TO ENSURE COMPONENT FIT-UP. DO NOT USE WORST-CASE TOLERANCE STACK-UP FROM THIS DRAWING TO DETERMINE COMPONENT FIT-UP.
3. THE REVISION LEVEL OF EACH INDIVIDUAL SHEET IN THE PACKAGE IS THE SAME AS THE REVISION LEVEL OF THIS COVER SHEET. A REVISION TO ANY SHEET(S) IN THIS PACKAGE REQUIRES UPDATING OF REVISION NUMBERS OF ALL SHEETS TO THE NEXT REVISION NUMBER.
4. APPLICABLE CODES AND STANDARDS ARE DELINEATED IN FSAR SECTION 2.2.4.
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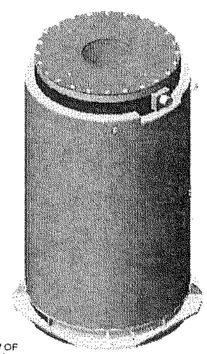
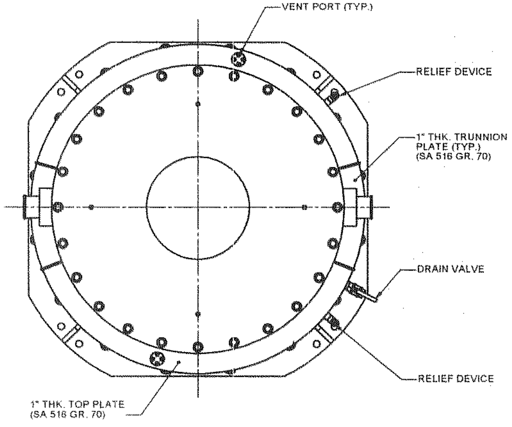
6. UNLESS OTHEWISE NOTED, FULL PENETRATION WELDS MAY BE MADE FROM EITHER SIDE OF A COMPONENT.
7. THIS COMPONENT IS IMPORTANT-TO-SAFETY, CATEGORY A, BASED ON THE HIGHEST CLASSIFICATION OF ANY SUBCOMPONENT. SUBCOMPONENT CLASSIFICATIONS ARE PROVIDED ON THE DESIGN DRAWING.
8. ALL WELD SIZES ARE MINIMUMS EXCEPT AS ALLOWED BY APPLICABLE CODES AS CLARIFIED IN THE FSAR. FABRICATOR MAY ADD WELDS WITH HOLTEC APPROVAL.



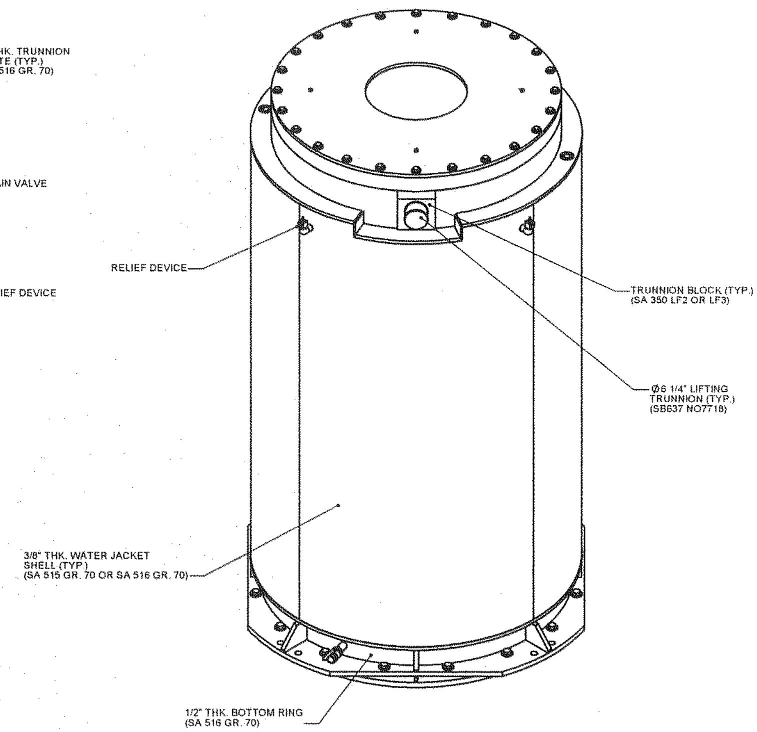
ISOMETRIC VIEW OF HI-TRAC 100-IP1 TRANSFER CASK

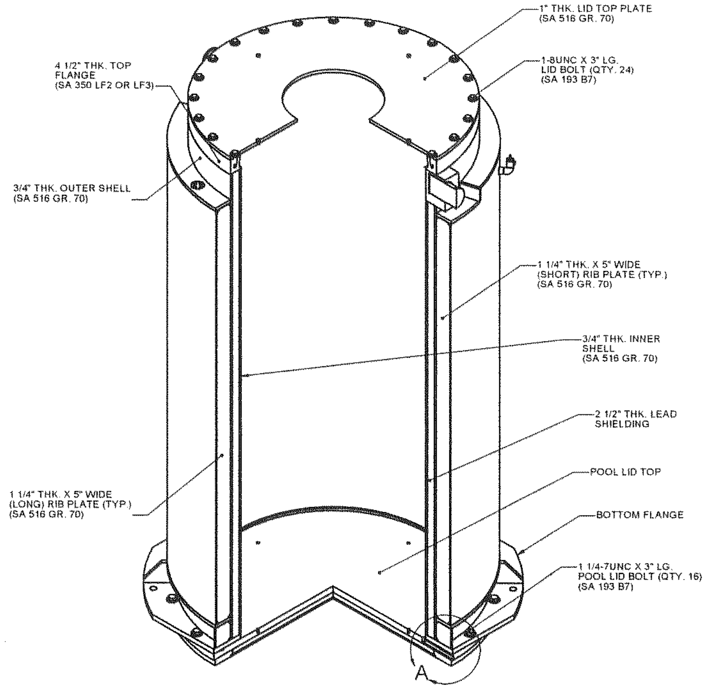
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN DRIVE WEST
MARLTON, NJ 08053

CLIENT	ENTERGY IPEC 1		
DESCRIPTION	HI-TRAC 100D VER. IP1 ASSEMBLY		
PROJECT NO. 1535	DRAWING NO. 4724	SHEET 1	TOTAL SHEETS 10
P.O. NO. 450054692		FILE PATH N:\DRAWINGS\1535\4724	

