ENCLOSURE 1

ANSCO PRODUCTS INC.

TRANSCO PROCEDURE No. TIQAP 9.20

FOR THE INSTALLATION OF KM-1 FIRE BARRIER SYSTEMS FOR ELECTRICAL RACEWAY SYSTEMS.

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1.0 Introduction:

This document is provided as a guideline to assist in the process of installing the KM-1 Fire Protection System for electrical raceway systems such as cable trays, conduits, cable air - drops, junction boxes, et cetera. Also, included in the items to be protected are intervening elements and interferences including (but not limited to) items such as hangers, tray stiffeners, connectors, and couplings.

In general, the KM-1 Fire Barrier System is an endothermic fire barrier material which is intended for both one and three hour fire protection applications geared to nuclear power applications.

The KM-1 system can be supplied either as a pre-engineered (already cut to size and ready to install) installation or as raw panel and barrier components which can be cut in the field in accordance with approved design drawings. In either case, the system offers a flexible alternative which can be field modified as needed (in accordance with this procedure and the approved details) to conform to a wide variety of field conditions.

2.0 Definitions:

Top of C/T	Top of Cable Tray: the face of the cable tray which is open; for cable tray risers this refers to the face which runs in conjunction with the open face of the connected able tray
Right Hand Side of C/T	Looking from the top of the cable tray (as defined above), the side on the right.
Panel Row	A section or length of the insulated item completely encapsulated around the periphery of the insulated specimen by one layer thickness of the KM-1 Fire Protection System.
Panel	KM-1 Panels; an individual component of the panel row, i.e. top panel, bottom panel, or side panel.

Lace	To secure (tie) one panel to an adjacent panel with lacing wire between adjacent anchors.
Gap	Areas where the previous layer is visible, or where a joint between two adjacent panels is greater than 1/8" wide.
Band	Any qualified stainless steel strapping device such as stainless steel cable ties or banding materials which have been qualified for use (as specified in the approved detail drawings).
KM-1 Thermal Filler	A constituent of the Darmatt KM1 System used as a filler for gaps in the installed system.

3.0 **Identification of Panels**:

3.1 **Identification**:

Where "pre-engineered" (cut to size and ready to install pieces) are supplied to a jobsite, each KM-1 panel will be marked with a unique panel number (per detail drawing) on its inner face which in turn corresponds to a specific location identified on a "piece-part" location drawing.

3.1.1 **Cable Tray Panels**: These are normally provided as four-pieces per section for each layer used (two layers are used for one hour systems while four layers are used for three hour systems). The KM-1 cable tray panels will have marks on the inner face to indicate whether the panel is a top panel ("T"), right hand side panel ("R"), left hand side panel ("L"), or bottom panel ("B"). Except where obstructions interfere with straight runs of cable tray, top and bottom panels, and side panels are interchangeable for each panel row and may be field modified as needed in accordance with this procedure.

3.1.2 **Pre-Molded Conduit Sections**: Pre-molded KM-1 conduit sections will be supplied in either two-piece single layer sections for one hour systems or two-piece double layer sections for three hour systems.

3.1.3 **Cable Air-Drop Sections:** KM-1 cable air-drop sections will be provided as either two-piece pre-molded conduit type sections or four piece cable tray type panels which may have integral steel angle steel frame sections.

3.1.4 **Junction Box Panels:** KM-1 junction box sections will be supplied as site specific designs.

4.0 **Installation Procedures:**

Systems are typically installed to general layout drawings ("piece-part" drawings) supplied which identify the locations of most of the individual panels.

4.1 **One-Hour System:**

4.1.1 **Cable Tray Runs:**

The client will be responsible to release work areas (trays, conduits, junction boxes, et cetera) prior to the installation of a KM-1 fire barrier system. One hour cable tray envelopes generally consist of two layers of KM-1 panels as well as protection of hangers, intervening members, et cetera.

4.1.1.1 **Straight Sections:**

Horizontal and vertical cable tray sections can be installed as described below. Each panel row has two types of panels which relate to either a top and bottom panel (*Type A*) or two side panels (*Type B*). In most cases, several multi-layered sections are laced together (from one section to the next) to form one long continuous fire barrier envelope for the length of tray to be protected.

It is suggested that the top panel be installed first when assembling a section of panels. As needed, one or both of the side panels can then be positioned on the appropriate side of the cable tray and a few adjacent lacing anchors (*"J-hooks"*) along the length of the panel can be loosely laced between the top and side panels to hold the side panels in position. After the side panels are connected loosely to the top panel, the bottom panel can then be fitted into place. This panel will be held into position by loosely lacing a few adjacent J-hooks along the length of the panel between the side and bottom panels. (*Note*: The sequence for placing panels may be modified at any time for installation convenience or as conditions require.)

In all cases, panels will typically have some of their outside edges (as decided during the design and manufacturing process) covered with KM-1 Expanding Gasket (as a result, each butt joint will automatically have a gasket between the interfaces of adjacent panels). If not already attached (as supplied) to the board, secure one layer of KM-1 Expanding Gasket material (using commercial grade staples) to the edge of the panel where needed. There are no technical requirements for staple types or placement, et cetera.

The bottom edge of the panel section can then be moved to butt up against the preceding section as necessary. A single layer of KM-1 Expanding Gasket should be attached to one panel edge which butts up to an ungasketed edge of the next panel section. Like the gaskets used in longitudinal joints described above, secure one layer of KM-1 Expanding Gasket material (using commercial grade staples) to the edge of the panel if one is not already attached. There are no technical requirements for staple types or placement, et cetera.

When the panel sections are tight up against each other, adjacent J-hooks around the periphery of each panel section can then be tied permanently using the approved lacing wire. *Note*: If the J-hook positions between adjacent panels are not exactly aligned, it is acceptable (as an option) to lace one J-hook on one panel to the two closest J-hook on the adjacent panel (the two J-hooks should be far enough apart in order to wrap lacing wire from one to the next J-hook while maintaining the ability to tighten the wire via twisting).

Once this has been completed, the adjacent lacing anchors between each panel section can be tied permanently to close any gaps (maximum of 1/8") between any adjacent panel. Resulting gaps larger than 1/8" will be filled with additional strips of expanding gasket material (it is suggested that no more than two layers of gasket be used in any joint) and/or KM-1 Thermal Filler .

It is suggested that the numerically sequential panel row can then be positioned and secured in the manner described above utilizing the following sequence: top panel, side panels, bottom panels. This process (if convenient) can be continued until all the first layer is installed. Inspection can be performed on any completed section of the first layer in accordance with Section 5.0 of this document prior to installing any portion of subsequent and final layers (each layer will be inspected separately).

The installation of the second (outer) can be carried out in an identical manner to the installation of the first layer (*i.e.*, installing panel row number one first,

and then proceeding in sequential numerical fashion, or as required). Again, it is suggested that sections of the panels be installed in the following sequence: top panel, side panels, bottom panels.

Again, the installation sequence suggested above can be modified at any point to suit the installation provided a complete inspection is performed for each individual layer. Also, the physical panels can be modified as needed in accordance with Section 4.3 of this procedure. Panels for covering hangers, stiffeners, and connector plates are addressed separately in this procedure.

Note: Some KM-1 cable tray envelope designs may require additional pieces not identified above (*i.e.*, some tray designs may require an additional layer of ceramic paper between the first layer and the bottom of the tray while other trays may require spacer panels between the sides of the tray and the first KM-1 panel layer). The installation and/or piece-part drawings will identify these variations.

4.1.1.2 Bend and Radius Sections:

On any cable tray run where a bend or radius is present, the suggested sequence for installing these sections is will be the same as for a straight sections (*i.e.*, top panels first, side panels next, and finally the bottom panels).

In some cases the top, bottom or side panels may have tapered edges on the top or bottom edges or both. These panels may require some site trimming in order to fit or to follow the profile of the layer. A single layer of KM-1 Expanding Gasket should be attached to one panel edge which butts up to an ungasketed edge of the next panel section. Like the gaskets used for straight cable tray panels described in item 4.1.1.1 above, secure one layer of KM-1 Expanding Gasket material (using commercial grade staples) to the edge of the panel if one is not already attached. There are no technical requirements for staple types or placement, et cetera.

Once this has been completed, the adjacent lacing anchors between each panel can be tied permanently to close any gaps (maximum of 1/8") between adjacent panels. Resulting gaps larger than 1/8" will be filled with additional strips of KM-1 Expanding Gasket material (it is suggested that no more than two layers of gasket be used in any joint) and/or KM-1 Thermal Filler.

Again, the installation sequence suggested above can be modified at any point to suit the installation provided a complete inspection is performed for each individual layer. Also, the physical panels can be modified as needed in accordance with Section 4.3 of this procedure. Panels for covering hangers, stiffeners, and connector plates are addressed separately in this procedure.

Note: Some KM-1 cable tray envelope designs may require additional pieces not identified above (*i.e.*, some tray designs may require an additional layer of ceramic paper between the first layer and the bottom of the tray while other trays may require spacer panels between the sides of the tray and the first KM-1 panel layer). The installation and/or piece-part drawings will identify these variations.

4.1.2 **Conduit Runs:**

4.1.2.1 **Straight Sections in "Free Air":**

One hour "free air" conduit fire barrier envelopes typically consist of two semi-circular panel pieces per section. When supplied as a pre-engineered system, both of these panels halves are identical in that a KM-1 Expanding Gasket is attached along one longitudinal and one circumferencial joint on each piece (when the two pieces are placed together both longitudinal joints and one section end are then automatically gasketed). Like the gaskets used for cable tray panels described in item 4.1.1.1 above, secure one layer of KM-1 Expanding Gasket material (using commercial grade staples) to the edge of the panel where needed if one is not already attached. There are no technical requirements for staple types or placement, et cetera.

Prior to installation, each conduit panel should be checked for cracks or dents by the installer. These should be filled in/smoothed over with the KM-1 Thermal Filler after the panels have been installed (cracks or dents on the inner radius of any piece should be covered with the thermal filler material prior to installation). *Note:* The use of a cracked piece of semi-circular pre-molded conduit section is acceptable for use provided the specified lacing wire is wrapped around the conduit wrap section (both semi-circular pieces) and twist tied on each side of the crack (and within approximately 2-3" of the crack).

In the case of horizontal conduit raceways, the first panel row number of the conduit wrap should be installed first at the start of the conduit run. The

longitudinal joint of the two panels should be oriented as close to horizontal as conditions allow. Fit the second panel around the bottom of the conduit and hold in position. Where the conduit sections are supplied with pre-attached expanding gaskets, the panels are fitted around the conduit in an orientation such that the circumferencial gaskets of both panels are at the same end. For vertical runs/sections, it is not necessary for the longitudinal joint to be continuous from one panel row to the next panel row. *(Note*: Trim the inside radius of a semi-circular conduit panels to accommodate conduit hardware such as connectors and couplers. Use a thin layer of KM-1 Thermal Filler between the hardware item and the panel during installation to help assure irregularities caused by trimming do not result in voids in the permanent installation.)

Take a length of lacing wire and position a maximum of 2" from each end of the conduit panel and secure the two panel sections in position with the specified wire (twist tie, cut excess, and then flatten against the panel). Repeat this step along the length of the panel section using a maximum spacing of 9" between each tie wire. Care should be exercised as to not over tighten the wire.

Repeat the above installation procedure for the following panel section so that the top edge of the preceding row and the bottom edge of the present row are butted up against each other. Resulting gaps larger than 1/8" will be filled with additional strips of KM-1 Expanding Gasket material (it is suggested that no more than two layers of gasket be used in any joint) and/or KM-1 Thermal Filler.

Once the installed panels have been inspected and verified to meet the requirements of this procedure, the outer surface fabric can be installed. (The cloth pieces will either be supplied in pre-cut numbered lengths or can be cut on site.) The pre-cut fabric is numbered and the respective pieces will be positioned at the correct location and wrapped around the conduit panels (the fabric can be initially held in place with metal staples). (It is suggested that the circumferential overlap of the fabric be located at the bottom of horizontal runs as to prevent the possible accidental entry of liquids.) This fabric will then be secured to the panels using nominal stainless steel bands located approximately 2" in from the bottom end of the first panel row of the run, and in the approximate middle of the panel. The bands should be installed so that they can not be moved by hand (otherwise there are no other tightness requirements for these bands).

The fabric will then be wrapped around the next section of the conduit run overlapping the previous place of cloth by approximately 2". (*Note*: because of certain conduit configurations and interferences, it is recognized that this 2" overlap is not always possible to maintain. Hence, the 2" overlap is suggested as an installation *guideline* and is not an installation *requirement*). A stainless steel band will then be fitted securely at the overlapping end approximately 1" from the end of the last piece of cloth installed (or as conditions allow). Install a band at the approximate center of the piece of cloth so that a length of no more than 24" exists between any two bands. This process is repeated for the length of the conduit run.

Again, the installation sequence suggested above can be modified at any point to suit the installation provided a complete inspection prior to installing the outer fabric. Also, the physical panels can be modified as needed in accordance with Section 4.3 of this procedure. Panels for interfacing with hangers, boxed sections, et cetera are addressed separately in this procedure.

Note: Some KM-1 conduit envelope designs may require additional pieces not identified above. If applicable, the installation and/or piece-part drawings will identify these variations.

4.1.2.2 **Bend and/or Sweep Sections**:

For bends and sweeps, a panel row may either be supplied as two pre-molded panels or as a series of mitered panels which are installed in the same sequence as described above. Field modification (trimming, *etc.*) of some or all of the pieces is permissible to facilitate a more accurate fit (than as supplied) of the fire barrier envelope. *Note*: where trimming or modification is performed, all gaskets must be replaced to their original intended positions. Pre-molded bends and sweeps as well as mitered sections will use the KM-1 Expanding Gasket material between all longitudinal and all circumferential butt joints.

Like the gaskets used for free-air conduit panels described above, secure one layer of KM-1 Expanding Gasket material (using commercial grade staples) to the edge of the panel where needed if one is not already attached. There are no technical requirements for staple types or placement, et cetera.

Mitered sweeps and elbows panels are of a slightly larger radius than the conduit that they cover (the larger radius is needed to accommodate the curvature of the

bend). Prior to placing a mitered panel piece on a conduit, fill the inside of the semi-circular conduit panel half with KM-1 Thermal Filler and press the piece onto the conduit (squeezing out any excess). Repeat the process for the other half of the panel section and tie with lacing wire as described below.

Take a length of the approved wire and position a maximum of 2" from each end of the conduit panel and secure the two panel half-sections in position (twist tie, cut excess, and then flatten against the panel). Repeat this step along the length of the panel section using a maximum spacing of 9" between each tie wire. Care should be exercised as to not over tighten the wire. (*Note*: Each mitered section should be tied with at least two wraps of wire.)

Repeat the above installation procedure for the following panel sections so that the top edge of the preceding row and the bottom edge of the present row are butted up against each other. Resulting gaps larger than 1/8" will be filled with additional strips of KM-1 Expanding Gasket material (it is suggested that no more than two layers of gasket be used in any joint) and/or KM-1 Thermal Filler.

Inspect the conduit panels in accordance with Section 5.0 of this procedure prior to installing the outer fabric. The fabric should be installed using the guidelines described above in item 4.1.2.1.

4.1.2.3 Boxed Sections:

For "boxed" sections of conduit runs, a angle steel framework will be used to support the KM-1 Board material. In most cases, this framework is supplied as a pre-engineered, partially assembled item. However, it is permissible to modify or scratch build a similar assembly as needed provided the metal used is at least 16 gauge galvanized or stainless steel and is held together utilizing spot welds, 3/16" steel rivets, and/or 1/4" x 20 machine screws (with lock washers). A frame may be modified to accommodate interferences as required.

The frames are held to concrete walls/floors/ceilings using 3/8" Hilti "Quick Bolt II" anchors. Anchors should be installed approximately 2" from each end of a frame section (for each longitudinal leg) and not more than 18" apart along the length of the frame section.

Prior to securing the framework to the concrete, KM-1 Expanding Gasket material will be installed along the entire frame/concrete interface. (*Note*: Any cracks in the surrounding concrete which intersect the box should be covered with the KM-1 Thermal Filler in the area under where the KM-1 Board will later be installed. The KM-1 Thermal Filler may also be used for filling any irregularity in the surrounding concrete (before or after the installation of the board) to provide a suitable mating surface for the KM-1 Board and/or frame.

The suggested installation sequence for the boards over the framework is as follows: the two side panels will be positioned and impaled over the pins of the frame so that the panels are flat against the frame. Install one speed clip washer over each pin to secure the board panel. The side boards are gasketed against the concrete as well as at longitudinal and end (butt) joints. At least one layer of KM-1 Expanding Gasket material is to be used inside of joints between pieces of the KM-1 Board. Like the gaskets used for free-air conduit panels described above, secure one layer of KM-1 Expanding Gasket material (using commercial grade staples) to the edge of the panel where needed if one is not already attached. There are no technical requirements for staple types or placement, et cetera. (*Note*: Panel edges which end at the surrounding concrete will also be gasketed as described above.)

Next, install the front/top (or bottom) panel by positioning and impaling it over the pins so that it sits flat against the frame. Install a speed clip washer over each pin to secure this board/panel. Bend over the excess pins and flatten against the KM-1 panels. Where J-hooks are provided, tie adjacent pieces together using the approved lacing wire. *Note:* If the J-hook positions between adjacent panels are not exactly aligned, it is acceptable (as an option) to lace one J-hook on one panel to the two closest J-hook on the adjacent panel (the two J-hooks should be far enough apart in order to wrap lacing wire from one to the next J-hook while maintaining the ability to tighten the wire via twisting).

Repeat the above installation procedure for any following panel section so that the top edge of the preceding row and the bottom edge of the present row are butted up against each other. Resulting gaps larger than 1/8" will be filled with additional strips of KM-1 Expanding Gasket material (it is suggested that no more than two layers of gasket be used in any joint) and/or KM-1 Thermal Filler.

Inspection can be performed on any completed section of the first layer in accordance with Section 5.0 of this document prior to installing any portion of subsequent and final layers (each layer will be inspected prior to installing a subsequent layer).

The installation sequence suggested above can be modified at any point to suit the installation provided a complete inspection prior to installing any subsequent layer or outer fabric. Also, the physical panels can be modified as needed in accordance with Section 4.3 of this procedure. Panels for interfacing with hangers, conduits, et cetera are addressed separately in this procedure.

Note: Some KM-1 conduit envelope designs may require additional pieces not identified above. If applicable, the installation and/or piece-part drawings will identify these variations.

4.1.3 **Junction Boxes:**

KM-1 fire barrier envelopes intended for junction box installations will follow the same installation guidelines as described above for boxed conduits.

4.1.4 **Hangers:**

KM-1 Hanger Wrap materials are typically installed after the conduit or tray raceway is wrapped. Prior to the installation of KM-1 hanger panels, channel shaped hangers (such as Unistrut) will have their hollow sections filled with ceramic fiber/blanket strips (for the length that they will be covered with the KM-1 materials). Hanger wrap designs will be provided on a site specific basis.

For each layer, side panels are typically installed first (temporary support can be used as needed). The first layer (as well as any other layer) may be trimmed to facilitate a more accurate fit. Gaps greater than 1/8" will be filled with additional KM-1 Expanding Gasket material or KM-1 Thermal Filler. Once the first layer of the hanger is completed, it will be inspected in accordance with Section 5.0. *(Note:* Inspection in accordance with Section 5.0 must be completed for each layer prior to installing any additional layer.)

Once an inspection is completed for the first layer, subsequent layers of the wrap can be installed.

Where J-hooks are provided, tie adjacent pieces together using the approved lacing wire. *(Note:* If the J-hook positions between adjacent panels are not exactly aligned, it is acceptable to lace one J-hook on one panel to the two closest J-hook{s} on the adjacent panel [the two J-hooks should be far enough apart in order to wrap lacing wire from one to the next J-hook while maintaining the ability to tighten the wire via twisting]). Resulting gaps larger than 1/8" will be filled with additional strips of KM-1 Expanding Gasket material (it is suggested that no more than two layers of gasket be used in any joint) and/or KM-1 Thermal Filler.

4.15 Stiffeners:

Where stiffeners are present on a the protected item (i.e., stiffeners on cable trays), the KM-1 panels will be installed on the item and will butt directly to the stiffener (use KM-1 Expanding Gasket material between the panels and stiffener). Fill any gap larger than 1/8" with the Thermal Filler material.

Typically, pre-engineered systems will provide an additional short panel piece which fits over the final layer of the envelope directly over/under the stiffener. These short pieces can be attached either by using insulation pins (which extend through the final layer of the envelope and would be used for pinning the short panel piece in place) or J-hooks (which would be used for lacing the short panel piece to adjacent panel pieces of the envelop). If pins are provided, it is suggested that two pins be used at each end (as well as every approximately 6" along both sides of the stiffener) to secure the short panel in place. The pins can be placed so that they extend out through the final layer of the envelope approximately on center to the overlap of the short panel piece. (Prior to installing the short panel piece, all gaps and voids below will be filled with KM-1 Thermal Filler - this shall be inspected in accordance with Section 5.0 before the short panel piece is installed.) After the short panel piece is impaled over the pins, install speed clip washers over the pins to secure the panel in place (bend and flatten any excess portion of the pins).

4.16 Connector Plates:

Adjacent cable tray side panels (KM-1 material) will butt up to the raceway connector plates and will more than likely require site trimming to fit. The resulting space between the two panels (on each side of the connector plate) will be filled with KM-1 Thermal Filler. (*Note*: Following layers of panels clear the connector plates and hardware items [nuts and bolts]. If not, subsequent layers may be trimmed as needed to accommodate these interferences. In all cases, all voids and/or gaps will be filled with KM-1 Thermal Filler.)

Typically, pre-engineered systems will provide an additional short panel piece which fits over the final layer of the envelope directly over the connector plate. These short pieces can be attached either by using anchor pins (which extend through the final layer of the envelope and would be used for pinning the short panel piece in place) or J-hooks (which would be used for lacing the short panel piece to adjacent panel pieces of the envelop). If pins are provided, it is suggested that two pins be used at each end (as well as every approximately 6" along both sides of the stiffener) to secure the short panel in place. The pins can be placed so that they extend out through the final layer of the envelope approximately on center to the overlap of the short panel piece. (Prior to installing the short panel piece, all gaps and voids below will be filled with KM-1 Thermal Filler - this shall be inspected in accordance with Section 5.0 before the short panel piece is installed.) After the short panel piece is impaled over the pins, install speed clip washers over the pins to secure the panel in place (bend and flatten any excess portion of the pins).

4.1.7 **Free Fall Cables/Air-Drops:**

Free fall cables/cable air-drops can be protected using pre-molded round conduit type panels or erecting an angle steel framework to support a KM-1 Panel box envelope around individual or multiple cables to be protected.

When pre-molded, semi-circular conduit sections are used for the envelope, the panels are installed in a similar manner as for the conduit panels described in section 4.1.2 of this procedure. The only difference to this item is the addition of the KM-1 Thermal Filler which is used for filling any voids in the inner radius of the molded section and to encapsulate the profile of the cables. In this case, the thermal filler will be spread out along the length of the panel, and the panel is then carefully pressed into position around the cable(s). The second panel of this section is fitted in an identical manner. (*Note*: During installation, the half sections can be slightly underfilled with the thermal filler material in order to facilitate installation.

It is recognized that it may not be possible to install the thermal filler so that it completely encapsulates the cable[s] without producing some voids in the filler material. Hence, the installation of the thermal filler here is intended as a "best effort" installation geared to both stabilizing the cable within the envelope as well as increasing the thermal mass around the cable as much as installation conditions will allow for fire protection purposes.) The two panels are then secured in position by the approved tie wire (approximately 2" from each panel end and then spaced not more than 9" apart). Fill any gaps greater than 1/8" with either additional strips of KM-1 Expanding Gasket or

KM-1 Thermal Filler. Resulting gaps larger than 1/8" will be filled with additional strips of KM-1 Expanding Gasket material (it is suggested that no more than two layers of gasket be used in any joint) and/or KM-1 Thermal Filler.

Prior to wrapping the fabric over the completed panel sections, inspection of the completed section will be performed in accordance with Section 5.0 of this procedure. Once completed, the fabric may be installed over the panels using the same guidelines for wrapping conduit panels described in item 4.1.2.1.

Where flat panels installed over an angle steel framework form a "boxed" envelope, the framework section can be installed as in a manner similar to a vertical cable tray run (Section 4.1.1 of this document). The bottom panel row can be installed first (unless conditions dictate otherwise) with the sequence of the top panel being installed first, followed by the sides, and finally the bottom panels where possible.

Some of the panels of the first layer will be supplied with associated steel angle sections already fitted in position with anchor pins penetrating through the panel, secured with speed clip washers, and turned over. Prior to installation, these anchor pins should not be bent back nor the panel removed from the angle section. It is suggested that both the angle section and panel are installed as a single composite piece (these panels should be installed first). Sections of the angle flange/panel can be cut as needed to accommodate interferences.

Straighten the anchor pins (on the bare flange of the angle sections) to a horizontal position during installation. This will enable the two panels perpendicular to this panel to be positioned and installed over the pins and to butt up to the angle sections. Once installed, the speed clip washers are pushed down over the anchor pins flush with the panels' outer faces. Bend and flatten the excess anchor pins. The panels are then laced (using the approved wire) to their adjacent panels utilizing the J-hooks provided. Resulting gaps larger than 1/8" will be filled with additional strips of KM-1 Expanding Gasket material (it is suggested that no more than two layers of gasket be used in any joint) and/or KM-1 Thermal Filler.

This process is repeated until the vertical section is completed. Inspection will be performed in accordance with Section 5.0 of this procedure after each layer is completed.

Note: Some KM-1 conduit envelope designs may require additional pieces not identified above. If applicable, the installation and/or piece-part drawings will identify these variations.

4.2 Three Hour System:

The KM-1 three hour system panels are installed in an identical manner as for the one hour system except that four layers are installed (instead of two) for flat panel installations and two layers (instead of just one) are used where the semi-circular conduit sections are installed (or as required by site specific designs).

4.2.1 Hangers:

For the three hour system, hanger panels will not be installed until the fitting of the final layer of the cable tray insulation. At this point, as the fourth layer cable tray bottom panels adjacent to the hanger are installed, four (typical) anchor pins are pushed through from inner to outer surface across the width of the cable tray panel on either side of the hanger. The four bottom hanger panels will be positioned centrally over the hanger and pushed onto the pins, having a speed clip washer pushed over the pin after each of the bottom hanger panels is installed. When the fourth and final bottom hanger panel and washer is installed, flatten the excess pin length against the KM-1 panel material.

The four layers of hanger panels to cover the horizontal and vertical sections of the hangers either side of the cable tray are then installed separately using the following suggested sequence: position the top panels on the horizontal and vertical sections of the hanger and then position and lace loosely the side panels to the top panels. Then position and loosely lace the bottom panels to the side panels. Once the position of the hanger insulation panels has been established, the panels can be laced up to each other securely.

Resulting gaps larger than 1/8" will be filled with additional strips of KM-1 Expanding Gasket material (it is suggested that no more than two layers of gasket be used in any joint) and/or KM-1 Thermal Filler. Each layer will be inspected in accordance with Section 5.0 of this procedure.

4.2.2 Stiffeners and Connector Plates:

There are no stiffener and connector plate cover panels for the three hour system as neither of these components penetrate through all four layers of the KM-1 three hour insulation system (after the second panel layer, the stiffeners and connector plates are typically covered by the third and fourth layers without any need for cutting or trimming panels).

The procedure for protecting the stiffeners and connector plates for the first and second layers of the cable tray insulation will be identical to that for the one hour system (refer to section 4.1.5 and 4.1.6 of this procedure).

4.2.3 **Boxed-in Conduit Sections:**

These sections will be installed in an identical manner to the one hour boxed-in conduit sections except that four layers will be installed instead of two.

4.3 **Site Trimming/Cut-Outs:**

As a result of the anticipated need for a degree of field modification of pre-engineered pieces, it is acceptable to cut or trim the KM-1 materials as needed to accommodate interferences, et cetera. Cutting and trimming should be performed carefully so that resulting gasketed joints (*should*) generally fit together without producing gaps exceeding 1/8". However, where gaps do exceed 1/8" in width, it is acceptable to either use an additional strip of KM-1 Expanding Gasket and/or KM-1 Thermal Filler. It should be noted that the KM-1 Thermal Filler is the same material as used for manufacturing the panels and semi-circular pre-molded conduit sections. The method for cutting or trimming is based on good workmanship practices and the discretion of the installer(s). (*Note*: It is also possible to file or grind [by rubbing against a flat, rough surface] the KM-1 pieces to facilitate a more accurate fit.)

Where additional KM-1 Expanding Gasket material is used for reducing gap widths, it is recommended that no more than two layers of the gasket be used at any one point in a joint or opening.

It is acceptable to modify outer layer panel pieces by first removing the fabric cover, trimming/cutting the KM-1 panel, and then re-wrapping the panel using the same piece of fabric (staple the fabric to the board using any commercial grade wire staple [the object of the staple is to temporarily hold the fabric in place until the panel is secured]). Also, holes, cuts, or tears in the fabric can be repaired by attaching an additional piece of fabric over (or under) the repair site. The repair piece should be at least approximately 2" larger than the area being repaired. The repair piece may be held in place with commercial grade staples as needed.

It is permissible to replace a J-hook (for lacing) with another J-hook provided the replacement is located within 2" of the original point of attachment.

5.0 **Inspection and Repairs of the Installation:**

As each layer of the KM-1 System has been installed, the layer (or portions of the layer) will be inspected for gaps, general fit-up and possible damage of the panel (other than the acceptability of using repaired cracked pieces in semi-circular conduit sections as described in this procedure, the use cracked pieces is not acceptable).

Where gaps are present in the system, the gaps are then corrected either by secondary tightening of the lacing anchors local to the gap or sealing gap with the KM-1 Thermal Filler or both.

In addition to the above two methods of reducing gaps, on the outer layer, strips of the expanding paper gasket (2/3" or 17 mm wide) can be cut to the length of the gap and inserted in the gap.

If any of the panels have incurred damage, i.e. surface cracks, pit holes or edge erosion, these can be filled in using the Darmatt KM1 Thermal Filler.

Once any necessary modifications have been made, the completed layer or portion of layer is inspected again, and if failed, the above process is repeated until the Quality Control Inspector passes the layer.

Darchem Engineering Inc.

DARMATT KM-1 SYSTEM
IN PROCESS/FINAL INSPECTION CHECKLIST

LOCATION _____
ITEM NBR _____

IN PROCESS INSTALLATION

	Yes	No	N/A	Q/C Init/Date
Is the Item Clean Prior to Installation	☐	☐	☐	
Inspect Each Layer of Panels Prior to Installation of Another Layer of Panel to Assure Proper Fit and the Gaps are Sealed	☐	☐	☐	
Distance Between Laces < = 6"	☐	☐	☐	
Conduit Attachment?	☐	☐	☐	
Appropriate Thickness per Detail Drawing Installed	☐	☐	☐	

FINAL INSPECTION

	Yes	No	N/A	Q/C Init/Date
Are the Proper Layers Installed per Drawing	☐	☐	☐	
Gaps Sealed Greater Than 1/8"	☐	☐	☐	
Area Clean Surrounding Item	☐	☐	☐	
S/S Bands Installed At Designated Distance Per Dwg/Procedure	☐	☐	☐	

INFORMATION ONLY

TRANSCO PRODUCTS INC.
Fifty Five East Jackson Boulevard
Chicago, Illinois 60604-4166, (312) 427-2818
Fax (312) 427-4975

TRANSCO INC.

QUALITY ASSURANCE PROGRAM MANUAL

(TIQAM-1)

MANUAL NO. _____

INFORMATION ONLY

This Quality Assurance Manual is applicable to the activities of Transco Products Inc. and Advance Thermal Corp.

Copies of this Manual have been distributed to Transco Products Inc. and Advance Thermal Corp. employees whose activities have an effect on quality related systems.

Where Transco is stated, it shall be considered inclusive of Transco Products Inc. and Advance Thermal Corp.

Should you require interpretation, please contact the individual listed below.

Approved By: _____ 3/31/94

Quality Assurance Manager — Date

Revision 0

Note: This Quality Assurance Program supersedes the following documents:

1. Nuclear Quality Assurance Manual (QAM-1) Rev. 6
2. Penetration Seal Quality Assurance Manual (PSQAM -1) Rev. 5
3. Manufacturing Quality Assurance Manual (QAM-1) Rev. 1

QUALITY ASSURANCE PROGRAM MANUAL INDEX

QUALITY ASSURANCE PROGRAM MANUAL INDEX

STATEMENT OF POLICY AND AUTHORITY

It is the policy of Transco Inc. as defined within this Quality Assurance Program Manual, to provide products and services in satisfaction of contract requirements assuring the manufacture and installation of a quality product. Personnel are made aware of the importance of quality through indoctrination and training programs.

The Quality Assurance Manager has been directed to develop this quality assurance manual in accordance with the following documents:

10CFR50 Appendix B - "Quality Assurance Program Requirements for Nuclear Power Plants"

ANSI/ASME NQA-1, 1989, NQA-2, 1989 - "Quality Assurance Requirements for Nuclear Power Plants"

ANSI/ASME N45.2 - "Quality Assurance Program Requirements for Nuclear Power Plants"

It is the responsibility of all Transco personnel performing activities to perform those activities in accordance with this Quality Assurance Program.

Personnel performing quality assurance functions in accordance with this program have my authority and the organizational freedom to identify quality problems; initiate, recommend or provide solutions through established channels of communication; verify implementation of solutions; and control further processing or delivery of a nonconforming item, deficiency, or unsatisfactory condition until proper dispositioning has occurred.

The Quality Assurance Manager has my authority to administer and enforce the contents of this program which is a planned and systematic course of action and provides confidence of quality throughout our operations. He shall regularly assess the implementation of the program by audit activity and report to the President on a regular basis. Should any conflicts on the implementation of the program occur, they are to be brought to my attention for resolution.

It is only through awareness and active participation by all Transco employees that maximum effectiveness is achieved for quality implementation. We at Transco are dedicated through Quality to benefit our customers, our company, and industry.

Robert M. Goss
President - Transco Inc.