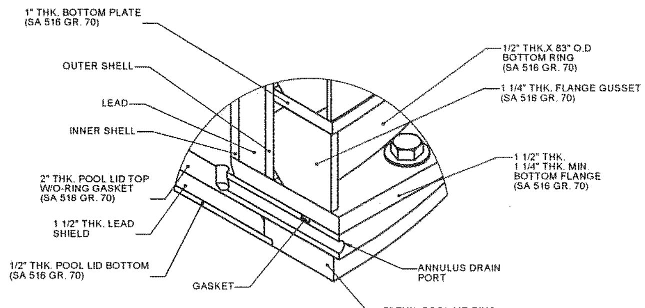


PLAN VIEW





SECTION ISOMETRIC VIEW



DETAIL A
SCALE 1 : 4

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN CENTER
MARLTON, NJ 08053

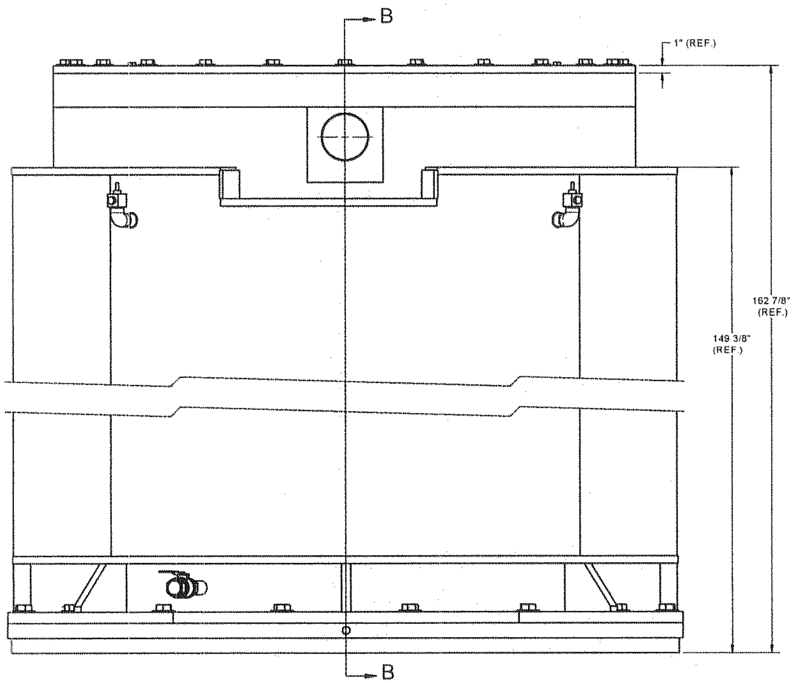
ENTERGY
IPEC 1

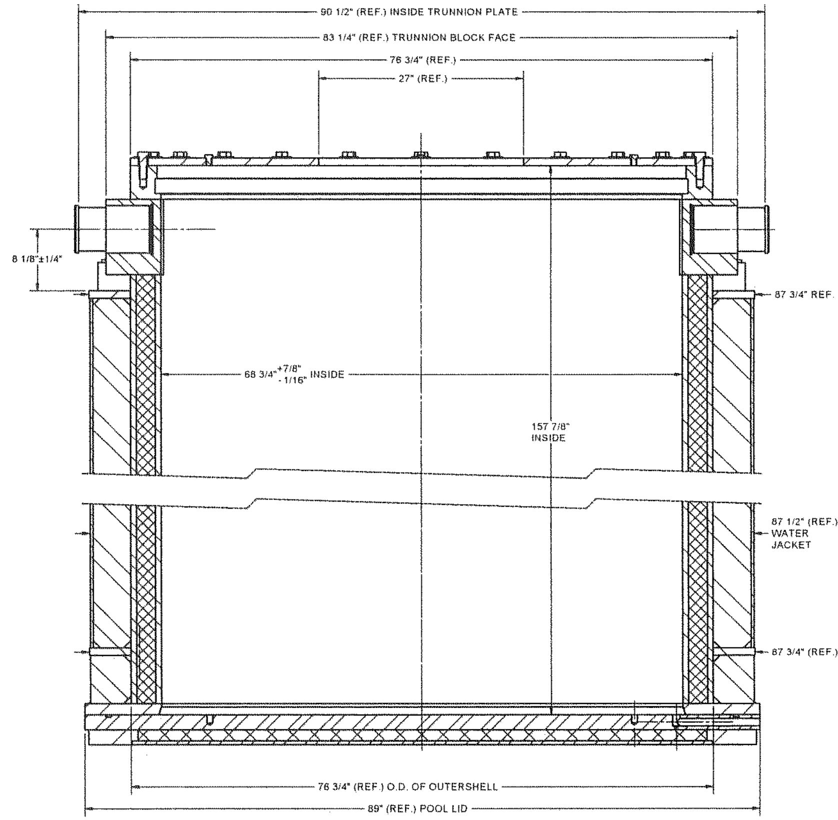
HI-TRAC 100D VER. IP1
ASSEMBLY

PROJECT NO.	1535
	450054692

SIZE	DRAWING NO.	SHEET	REV.
D	4724	2	0

SCALE NONE





SECTION B-B

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN CENTER
MARLTON, NJ 08053

ENTERGY
IPEC 1

HI-TRAC 100D VER. IP1
ASSEMBLY

1535	D	4724	3	0
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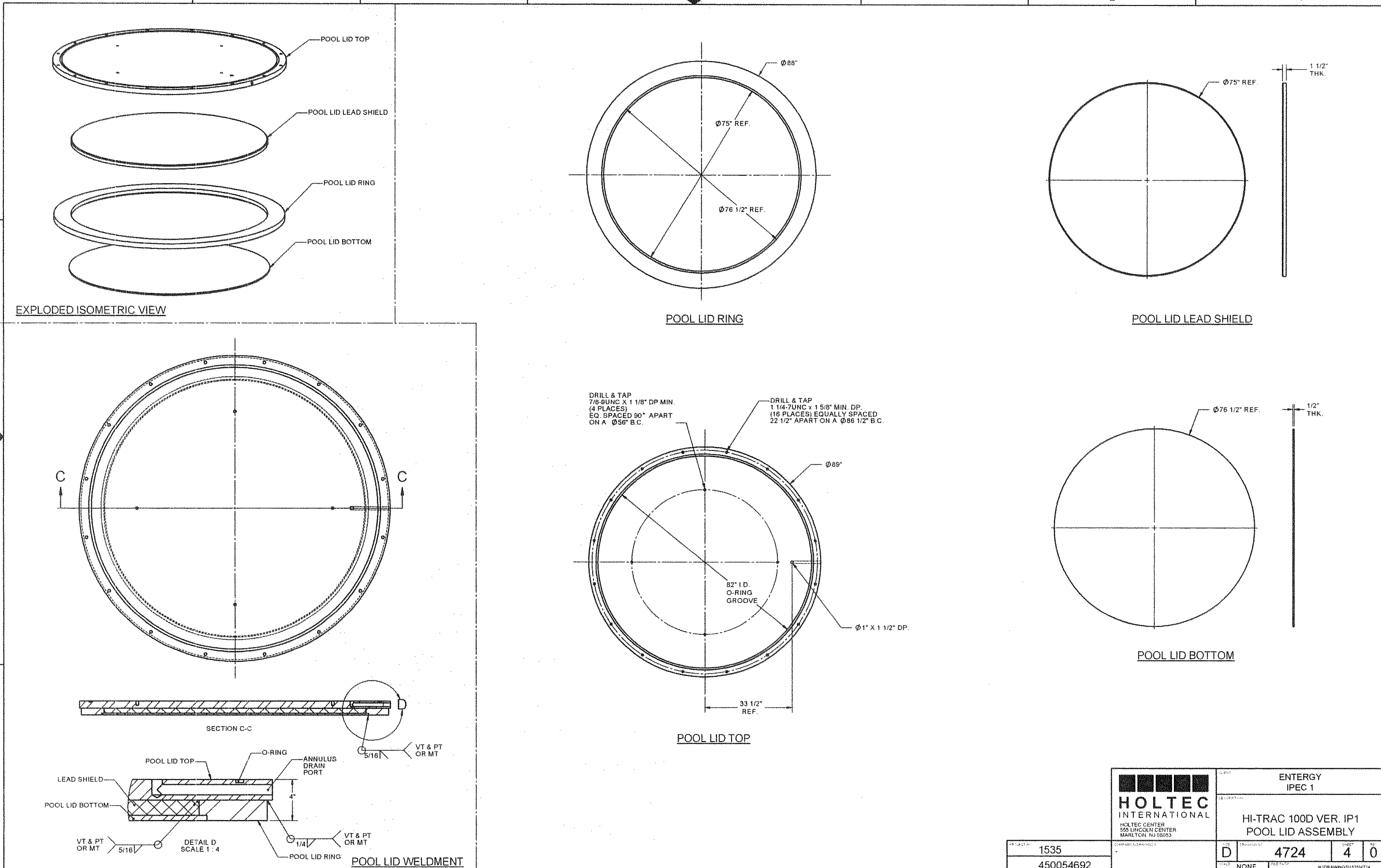

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN CENTER
MARLTON, NJ 08053

CLIENT	ENTERGY IPEC 1
DESCRIPTION	HI-TRAC 100D VER. IP1 POOL LID ASSEMBLY
PROJECT NO.	1535
	450054692
COMPANION DRAWINGS	-
SIZE	D
DRAWING NO.	4724
SHEET	4
REV	0
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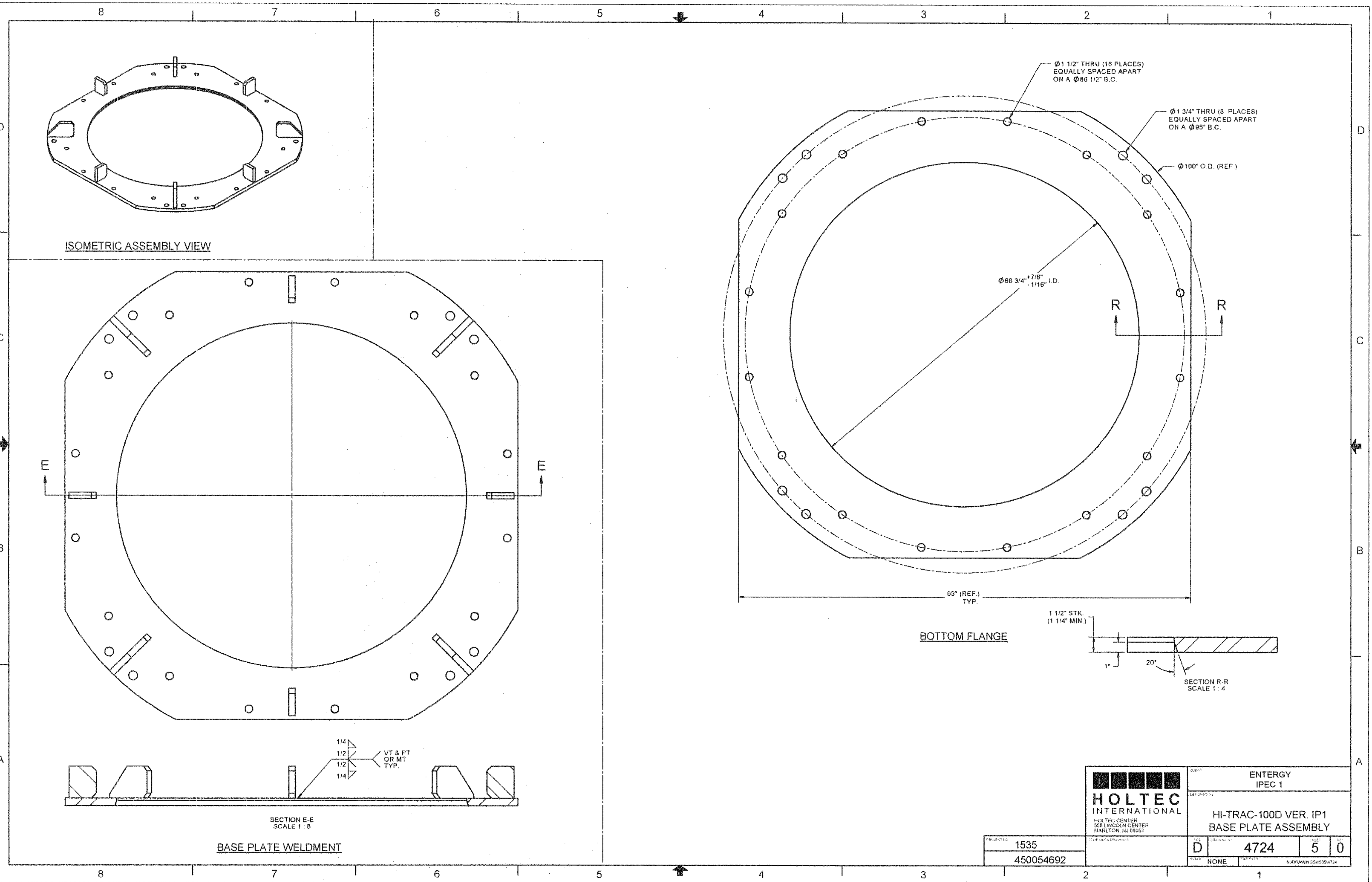
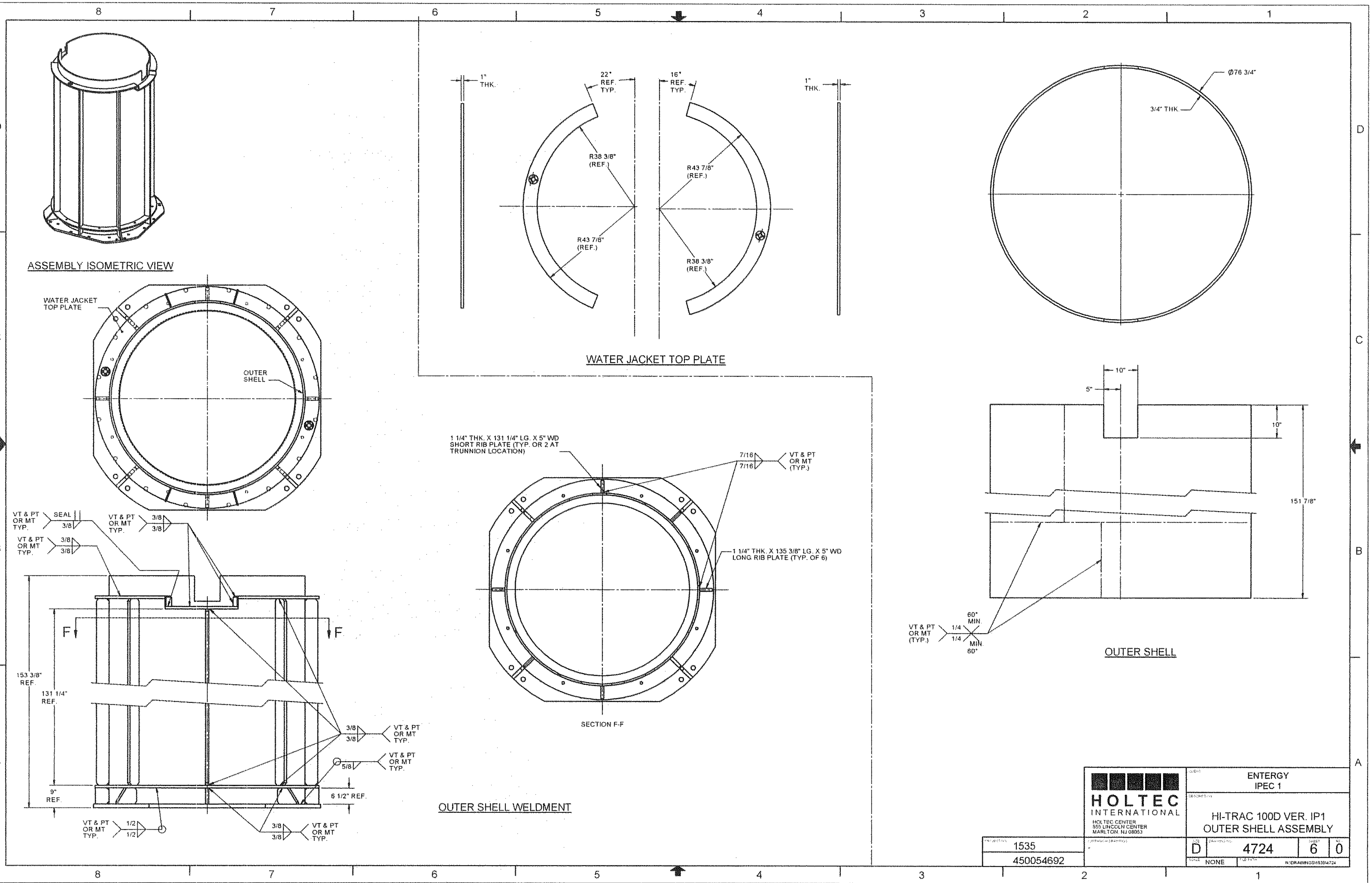
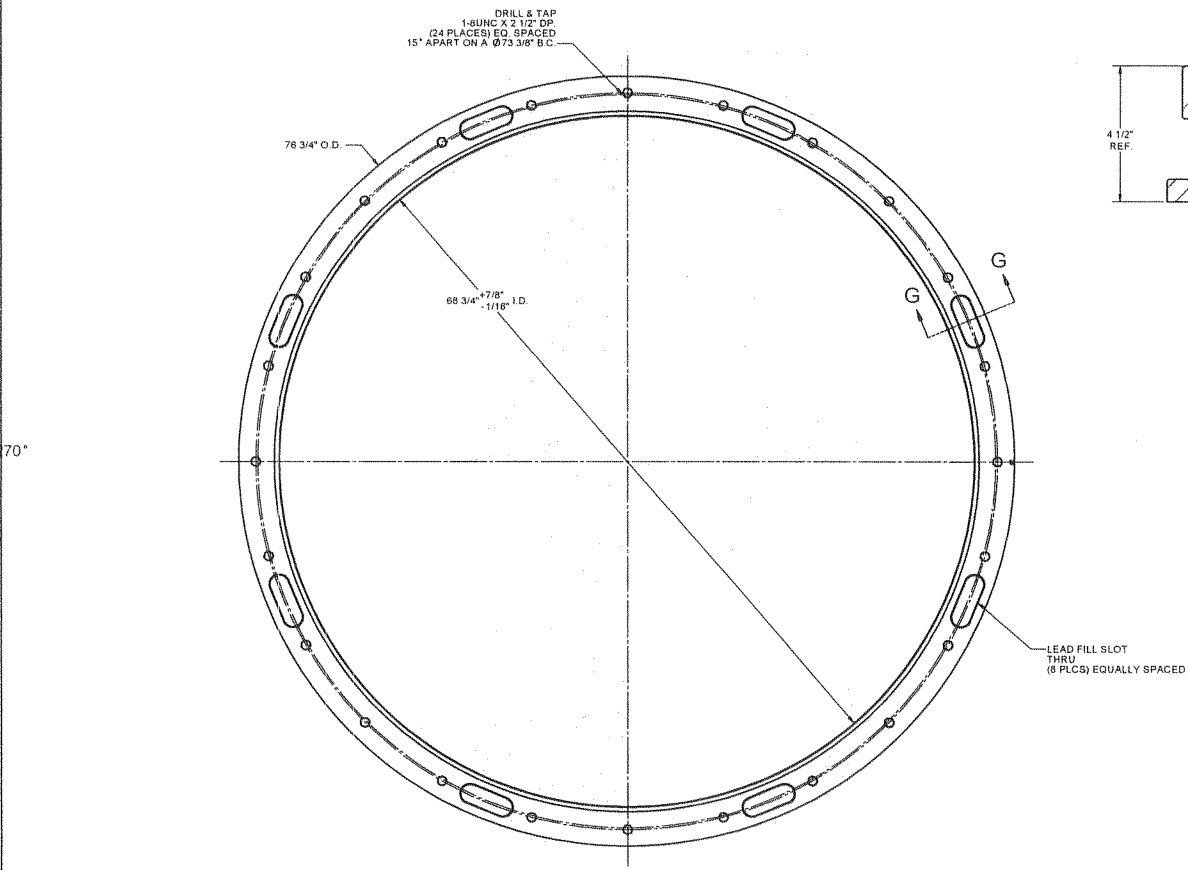
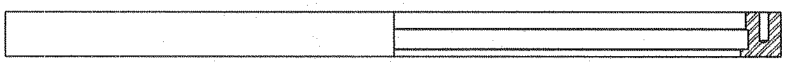

ISOMETRIC ASSEMBLY VIEW
Ø1 1/2" THRU (16 PLACES) EQUALLY SPACED APART ON A Ø86 1/2" B.C.
Ø1 3/4" THRU (8 PLACES) EQUALLY SPACED APART ON A Ø95" B.C.
Ø100" O.D. (REF.)
Ø68 3/4" +7/8" -1/16" I.D.
R
R
89" (REF.) TYP.
BOTTOM FLANGE
1 1/2" STK. (1 1/4" MIN.)
1"
20°
SECTION R-R SCALE 1 : 4
E
E
1/4
1/2
1/2
1/4
VT & PT OR MT TYP.
SECTION E-E SCALE 1 : 8
BASE PLATE WELDMENT
HOLTEC INTERNATIONAL
HOLTEC CENTER 555 LINCOLN CENTER MARLTON, NJ 08053
ENTERGY IPEC 1
HI-TRAC-100D VER. IP1 BASE PLATE ASSEMBLY
1535
450054692
D
4724
5
0
NONE

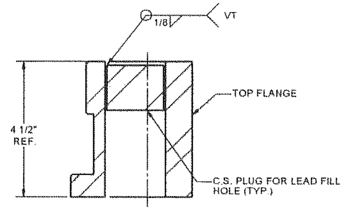


ASSEMBLY ISOMETRIC VIEW
WATER JACKET TOP PLATE
OUTER SHELL
1" THK.
22" REF. TYP.
16" REF. TYP.
R38 3/8" (REF.)
R43 7/8" (REF.)
WATER JACKET TOP PLATE
Ø76 3/4"
3/4" THK.
10"
5"
151 7/8"
60° MIN
1/4
MIN 60°
VT & PT OR MT (TYP.)
OUTER SHELL
1 1/4" THK. X 131 1/4" LG. X 5" WD SHORT RIB PLATE (TYP. OR 2 AT TRUNNION LOCATION)
7/16
VT & PT OR MT (TYP.)
1 1/4" THK. X 135 3/8" LG. X 5" WD LONG RIB PLATE (TYP. OF 6)
SECTION F-F
OUTER SHELL WELDMENT
VT & PT OR MT TYP.
SEAL
3/8
3/16
F
153 3/8" REF.
131 1/4" REF.
9" REF.
6 1/2" REF.
5/8
1/2
ENTERGY
IPEC 1
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN CENTER
MARLTON, NJ 08053
HI-TRAC 100D VER. IP1
OUTER SHELL ASSEMBLY
1535
450054692
D
4724
6
0
NONE

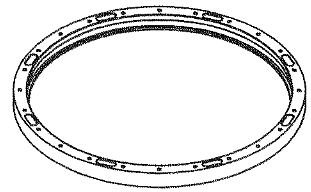


TOP FLANGE



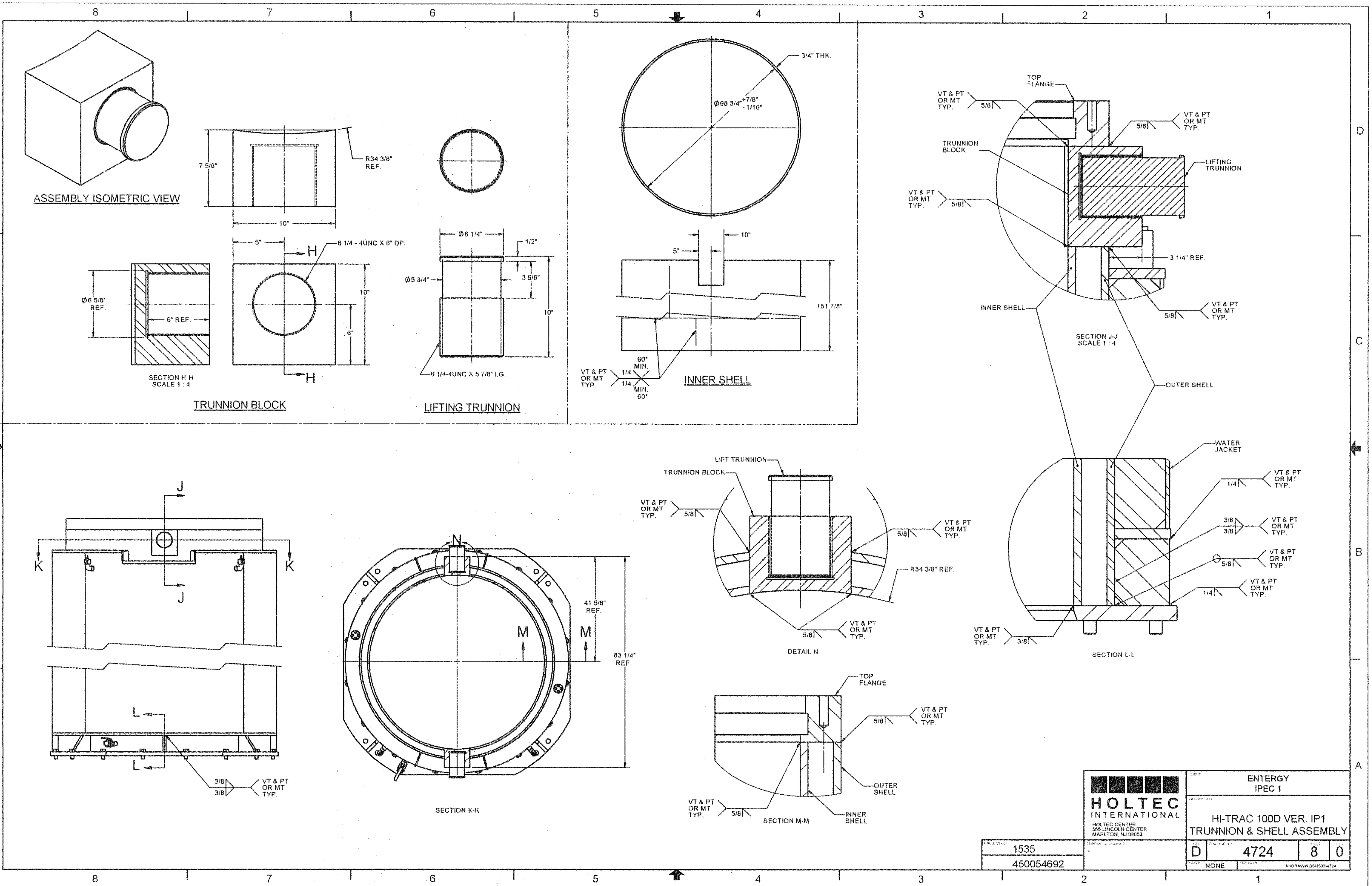


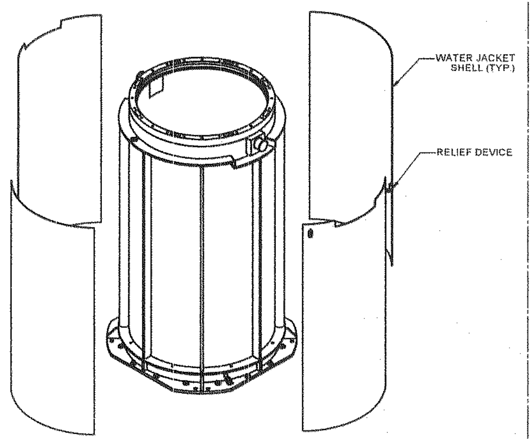
SECTION G-G



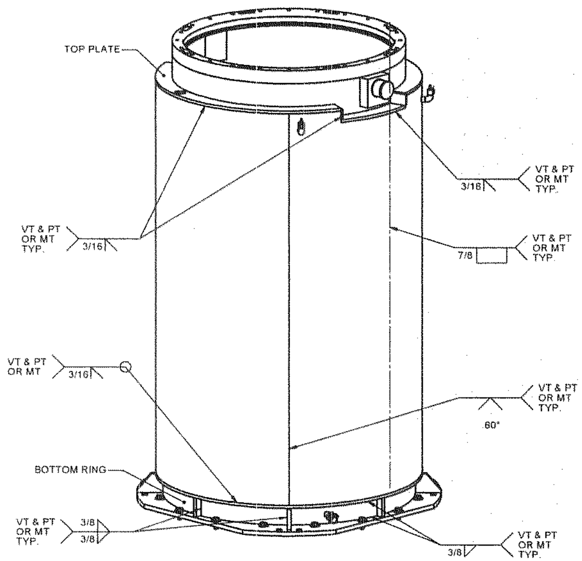
ASSEMBLY ISOMETRIC VIEW

HOLTEC INTERNATIONAL HOLTEC CENTER 555 LINCOLN CENTER MARLTON, NJ 08053	ENTERGY IPEC 1
	HI-TRAC 100D VER. IP1 TOP FLANGE ASSEMBLY
PROJECT NO. 1535	SIZE D · DRAWING NO. 4724 · SHEET 7 · REV. 0
450054692	SCALE NONE · FILE PATH N:\DRAWINGS\1535\4724

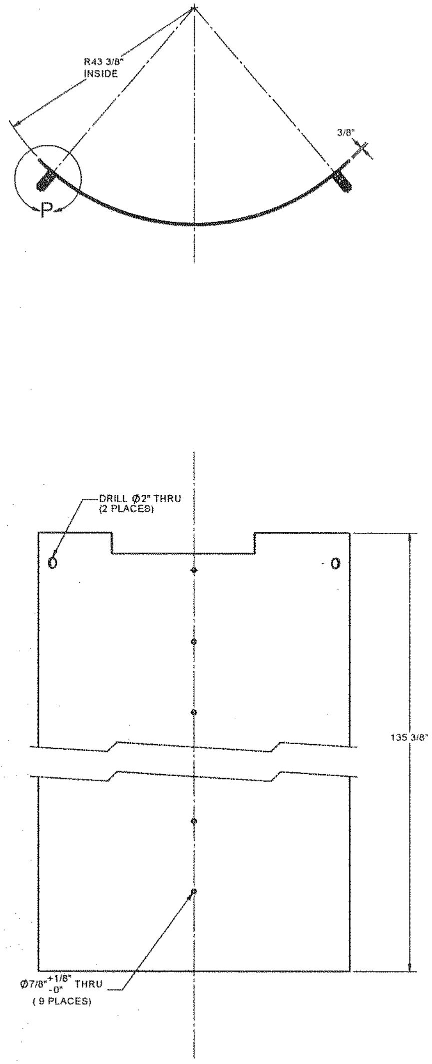

ASSEMBLY ISOMETRIC VIEW
R34 3/8" REF.
7 5/8"
10"
5"
6 1/4 - 4UNC X 6" DP.
Ø6 5/8" REF.
6" REF.
SECTION H-H
SCALE 1 : 4
TRUNNION BLOCK
Ø6 1/4"
1/2"
Ø5 3/4"
3 5/8"
6 1/4-4UNC X 5 7/8" LG.
LIFTING TRUNNION
3/4" THK.
Ø68 3/4" +7/8" -1/16"
151 7/8"
60° MIN.
VT & PT OR MT TYP.
INNER SHELL
TOP FLANGE
LIFTING TRUNNION
3 1/4" REF.
INNER SHELL
OUTER SHELL
SECTION J-J
SCALE 1 : 4
WATER JACKET
SECTION L-L
LIFT TRUNNION
R34 3/8" REF.
DETAIL N
41 5/8" REF.
83 1/4" REF.
SECTION K-K
SECTION M-M
ENTERGY
IPEC 1
HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN CENTER
MARLTON, NJ 08053
HI-TRAC 100D VER. IP1
TRUNNION & SHELL ASSEMBLY
1535
450054692
D
4724
8
0
NONE