3-31-94
Date

1.0 ORGANIZATION

Transco has it's corporate office located in Chicago, Illinois with various fabrication facilities and/or licensee's throughout the world.

The President has recognized and affirmed his position for the necessity of a viable Quality Assurance Program as evidenced by his "Statement of Policy and Authority". He has delegated the responsibility of administering this Quality Assurance Program through the Quality Assurance Manager.

The Assistant Vice Presidents are responsible for coordinating all aspects involving all Transco systems and for delegating specific tasks to various departments as required in the implementation of contract requirements.

The Quality Assurance Manager reports on the adequacy and implementation of the program on a quarterly basis. In implementing the Quality Assurance Program, the Quality Assurance Manager, through management personnel, sets forth objectives for necessary improvements and is responsible for:

A. Assignment of Quality Control personnel to the job site and/or manufacturing facility;
B Indoctrination and training of personnel, and maintenance of necessary documentation;
C. Review and approval of purchases, procedures, and specifications upon initial release or revision;
D. Development and enforcement of the Quality Assurance Program Manual, Quality Assurance Procedures, and all subsequent revisions;
E. Quality Assurance Program Manual and The Quality Assurance Procedures Control;
F. Development and Quality Approval of the Approved Vendor List;
G. Management Evaluation of the Quality Assurance Program;
H. Coordination of quality related issues between the Assistant Vice President, Product Manager, Project Managers, Manager of Manufacturing, Plant Manager, QC Personnel and Purchasing Manager;
I. Reporting to management on Quality Assurance Program effectiveness as determined by internal audits and as required by the Quality Assurance Procedures.
J. Certifying satisfactory conformance/compliance of completed work.

The Quality Control Manager at the job-site or plant reports directly to the Quality Assurance Manager. He is responsible for verification of Quality, which includes, but is not limited to:

A. Assuring completed assemblies are manufactured/installed in accordance with approved drawings;
B. Assuring that Quality-related functions are performed in accordance with procedures;
C. Reviewing and approving work orders and/or travelers;
D. Assuring that Quality-related activities are properly documented;
E. Assuring necessary calibrations are performed and documented for measuring and test equipment;
F. Observing Quality-related activities through in-process surveillance.
G. Assuring that qualifications of all field and/or shop personnel are current.

The Quality Control Managers interface with the Project Engineer, Purchasing Manager, Product Manager, Plant Manager and/or Field Superintendent as necessary in the performance of their duties.

Plant Managers report directly to the Assistant Vice President of Operations and are responsible for completion of the necessary work orders in accordance with the contract, drawings, specifications, Transco Inc. Quality Program and applicable Quality Assurance Procedures. They are responsible for

the indoctrination/ training of Shop Personnel and assuring craft personnel are qualified to perform their applicable activities. Plant foremen and production personnel report directly to the Plant Manager. The Plant Manager interfaces with the Quality Assurance and Plant Quality Control Manager, Project Managers, Product Manager and Purchasing Manager as necessary in the performance of his duties.

The Engineering Manager/Engineering Group is responsible for identification and documentation of design inputs, prescribe design process, performance and review of design analysis, verification of design adequacy including verification of computer program, control of changes to final designs and control and identification of design interfaces.

The Product Manager is responsible for product research development testing and the associated documentation if required. The Product Manager interfaces with Quality Assurance, Project Managers, Purchasing Manager, Field Superintendents, and the Plant Managers as necessary in the performance of their duties. Personnel reporting to him have been indoctrinated relative to the quality requirements of their specific activity. The functions of Product Manager and Project Manager may be performed by the same individual.

The Purchasing Manager reports directly to the President and is responsible for preparing purchase documents and cost evaluations. He maintains joint responsibility for the preparation and approval of the Approved Vendor List and assures that the purchase is made for Quality related products from approved suppliers. He is also responsible for ensuring that applicable Quality requirements are stated in the purchase documents.

Project Managers have total responsibility for their assigned project and report directly to the Assistant Vice Presidents. They are responsible for customer interface, assuring coordination of the project, project planning, dissemination of project related information to management personnel and maintaining overall cognizance of project activities. They schedule and assign certain tasks for completion in accordance with customer requirements and interface closely with Transco Field Superintendents, Plant Management Personnel, Quality Assurance, Purchasing, and Engineering personnel.

Field Superintendents report directly to the Project Manager. They are responsible for project planning after initiation of the project, assigning duties to site personnel excluding Quality Assurance/Quality Control activities, assuring completeness of installation to customer and Transco Quality Assurance requirements, and reporting to the assigned Project manager on a regular basis.

Specific Quality Assurance activities may be delegated to other organizations with prior approval of the Quality Assurance Manager. Such delegations are documented by the Quality Assurance Manager.

Personnel who verify conformance of work activities are qualified to perform their work activities as a result of indoctrination, formal training, experience and education. Indoctrination is given by the Quality Assurance Manager as necessary, and he may elect to utilize outside training sources in the fulfillment of this responsibility. The Quality Assurance Manager is responsible for the maintenance of the training documentation for all quality personnel.

The organizational structure for Transco Inc. is depicted by Exhibit I.

The organizational chart structure for Transco Products Inc. is depicted by Exhibit II.

The organizational structure for Advance Thermal Corp. is depicted by Exhibit III.

TRANSCO INC.
ORGANIZATIONAL CHART

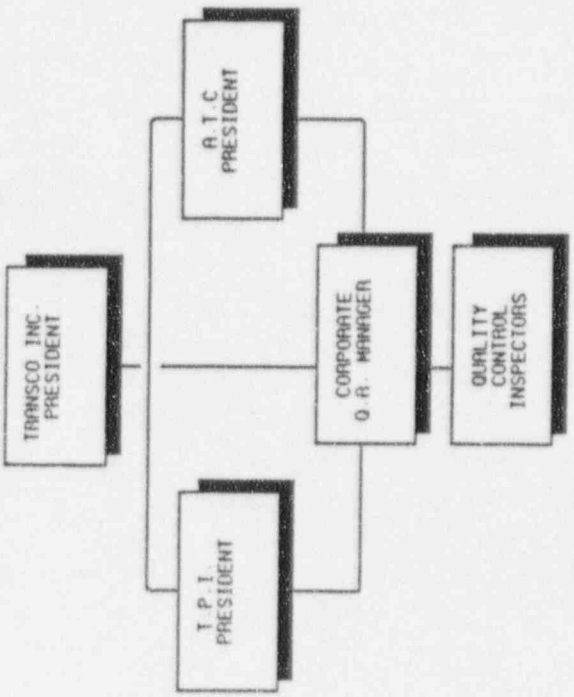

EXHIBIT I

TRANSCO PRODUCTS INC.
ORGANIZATIONAL CHART

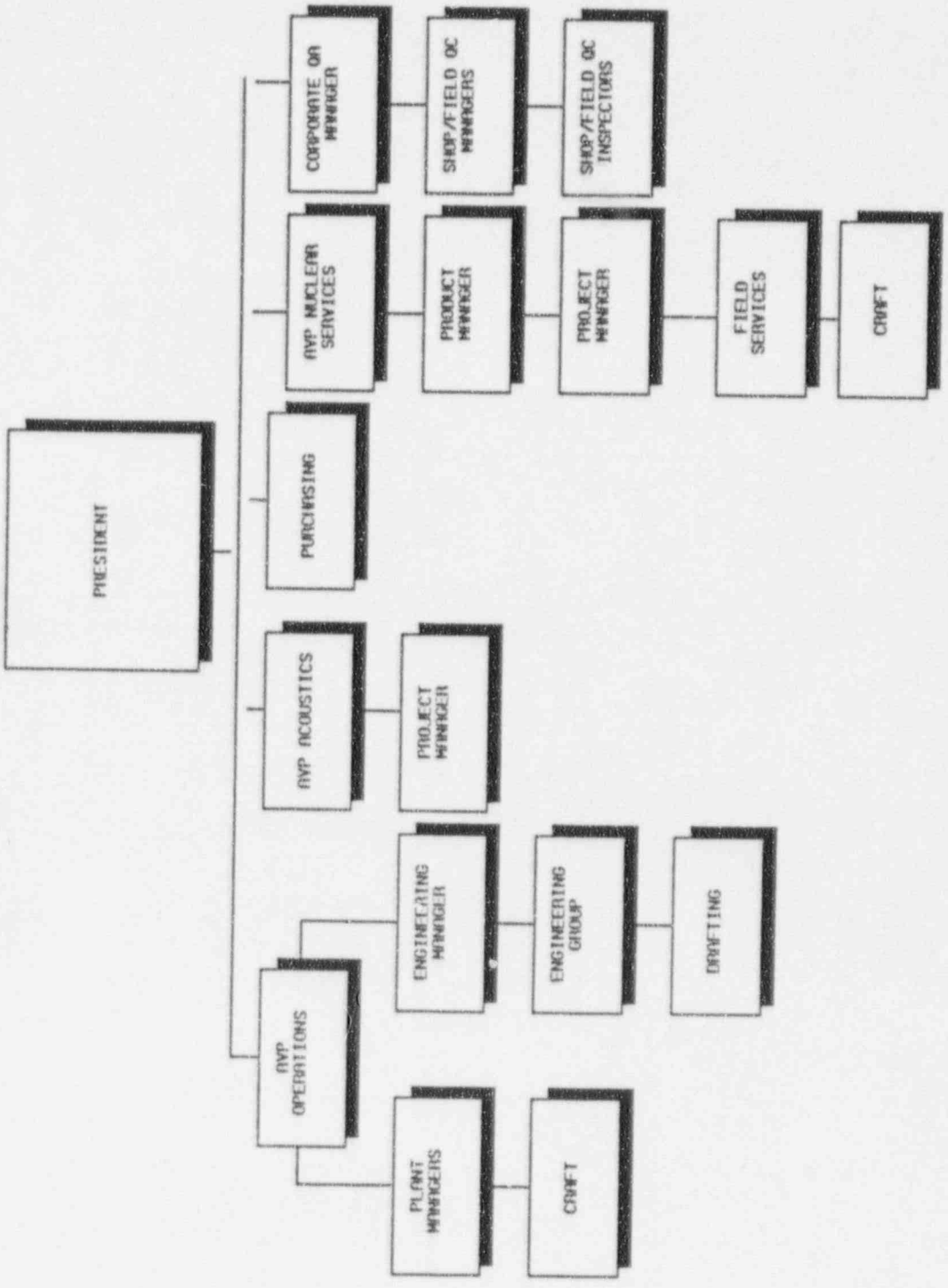

EXHIBIT II

ADVANCE THERMAL CORP.
ORGANIZATIONAL CHART

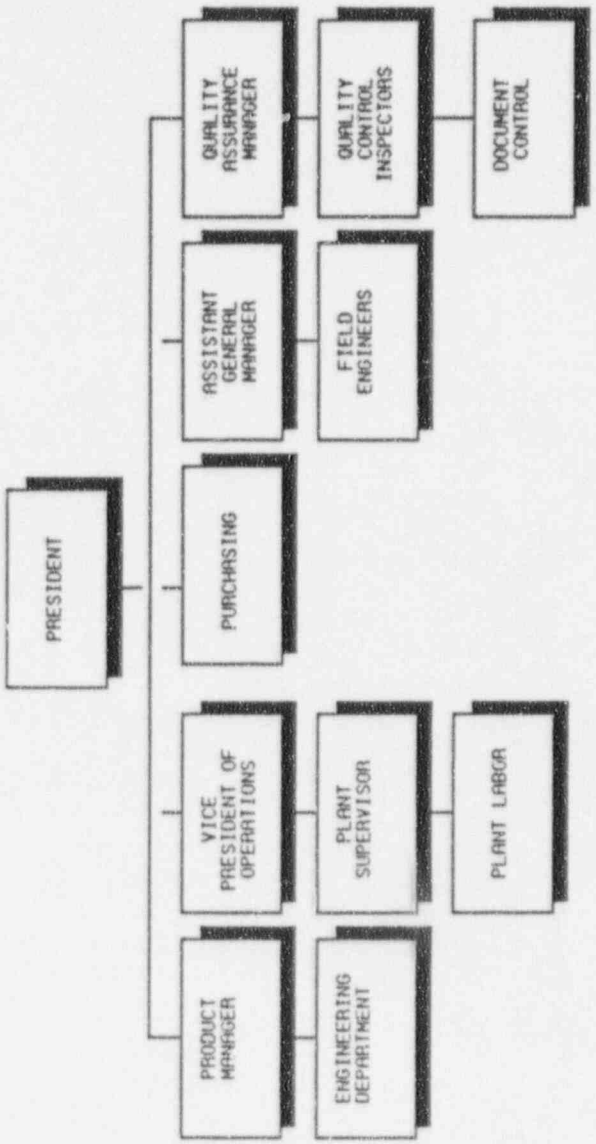

EXHIBIT III

2.0 QUALITY ASSURANCE PROGRAM

The Quality Assurance Program herein described is applicable to the products and services of Transco. The extent to which the individual sections and elements of this program apply will depend upon factors such as the nature and scope of activities to be performed and the required quality of items or services as determined by Transco and customer contract documents.

The Program has been developed based on Title 10 Code of Federal Regulations, Part 50 Appendix B, and ASME/ANSI NQA -1, 1989, NQA-2, 1989, and ANSI N45.2. Conformance to specific requirements are as stated within this document, and Transco Quality Assurance Procedures (TIQAP).

The principal documents for implementing this program are: Transco Quality Assurance Procedures, Instructions and Drawings. These procedures, instructions and drawings delineate specific instructions on how to perform certain activities such as, but not limited to, Design Control, Purchasing Control, Document Control, Special Processes etc.

They are developed to provide a method for accomplishing activities under suitably controlled conditions utilizing qualified personnel and equipment. Procedures, instructions and drawings have been qualified as necessary and approved by the Quality Assurance Manager with technical approval provided by the responsible Transco Department.

3.0 DESIGN CONTROL

Design Control activities are accomplished in accordance with an approved procedure. This procedure specifies the individuals responsible for the design inputs such as design bases, performance requirements, regulatory requirements, codes and standards necessary to assure the applicable industry, regulatory, customer requirements, are correctly translated in drawings, instructions, and procedures.

DESIGN INPUT

Applicable design inputs, such as design bases, performance requirements, regulatory requirements, codes, and standards, shall be identified and documented and their selection reviewed and approved by Transco's responsible design engineering group. The design input shall be specified and approved on a timely basis and to the level of detail necessary to permit the design activity to be carried out in a correct manner and to provide a consistent basis for making design decisions, accomplishing design verification measures, and evaluating design changes. Changes from approved design inputs, including the reason for the changes, shall be identified, approved, documented, and controlled.

DESIGN PROCESS

Transco's responsible design engineering group shall prescribe and document the design activities on a timely basis and to the level of detail necessary to permit the design process to be carried out in a correct manner, and to permit verification that the design meets requirements. Design documents shall be adequate to support the design, construction, and operation of the supplied equipment. Appropriate quality standards shall be identified and documented, and their selection reviewed and approved.

Changes from specified quality standards, including the reasons for the changes, shall be identified, approved, documented, and controlled. Design methods, materials, parts, equipment, and processes that are essential to the function of the structure, system or component shall be selected and reviewed for suitability of application. Applicable information derived from experience, as set forth in reports or other documentation, shall be made available to cognizant design personnel. The final design (approved design output documents and approved changes thereto) shall:

(a) be relatable to the design input by documentation in sufficient detail to permit design verification; and

(b) identify assemblies and/or components that are part of the item being designed. When such an assembly or component part is a commercial grade item that, prior to its installation, is modified or selected by special inspection and/or testing to requirements that are more restrictive than the Supplier's published product description, the component part shall be represented as different from the commercial grade item in a manner traceable to a documented definition of the difference.

DESIGN ANALYSES

Design analyses shall be performed by Transco engineering group in a planned, controlled, and documented manner. Design analysis documents shall be legible and in a form suitable for reproduction, filing and retrieval. They shall be sufficiently detailed as to purpose, method, assumptions, design input, references, and units such that a person technically qualified in the subject can review and understand the analyses and verify the adequacy of the results without recourse to the originator. Calculations shall be identifiable by subject (including structure, system, or component to which the calculation applies),

originator, reviewer, and date; or by other data such that the calculations are retrievable.

(a) Computer programs may be utilized for design analysis without individual verification of the program for each application provided:

(1) the computer program has been verified to show that it produces correct solutions for the encoded mathematical model within defined limits for each parameter employed; and

(2) the encoded mathematical model has been shown to produce a valid solution to the physical problem associated with the particular application.

Computer programs shall be controlled to assure that changes are documented and approved by authorized personnel. Where changes to previously verified computer programs are made, verification shall be required for the change, including evaluation of the effects of these changes on (1) and (2) above.

(b) Documentation of design analyses shall include (1) through (6) below:

(1) definition of the objective of the analyses;
(2) definition of design inputs and their sources;
(3) results of literature searches or other applicable background data;
(4) identification of assumptions and indication of those that must be verified as the design proceeds;
(5) identification of any computer calculation, including computer type, computer program (e.g., name), revision identification, inputs, outputs, evidence of or reference to computer program verification, and the bases (or reference thereto) supporting application of the computer program to the specific physical problem;
(6) review and approval.

DESIGN VERIFICATION

Design control measures shall be applied by Transco engineering group to verify the adequacy of design, such as by one or more of the following: The performance of design reviews, the use of alternate calculations, or the performance of qualification tests. Verification of computer programs shall include appropriate testing. Transco Engineering shall identify and document the particular design verification method(s) used. The results of design verification shall be clearly documented with the identification of the verifier clearly indicated. Design verification shall be performed by any competent individual(s) or group(s) other than those who performed the original design. This verification may be performed by the originator's supervisor, provided the supervisor did not specify a singular design approach or rule out certain design considerations and did not establish the design inputs used in the design or, provided the supervisor is the only individual in the organization competent to perform the verification.

Verification shall be performed in a timely manner. Design verification, for the level of design activity accomplished, shall be performed prior to release for procurement, manufacture, construction, or release to another organization for use in other design activities except in those cases where this timing cannot be met, such as when insufficient data exist. In those cases, the unverified portion of the design shall be identified and controlled. In all cases the design verification shall be completed prior to relying upon the component, system, structure, or computer program to perform its function.

EXTENT OF DESIGN VERIFICATION

The extent of the design verification required is a function of the importance to safety, the complexity of the design, the degree of standardization, the state of the art, and the similarity with previously proven designs. Where the design has been subjected to a verification process in accordance with this standard, the verification process need not be duplicated for identical designs. However, the applicability of standardized or previously proven designs, with respect to meeting the pertinent design inputs, shall be verified for each application. Known problems affecting the standard or previously proven designs and their effects on other factors shall be considered. The original design and associated verification measures shall be adequately documented and referenced in the files of the subsequent application of design.

Where changes to previously verified designs have been made, design verification shall be required for the changes, including evaluation of the effects of those changes on the overall design and on any design analyses upon which the design is based that are affected by the change to previously verified design.

DESIGN VERIFICATION METHODS

Acceptable verification methods include, but are not limited to, any one or a combination of the following: design reviews, alternate calculation, and qualification testing.

1. **Design Reviews.** These are critical reviews to provide assurance that the final design is correct and satisfactory. Where applicable, (a) through (f) below shall be addressed.

   (a) Were the design inputs correctly selected?
   (b) Are assumptions necessary to perform the design activity adequately described and reasonable? Where necessary, are the assumptions identified for subsequent reverifications when the detailed design activities are completed?
   (c) Was an appropriate design method used?
   (d) Were the design inputs correctly incorporated into the design?
   (e) Is the design output reasonable compared to design inputs?
   (f) Are the necessary design input and verification requirements for interfacing organizations specified in the design documents or in supporting procedures or instructions?

2. **Alternate Calculations.** These are calculations or analyses that are made with alternate methods to verify correctness of the original calculations or analyses. The appropriateness of assumptions, input data used, and the computer program or other calculation method used shall also be reviewed.

3. **Qualification Tests.** Where design adequacy is to be verified by qualification tests, the tests shall be identified. The test configuration shall be clearly defined and documented. Testing shall demonstrate adequacy of performance under conditions that simulate the most adverse design conditions. Operating modes and environmental conditions in which the item must perform satisfactorily shall be considered in determining the most adverse conditions. Where the test is intended to verify only specific design features, the other features of the design shall be verified by other means. Test results shall be documented and evaluated by Transco Engineering Group to assure that test requirements have been met.

   If qualification testing indicates that modifications to the item are necessary to obtain acceptable

performance, the modification shall be documented and the item modified and retested or otherwise verified to assure satisfactory performance. When tests are being performed on models or mockups, scaling laws shall be established and verified. The results of model test work shall be subject to error analysis, where applicable, prior to use in final design work.

CHANGE CONTROL

Changes to final designs, field changes, modifications to operating facilities, and nonconforming items dispositioned use-as-is or repair shall be justified and subject to design control measures commensurate with those applied to the original design. These measures shall include assurance that the design analyses for the structure, system, or component are still valid. Changes shall be approved by the same engineering group which reviewed and approved the original design documents.

INTERFACE CONTROL

Design interfaces shall be identified and controlled by Transco Engineering Group and the design efforts shall be coordinated among the participating organizations. Interface controls shall include the assignment of responsibility and the establishment of procedures among participating design organizations for the review, approval, release, distribution, and revision of documents involving design interfaces.

Design information transmitted across interfaces shall be documented and controlled. Transmittals shall identify the status of the design information or document provided and, where necessary, identify incomplete items which require further evaluation, review, or approval. Where it is necessary to initially transmit design information orally or by other informal means, the transmittal shall be confirmed promptly by a controlled document.

DOCUMENTATION AND RECORDS

Design documentation and records, which provide evidence that the design and design verification processes were performed in accordance with the requirements of this Standard, shall be collected, stored, and maintained in accordance with documented procedures.

The documentation shall include not only final design documents, such as drawings and specifications, and revisions thereto but also documentation which identifies the important steps, including sources of design inputs that support the final design.

4.0 PROCUREMENT DOCUMENT CONTROL

Procurement document control activities are accomplished in accordance with an approved procedure. The procedure specifies the individuals by title who are responsible for the review, approval and distribution of the procurement documents.

TECHNICAL REQUIREMENTS:

Technical requirements shall be specified within the body of the procurement documents. Where necessary, these requirements shall be specified by reference to specific drawings, specifications, codes, standards, regulations, procedures, or instructions, including revisions thereto that describe the items or services to be furnished. The procurement documents shall provide for identification of test, inspection, and acceptance requirements of Transco for monitoring and evaluating the Supplier's performance.

QUALITY ASSURANCE PROGRAM REQUIREMENTS:

Procurement documents shall require that the Supplier have a documented quality assurance program that implements portions of all of the requirements of this Standard. The extent of the program required shall depend upon the type and use of the item or service being procured. The procurement documents shall require the Supplier to incorporate appropriate quality assurance program requirements in subtier procurement documents.

RIGHT OF ACCESS:

The procurement documents shall provide for access to the Supplier's plant facilities and records for inspection or audit by the Purchaser, his designated representative, and/or other parties authorized by Transco.

DOCUMENTATION REQUIREMENT:

The procurement documents shall identify the documentation required to be submitted for information, review, or approval by Transco. The time of submittal shall also be established. When Transco requires the Supplier to maintain specific quality assurance records, the retention times and disposition requirements shall be prescribed.

NONCOMFORMANCES:

The procurement documents shall include Transco's requirements for reporting and approving disposition of nonconformances.

PROCUREMENT DOCUMENT REVIEW:

A review of the procurement documents and changes thereto shall be made to assure that documents transmitted to the prospective Supplier(s) include appropriate provisions to assure that items or services will meet the specified requirements.

Reviews shall be performed and documented to provide objective evidence of satisfactory accomplishment of such review prior to contract award or purchasing.

Changes made as a result of the bid evaluations or precontract negotiations shall be incorporated into the procurement documents. The review of such changes and their effects shall be completed prior to contract award.

This review shall include the following considerations:

(a) appropriate requirements specified above in this section;
(b) determination of any additional or modified design criteria;
(c) analysis of exceptions or changes requested or specified by the Supplier and determination of the effects such changes may have on the intent of the procurement documents or quality of the item or service to be furnished.

Reviews shall be performed by the Personnel who have access to pertinent information and who have an adequate understanding of the requirements and intent of the procurement documents.

Procurement document changes shall be subject to the same degree of control as utilized in the preparation of the original documents.

Purchasing shall maintain documentation supporting the review and approval of purchase orders and their supplements or revisions.

5.0 INSTRUCTIONS, PROCEDURES, & DRAWINGS

The activities that directly affect product quality are covered by documented rules appropriate to the job. These generally take the form of instructions or procedures, and drawings.

Instructions and procedures are developed for specific activities requiring a specific sequence of operations, tests, inspection. These documents shall include or reference appropriate quantitative or qualitative acceptance criteria for determining that prescribed activities have been satisfactorily completed.

Design and fabrication drawings are prepared on standard drawing formats unless specified otherwise by the customer. In either case the drawings will contain the information necessary to fabricate and inspect the item(s). Dimensional tolerance as appropriate will be contained in these drawings.

The Engineering Manager is responsible for the quality of drawings.

Instructions, Procedures and drawings are reviewed to verify conformance to the customer requirements, quality features, and compliance with Transco design requirements.

Reviews shall be conducted by the personnel competent in the operation, function or design and shall be other than the originator.

6.0 DOCUMENT CONTROL

Documents which specify quality requirements or prescribe activities are controlled for external and internal distribution by a procedure which explains the use of transmittal forms, approval for issuance by authorized personnel, and control of originals and superseded documents and customer forwarded documents.

Approved documents are reviewed for adequacy and released by an authorized personnel, including changes, shall be distributed to and used at the location where the prescribed activity is performed.

The control system is documented and provides for (a) through (c) below:

(a) identification of documents to be controlled and their specified distribution;

(b) identification of assignment of responsibility for preparing, reviewing, approving, and issuing documents;

(c) review of documents for adequacy, completeness, and correctness prior to approval and issuance.

Changes to documents, other than minor changes, are considered as major changes and shall be reviewed and approved by the same organizations that performed the original review and approval, unless other organizations are specifically designated. The reviewing organization shall have access to pertinent background data or information upon which to base their approval.

Minor changes to documents, such as inconsequential editorial correction, shall not require that the revised documents receive the same review and approval as the original documents. To avoid a possible omission of a required review, the type of minor changes that do not require such a review and approval and the persons who can authorize such a decision shall be clearly delineated.

Outdated documents shall be returned to the originator for destruction when directed, and measures shall provide for assuring that the proper document is being used.

Quality documents submitted by suppliers shall be reviewed by the Quality Assurance Manager to verify that contract requirements have been met.

7.0 CONTROL OF PURCHASED MATERIAL, EQUIPMENT & SERVICES

PROCUREMENT PLANNING:

Procurement activities shall be planned and documented to assure a systematic approach to the procurement process.

Planning determines the following:

(a) what is to be accomplished;
(b) who is to accomplish it;
(c) how it is to be accomplished;
(d) when it is to be accomplished.

Planning is accomplished as early as practicable, and no later than at the start of the procurement activities.

Planning provides for the integration of (a) through (i) below:

(a) procurement document preparation, review, and change control;
(b) selection of procurement sources;
(c) bid evaluation and award (if applicable);
(d) Transco control of Supplier performance;
(e) verification (surveillance, inspection, or audit) activities by Transco, including notification for hold and witness points;
(f) control of nonconformances;
(g) corrective action;
(h) acceptance of item or service;
(i) quality assurance records.

SUPPLIER SELECTION:

Measures for evaluation and selection of Transco suppliers, and the results therefrom, shall be documented and shall include one or more of the following:

A. Evaluation of the suppliers history of providing an identical or similar product which performs satisfactorily in actual use. The history shall reflect current capability.

B. Suppliers current quality records supported by qualitative and quantitative information which can be objectively evaluated;

C. Suppliers technical and quality capability as determined by a direct evaluation of his facilities and personnel and the implementation of his quality assurance program.

Activities performed to verify conformance to requirements of procurement documents shall be recorded. Source surveillances and inspections, audits, receiving inspections, nonconformances, dispositions, waivers, and corrective actions shall be documented.

SUPPLIER PERFORMANCE EVALUATION:

Transco shall establish measures to interface with the Supplier and to verify Supplier's performance as deemed necessary by Transco. The measures shall include (a) through f) below:

(a) establishing an understanding between Transco and Supplier of the provisions and specifications of the procurement documents;
(b) requiring the Supplier to identify planning techniques and processes to be utilized in fulfilling procurement document requirements;

(c) reviewing Supplier documents which are generated or processed during activities fulfilling procurement requirements;

(d) identifying and processing necessary change information;

(e) establishing methods of document information exchange between Transco and Supplier;
(f) establishing the extent of source surveillance and inspection activities.

These verification activities shall be conducted as early as practicable. Transco's verification activities, however, shall not relieve the Supplier of his responsibilities for verification of quality achievement.

EXTENT OF ACTIVITIES:

The extent of verification activities, including planning, shall be a function of the relative importance, complexity, and quantity of the time or services procured and the Supplier's quality performance. Verification activities shall be accomplished by qualified personnel assigned to check, inspect, audit, or witness the activities of Suppliers.

RECORDS:

Activities performed to verify conformance to requirements of procurement documents shall be recorded. Source surveillances and inspections, audits, receiving inspections, noconformances, dispositions, waivers, and corrective actions shall be documented.

Transco shall assure that his documentation is evaluated to determine the Supplier's quality assurance program effectiveness.

CONTROL OF SUPPLIER GENERATED DOCUMENTS:

Supplier generated documents shall be controlled, handled, and approved in accordance with established methods. Means shall be implemented to assure that the submittal of these documents is accomplished in accordance with the procurement document requirements. These measures shall provide for the acquisition, processing, and recorded evaluation of technical, inspection, and test data against acceptance criteria.

CONTROL OF CHANGES IN ITEMS OR SERVICES:

Transco and the Supplier shall assure that measures to control changes in procurement documents are established, implemented, and documented and are in accordance with this Program.

ACCEPTANCE OF AN ITEM OR SERVICE:

Methods shall be established for the acceptance of an item or service being furnished by the Supplier. Prior to offering the item or service for acceptance, the Supplier shall verify that the item or service being furnished complies with the procurement requirements. Where required by code, regulation, or contract requirement, documentary evidence that items conform to procurement documents shall be available at the facility prior to installation or use.

Methods used to accept an item or related service from a Supplier shall be Supplier Certificate of Conformance, source verification, receiving inspection, or post installation test at the facility, or a combination thereof.

CERTIFICATE OF CONFORMANCE:

When a Certificate of Conformance is used, the minimum criteria of (a) through (f) below shall be met.

(a) The certificate shall identify the purchased material or equipment, such as by the purchase order number.

(b) The certificate shall identify the specific procurement requirements met by the purchased material or equipment, such as codes, standards, and other specifications. This may be accomplished by including a list of the specific requirements or by providing, on-site, a copy of the purchase order and the procurement specifications or drawings, together with a suitable certificate. The procurement requirements identified shall include any approved changes, waivers, or deviations applicable to the subject material or equipment.

(c) The certificate shall identify any procurement requirements that have not been met, together with an explanation and the means for resolving the nonconformances.

(d) The certificate shall be signed or otherwise authenticated by a person who is responsible for this quality assurance function and whose function and position are described in the Purchaser's or Supplier's quality assurance program.

(e) The certification system, including the procedures to be followed in filling out a certificate and the administrative procedures for review and approval of the certificates, shall be described in the Purchaser's or Supplier's quality assurance program.

(f) Means shall be provided to verify the validity of Supplier certificates and the effectiveness of the certification system, such as during the performance of audits of the supplier or independent inspection or test of the items. Such verification shall be conducted by the Purchaser at intervals commensurate with the Supplier's past quality performance.

SOURCE VERIFICATION:

When source verification is used, it shall be performed at intervals consistent with the importance and complexity of the item or service, and it shall be implemented to monitor, witness, or observe activities. Source verification shall be implemented in accordance with plans to perform inspections, examinations, or tests at predetermined points. Upon Purchaser acceptance of source verification, documented evidence of acceptance shall be furnished to the receiving destination of the item, to the Purchaser, and to the Supplier.

RECEIVING INSPECTION:

When receiving inspection is used, purchased items shall be inspected as necessary to verify conformance to specified requirements, taking into account source verification and audit activities and the demonstrated quality performance of the Supplier. Receiving inspection shall be performed in accordance with established procedures and inspection instructions, to verify by objective evidence such features as proper configuration; identification; dimensional, physical, and other characteristics; freedom from shipping damage, and cleanness. Receiving inspection shall be coordinated with review of Supplier documentation when procurement documents require such documentation to be furnished prior to receiving inspection.

When post-installation testing is used, post-installation test requirements and acceptance documentation shall be mutually established by Transco and Supplier.

ACCEPTANCE OF SERVICES ONLY:

In certain cases involving procurement of services only, such as third party inspection; engineering and consulting services; and installation, repair, overhaul, or maintenance work, the Purchaser shall accept the service by any or all of the following methods:

(a) technical verification of data produced;
(b) surveillance and/or audit of the activity;
(c) review of objective evidence for conformance to the procurement document requirements such as certifications, stress reports, etc.

The responsibility for determining supplier capability and placement on the Approved Vendor List (AVL) is maintained by the Quality Assurance department. The AVL will show signature approval by Quality Assurance. The preparation, maintenance and control of the AVL is as directed by an approved procedure.

Continued evaluation of supplier capability and acceptability is based on review of records such as Certificate of Conformance, Receiving, Inspection from previous purchases and/or by quality audit or surveillance, at the discretion of the Quality Assurance Manager. Documentation of evaluations is maintained and controlled by the applicable procedure.

CONTROL OF SUPPLIER NONCONFORMANCE:

Transco and Supplier shall establish and document methods for disposition of items and services that do not meet procurement documentation requirements.