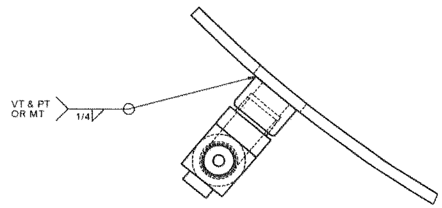
ISOMETRIC ASSEMBLY VIEW



WATER JACKET WELDMENT



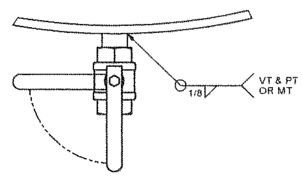
WATER JACKET SHELL



DETAIL P

RELIEF DEVICE

(ACTUAL CONFIGURATION MAY VARY)



LOWER WATER JACKET DRAIN VALVE

(ACTUAL CONFIGURATION MAY VARY)

HOLTEC INTERNATIONAL
HOLTEC CENTER
555 LINCOLN CENTER
MARLTON, NJ 08053

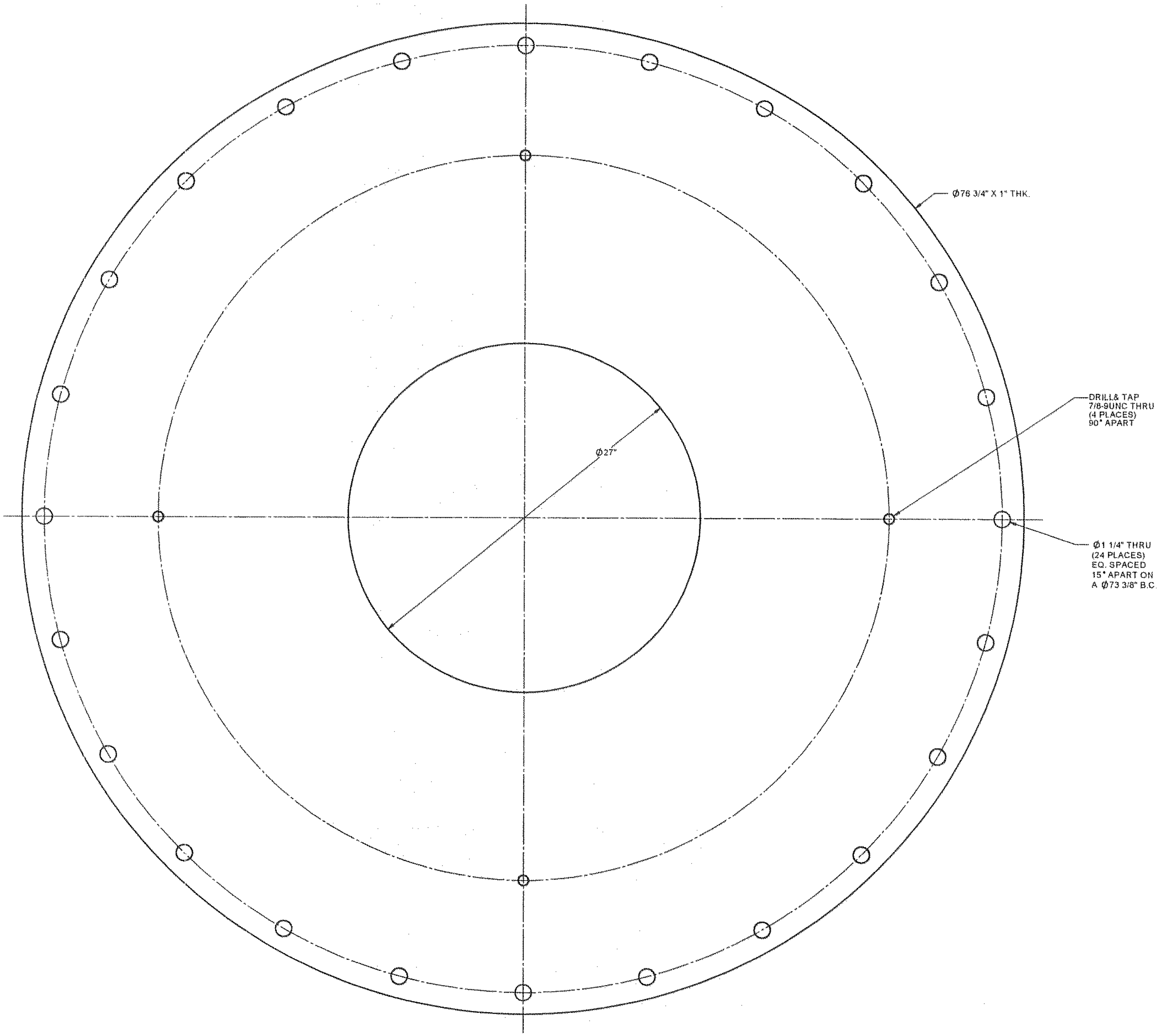
ENTERGY
IPEC 1

HI-TRAC 100D VER. IP1
ASSEMBLY

1535
450054692

D 4724 9 0

NONE



TOP CLOSURE LID

HOLTEC INTERNATIONAL HOLTEC CENTER 555 LINCOLN CENTER MARLTON, NJ 08053	ENTERGY IPEC - 1		
	HI-TRAC 100D VER. IP1 TOP CLOSURE LID		
1535	-	D	4724	10	0
450054692		NONE			

1.6 REFERENCES

[1.0.1] 10CFR Part 72, "Licensing Requirements for the Storage of Spent Fuel in an Independent Spent Fuel Storage Installation", Title 10 of the Code of Federal Regulations, 1998 Edition, Office of the Federal Register, Washington, D.C.

[1.0.2] Regulatory Guide 3.61 (Task CE306-4) "Standard Format for a Topical Safety Analysis Report for a Spent Fuel Storage Cask", USNRC, February 1989.

[1.0.3] NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems", U.S. Nuclear Regulatory Commission, January 1997.

[1.0.4] American Concrete Institute, "Code Requirements for Nuclear Safety Related Concrete Structures", ACI 349-85, ACI, Detroit, Michigan†

[1.0.5] American Concrete Institute, "Building Code Requirements for Structural Concrete", ACI 318-95, ACI, Detroit, Michigan.

[1.1.1] ASME Boiler & Pressure Vessel Code, Section III, Subsection NB, American Society of Mechanical Engineers, 1995 with Addenda through 1997.

[1.1.2] USNRC Docket No. 72-1008, Final Safety Analysis Report for the (Holtec International Storage, Transport, and Repository) HI-STAR System, latest revision.

[1.1.3] USNRC Docket No. 71-9261, Safety Analysis Report for Packaging for the (Holtec International Storage, Transport, and Repository) HI-STAR System, latest revision.

[1.1.4] 10CFR Part 50, "Domestic Licensing of Production and Utilization Facilities", Title 10 of the Code of Federal Regulations, 1998 Edition, Office of the Federal Register, Washington, D.C.

[1.1.5] Deleted.

[1.2.1] U.S. NRC Information Notice 96-34, "Hydrogen Gas Ignition During Closure Welding of a VSC-24 Multi-Assembly Sealed Basket".

[1.2.2] Directory of Nuclear Reactors, Vol. II, Research, Test & Experimental Reactors, International Atomic Energy Agency, Vienna, 1959.

[1.2.3] V.L. McKinney and T. Rockwell III, "Boral: A New Thermal-Neutron Shield", USAEC Report AECD-3625, August 29, 1949.

† The 1997 edition of ACI-349 is specified for ISFSI pad and embedment design for deployment of the anchored HI-STORM 100A and HI-STORM 100SA.

[1.2.4] Reactor Shielding Design Manual, USAEC Report TID-7004, March 1956.

[1.2.5] "Safety Analysis Report for the NAC Storable Transport Cask", Revision 8, September 1994, Nuclear Assurance Corporation (USNRC Docket No. 71-9235).

[1.2.6] Deleted.

[1.2.7] Materials Handbook, 13th Edition, Brady, G.S. and H.R. Clauser, McGraw-Hill, 1991, Page 310.

[1.2.8] Deleted.

[1.2.9] ANSI N14.6-1993, "American National Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials," American National Standards Institute, June, 1993.

[1.2.10] Deleted.

[1.2.11] "Qualification of METAMIC® for Spent Fuel Storage Application," EPRI, 1003137, Final Report, October 2001.

[1.2.12] "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Holtec International Report HI-2022871 Regarding Use of Metamic in Fuel Pool Applications," Facility Operating License Nos. DPR-51 and NPF-6, Entergy Operations, Inc., Docket No. 50-313 and 50-368, USNRC, June 2003.

[1.2.13] "Metamic 6061+40% Boron Carbide Metal Matrix Composite Test", California Consolidated Tech. Inc. Report dated August 21, 2001 to NAC International.

[1.2.14] "Recommendations for Preparing the Criticality Safety Evaluation for Transportation Packages," NUREG/CR-5661, USNRC, Dyer and Parks, ORNL.

APPENDIX 1.A: ALLOY X DESCRIPTION

1.A ALLOY X DESCRIPTION

1.A.1 Alloy X Introduction

Alloy X is used within this licensing application to designate a group of stainless steel alloys. Alloy X can be any one of the following alloys:

- Type 316
- Type 316LN
- Type 304
- Type 304LN

Qualification of structures made of Alloy X is accomplished by using the least favorable mechanical and thermal properties of the entire group for all MPC mechanical, structural, neutronic, radiological, and thermal conditions. The Alloy X approach is conservative because no matter which material is ultimately utilized, the Alloy X approach guarantees that the performance of the MPC will meet or exceed the analytical predictions.

This appendix defines the least favorable material properties of Alloy X.

1.A.2 Alloy X Common Material Properties

Several material properties do not vary significantly from one Alloy X constituent to the next. These common material properties are as follows:

- density
- specific heat
- Young's Modulus (Modulus of Elasticity)
- Poisson's Ratio

The values utilized for this licensing application are provided in their appropriate chapters.

1.A.3 Alloy X Least Favorable Material Properties

The following material properties vary between the Alloy X constituents:

- Design Stress Intensity (S_m)
- Tensile (Ultimate) Strength (S_u)
- Yield Strength (S_y)
- Coefficient of Thermal Expansion (α)
- Coefficient of Thermal Conductivity (k)

Each of these material properties are provided in the ASME Code Section II [1.A.1]. Tables 1.A.1 through 1.A.5 provide the ASME Code values for each constituent of Alloy X along with the least favorable value utilized in this licensing application. The ASME Code only provides values to -20°F. The design temperature of the MPC is -40°F to 725°F as stated in Table 1.2.2. Most of the above-mentioned properties become increasingly favorable as the temperature drops. Conservatively, the values at the lowest design temperature for the HI-STORM 100 System have been assumed to be equal to the lowest value stated in the ASME Code. The lone exception is the thermal conductivity. The thermal conductivity decreases with the decreasing temperature. The thermal conductivity value for -40°F is linearly extrapolated from the 70°F value using the difference from 70°F to 100°F.

The Alloy X material properties are the minimum values of the group for the design stress intensity, tensile strength, yield strength, and coefficient of thermal conductivity. Using minimum values of design stress intensity is conservative because lower design stress intensities lead to lower allowables that are based on design stress intensity. Similarly, using minimum values of tensile strength and yield strength is conservative because lower values of tensile strength and yield strength lead to lower allowables that are based on tensile strength and yield strength. When compared to calculated values, these lower allowables result in factors of safety that are conservative for any of the constituent materials of Alloy X. Further discussion of the justification for using the minimum values of coefficient of thermal conductivity is given in Chapter 3. The maximum and minimum values are used for the coefficient of thermal expansion of Alloy X. The maximum and minimum coefficients of thermal expansion are used as appropriate in this submittal. Figures 1.A.1-1.A.5 provide a graphical representation of the varying material properties with temperature for the Alloy X materials.

1.A.4 References

[1.A.1] ASME Boiler & Pressure Vessel Code Section II, 1995 ed. with Addenda through 1997.