These methods shall contain provision for (a) through (e) below:

(a) evaluation of nonconforming items;

(b) submittal of nonconformance notice to Transco by Supplier as directed by Transco. These submittals shall include Supplier-recommended disposition (e.g., *use-as-is* or *repair*), and technical justification. Nonconformances to the procurement requirements or Transco-approved documents, which consist of one or more of the following, shall be submitted to Transco for approval of the recommended disposition:

(1) technical or material requirement is violated;

(2) requirement in Supplier documents, which has been approved by the Purchaser, is violated;

(3) nonconformance cannot be corrected by continuation of the original manufacturing process or by rework;

(4) the item does not conform to the original requirement even though the item can be restored to a condition such that the capability of the item to function is unimpaired;

(c) Transco disposition of Supplier recommendation;

(d) verification of the implementation of the disposition;

(e) maintenance of records of Supplier-submitted nonconformances

COMMERCIAL GRADE ITEMS:

Where the design utilizes commercial grade items, the following requirements are an acceptable alternate to the requirements of this section:

Where the design utilizes commercial grade items, the following requirements are an acceptable alternate to other requirements of this section.

(a) The commercial grade item is identified in an approved design output document. An alternate commercial grade item may be applied, provided the cognizant design organization provides verification that the alternate commercial grade item will perform the intended function and will meet design requirements applicable to both the replaced item and its application.

(b) Source evaluation and selection, where determined necessary by Transco based on complexity and importance to safety, shall be in accordance with this section.

(c) Commercial grade items shall be identified in the purchase order by the manufacturer's published product description (for example, catalog number).

(d) After receipt of a commercial grade item, Transco shall determine that:

(1) damage was not sustained during shipment;

(2) the item received was the item ordered:

(3) inspection and/or testing is accomplished, as required by Transco, to assure conformance with the manufacturer's published requirements;

(4) documentation, as applicable to the item, was received and is acceptable.

8.0 IDENTIFICATION & CONTROL OF MATERIALS, PARTS, & COMPONENTS

ITEM IDENTIFICATION:

Items of production (batch, lot, component, part) shall be identified from the initial receipt and fabrication of the items up to and including installation and use. This identification shall relate an item to an applicable design or other pertinent specifying document.

PHYSICAL IDENTIFICATION:

Physical identification shall be used to the maximum extent possible. Where physical identification on the item is either impractical or insufficient, physical separation, procedural control, or other appropriate means shall be employed.

MARKINGS:

Identification markings, when used, shall be applied using materials and methods which provide a clear and legible identification and do not detrimentally affect the function or service life of the item. Markings shall be transferred to each part of an identified item when subdivided and shall not be obliterated or hidden by surface treatment or coatings unless other means of identification are substituted.

IDENTIFICATION AND TRACEABILITY OF ITEMS:

When specified by codes, standards, or specifications that include specific identification or traceability requirements (such as identification or traceability of the item to applicable specification and grade of material; heat, batch, lot, part, or serial number; or specified inspection, test, or other records), Transco shall provide such identification and traceability control.

LIMITED SHELFLIFE ITEM:

Items having limited shelf life shall be identified and controlled to prevent use of items whose shelf life has expired.

MAINTAINING IDENTIFICATION OF STORED ITEMS:

Provisions shall be made for the control of item identification consistent with the planned duration and conditions of storage, such as:

(1) provisions for maintenance or replacement of markings and identification records due to damage during handling or aging;
(2) protection of identifications on items subject to excessive deterioration due to environmental exposure;
(3) provisions for updating existing plant records.

The location and method of identification used shall be in accordance with an approved procedure or the customer's specifications and shall not affect the fit, form, or the function of the parts or finished component.

9.0 CONTROL OF SPECIAL PROCESSES

Procedures have been developed which define the processes for the manufacture and installation of all Transco systems. These special processes are covered under the **Fabrication, Installation and Inspection Manual.**

PROCESS CONTROL:

Process shall be controlled by instructions, procedures, drawings, checklists, travellers, or other appropriate means. These means shall assure that process parameters are controlled and that specified environmental conditions are maintained.

SPECIAL PROCESS:

Each special process shall be performed in accordance with appropriate instructions which include or reference procedure, personnel, and equipment qualification requirements.

RESPONSIBILITY:

It is the responsibility of the personnel performing the special process to adhere to the approved procedures and processes.

Qualification of personnel, procedures, and equipment shall comply with specified requirements.

Conditions necessary for accomplishment of the process shall be included in procedures or instruction. These conditions shall include proper equipment, controlled parameters of the process, and calibration requirements.

ACCEPTANCE CRITERIA:

The requirements of applicable codes and standards, including acceptance criteria for the process, shall be specified or referenced in the procedures or instructions.

RECORDS:

Records shall be maintained as appropriate for the currently qualified personnel, processes, and equipment of each special process.

SPECIAL REQUIREMENTS:

For special processes not covered by existing codes and standards or where quality requirements specified for an item exceed those of existing codes or standards, the necessary requirements for qualifications of personnel, procedures, or equipment shall be specified or referenced in the procedures or instructions.

The Plant Manager and/or Field Superintendent are responsible for the manufacture and installation of all Transco systems except where contractual requirements dictate installation by others. The Quality Control manager and Quality Control personnel are responsible for inspection activities which may also be stated in the same procedure or corresponding inspection procedures.

Special provisions shall be made for customer inspection hold points.

10.0 INSPECTION

PERSONNEL:

Inspection personnel shall not report directly to the immediate supervisors who are responsible for performing the work being inspected.

Each person who verifies conformance of work activities for purposed of acceptance shall be qualified to perform the assigned inspection task.

Inspections by persons during on-the-job training for qualification shall be performed under the direct observation and supervision of a qualified person and verification of conformance shall be by the qualified person until certification is achieved.

INSPECTION HOLD POINTS:

If mandatory inspection hold points are required beyond which work shall not proceed without the specific consent of the designated representative, the specific hold points shall be indicated in appropriate documents. Consent to waive specified hold points shall be recorded prior to continuation of work beyond the designated hold point.

INSPECTION PLANNING:

Planning for inspection activities shall be accomplished and documented. The documentation shall identify characteristics, methods, and acceptance criteria, and shall provide for recording objective evidence of inspection results.

Where a sample is used to verify acceptability of a group of items, the sampling procedure shall be based on recognized standard practices.

IN-PROCESS INSPECTION:

Inspection of items in-process or under construction shall be performed for work activities where necessary to verify quality. If inspection of processed items is impossible or disadvantageous, indirect control by monitoring of processing methods, equipment, and personnel shall be provided.

Both inspection and process monitoring shall be provided when control is inadequate without both.

A combination of inspection and process monitoring methods, when used, shall be performed in a systematic manner to assure that the specified requirements for control of the process and quality of the item are being achieved throughout the duration of the process.

Controls, where required, shall be established and documented for the coordination and sequencing of these activities at established points during successive stages of the conducted process or construction.

FINAL INSPECTIONS:

Final inspections shall include a records review of the results and resolution of nonconformances identified by prior inspections. The final inspection shall be planned to arrive at a conclusion regarding conformance of the item to specified requirements.

Completed items shall be inspected for completeness, markings, calibration, adjustments, protection from damage, or other characteristics as required to verify the quality and conformances of the item to specified requirements. Quality records shall be examined for adequacy and completeness if not previously so examined.

The acceptance of the item shall be documented and approved by authorized personnel.

Modifications, repairs, or replacements of items performed subsequent to final inspection shall require reinspection or retest, as appropriate, to verify acceptability.

RECORDS:

Records shall, as a minimum, identify (a) through (f) below:

(a) item inspected
(b) date of inspection
(c) inspector
(d) type of observation
(e) results of acceptability
(f) reference to information on action taken in connection with nonconformances

11.0 TEST CONTROL

TEST REQUIREMENTS:

Test requirements and acceptance criteria shall be provided or approved by the organization responsible for the design of the item to be tested unless otherwise designated. Required tests, including, as appropriate, prototype qualification tests, production tests, proof tests prior to installation, shall be controlled. Test requirements and acceptance criteria shall be based upon specified requirements contained in applicable design or other pertinent technical documents.

TEST PROCEDURES:

Tests procedures shall include or reference test objectives and provisions for assuring that prerequisites for the given test have been met, that adequate instrumentation is available and used, that necessary monitoring is performed, and that suitable environmental conditions are maintained. Prerequisites shall include the following, as applicable: calibrated instrumentation, appropriate equipment, trained personnel, condition of test equipment and the item to be tested, suitable environmental conditions, and provisions for data acquisition.

In lieu of specially prepared written test procedures, appropriate sections of related documents, such as ASTM methods, Supplier manuals, equipment maintenance instructions, or approved drawings or travelers with acceptance criteria, can be used. Such documents shall include adequate instructions to assure the required quality of work.

TEST RESULTS:

Test results shall be documented and evaluated by a responsible authority to assure that test requirements have been satisfied.

TEST REPORTS:

Test records shall, as a minimum, identify (a) through (g) below:

(a) item tested
(b) date of test
(c) tester or data recorder
(d) type of observation
(e) results and acceptability
(f) action taken in connection with any deviations noted
(g) person evaluating test results

12.0 CONTROL OF MEASURING AND TEST EQUIPMENT

SELECTION:

Selection of measuring and test equipment shall be controlled to assure that such items are of proper type, range, accuracy, and tolerance to accomplish the function of determining conformance to specified requirements.

CALIBRATION AND CONTROL:

Measuring and test equipment shall be calibrated, adjusted, and maintained at prescribed intervals or, prior use, against certified equipment having known valid relationships to nationally recognized standards. If no nationally recognized standards exist, the bases for calibration shall be documented.

The method and interval of calibration for each item shall be defined, based on the type of equipment stability characteristics, required accuracy, intended use, and other conditions affecting measurement control. When measuring and test equipment is found to be out of calibration, an evaluation shall be made and documented of the validity or previous inspection or test results and of the acceptability of items previously inspected or tested. Out-of- calibration devices shall be tagged or segregated and not used until they have been recalibrated. If any measuring or test equipment is consistently found to be out of calibration, it shall be repaired or replaced. A calibration shall be performed when the accuracy of the equipment is suspect.

Calibration and control measures may not be required for rulers, tape measures, levels, and other such devices, if normal commercial equipment provides adequate accuracy.

HANDLING AND STORAGE:

Measuring and test equipment shall be properly handled and stored to maintain accuracy.

RECORDS:

Records shall be maintained and equipment shall be suitably marked to indicate calibration status.

13.0 HANDLING, STORAGE, AND SHIPPING

INSTRUCTION:

Handling, storage, and shipping of items shall be conducted in accordance with established procedures and conducted in accordance with established work and inspection instructions, drawings, specifications, shipment instructions, or other pertinent documents or procedures specified for use in conducting the activity.

REQUIREMENTS:

When required for particular items, special equipment (such as containers, shock absorbers, and accelerometers) and special protective environments (such as inert gas atmosphere, specific moisture content levels, and temperature levels) shall be specified, provided, and their existence verified.

When required for critical, sensitive, perishable, or high-value articles, specific procedures for handling, storage, packaging, shipping, and preservation shall be used.

Special handling tools and equipment shall be utilized and controlled as necessary to ensure safe and adequate handling. Special handling tools and equipment shall be utilized and controlled as necessary to ensure safe and adequate handling. Special handling tools and equipment shall be inspected and tested in accordance with procedures and at specified time intervals to verify that the tools and equipment are adequately maintained.

Operators of special handling and lifting equipment shall be experienced or trained in use of the equipment.

MARKING:

Instructions for marking and labeling for packaging, shipment, handling, and storage of items shall be established as necessary to adequately identify, maintain, and preserve the item, including indication of the presence of special environments or the need for special controls.

14.0 INSPECTION, TEST, AND OPERATING STATUS

The inspection, test and operating status of all Transco materials, systems, and assemblies shall be identified through the use of tags, stamps, labels, or other appropriate means to assure that only acceptable items are installed or used. The results of inspections and/or tests shall be documented and evaluated to assure that the test requirements and contract document requirements have been satisfied.

Items shall be identified by the Quality Control personnel as either accept, reject, or on hold. Items on hold shall not be used until proper dispositioning has been completed and an acceptable status obtained.

Inspection and identification of item status is defined in an applicable procedure. Only Quality control personnel are authorized to physically identify item status, however under certain circumstances, other personnel may be authorized to place items on Hold until Quality Control is available to determine actual item status.

The following definitions apply to inspection status:

HOLD - Issued for each item for which immediate determination of Accept or Reject status cannot be made.

Issued upon determining, or being informed of, a potential nonconforming condition.

ACCEPT - Issued for each item as soon as it can be determined that all requirements have been accomplished and the item acceptable.

REJECT - Issued for any item determined to be not acceptable which cannot be repaired or reworked.

Items placed in a hold or reject status shall be segregated (whenever possible) until final dispositioning may be determined.

Various stages of inspection may not result in tagging the item to indicate the inspection status, unless the inspection results in a hold or nonconforming condition.

15.0 NONCONFORMING ITEM

The Quality Assurance Manager is informed by the Quality Control Inspector of nonconforming items, services, or activities by issuance of the "Report of Nonconformance". The "Report of Nonconformance" is controlled in accordance with an approved procedure which provides for:

A. Identification of Nonconformance:

(a) Identification of nonconforming items shall be by marking, tagging, or other methods which shall not adversely affect the end use of the item. The identification shall be legible and easily recognizable.

(b) If identification of each nonconforming item is not practical, the container, package, or segregated storage area, as appropriate, shall be identified.

B. Documentation of Nonconformance:

Documentation of Nonconformance shall be maintained by Quality Assurance Manager. He shall provide sequential number for the nonconformance to Quality Control Personnel and record the number on the Log of Nonconformance. Quality Control Personnel shall submit a copy of nonconformance to QA Manager.

C. Segregation of Nonconforming Item:

(a) Nonconforming items shall be segregated, when practical, by placing them in a clearly identified and designated hold area until properly dispositioned.

(b) When segregation is impractical or impossible due to physical conditions such as size, weight, or access limitations, other precautions shall be employed to preclude inadvertent use of a nonconforming item.

D. Disposition of Nonconformance:

The disposition, such as use-as-is, reject, repair, or rework, of nonconforming items shall be identified and documented.

Technical justification for the acceptability of a nonconforming item, dispositioned repair, or use-as-is shall be documented. Nonconformances to design requirements dispositioned use-as-is or repair shall be subject to design control measures commensurate with those applied to the original design. The as-built records, if such records are required, shall reflect the accepted deviation.

E. Notification to Affected Organizations:

The Customer shall be notified of each deficiency found in the design, fabrication, or installation which, were it to have remained uncorrected, could have adversely affected the operation of the item supplied at any time throughout the expected lifetime of the item, and which represents:

1. A significant breakdown in any portion of the quality program established for design, fabrication, or installation of the item; or

2. A significant deficiency in final design as approved and released for fabrication or installation, such that the design does not conform to the criteria and requirements stated in the contract documents or referenced specifications; or

3. A significant deficiency in fabrication, or installation of, or damage to the item which will require extensive evaluation, extensive redesign, or extensive repair to meet the criteria and requirements stated in the contract documents or referenced specifications, or to otherwise establish the adequacy of the item to fulfill its intended functions; or

4. A significant deviation from performance specifications which requires extensive evaluation, extensive redesign, or extensive repair to establish the adequacy of the item to meet the criteria or to otherwise establish the adequacy of the item to perform its intended function.

The responsibility and authority for disposition of a nonconforming item rests with the Quality Assurance Manager, Assistant Vice President, Product Manager, Project Manager, and Customer as applicable. All parties involved in the approval of a disposition of a Report of Nonconformance, must be in agreement. Further processing or delivery must stop until such time as the disposition is made and corrective action taken as necessary. Timely corrective action is required for all nonconformances. There are four alternatives in which to dispose of a nonconforming item:

A. Accept "as is";
B. Scrap
C. Repair,
D. Rework.

16.0 CORRECTIVE ACTION

Corrective Action is required as the result of nonconforming items, system deficiencies, or audit findings. When corrective action is required by the Quality Assurance Manager, it does not imply that a departure from contract requirements is or was evident, but it may be instituted to improve a quality system, the design of the product or method of fabrication or installation.

Provisions are accounted for within the program to assure that:

A. Conditions adverse to quality are properly identified;
B. Corrective action is initiated as soon as practicable;
C. Cause of condition is identified;
D. Corrective action is taken to preclude recurrence;
E. Corrective action is documented and reported to appropriate levels of management.

The Quality Control Manager reports to the Quality Assurance Manager on a quarterly basis on the status of his activities which include Corrective Action follow-up. Personnel who are responsible for implementing the Corrective Action within a specific time frame and fail to satisfy the requirement are reported by the Quality Assurance Manager to the next higher level of management. An "Open Items List" is maintained by the Quality Assurance Manager describing the deficiency, target date for implementation, and close-out date.

Corrective Action may be verified by review of documentation.

17.0 QUALITY ASSURANCE RECORDS

The Quality Assurance Manager and applicable Quality Control Staff are responsible for maintaining quality assurance documentation generated as a result of this manual and associated procedures. Quality Assurance records generated by the QA Manual and procedures shall be prepared, collected, organized and maintained. These documents include items such as personnel training records, material certifications, inspection records, (i.e. receiving, in-process, final acceptance), test reports, audit reports, nonconformance reports, and other documents which provide verification of quality activities. Inspection records shall, as a minimum, identify the inspector, the date the inspection was performed, the type of observation, the results, the acceptance, and the action taken in connection with any deficiencies noted. The preparation, collection, and maintenance of records and documents is controlled by approved procedures which provide assurance of document availability when needed for their support of Transco systems. All quality records, procedures, and qualifications shall be available for examination by the Contractor, Owner, and their authorized agents. Required records shall be accurate, legible, identifiable and retrievable. Duplicate records shall be maintained to eliminate chance of exposure to a simultaneous hazard.

RECORDS ADMINISTRATION:

A records system(s) shall be established by the organization responsible at the earliest practicable time consistent with the schedule for accomplishing work activities and in compliance with the general requirements of this Manual. The records system(s) shall be defined, implemented, and enforced in accordance with written procedures, instructions, or other documentation.

The applicable design specifications, procurement documents, test procedures, operational procedures, or other documents shall specify the records to be generated, supplied, or maintained by or for the Owner. Documents that are designated to become records shall be legible, accurate, and completed appropriate to the work accomplished.

Documents shall be considered valid records only if stamped, initialed, or signed and dated by authorized personnel or otherwise authenticated. This authentication may take the form of a statement by the responsible individual or organization. Handwritten signatures are not required if the document is clearly identified as a statement by the reporting individual or organization. These records may be originals or reproduced copies.

The records shall be indexed. The indexing system(s) shall include, as a minimum, record retention times and the location of the record within the record system.

The records shall be distributed, handled, and controlled in accordance with written procedures.

Records and/or indexing system(s) shall provide sufficient information to permit identification between the record and the item(s) or activity(ies) to which it applies.

Records shall be classified as *Lifetime* or *Nonpermanent* by the Owner, or his agent when authorized, in accordance with the procedure.

Lifetime Records. Lifetime records are those that meet one or more of the following criteria:

(a) those which would be of significant value in demonstrating capability for safe operation;

(b) those which would be of significant value in maintaining , reworking, repairing, replacing, or modifying an item;
(c) those which would be of significant value in determining the cause of an accident or malfunction of an item:
(d) those which provide required baseline data for in-service inspections.

Lifetime records are required to be maintained by or for the plant owner for the life of the particular item while it is installed in the plant or stored for future use.

Nonpermanent Records. Nonpermanent records are those required to show evidence that an activity was performed in accordance with the applicable requirements but need not be retained for the life of the item because they do not meet the criteria for lifetime records.

Records shall be retained in accordance with the above classifications. The retention periods for nonpermanent records shall be established in the applicable procedure.

Quality Assurance Manager and Quality Control Manager are responsible for protection from damage or loss during the time that the records are in their possession.

The records shall be stored in accordance with applicable procedures in predetermined location(s) that meet the requirements of applicable standards, codes, and regulatory agencies.

Records shall be stored in a manner which precludes deterioration of the records, the requirements of (a) and (b) below shall apply.

(a) Provisions shall be made in the storage arrangement to prevent damage from moisture, temperature, and pressure.

(b) Records shall be firmly attached in binders or placed in folders or envelopes for storage in steel file cabinets or on shelving in containers.

Records shall be stored in facilities constructed and maintained in a manner which minimizes the risk of damage or destruction from the following:

(a) natural disasters such as winds, floods, or fires;
(b) environmental conditions such as high and low temperatures and humidity;
(c) infestation of insects, mold, or rodents.

Documents other than lifetime records are classified as non-permanent documents. While permanent Quality Assurance Records are intended to be maintained for the life of the item while it is installed or stored, the Nonpermanent Documents are intended to only show evidence that a given activity was performed for an it to satisfy a specified requirement. In both cases the record or document provide sufficient recorded data to allow identification with the item or service provided.

Permanent Quality Assurance Records are normally turned over to the Customer in the manner stipulated by contract. Nonpermanent Documents will be made available to the Customer at the completion of the project. Transco may elect not to maintain documents after documentation package turnover to the Customer has taken place.

18.0 AUDITS

SCHEDULING:

Internal or external quality assurance audits, or both, shall be scheduled in a manner to provide coverage and coordination with ongoing Quality Assurance program activities. Audits shall be scheduled at a frequency commensurate with the status and importance of the activity. The audit schedule shall be reviewed periodically and revised as necessary to assure that coverage is maintained current. Regularly scheduled audits shall be supplemented by additional audits of specific subjects when necessary to provide adequate coverage.

AUDIT PLAN:

The auditing organization shall develop and document an audit plan for each audit. This plan shall identify the audit scope, requirements, audit personnel, activities to be audited, organizations to be notified, applicable documents, schedule, and written procedures or checklists.

PERSONNEL:

Transco shall select and assign auditors who are independent of any direct responsibility for performance of the activities which they will audit. In the case of internal audits, personnel having direct responsibility for performing the activities being audited shall not be involved in the selection of the audit team. Audit personnel shall have sufficient authority and organizational freedom to make the audit process meaningful and effective.

SELECTION OF AUDIT TEAM:

An audit team shall be identified prior to the beginning of each audit. This team shall contain one or more auditors and shall have an individual appointed to lead the team who organizes and directs the audit, coordinates the preparation and issuance of the audit report, and evaluates responses. The audit team leader shall ensure that the audit team is prepared prior to initiation of the audit.

PERFORMANCE:

Audits shall be performed in accordance with written procedures or checklists. Auditing shall begin as early in the life of the activity as practical and shall be continued at intervals consistent with the schedule for accomplishing the activity. Elements that have been selected for audit shall be evaluated against specified requirements. Objective evidence shall be examined to the depth necessary to determine if these elements are being implemented effectively. Audit results shall be documented by auditing personnel and shall be reviewed by management having responsibility for the area audited. Conditions requiring prompt corrective action shall be reported immediately to management of the audited organization.

REPORTING:

The audit report shall be signed by the audit team leader and issued, and it shall include the following information, as appropriate:

(a) description of the audit scope;

(b) identification of the auditors;

(c) identification of persons contacted during audit activities;

(d) summary of audit results, including a statement on the effectiveness of the quality assurance program elements which were audited;

(e) description of each reported adverse audit finding in sufficient detail to enable corrective action to be taken by the audit organization.

RESPONSE:

Management of the audited organization or activity shall investigate adverse audit findings, schedule corrective action, including measures to prevent recurrence, and notify the appropriate organization in writing of action taken or planned. The adequacy of audit responses shall be evaluated by or for the auditing organization.

FOLLOW-UP ACTION:

Follow-up action shall be taken to verify that corrective action is accomplished as scheduled.

RECORDS:

Audit records shall include audit plans, audit reports, written replies, and the record of completion of corrective action.

I. TERMS AND DEFINITIONS

acceptance criteria - specified limits placed on characteristics of an item, process, or service defined in codes, standards, or other requirement documents.

audit - a planned and documented activity performed to determine by investigation, examination, or evaluation of objective evidence the adequacy of and compliance with established procedures, instructions, drawings, and other applicable documents, and the effectiveness of implementation. An audit should not be confused with surveillance or inspection activities performed for the sole purpose of process control or product acceptance.

Certificate of Compliance - A written statement, signed by a qualified party, attesting that the items or services are in accordance with specified requirements and accompanied by additional information to substantiate the statement.

Certificate of Conformance - a document signed or otherwise authenticated by an authorized individual certifying the degree to which items or services meet specified requirements.

certification - the act of determining, verifying, and attesting in writing to the qualifications of personnel, processes, procedures, or items in accordance with specified requirements.

characteristic - any property or attribute of an item, process, or service that is distinct, describable, and measurable.

commercial grade item - an item satisfying (a), (b) and (c) below:

(a) not subject to design or specification requirements that are unique to nuclear facilities;
(b) used in applications other than nuclear facilities;
(c) is to be ordered from the manufacturer/supplier on the basis of specifications set forth in the manufacturer's published product description (for example, catalog).

computer program -a sequence of instructions suitable for processing by a computer. Processing may include the use of an assembler, a compiler, an interpreter, or a translator to prepare the program for execution as well as to execute it.

condition adverse to quality - an all-inclusive term used in reference to any of the following: failures, malfunctions, deficiencies, defective items, and nonconformances. A significant condition adverse to quality is one which, if uncorrected, could have a serious effect on safety or operability.

corrective action -measures taken to rectify conditions adverse to quality and, where necessary, to preclude repetition.

design change- any revision or alteration of the technical requirements defined by approved and issued design output documents and approved and issued changes thereto.

design input - those criteria, parameters, bases, or other design requirements upon which detailed final design is based.

design output - drawings, specifications, and other documents used to define technical requirements of

structures, systems, components, and computer programs.

design process - technical and management processes that commence with identification of design input and that lead to and include the issuance of design output documents.

deviation - a departure from specified requirements.

document - any written or pictorial information describing, defining, specifying, reporting or certifying activities, requirements, procedures, or results. A document is not considered to be a Quality Assurance Record until it satisfies the definition of a Quality Assurance Record as defined in this Supplement.

external audit - an audit of those portions of another organization's quality assurance program not under the direct control or within the organizational structure of the auditing organization.

final design - approved design output documents and approved changes thereto.

guideline - a suggested practice that is not mandatory in programs intended to comply with a standard. The word *should* denotes a guideline; the word *shall* denotes a requirement.

inspector - a person who performs inspection activities to verify whether an item or activity conforms to specified requirements.

internal audit - an audit of those portions of an organization's quality assurance program retained under its direct control and within its organizational structure.

item - an all-inclusive term used in place of any of the following : appurtenance, assembly, component, equipment, material, module, part, structure, subassembly, subsystem, system, or unit.

measuring and test equipment (M & T) - devices or systems used to calibrate, measure ,gage, test, or inspect in order to control or acquire data to verify conformance to specified requirements.

nonconformance - a deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate.

objective evidence - any documented statement of fact, other information, or record, whether quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests which can be verified.

Owner- the person, group, company, agency, or corporation who has or will have title to the nuclear power plant.

procedure - a document that specifies or describes how an activity is to be performed.

procurement document - purchase requisitions, purchase orders, drawings, contracts, specifications, or instructions used to define requirements for purchase.

Purchaser - the organization responsible for establishment of procurement requirements and for issuance, administration, or both, or procurement documents.

qualification (personnel)- the characteristics or abilities gained through education, training, or experience, as measured against established requirements, such as standards or tests, that qualify an individual to perform a required function.

qualified procedures - an approved procedure that has been demonstrated to meet the specified requirements for its intended purpose.

quality assurance (QA) - all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service.

quality assurance record - a completed document that furnishes evidence of the quality or items and/or activities affecting quality.

quality control - Those quality assurance actions which provide a means to control and measure the characteristics of an item, process, or facility to established requirements.

receiving - taking delivery of an item at a designated location.

repair - the process of restoring a nonconforming characteristic to a condition such that the capability of an item to function reliably and safely is unimpaired, even though that item still does not conform to the original requirement.

rework - the process by which an item is made to conform to original requirements by completion or correction.

right of access - the right of a Purchaser or designated representative to enter the premises of a Supplier for the purpose of inspection, surveillance, or quality assurance audit.

service - the performance of activities such as design, fabrication, inspection, nondestructive examination, repair, or installation.

special process - a process, the results of which are highly dependent on the control of the process or the skill of the operators, or both, and in which the specified quality cannot be readily determined by inspection or test of the product.

Supplier - any individual or organization who furnishes items or services in accordance with a procurement document. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, consultant, and their subtier levels.

surveillance - the act of monitoring or observing to verify whether an item or activity conforms to specifies requirements.

testing - an element of verification for the determination of the capability of an item to meet specified requirements by subjecting the item to a set of physical, chemical, environmental, or operating conditions.

traceability - the ability to trace the history, application, or location of an item and like items or activities by means of recorded identification.

use-as-is- a disposition permitted for a nonconforming item when it can be established that the item is

satisfactory for its intended use.

verification - the act or reviewing, inspecting, testing, checking, auditing, or otherwise determining and documenting whether items, processes, services, or documents conform to specified requirements.

waiver - documented authorization to depart from specified requirements.

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FAVERDALE
TECHNOLOGY
CENTRE

official issue

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TECHNOLOGY
CENTRE LTD

TEST REPORT

Order number	Document number
310076	FTCR/94/0060

Client

Darchem Engineering Inc
81 West Bellevue Drive
Pasadena CA91105
Chicago
USA

TEST REPORT FOR A 1 HOUR FIRE HOSE STREAM TESTS ON DARMATT KM1 FIRE PROTECTION SYSTEM FOR ELECTRICAL CIRCUITS SYSTEMS TO ASTM E119 NRC GL 86/10 SUPPLEMENT 1

Issue	Date	Modification	Issued by	Issued date	Approved by	Approved date
A	8/4/94	ORIGINAL	P HOGG	8/4/94	M R GARDNER	8/4/94
B	1/9/94		P HOGG	1/9/94	M R GARDNER	1/9/94

NAMAS

REVISION SHEET

PAGES AFFECTED	SECTION	DATE	REVISION SUMMARY	REVISED BY
1		31.8.94	Address	
3	Summary	31.8.94	Inclusion of hose stream test	
6	2.1	31.8.94	Gas flow and pressure control	
8	3	31.8.94	Moisture content statement	
6	Addendum 1	31.8.94	Hose stream test	

SUMMARY

A fire test was performed on a 36" x 6" cable tray, a 12" x 3.5" cable tray and a 3/4" diameter conduit insulated with KM1 Darmatt fire protection system. The test was carried out in accordance with ASTM E119 specification at the Faverdale Technology Centre, Darlington on 29 March 1994 and was witnessed by Mr J Behn (Commonwealth Edison), Mr K Hawks (Transco) and Mr C Philpott (DEI).

The pass/fail criterion applied was a rise of 139°C in the mean temperature or a 181°C rise in an individual temperature reading.

The time to failure of the three samples under test were as follows:-

36" x 6" cable tray - 79 minutes (139°C rise on mean conductor temperature).

12" x 3½" cable tray - 81 minutes (139°C rise on mean conductor temperature).

$^{3}/_{4}$" conduit - 70 minutes (181°C rise on conduit surface).

A separate fire/hose stream test was performed on a short section of 36" x 6" cable tray insulated with KM1 Darmatt fire protection system. The sample complied with the pass criteria as detailed in ASTM E119 NRC GL 86-10 Supplement 1.

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur.

For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

CONTENTS

1 INTRODUCTION

This document describes the performance of the developed Darmatt electrical circuit protective system when subjected to fire test conditions.

The Darmatt KM1 system was tested in accordance with the UL 1724 (ASTM E119) (Fire Tests for Electrical Circuit Protective Systems) Specification at the Faverdale Technology Centre (FTC) in the United Kingdom.

The testing of the Darmatt KM1 system was monitored by Mr J Behn (Commonwealth Edison), Mr K Hawks (Transco) and Mr C Philpott (DEI).

2 DESCRIPTION OF THE TEST EQUIPMENT

2.1 Furnace

The fire test furnace used was 4 metres long by 3 metres wide and 1.8 metres high (measured internally) and is constructed from a mild steel outer shell and structural steel members.

The furnace was lined with ceramic fibre of 200 mm thickness and fired using 16 natural gas burners providing an approximate heat flux of 200 kW/m^2.

The burners are controlled individually from a central manifold system using a pump and series of valves to ensure a constant gas flow and pressure to the burners. The pressure within the furnace was monitored by an electronic manometer and adjusted by a system of dampers and forced air injection.

2.2 Floor/Roof Assembly

A roof was constructed from carbon steel sheet which will cover the complete 4 m x 3 m opening in the furnace. Attached to the unexposed surface were steel frameworks from which the raceways were supported externally.

The roof was lined with 200 mm of high grade ceramic fibre. Openings were made in the furnace for the raceways to pass through.

Attachments made for unistrut supports for the raceways descended from the roof of the furnace.

2.3 Raceways

The raceways were constructed from carbon steel and to the sizes shown below.

(a) Cable Trays (Ref Figs 1 and 2, Appendix A)

915 mm wide by 150 mm deep (36" x 6")
305 mm wide by 90 mm deep (12" x 3½")

(b) Conduits

3/4" diameter conduit.

The raceways were U-shaped with the vertical drop from the roof being no less than 915 mm as measured from the underside of the roof to the bottom of the tray on the horizontal run.

The horizontal raceways span between the centres of the two vertical drops were 1900 mm in length.

2.4 Cables

All raceways had a 0% solid area cable fill.

3 SAMPLE DETAILS (Ref. Figs 1 and 2, Appendix A)

The insulation itself comprises of an inorganic endothermic material, an organic fibre and an organic polymer binder which are mixed and dried to form a sheet of uniform thickness. From these sheets, fabricated panels were then cut to size and manufactured.

The number of layers and nominal thicknesses used on each raceway are detailed below.

(i)	3/4" conduit.	1 layer of moulded sectional insulation of nominal thickness 39 mm.
(ii)	12" x 6" Cable Tray	2 layers at nominal 16 mm thick.
(iii)	36" x 6" Cable Tray	2 layers at nominal 16 mm thick.

The Darmatt panels require no conditioning or curing time after installation as wet installation methods are not used. Sample checks on moisture content on the Darmatt KM1 boards showed levels were less than 3%.

4 INSTRUMENTATION

4.1 Data Recorder

The two data recorders used were the Solartron Orion Delta model. These are multi-task data processing and recording devices with an accuracy of 0.05°.