Table 1.A.1

ALLOY X AND CONSTITUENT DESIGN STRESS INTENSITY (S_m) vs. TEMPERATURE

Temp. (°F)	Type 304	Type 304LN	Type 316	Type 316LN	Alloy X (minimum of constituent values)
-40	20.0	20.0	20.0	20.0	20.0
100	20.0	20.0	20.0	20.0	20.0
200	20.0	20.0	20.0	20.0	20.0
300	20.0	20.0	20.0	20.0	20.0
400	18.7	18.7	19.3	18.9	18.7
500	17.5	17.5	18.0	17.5	17.5
600	16.4	16.4	17.0	16.5	16.4
650	16.2	16.2	16.7	16.0	16.0
700	16.0	16.0	16.3	15.6	15.6
750	15.6	15.6	16.1	15.2	15.2
800	15.2	15.2	15.9	14.9	14.9

Notes:

1. Source: Table 2A on pages 314, 318, 326, and 330 of [1.A.1].

2. Units of design stress intensity values are ksi.

Table 1.A.2

ALLOY X AND CONSTITUENT TENSILE STRENGTH (S_u) vs. TEMPERATURE

Temp. (°F)	Type 304	Type 304LN	Type 316	Type 316LN	Alloy X (minimum of constituent values)
-40	75.0 (70.0)	75.0 (70.0)	75.0 (70.0)	75.0 (70.0)	75.0 (70.0)
100	75.0 (70.0)	75.0 (70.0)	75.0 (70.0)	75.0 (70.0)	75.0 (70.0)
200	71.0 (66.2)	71.0 (66.2)	75.0 (70.0)	75.0 (70.0)	71.0 (66.2)
300	66.0 (61.5)	66.0 (61.5)	73.4 (68.5)	70.9 (66.0)	66.0 (61.5)
400	64.4 (60.0)	64.4 (60.0)	71.8 (67.0)	67.1 (62.6)	64.4 (60.0)
500	63.5 (59.3)	63.5 (59.3)	71.8 (67.0)	64.6 (60.3)	63.5 (59.3)
600	63.5 (59.3)	63.5 (59.3)	71.8 (67.0)	63.1 (58.9)	63.1 (58.9)
650	63.5 (59.3)	63.5 (59.3)	71.8 (67.0)	62.8 (58.6)	62.8 (58.6)
700	63.5 (59.3)	63.5 (59.3)	71.8 (67.0)	62.5 (58.4)	62.5 (58.4)
750	63.1 (58.9)	63.1 (58.9)	71.4 (66.5)	62.2 (58.1)	62.2 (58.1)
800	62.7 (58.5)	62.7 (58.5)	70.9 (66.2)	61.7 (57.6)	61.7 (57.6)

Notes:

1. Source: Table U on pages 437, 439, 441, and 443 of [1.A.1].

2. Units of tensile strength are ksi.

3. The ultimate stress of Alloy X is dependent on the product form of the material (i.e., forging vs. plate). Values in parentheses are based on SA-336 forged materials (type F304, F304LN, F316, and F316LN), which are used solely for the one-piece construction MPC lids. All other values correspond to SA-240 plate material.

Table 1.A.3

ALLOY X AND CONSTITUENT YIELD STRESSES (S_y) vs. TEMPERATURE

Temp. (°F)	Type 304	Type 304LN	Type 316	Type 316LN	Alloy X (minimum of constituent values)
-40	30.0	30.0	30.0	30.0	30.0
100	30.0	30.0	30.0	30.0	30.0
200	25.0	25.0	25.8	25.5	25.0
300	22.5	22.5	23.3	22.9	22.5
400	20.7	20.7	21.4	21.0	20.7
500	19.4	19.4	19.9	19.4	19.4
600	18.2	18.2	18.8	18.3	18.2
650	17.9	17.9	18.5	17.8	17.8
700	17.7	17.7	18.1	17.3	17.3
750	17.3	17.3	17.8	16.9	16.9
800	16.8	16.8	17.6	16.6	16.6

Notes:

1. Source: Table Y-1 on pages 518, 519, 522, 523, 530, 531, 534, and 535 of [1.A.1].
2. Units of yield stress are ksi.

Table 1.A.4

ALLOY X AND CONSTITUENT COEFFICIENT OF THERMAL EXPANSION vs. TEMPERATURE

Temp. (^{o}F)	Type 304 and Type 304LN	Type 316 and Type 316LN	Alloy X Maximum	Alloy X Minimum
-40	8.55	8.54	8.55	8.54
100	8.55	8.54	8.55	8.54
150	8.67	8.64	8.67	8.64
200	8.79	8.76	8.79	8.76
250	8.90	8.88	8.90	8.88
300	9.00	8.97	9.00	8.97
350	9.10	9.11	9.11	9.10
400	9.19	9.21	9.21	9.19
450	9.28	9.32	9.32	9.28
500	9.37	9.42	9.42	9.37
550	9.45	9.50	9.50	9.45
600	9.53	9.60	9.60	9.53
650	9.61	9.69	9.69	9.61
700	9.69	9.76	9.76	9.69
750	9.76	9.81	9.81	9.76
800	9.82	9.90	9.90	9.82

Notes:

1. Source: Table TE-1 on pages 590 and 591 of [1.A.1].

2. Units of coefficient of thermal expansion are in./in.-^{o}F x 10^{-6}.

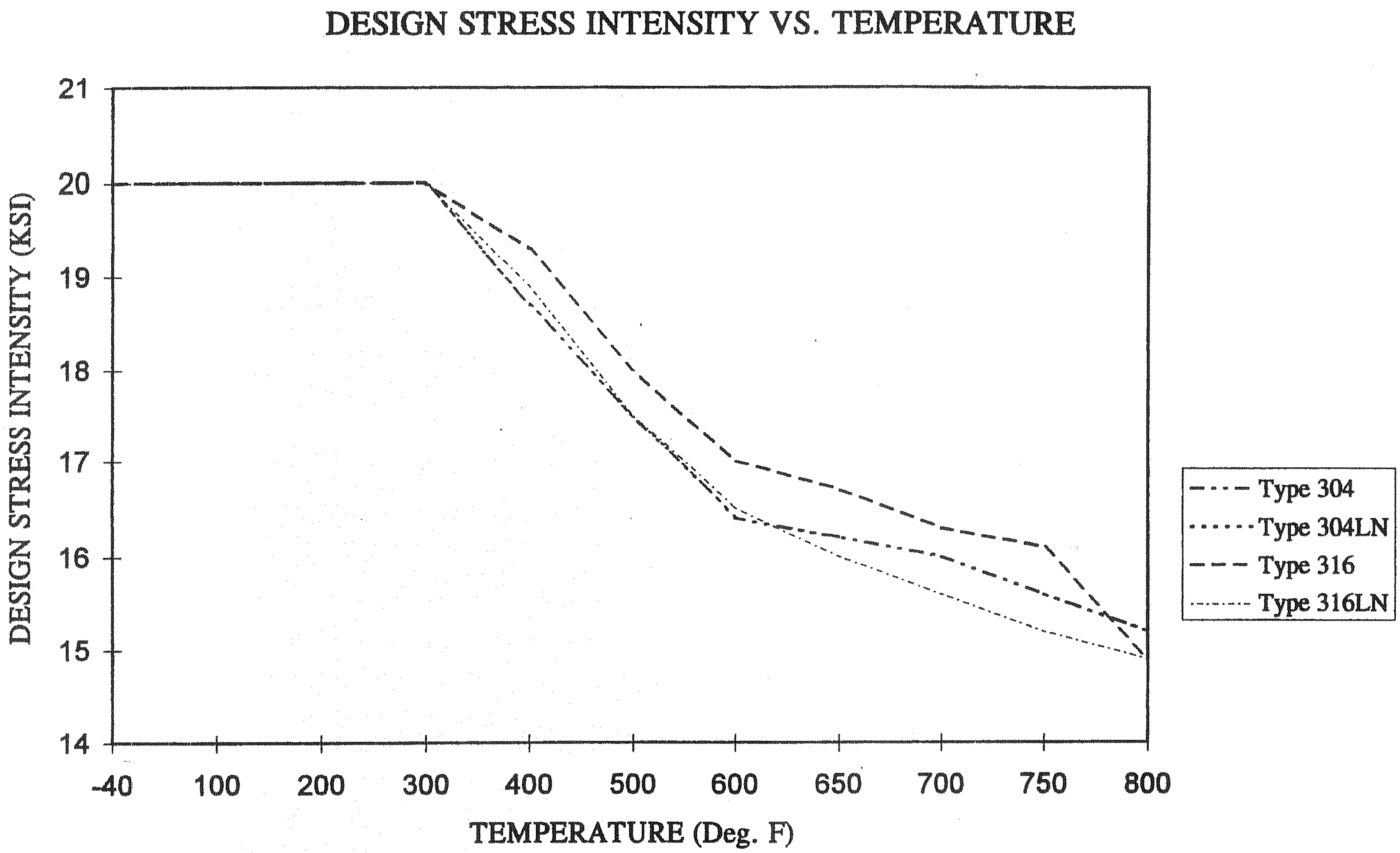
Table 1.A.5

ALLOY X AND CONSTITUENT THERMAL CONDUCTIVITY vs. TEMPERATURE

Temp. (°F)	Type 304 and Type 304LN	Type 316 and Type 316LN	Alloy X (minimum of constituent values)
-40	8.23	6.96	6.96
70	8.6	7.7	7.7
100	8.7	7.9	7.9
150	9.0	8.2	8.2
200	9.3	8.4	8.4
250	9.6	8.7	8.7
300	9.8	9.0	9.0
350	10.1	9.2	9.2
400	10.4	9.5	9.5
450	10.6	9.8	9.8
500	10.9	10.0	10.0
550	11.1	10.3	10.3
600	11.3	10.5	10.5
650	11.6	10.7	10.7
700	11.8	11.0	11.0
750	12.0	11.2	11.2
800	12.2	11.5	11.5

Notes:

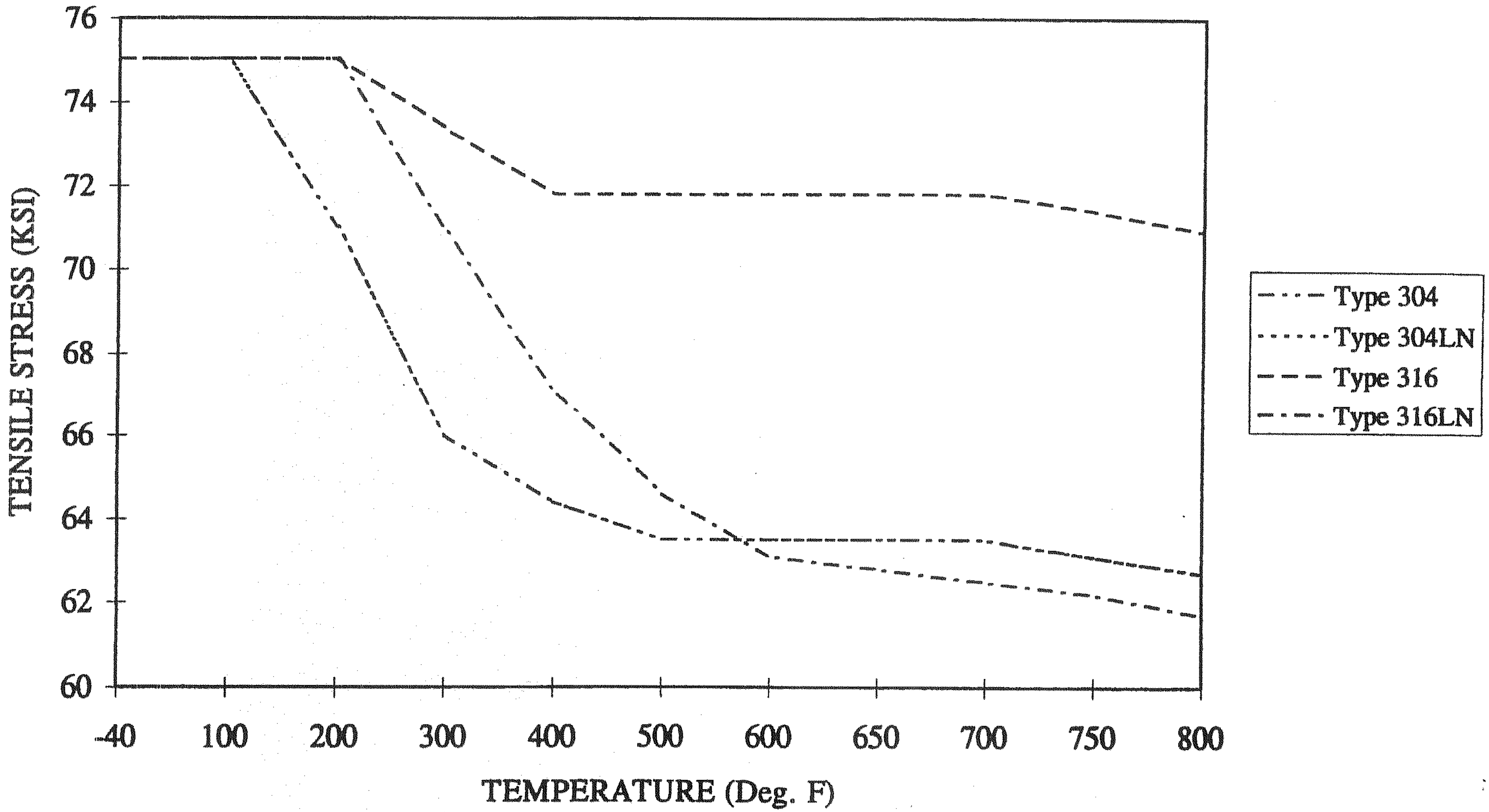
1. Source: Table TCD on page 606 of [1.A.1].
2. Units of thermal conductivity are Btu/hr-ft-°F.



SOURCE: TABLE 1.A.1

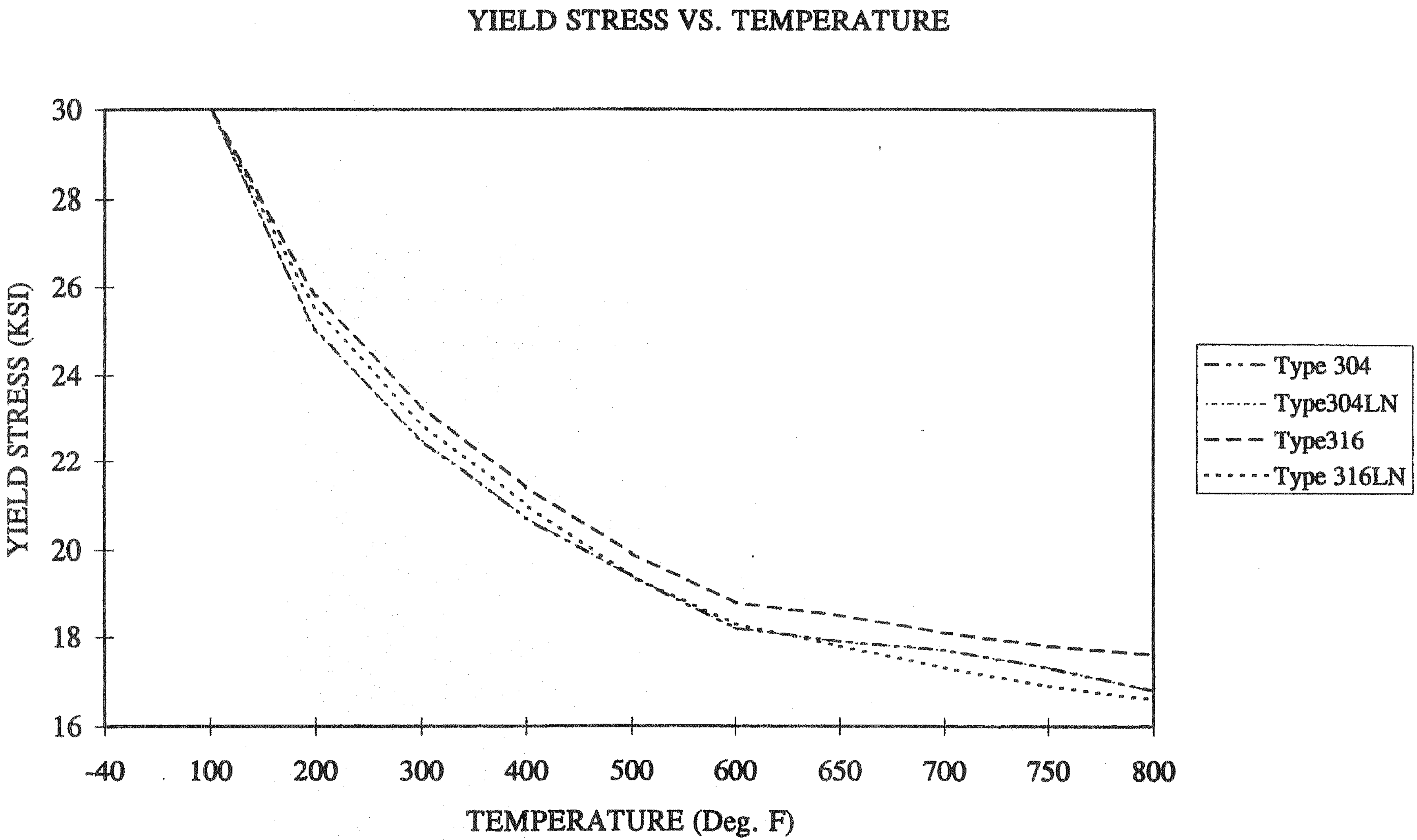
FIGURE 1.A.1; DESIGN STRESS INTENSITY VS. TEMPERATURE

TENSILE STRENGTH VS. TEMPERATURE



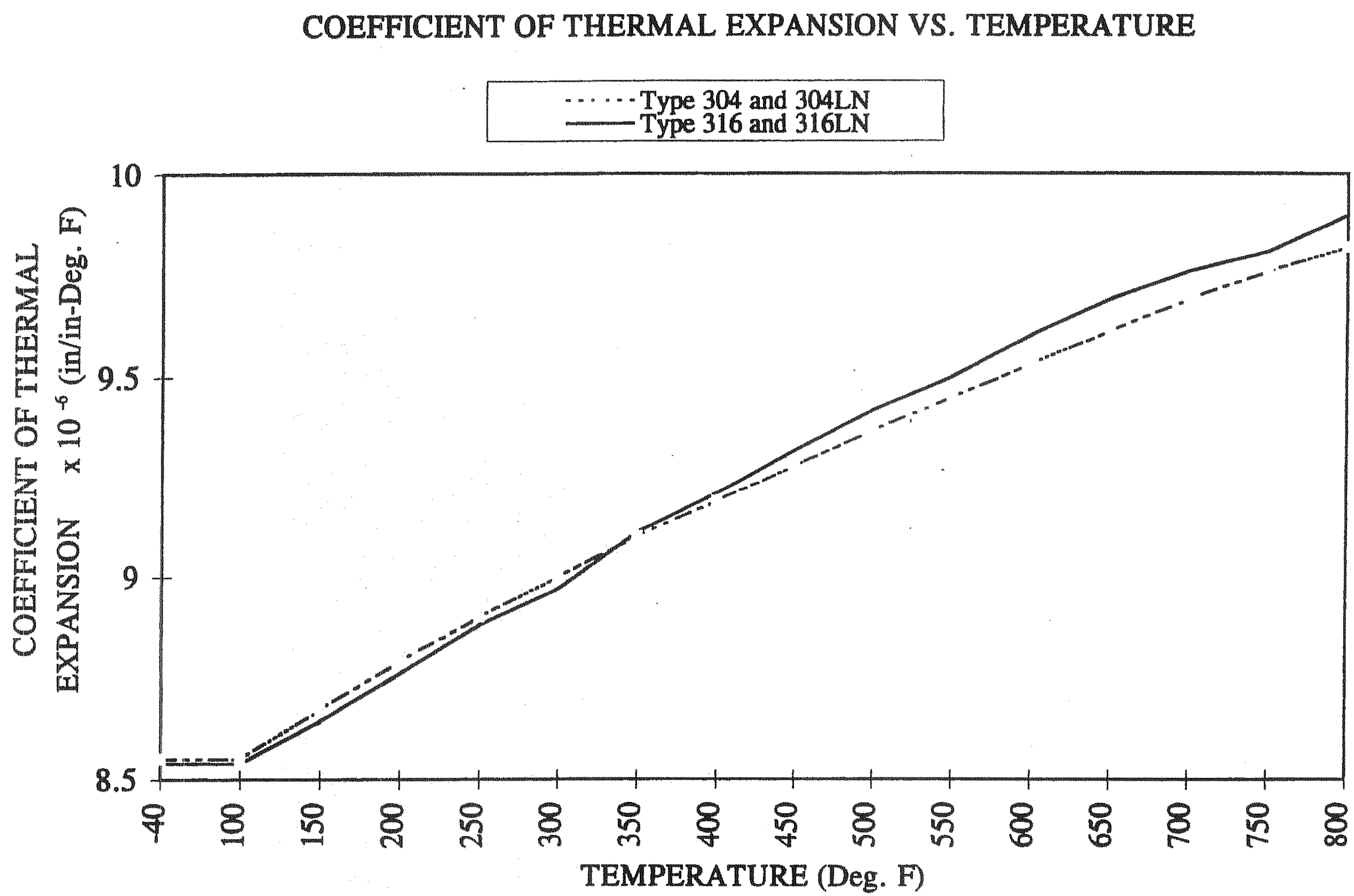
SOURCE: TABLE 1.A.2

FIGURE 1.A.2; TENSILE STRENGTH VS. TEMPERATURE



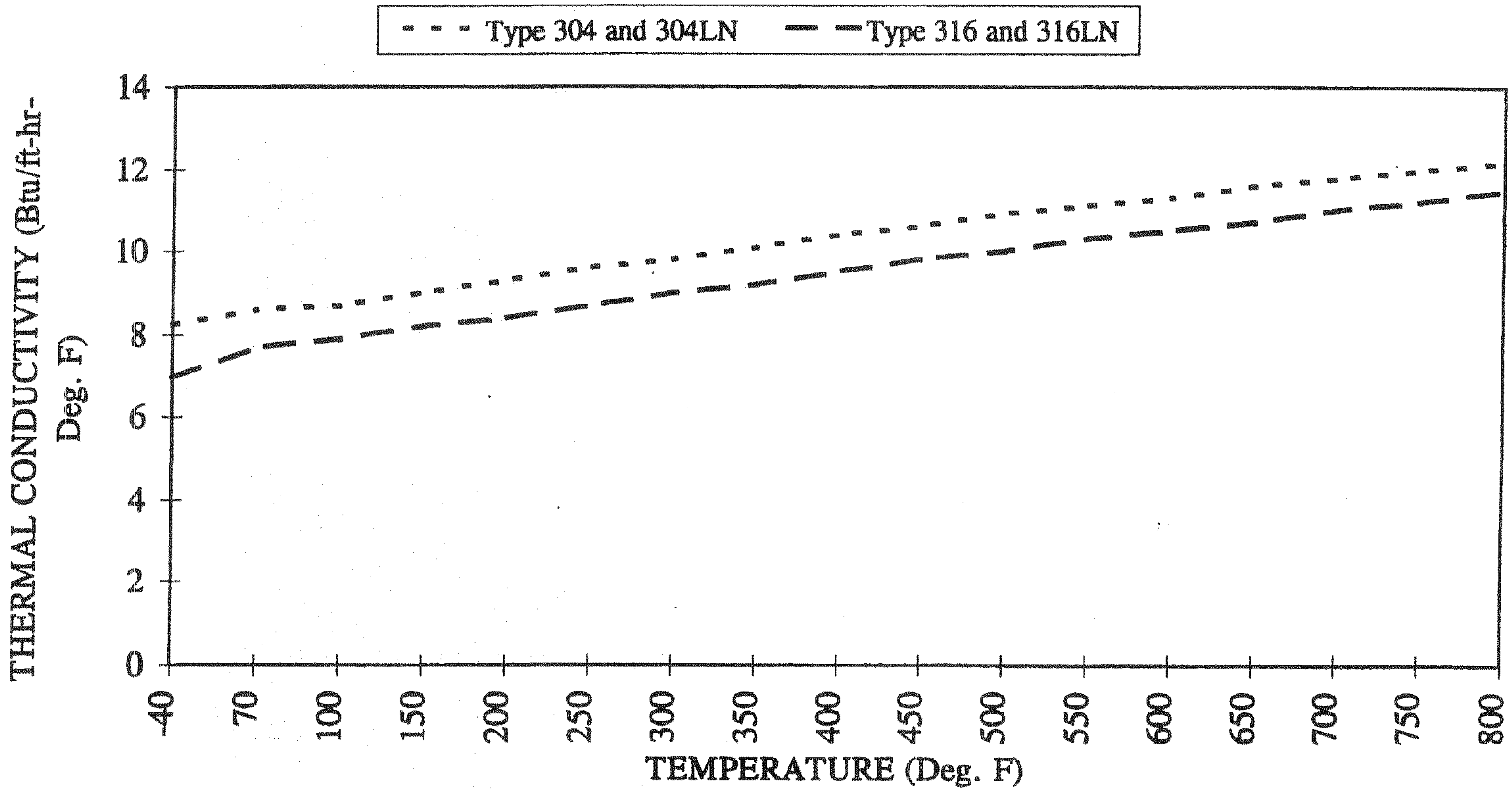
SOURCE: TABLE 1.A.3

FIGURE 1.A.3; YIELD STRESS VS. TEMPERATURE



SOURCE: TABLE 1.A.4 FIGURE 1.A.4; COEFFICIENT OF THERMAL EXPANSION VS. TEMPERATURE

THERMAL CONDUCTIVITY VS. TEMPERATURE



SOURCE: TABLE 1.A.5

FIGURE 1.A.5; THERMAL CONDUCTIVITY VS. TEMPERATURE

APPENDIX 1.B: HOLTITE ™ MATERIAL DATA

The information provided in this appendix describes the neutron absorber material, Holtite-A for the purpose of confirming its suitability for use as a neutron shield material in spent fuel storage casks. Holtite-A is one of the family of Holtite neutron shield materials denoted by the generic name Holtite™. It is currently the only solid neutron shield material approved for installation in the HI-TRAC transfer cask. It is chemically identical to NS-4-FR which was originally developed by Bisco Inc. and used for many years as a shield material with B_4C or Pb added.