4.2 Furnace Thermocouples

The furnace temperature was monitored and controlled with 8 symmetrically positioned thermocouples 1.6 mm diameter, metal sheathed type K, to BS 1041 and BS 4937 Part 4. ASTM thermocouples provided by Underwriter Laboratories (Northbrook) were used for reference and positioned adjacent to the controlling thermocouples.

4.3 Test Sample Thermocouples (Ref Figs 2, 3, 4 and 5, Appendix C)

The test sample thermocouples were calibrated glass covered type K to BS 1041 and BS 4937 Part 4.

The thermocouples are to be positioned as in the above drawings.

(a) Type C30 with a conductor area of 0.5 mm^2 on the sides of the raceway. (1) At a point 25 mm from the floor surface, (2) immediately adjacent to the intermediate raceway support and (3) at intermediate pitches of 150 mm.

(b) Type C40 with a conductor area of 0.22 mm^2 on 8 AWG bare electrical conductors running the length of the centre line of the raceway on the rungs of the cable tray, below the rungs of the cable tray and where applicable on top of the cable fill at a pitch as defined in section a).

4.4 Differential Pressure Measurement

The differential pressure was measured by an electrical manometer capable of reading pressure within an accuracy of 0.01 inch (2.5 Pa) of water.

The pressure measuring probe tips were manufactured from stainless steel or equivalent material.

5 CONTROL OF FIRE TESTS (Ref figs 7 and 8)

The furnace was controlled to follow the ASTM E119 standard fire curve, the limits imposed were those stated in BS 476 part 20 1987.

A graph showing the ASTM E119 standard fire curve and the actual fire curve achieved during the tests is included in Figure 8a, 8b and 8c of Appendix D.

The percentage deviation (p) of the mean furnace temperature/time curve from the standard temperature/time curve is given by:-

$$p = \frac{A - B}{x} \times 100$$

Where A is the area under the mean furnace temperature/time curve, B is the area under the specified standard temperature/time curve.

A computer programme using Simpsons Rule was used to show the limits on deviation between the measured temperature and the standard temperature/time curve. A typical example of this is shown in Figure 9, Appendix D.

(i) Tolerance

Measured furnace temperature deviations were within the following limits.

(a) Less than 15% to the end of the first 10 minutes of the heating period or to the end of the test if this is less than 10 minutes.

(b) Less than 10% from 10 minutes into the test to the end of 30 minutes into the heating period.

(c) Less than 5% from 30 minutes into the test to the end of the fire test.

(ii) Uniformity of Temperature Distribution

At any time after the first 10 minutes of the heating period, the temperature rise indicated by any of the thermocouples used to determine the mean furnace temperatures did not differ from the corresponding temperature rise given by the standard temperature/time curve by more than 100°C.

6 TEST PROCEDURE

6.1 Installation of the Raceway and Cables

The raceways were supported from the floor/roof at each end from outside of the furnace.

All raceways included a support at the centre of the horizontal run comprising of a P1001 unistrut suspended from the furnace roof. The conduit sample was not supported at its midpoint.

The raceways protected by electrical circuit protective systems were representative of the smallest and largest installed as complete systems and each incorporated at least one intermediate support representative of that for which rating is desired. The raceways terminated a maximum of 915 mm beyond the unexposed surface of the floor or wall assembly.

The electrical conductors within the electrical circuit protective system were simulated by No. 8 AWG (8.38 mm^2) stranded medium or hard-drawn temper bar copper conductors weighing 75 g/m. The bare copper conductors had an outside diameter of 3.71 mm and consisted of seven 1.24 mm diameter strands. The bare copper conductors were installed along the entire length of the electrical circuit protective system, and terminated within the floor firestop system.

The firestop system for the floor opening was constructed using materials and techniques that provide an effective heat and smoke seal without influencing the performance of the electrical circuit protective system as a result of degradation or excessive heat transfer to the electrical conductors within the firestop system.

The periphery of the test sample was no closer than 305 mm from the furnace edge.

6.2 Installation of the Test

The test sample was installed in accordance with the assembly steps shown in Figure 1 of Appendix A.

6.3 Furnace Ignition and Temperature (Ref Fig 8, Appendix C)

After all instrumentation had been checked for functionality the burners were ignited and the average furnace temperature was controlled to match as closely as possible the UL 1724 (ASTM E119 standard fire curve). A graph of the time/temperature curve is presented in Figure 8.

6.4 Test Readings

(i) Temperatures

(a) The average conductor temperature as indicated by the thermocouples on the bare copper conductor for the cable trays and conduits were printed to paper at:

2 minute intervals until 30 minutes into the test,
5 minute intervals from 30 minutes into the test until the end of the test.

(b) The average furnace temperature was continuously displayed on the data recorder and printed to paper at the frequencies stated above.

(c) All the individual thermocouple readings were printed to paper at the frequency stated in Clause 6.4 a).

Note an initial print-out was taken before the ignition of the burners to establish ambient conditions.

(ii) Observations

The test samples were continuously monitored and any significant behaviour noted together with the time of the occurrence (refer to Section 8 of this document).

6.5 Duration of the Test

The duration of the test is 60 minutes for both cable trays and the conduit. The duration was extended until the highest mean temperature exceeded 139°C above initial mean temperature.

6.6 Pass/Failure Criteria

(i) Temperature

The pass/failure criteria was that the highest average temperature recorded by any set of thermocouples must not exceed 139°C above the initial starting mean. Also the maximum temperature recorded by any thermocouple must not exceed a 181°C rise above the initial mean.

7 TEST RESULTS

Summarised below are the time to failure results when the results are assessed against the criteria detailed in 6.7.

	Time to Failure (Minutes)	
	139°C rise on mean	181°C rise on individual thermocouple
36" x 6" Cable Tray (A)		
Tray Face X	89	Not achieved
Tray Face Y	88	Not achieved
Inner Conductor	79	84
Outer Conductor	79	84
3/4" Conduit		
Outer surface	74	70
Conductor	83	76
12" x 3½" Cable Tray (B)		
Tray Face X	85	88
Tray Face Y	87	Not achieved
Inner Conductor	81	87
Outer Conductor	82	87

The furnace pressure was found to be 7 Pa throughout the test.

At the time of test the samples obtained for moisture and density determination had the following values:-

	Dry Density (kg/m^3)	% Moisture
Slab	668	0.4
Section 1	458	1.3
Section 2	340	0.8

8 OBSERVATIONS

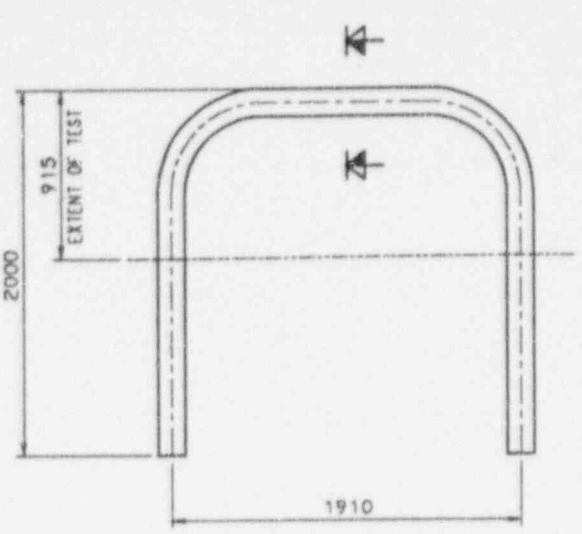
Flaming was observed at intervals throughout the 90 minute test from the Darmatt applied to the 36" x 6" cable tray. No flaming was observed from the Darmatt applied to the 12" x 3½" cable tray or the ¾" conduit.

APPENDIX A

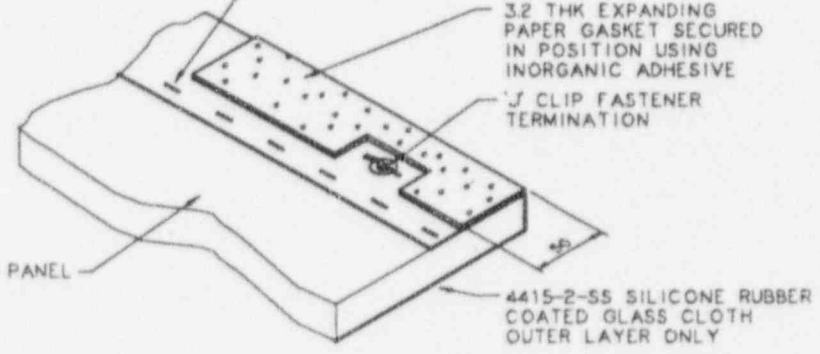
Fig 1a - 36" Cable Tray

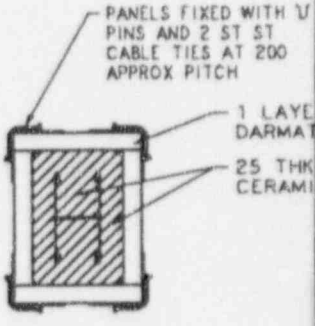
Fig 1b - 12" Cable Tray

Any errors on this drawing are to be reported to the drawing office immediately/if in doubt,ask

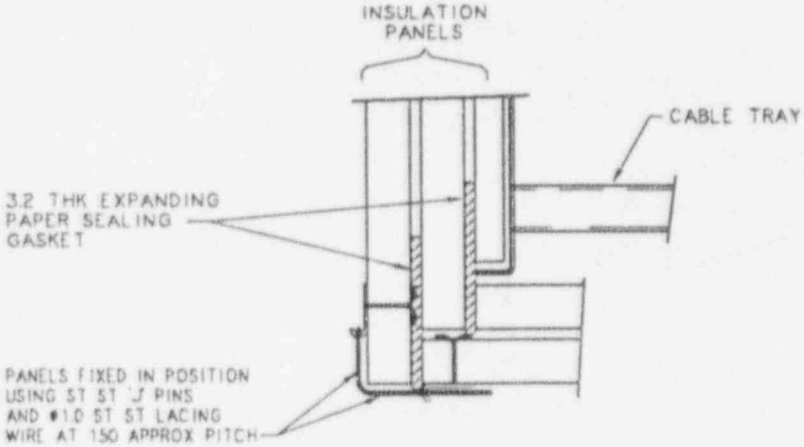


12" CABLE LADDER

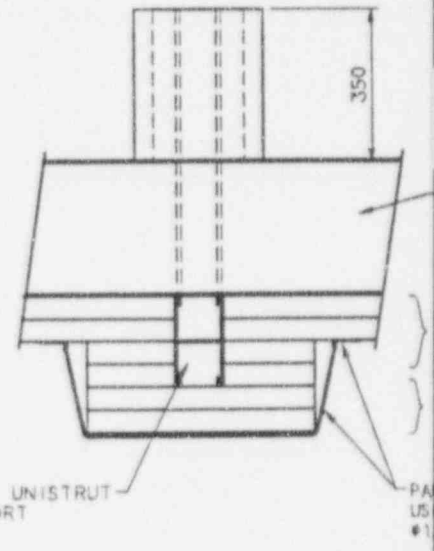




TYPICAL DETAIL OF PANEL GASKET



TYPICAL PANEL ASSEMBLY



DETAIL OF INSULATION ARO
UNISTRUT SUPPORT

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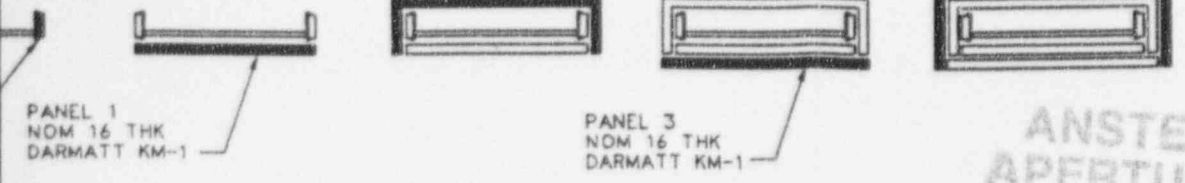
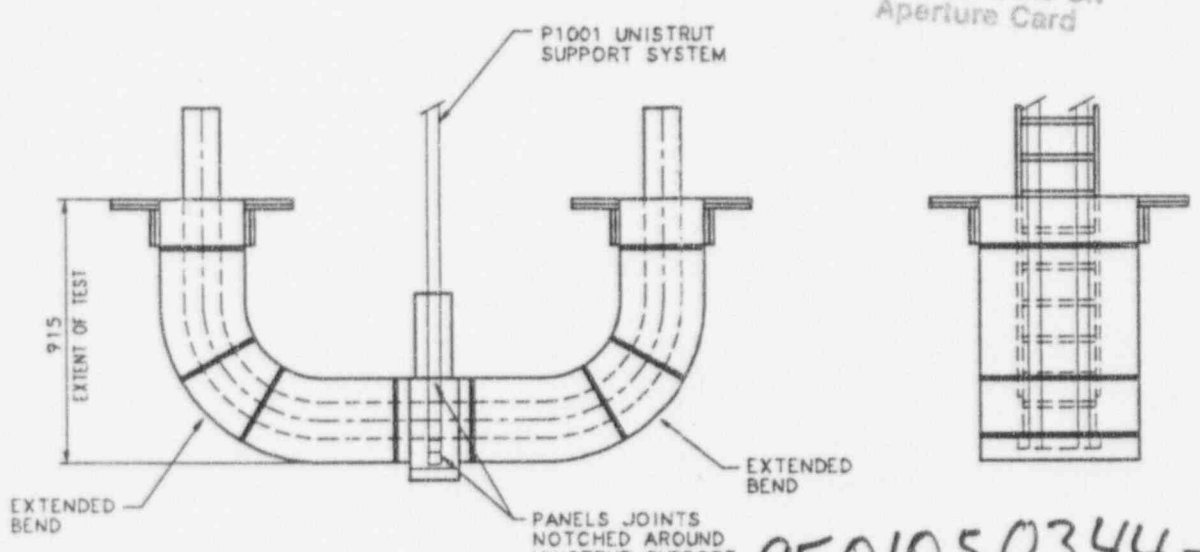
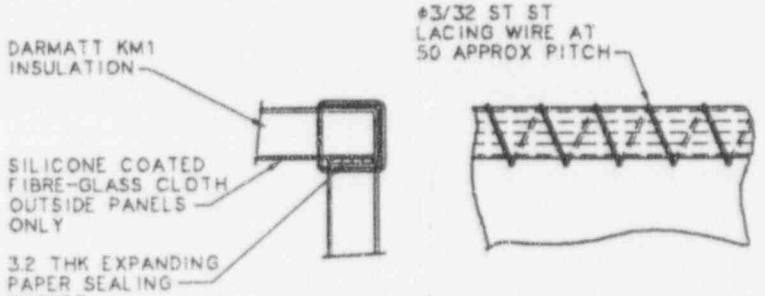


ASSEMBLY OF INSULATION AROUND 12" CABLE LADDER



950105 0344-01

TRUE ORIENTATION OF INSULATED
TEST SAMPLE IN FURNACE



TYPICAL CORNER DETAIL

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C FIBRE

CABLE TRAY

CABLE TRAY
INSULATION
PANELS

SUPPORT
COVER PAD

ELS FIXED IN POSITION
NG ST ST 'J' PINS AND
0 ST ST LACING WIRE

UND

Darchem Engineering Ltd Stalingtón Stockton-on-Tees Cleveland TS21 1LB England			DARCHEM
title: DETAIL OF 12" CABLE LADDER FIRE PROTECTION (KM-1) TEST SAMPLE 1 HOUR TEST			
	name	date	drawing no
drawn	BW	24.3.94	310076/DSK2
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approved	KJM	24.3.94	issue A
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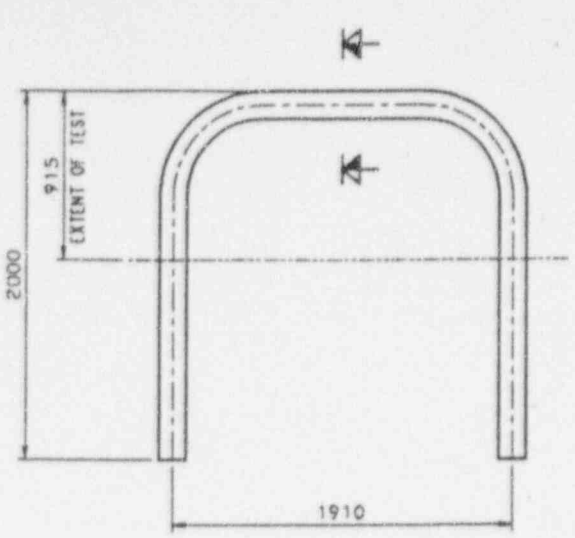
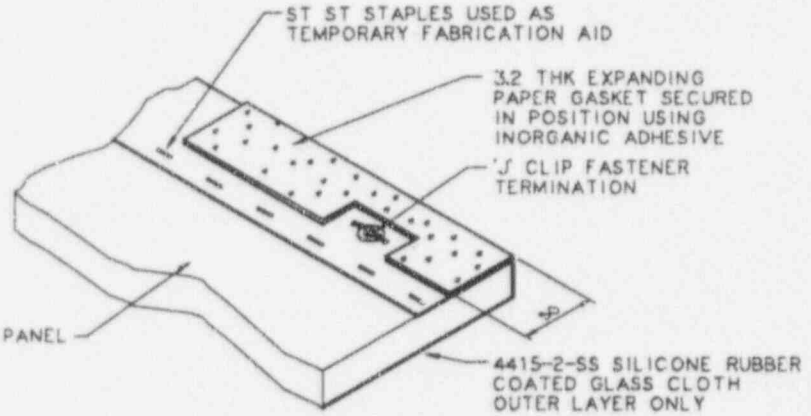
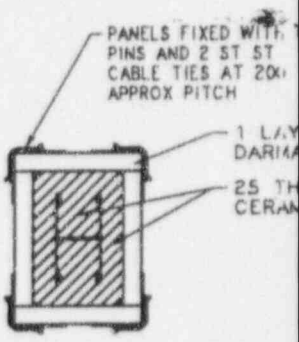
do not scale from drawing	order no		