Holtite-A contains aluminum hydroxide ($Al(OH)_3$) in an epoxy resin binder. Aluminum hydroxide is also known by the industrial trade name of aluminum tri-hydrate or ATH. ATH is often used commercially as a fire-retardant. Holtite-A contains approximately 62% ATH supported in a typical 2-part epoxy resin as a binder. Holtite-A contains 1% (nominal) by weight B_4C, a chemically inert material added to enhance the neutron absorption property. Pertinent properties of Holtite-A are listed in Table 1.B.1.

The essential properties of Holtite-A are:

1. the hydrogen density (needed to thermalize neutrons),

2. thermal stability of the hydrogen density, and

3. the uniformity in distribution of B_4C needed to absorb the thermalized neutrons.

ATH and the resin binder contain nearly the same hydrogen density so that the hydrogen density of the mixture is not sensitive to the proportion of ATH and resin in the Holtite-A mixture. B_4C is added as a finely divided powder and does not settle out during the resin curing process. Once the resin is cured (polymerized), the ATH and B_4C are physically retained in the hardened resin. Qualification testing for B_4C throughout a column of Holtite-A has confirmed that the B_4C is uniformly distributed with no evidence of settling or non-uniformity. Furthermore, an excess of B_4C is specified in the Holtite-A mixing and pouring procedure as a precaution to assure that the B_4C concentration is always adequate throughout the mixture.

The specific gravity specified in Table 1.B.1 does not include an allowance for weight loss. The specific gravity assumed in the shielding analysis includes a 4% reduction to conservatively account for potential weight loss at the design temperatures listed in Table 1.B.1. or an inability to reach theoretical density. Tests on the stability of Holtite-A were performed by Holtec International. The results of the tests are summarized in Holtec Reports HI-2002396, "Holtite-A Development History and Thermal Performance Data" and HI-2002420, "Results of Pre- and Post-Irradiation Test Measurements." The information provided in these reports demonstrates that Holtite-A™ possesses the necessary thermal and radiation stability characteristics to function as a reliable shielding material in the HI-TRAC transfer cask.

The Holtite-A is encapsulated in the HI-TRAC transfer cask lid and, therefore, should experience a very small weight reduction during the design life of the cask. The data and test results confirm that Holtite-A remains stable under design thermal and radiation conditions, the material properties meet or exceed that assumed in the shielding analysis, and the B_4C remains uniformly distributed with no evidence of settling or non-uniformity.

Based on the information described above, Holtite-A meets all of the requirements for an acceptable neutron shield material.

Table 1.B.1

REFERENCE PROPERTIES OF HOLTITE-A NEUTRON SHIELD MATERIAL

PHYSICAL PROPERTIES	
% ATH	62 nominal
Specific Gravity	1.68 g/cc nominal
Max. Continuous Operating Temperature	300°F
Max. Short-Term Operating Temperature	350°F (Note 1)
Hydrogen Density	0.096 g/cc minimum
Radiation Resistance	Excellent
CHEMICAL PROPERTIES (Nominal)	
wt% Aluminum	21.5
wt% Hydrogen	6.0
wt% Carbon	27.7
wt% Oxygen	42.8
wt% Nitrogen	2.0
wt% B_4C	1.0

NOTES:

1. As defined in Section 2.2, all operations involving the HI-TRAC transfer cask are short-term operating conditions. The short-term operating temperature limit is, therefore, the appropriate maximum design temperature for the Holtite-A in the HI-TRAC transfer cask.

APPENDIX 1.C: MISCELLANEOUS MATERIAL DATA
(Total of 2 Pages Including This Page)

The information provided in this appendix specifies the paint properties and demonstrates their suitability for use in spent nuclear fuel storage casks.

Thermaline 450 or equivalent is specified to coat the overpack to the maximum extent practical and the inner cavity of the HI-TRAC transfer cask. Carboline 890 or equivalent is specified to coat external surfaces of the HI-TRAC transfer cask. The paints are suitable for the design temperatures (see Table 2.2.3) and the environment.

PAGE 1.C-2 THROUGH 1.C-5 INTENTIONALLY DELETED

APPENDIX 1.D: Requirements on HI-STORM 100 Shielding Concrete

1.D.1 Introduction

The HI-STORM 100 overpack utilizes plain concrete for neutron and gamma shielding. Plain concrete used in the HI-STORM overpack provides only a compressive strength structural function due to the fact that both the primary and secondary load bearing members of the overpack are made of carbon steel. While most of the shielding concrete used in the HI-STORM 100 overpack is installed in the annulus between the concentric structural shells, smaller quantities of concrete are also present in the pedestal shield and the overpack lid. Because plain concrete has little ability to withstand tensile stresses, but is competent in withstanding compressive and bearing loads, the design of the HI-STORM 100 overpack places no reliance on the tension-competence of the shielding concrete.

During normal operations of the HI-STORM, the stresses in the concrete continuum are negligible, arising solely from its self-weight. ACI 318-95 provides formulas for permissible compressive and bearing stresses in plain concrete, which incorporate a penalty over the corresponding permissible values in reinforced concrete. The formulas for permissible compressive and bearing stresses set forth in ACI 318-95 are used in calculations supporting this FSAR in load cases involving compression or bearing loads on the overpack concrete. However, since the overpack concrete is designated as an ITS Category B material, it is appropriate to ensure that all "*critical characteristics*" of the concrete, as defined herein, are fully satisfied. During normal storage operations, the overpack concrete is completely enclosed by the overpack steel structure, protecting it from the deleterious effects of direct exposure to the environment, typical of most concrete structures governed by the ACI codes.

The "*critical characteristics*" of the plain concrete in the HI-STORM overpack are: (i) its density and (ii) its compressive strength. This appendix provides the complete set of criteria applicable to the plain concrete in the HI-STORM 100 overpack.

1.D.2 Design Requirements

The primary function of the plain concrete is to provide neutron and gamma shielding. As plain concrete is a competent structural member in compression, the plain concrete's effect on the performance of the HI-STORM overpack under compression loadings is considered and modeled in the structural analyses, as necessary. The formulas for permissible compressive and bearing stresses set forth in ACI 318-95 are used. However, as plain concrete has very limited capabilities in tension, no tensile strength capability is allotted to the HI-STORM concrete.

The steel structure of the HI-STORM overpack provides the strength to meet all load combinations specified in Chapters 2 and 3, due to the fact that both the primary and secondary load bearing members (as defined in the ASME Code, Section III, Subsection NF-1215) of the HI-STORM overpack are made from carbon steel. Credit for the structural strength of the plain concrete is only taken to enhance the compressive load carrying capability of the concrete in calculations appropriate to handling and transfer operations, and to demonstrate that the HI-STORM 100 System continues to provide functional performance in a post-accident environment. Therefore, the load combinations provided in ACI 349 and NUREG-1536, Table 3-1 are not applicable to the plain concrete in the HI-STORM overpack.

The shielding performance of the plain concrete is maintained by ensuring that the minimum concrete density is met during construction and the allowable concrete temperature limits are not exceeded. The thermal analyses for normal and off-normal conditions demonstrate that the plain concrete does not exceed the allowable long term temperature limit provided in Table 1.D.1. Under accident conditions, the bulk of the plain concrete in the HI-STORM overpack does not exceed the allowable short term temperature limit provided in Table 1.D.1. Any portion of the plain concrete, which exceeds the short-term temperature limit under accident conditions, is neglected in the post-accident shielding analysis and in any post-accident structural analysis.

1.D.2.1 Test Results to Support Normal Condition Temperature Limit

Note 3 to Table 1.D.1 references Paragraph A.4.3 of ACI-349, which requires that normal condition temperatures in excess of 150°F bulk and 200°F local must be supported by test data to demonstrate that strength reductions are acceptable and that concrete deterioration does not occur. Such data are described and discussed in this subsection.

With respect to concrete compressive strength at bulk temperatures up to 300°F, test studies for elevated temperatures were performed by Carette and Malhorta [1.D.1] that examined conditions very similar to those of the HI-STORM concrete. Their tests were performed on 4" diameter by 8" long test cylinders. The test condition most closely matching the HI-STORM concrete was: 0.6 water-to-cement ratio, limestone aggregate and 300°F for four months. While the HI-STORM storage period is much greater than 4 months, the investigators state "any major strength loss is found to occur within the first month of exposure." The four-month compressive strength for these conditions was actually determined to be greater than the nominal concrete strengths despite the elevated temperatures. This is attributable to the increase in compressive strength that accompanies concrete aging, which more than offsets the temperature effects.

With respect to concrete shielding performance at local temperatures above 300°F, a report by Schneider and Horvath [1.D.2] examined weight loss of concrete at elevated temperatures. Tests were performed on 12mm diameter by 40 mm long test cylinders in an apparatus called a thermo-balance. A variety of aggregates (i.e., quartz, limestone and basalt) were tested. The test results indicate a worst-case weight loss of 0.424% from 300°F to 365°F for quartz aggregates. This maximum level of weight loss would reduce the concrete density from 2.35 gm/cc to 2.34 gm/cc. If the entire weight loss is attributed to water loss, the corresponding limiting reduction in hydrogen content is from 0.6% to 0.555%. As discussed in Section 5.3.2, such reductions are negligible with respect to shielding performance.

1.D.3 Material Requirements

Table 1.D.1 provides the material limitations and requirements applicable to the overpack plain concrete. These requirements, drawn from ACI 349-85 and supplemented by the provisions of NUREG 1536 (page 3-21), are intended to ensure that the "*critical characteristics*" of the concrete placed in the HI-STORM overpack comply with the requirements of this Appendix and standard good practice. Two different minimum concrete densities are specified for the overpack concrete, based on the presence or absence of the steel shield shell. The steel shield shell was deleted from the overpack design after the construction of overpack serial number 1024-7.

ACI 349 was developed to govern the design and construction of steel reinforced concrete structures for the entire array of nuclear power plant applications, except for concrete reactor vessels and containment structures. Therefore, ACI 349 contains many requirements not germane to the plain concrete installed in and completely enclosed by the steel HI-STORM overpack structure. For example, the overpack concrete is not exposed to the environment, so provisions in the standard for protecting concrete from the environment would not be applicable to the concrete contained in the overpack.

In accordance with the requirement in Section 3.3 of Appendix B of the HI-STORM 100 CoC, Section 1.D.4, Table 1.D.1 and Table 1.D.2 were developed using the guidance of ACI 349-85, to the extent it needs to be applied to the unique application of placing unreinforced concrete inside the steel enclosure of the HI-STORM overpack. Other concrete standards were used, as appropriate, to provide the controls necessary to assure that the *critical characteristics* of the overpack concrete will be achieved and that the concrete will perform its design function.

1.D.3.1 Essential Requirements for Concrete Supplier and Lab Testing Support

The material used in HI-STORM related concrete shall be procured from suppliers that have been qualified under Holtec QA program through appropriate validation and surveillance. The QA surveillance record on the concrete supplier must be current at the time of concrete placement. Among the many missions of the surveillance program are activities that are crucial to insure that all required *critical characteristics* shall be met such as, all scales used in the batching process are calibrated, delivery trucks are in good working condition, and all aggregate material stored at the facility is segregated. These parameters ensure that the batched concrete is in compliance with the Holtec concrete mix design.

With respect to the test lab services, surveillance of the lab ensures that all equipment used in testing of aggregates and concrete cylinder samples are calibrated. Additionally, inspections are completed on the concrete cylinder storage facilities as well as basic material controls. With these controls in place, the results of any aggregate testing or concrete cylinder testing can be confirmed to be accurate and reliable.

1.D.3.2 Concrete Mix Design and Material Requirements

A concrete mix design shall first be established to determine the necessary recipe to produce a HI-STORM concrete that meets the *critical characteristics* of the HI-STORM as specified in this section. Once the mix design is formulated, actual site testing shall be conducted to confirm the mix design. At the batch plant, the mix design will be used to make concrete for initial testing purposes. This initial batch shall be checked for slump and density. The mix design may be altered as necessary at this time until the desired results are achieved. Additionally, a total of ten cylinders from the final acceptable batch shall be taken for laboratory testing. These cylinders shall be used for compressive strength break test to determine the strength of the concrete mix.

With respect to individual aggregate testing, the provisions from ACI 349 those are germane to the plain concrete installed in and completely enclosed by the steel HI-STORM overpack structure are summarized herein. For example, the overpack concrete is not exposed to the environment, so provisions in the ACI standards for protecting concrete from the environment would not be applicable to the concrete contained in the overpack.

For the standard use local course and fine aggregates supplied by the local batch, a high level of confidence based on continued use in area concrete obviates the need for many of the aggregate testing recommended by ASTM C33. However, certain testing relevant to confirming the acceptability of the aggregate is required by this specification. For both the local fine and course aggregate, laboratory testing shall be carried out to confirm grading per ASTM C33 as well as the test per ASTM C117 to determine materials finer than 200 sieve. A laboratory technician shall also visually inspect the source pile to evaluate the aggregates for any deleterious substances or organic impurities. If this visual inspection reveals any evidence of deleterious substances or organic impurities, additional aggregate testing that addresses deleterious substances per ASTM C33 for both fine and course aggregates as well as organic impurities testing per ASTM C40 for the local fine aggregate shall be conducted.

For the specially supplied dense aggregate that is supplied from an outside source, applicable grading and 200 sieve testing shall be completed.

1.D.4 Construction Requirements

Method of placement of the concrete is important to achieving the desired properties in the concrete. It is imperative to achieve a concrete placement with no voids. In order to accomplish this, procedural steps shall be in place to control the placement technique with respect to lift height and vibratory agitation. The concrete shall be placed in the HI-STORM in two foot (approximate) lifts. Vibration of poured concrete shall be such that the vibrator is inserted and removed in a vertical movement with no dragging of the vibrator through the concrete. Vibrator placement shall be based on the size of the vibrator as detailed in ACI-309R.

The slump of the concrete shall be checked as necessary prior to placement to ensure that the concrete is suitable for pumping.

Appropriate measures shall be taken for hot and cold weather conditions as prescribed by ACI-305R and ACI-306R, respectively.

1.D.5 <u>Testing Requirements</u>

Concrete may be tested for temperature, slump, and density for each truck prior to placement in the HI-STORM for informational purposes. Official samples, as required by the applicable Holtec procedure, shall be taken from the approximate middle of the truck discharge and will become the sample of record for slump, temperature, and density. Additionally, compressive test cylinder samples shall be taken as detailed in the governing Holtec procedure. Samples taken shall be of a quantity to support required break tests and shall be taken from two trucks per HI-STORM to ensure a representative sample of the concrete in each HI-STORM. Samples taken in the field should be stored as best possible to protect the samples from extreme temperature conditions. Compressive break strengths of the official concrete cylinder samples taken shall be tested for the required minimum concrete strength. The compressive strength of concrete is observed to increase monotonically with the time of curing [1.D.3]. Therefore, break tests resulting in a compressive strength exceeding the minimum required compressive strength may be used as the official concrete break data in lieu of waiting for 28-day breaks.

1.D.6 <u>References</u>

[1.D.1] Carette and Malhorta, "Performance of Dolostone and Limestone Concretes at Sustained High Temperatures," Temperature Effects on Concrete, ASTM STP 858.

[1.D.2] Schneider and Horvath, "Behaviour of Ordinary Concrete at High Temperature," Vienna Technical University – Institute for Building Materials and Fire Protection, Research Report Volume 9.

[1.D.3] Concrete Manual, 8th Edition, US Bureau of Proclamation, Denver, Colorado, 1975.

Table 1.D.1
Requirements for Plain Concrete

ITEM	APPLICABLE LIMIT OR REFERENCE
Density in overpack body (Minimum) (see Table 3.2.1 for information on maximum concrete density)	146 lb/ft^3 (HI-STORM 100 up to Serial Number (S/N) 7), 155 lb/ft^3 (S/N 8 and higher)
Density in lid and pedestal (Minimum) (See Table 3.2.1 for information on maximum concrete density)	146 lb/ft^3 (HI-STORM 100S Version B does not have a concrete-filled pedestal)
Specified Compressive Strength	3,300 psi (min.)
Compressive and Bearing Stress Limit	Deleted
Cement Type and Mill Test Report	Type II; (ASTM C 150 or ASTM C595)
Aggregate Type	Fine and coarse aggregate as required (Note 2)
Nominal Maximum Aggregate Size	1-1/2 (inch)
Water Quality	Deleted
Material Testing	See Note 4.
Admixtures	Deleted
Maximum Water to Cement Ratio	0.5 (Table 4.5.2)
Maximum Water Soluble Chloride Ion Cl in Concrete	1.00 percent by weight of cement (Table 4.5.4) (See Table 1.D.2, Note 1)
Concrete Quality	Deleted
Mixing and Placing	See Note 6.
Consolidation	Deleted
Quality Assurance	Per Holtec Quality Assurance Manual, 10 CFR Part 72, Appendix G commitments
Through-Thickness Section Average† Temperature Limit Under Long Term Conditions	300°F (See Note 3)
Through-Thickness Section Average† Temperature Limit Under Short Term Conditions	350°F (Appendix A, Paragraph A.4.2)
Aggregate Maximum Value†† of Coefficient of Thermal Expansion (tangent in the range of 70°F to 100°F)	6E-06 inch/inch/°F (NUREG-1536, 3.V.2.b.i.(2)(c)2.b)

† The through-thickness section average is the same quantity as that defined in Paragraph A.4.3 of Appendix A to ACI 349 as the mean temperature distribution. A formula for determining this value, consistent with the inner and outer surface averaging used in this FSAR, is presented in Figure A-1 of the commentary on ACI 349. Use of this quantity as an acceptance criterion is, therefore, in accordance with the governing ACI code.

†† The following aggregate types are a priori acceptable: limestone, marble, basalt, granite, gabbros, or rhyolite. The thermal expansion coefficient limit does not apply when these aggregates are used. Careful consideration shall be given to the potential of long-term degradation of concrete due to chemical reactions between the aggregate and cement selected for HI-STORM overpack concrete.

Table 1.D.1 (continued)
Requirements for Plain Concrete

Notes:

1. Deleted

2. The coarse aggregate shall meet the requirements of ASTM C33 for class designation 1S from Table 3. However, if the requirements of ASTM C33 cannot be met, concrete aggregates that have been shown by special tests or actual service to produce concrete of adequate strength, unit weight, and durability meeting the requirements of Tables 1.D.1 and 1.D.2 are acceptable in accordance with ACI 349 Section 3.3.2. The high-density coarse aggregate percentage of Material Finer than No. 200 Sieve may be increased to 10 % if the material is essentially free of clay or shale.

3. The 300°F long term temperature limit is specified in accordance with Paragraph A.4.3 of Appendix A to ACI 349 for normal conditions considering the very low maximum stresses calculated and discussed in Section 3.4 of this FSAR for normal conditions. In accordance with this paragraph of the governing code, the specified concrete compressive strength is supported by test data and the concrete is shown not to deteriorate, as evidenced by a lack of reduction in concrete density or durability.

4. Tests of materials and concrete, as required, shall be made in accordance with standards of the American Society for Testing and Materials (ASTM) as specified here, to ensure that the *critical characteristics* for the HI-STORM concrete are achieved. ASTM Standards to be used include: C 31-96, C 33-82, C 39-96, C 88-76, C 131-81, C 138-92, C 143-98, C 150-97, C 172-90, C 192-95, C 494-92, C 637-73. More recent approved editions of the referenced standards may be used.

5. Deleted

6. Water and admixtures may be added at the job site to bring both the slump and wet unit weight of the concrete within the mix design limits. Water or admixtures shall not be added to the concrete after placement activities have started. The tolerance for individual and combined aggregate weights in the concrete batch may be outside of tolerances specified in ASTM C94, provided that the wet unit weight of the concrete is tested prior to placement and confirmed to be within the approved range.

Table 1.D.2: Testing Requirements for Plain Concrete

TEST	SPECIFICATION
Compression Test	ASTM C31, ASTM C39, ASTM C192
Unit Weight (Density)	ASTM C138
Maximum Water Soluble Chloride Ion Concentration	Federal Highway Administration Report FHWA-RD-77-85, "Sampling and Testing for Chloride Ion in Concrete" (Note 1)

Notes:

1. If the concrete or concrete aggregates are suspected of containing excessive amounts of chlorides, they will be tested to ensure that their contribution will not cause the water-soluble chloride concentration to exceed the required maximum. Factors to be considered will consist of the source of the aggregates (proximity to a salt water source, brackish area, etc.) and service history of the concrete made from aggregates originating from the same source. No specific tests are required unless the aggregates or water source are suspected of containing an excessive concentration of chloride ions.

SUPPLEMENT 1.I

(This Section Reserved for Future Use)

SUPPLEMENT 1.II

GENERAL DESCRIPTION OF HI-STORM 100 SYSTEM FOR IP1

1.II.0 GENERAL INFORMATION

The HI-STORM 100 System has been expanded to include options specific for Indian Point Unit 1. Indian Point Unit 1 (IP1) fuel assemblies are approximately 137 inches in length which is considerably shorter than most PWR fuel assemblies. As a result of the shorter fuel assemblies and a reduced crane capacity at IP1, the HI-STORM 100 System now includes a shorter HI-STORM overpack, MPC, and HI-TRAC for IP1. Information pertaining to the HI-STORM 100 System modifications for IP1 is generally contained in the "II" supplements to each chapter of this FSAR. Certain sections of the main FSAR are also affected and are appropriately modified for continuity with the "II" supplements. Unless superseded or specifically modified by information in the "II" supplements, the information in the main FSAR is applicable to the HI-STORM 100 System for use at IP1.

1.II.1 INTRODUCTION

The HI-STORM 100 System as deployed at Indian Point Unit 1 will consist of a HI-STORM 100S Version B overpack, an MPC-32, and a HI-TRAC 100D.

1.II.2 GENERAL DESCRIPTION OF HI-STORM 100 SYSTEM FOR IP1

1.II.2.1 System Characteristics

The HI-STORM 100S Version B, MPC-32, and HI-TRAC 100D have been shortened for use at Indian Point Unit 1.

The HI-STORM 100S Version B overpack was shortened by approximately 33 inches. The other physical characteristics (e.g. inlet and outlet vents, inner and outer shells, and lid) of the HI-STORM 100S Version B overpack remain unchanged. This reduction in height creates another variant of the HI-STORM 100S Version B overpack, differing from the others variants by only height and weight. The variant for IP1 is referred to as the HI-STORM 100S-185 and is approximately 185 inches high.

The MPC-32 basket and shell, for use at IP1, were shortened by approximately 33 inches. The neutron absorber panels and sheathing were shortened by approximately 20 inches. The neutron absorber panels in the MPC-32 for IP1 effectively cover the entire height of the basket. Since the primary features that define an MPC-32 (e.g. cell opening, cell pitch, basket wall thickness, neutron absorber thickness and B-10 loading) are unchanged for use at IP1, the basket is still designated as an MPC-32. The MPC-32 for IP1 may be used with both the HI-STORM 100S-185 and the standard height HI-STORM 100S Version B (the HI-STORM 100S-218 also referred to as the HI-STORM 100S Version B (218)).

The HI-TRAC 100D was also shortened by approximately 33 inches. Due to a crane capacity of 75 tons at IP1 it was also necessary to reduce the thickness of the outer steel shell by a 1/4 inch and reduce the lead thickness by 3/8 inch. The water jacket thickness, pool lid, and bottom flange were not modified. This variant of the HI-TRAC 100D is referred to as the HI-TRAC 100D Version IP1.

Table 1.II.1 contains the key parameters for the HI-STORM 100 System that are unique for its use at IP1.

1.II.2.2 Operational Characteristics

With the exception of the helium fill requirements specified in Table 1.II.1, the operational characteristics of the IP1 specific HI-STORM 100 System and the generic HI-STORM 100 System (as described in Section 1.2.2) are identical.

1.II.2.2.1 Criticality Prevention

Criticality is controlled by geometry and neutron absorbing materials in the fuel basket. The MPC-32 for IP1 does not rely on soluble boron credit during loading or the assurance that water cannot enter the MPC during storage to meet the stipulated criticality limits.

Each MPC model is equipped with neutron absorber plates affixed to the fuel cell walls as shown on the drawings in Section 1.5. The minimum ^{10}B areal density specified for the neutron absorber in each MPC model is shown in Table 1.2.2 in Section 1.2. These values are chosen to be consistent with the assumptions made in the criticality analyses.

1.II.2.3 Cask Contents

The MPC-32 and MPC-32F for IP1 are designed to accommodate up to thirty-two IP1 PWR fuel assemblies. All thirty-two of these fuel assemblies may be classified as intact or damaged fuel assemblies. Fuel debris is not permitted to be stored in the MPC-32 or MPC-32F for IP1.

1.II.3 IDENTIFICATION OF AGENTS AND CONTRACTORS

Same as in Section 1.3.

1.II.4 GENERIC CASK ARRAYS

Same as in Section 1.4.

1.II.5 DRAWINGS

The drawings of the HI-STORM 100S Version B, MPC enclosure vessel, and MPC-32 provided in Section 1.5, contain notes regarding the IP1 specific variants. A separate drawing is provided in Section 1.5 for the HI-TRAC 100D Version IP1.

Table 1.II.1
KEY PARAMETERS FOR HI-STORM 100 SYSTEM SPECIFIC TO IP1

Item	Value
IP1 MPC-32/32F storage capacity	Up to 32 intact or damaged stainless steel clad IP1 fuel assemblies with or without non-fuel hardware.
MPC internal environment Helium fill (99.995% fill helium purity) MPC-32/32F (heat load $\leq$ 8.0 kW)	(all pressure ranges are at a reference temperature of 70°F) $\geq$ 22.0 psig and $\leq$ 33.3 psig