Any errors on this drawing are to be reported to the drawing office immediately/if in doubt,ask

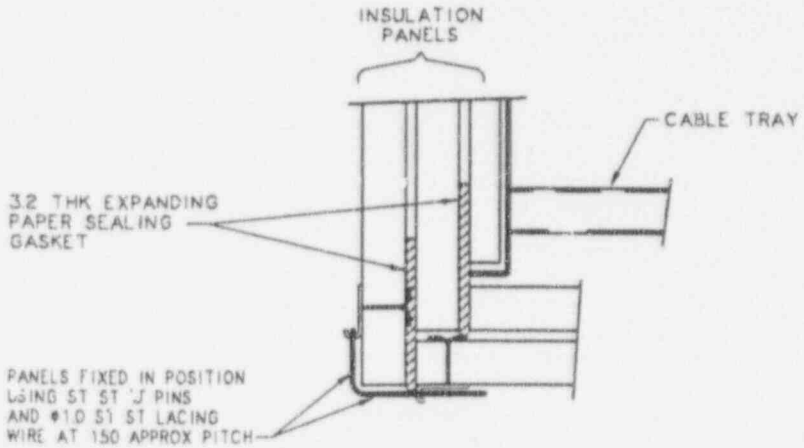


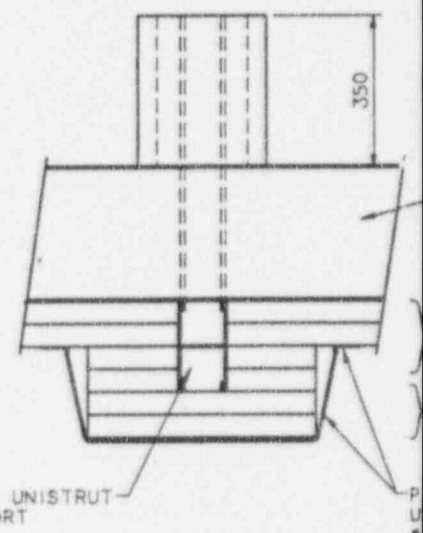
36" CABLE LADDER





TYPICAL DETAIL OF PANEL GASKET





TYPICAL PANEL ASSEMBLY

DETAIL OF INSULATION AR
UNISTRUT SUPPORT

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INITIAL ISSUE																							

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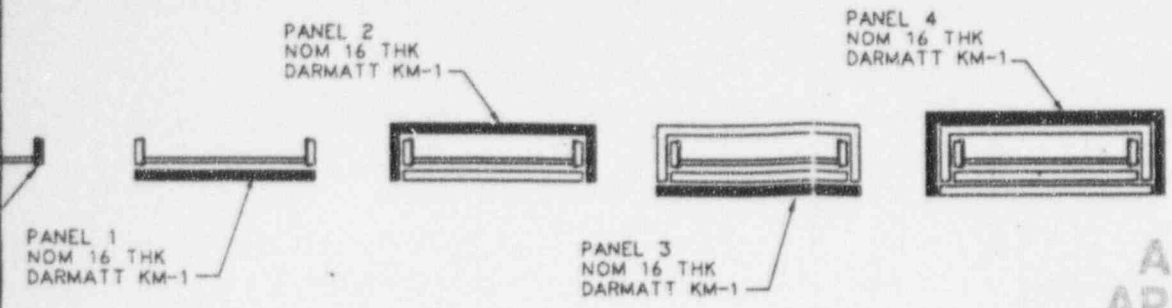
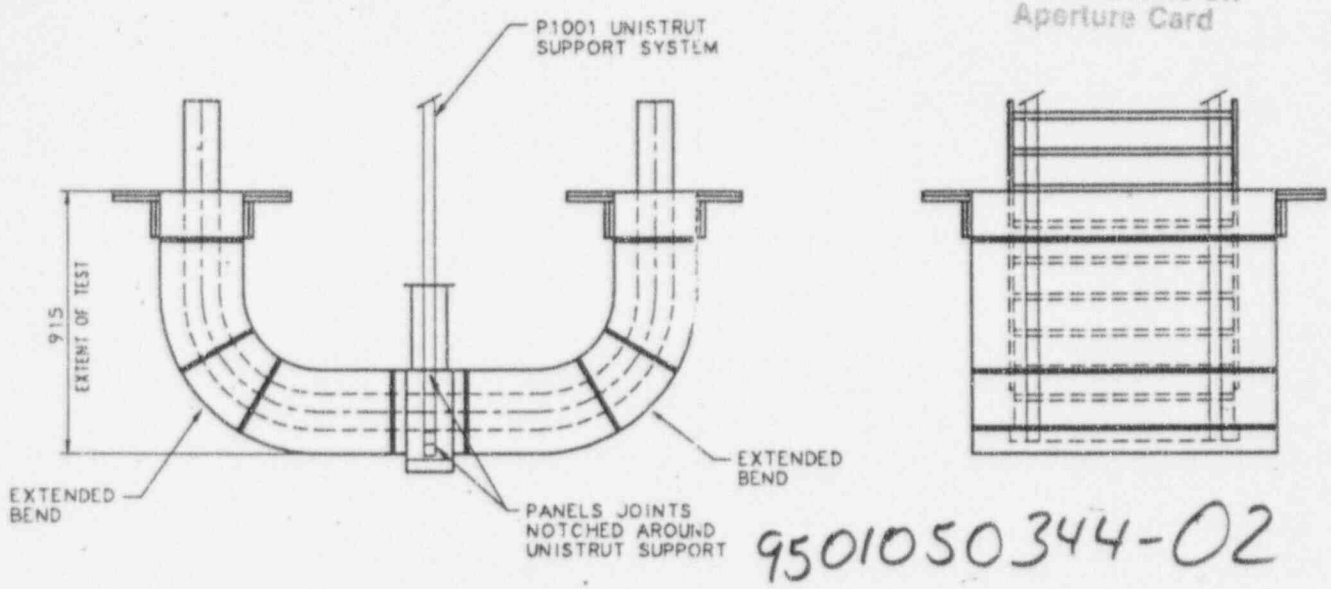


ASSEMBLY OF INSULATION AROUND 36" CABLE LADDER



9501050344-02

TRUE ORIENTATION OF INSULATED
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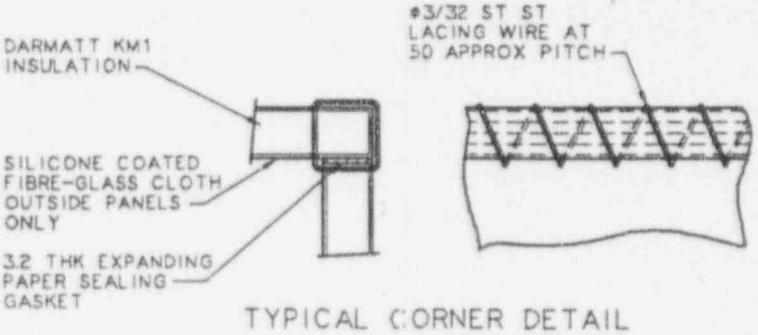

TYPICAL CORNER DETAIL

Darchem Engineering Ltd
Stillington
Stockton-on-Tees
Cleveland TS21 1LB
England

DARCHEM

title: DETAIL OF 36" CABLE LADDER
FIRE PROTECTION (KM-1) TEST SAMPLE
1 HOUR TEST

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drawn	BW	24.3.94
checked	K.M	24.3.94
approved	K.M	24.3.94

drawing no: 310076/DSK1

issue: A

original scale: NTS

dimensions

do not scale from drawing

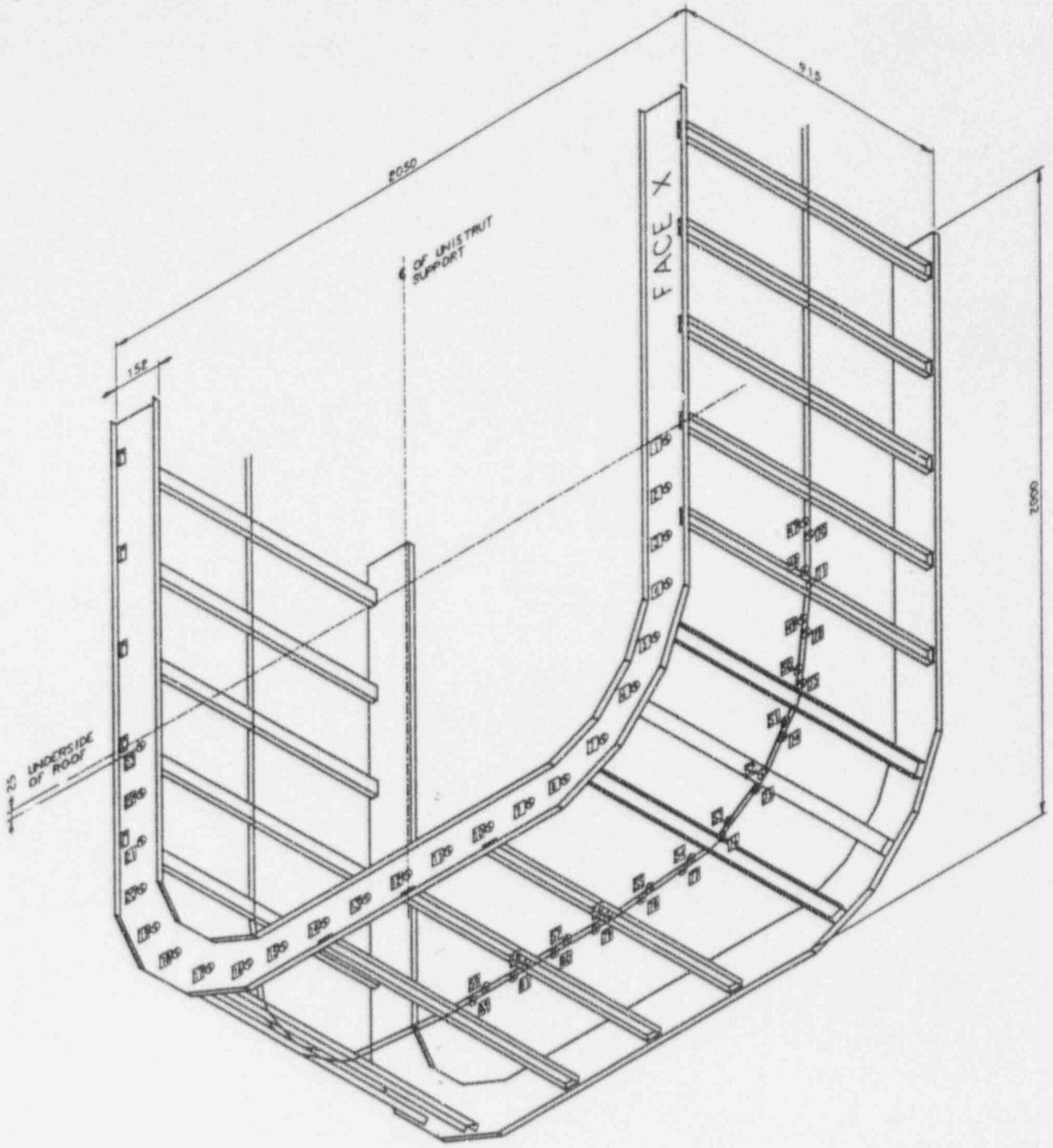
third angle projection

order no

customer

customers allocated drg no

Any errors on this drawing are to be reported to the drawing office immediately/ if in doubt,ask



ISOMETRIC VIEW ON FACE X SHOWING THERMOCOUPLE POSITIONS

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INITIAL ISSUE																							

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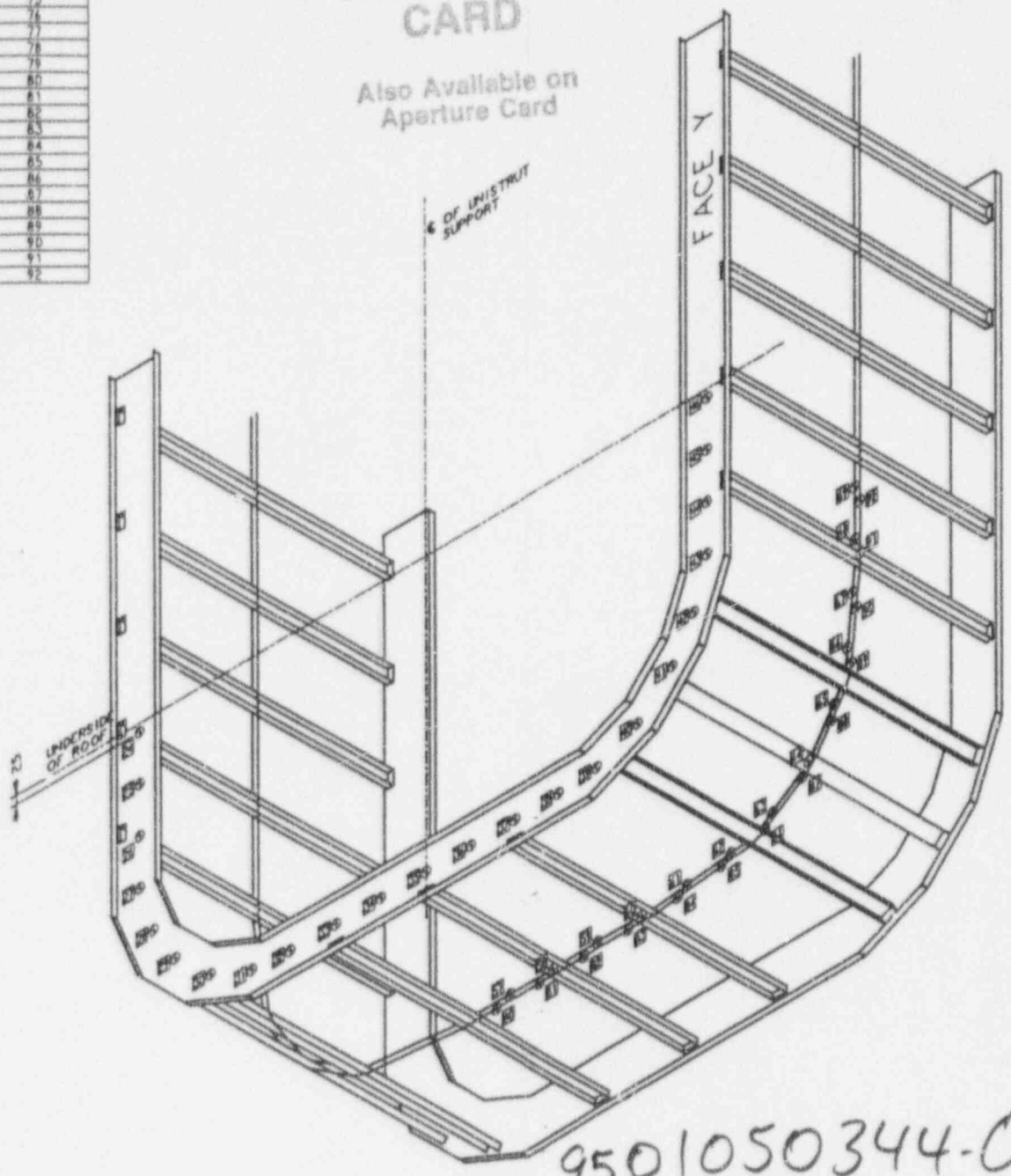
61	61		
62	62		
63	63		
64	64		
65	65		
66	66		
67	67		
68	68		
69	69		
70	70		



9501050344-03

ISOMETRIC VIEW ON FACE Y SHOWING THERMOCOUPLE POSITIONS

NOTE

THERMOCOUPLES ARE AT 6" PITCH APPROX
Nos 1 - 23 ARE ON FACE X
Nos 24 - 46 ARE ON FACE Y
Nos 47 - 69 ARE ON INNER COPPER WIRE
Nos 70 - 92 ARE ON OUTER COPPER WIRE

Darchem Engineering Ltd
Stillington
Stockton-on-Tees
Cleveland TS21 1LB
England

DARCHEM

title

THERMOCOUPLE POSITIONS ON 36" WIDE x 6" DEEP CABLE LADDER

	name	date
drawn	B.W.	25.3.94
checked	K.J.M.	25.3.94
approved	K.J.M.	25.3.94

drawing no 310076-DSK3

issue A B

original scale N.T.S.

dimensions mm

do not scale from drawing

third angle projection

order no 310075

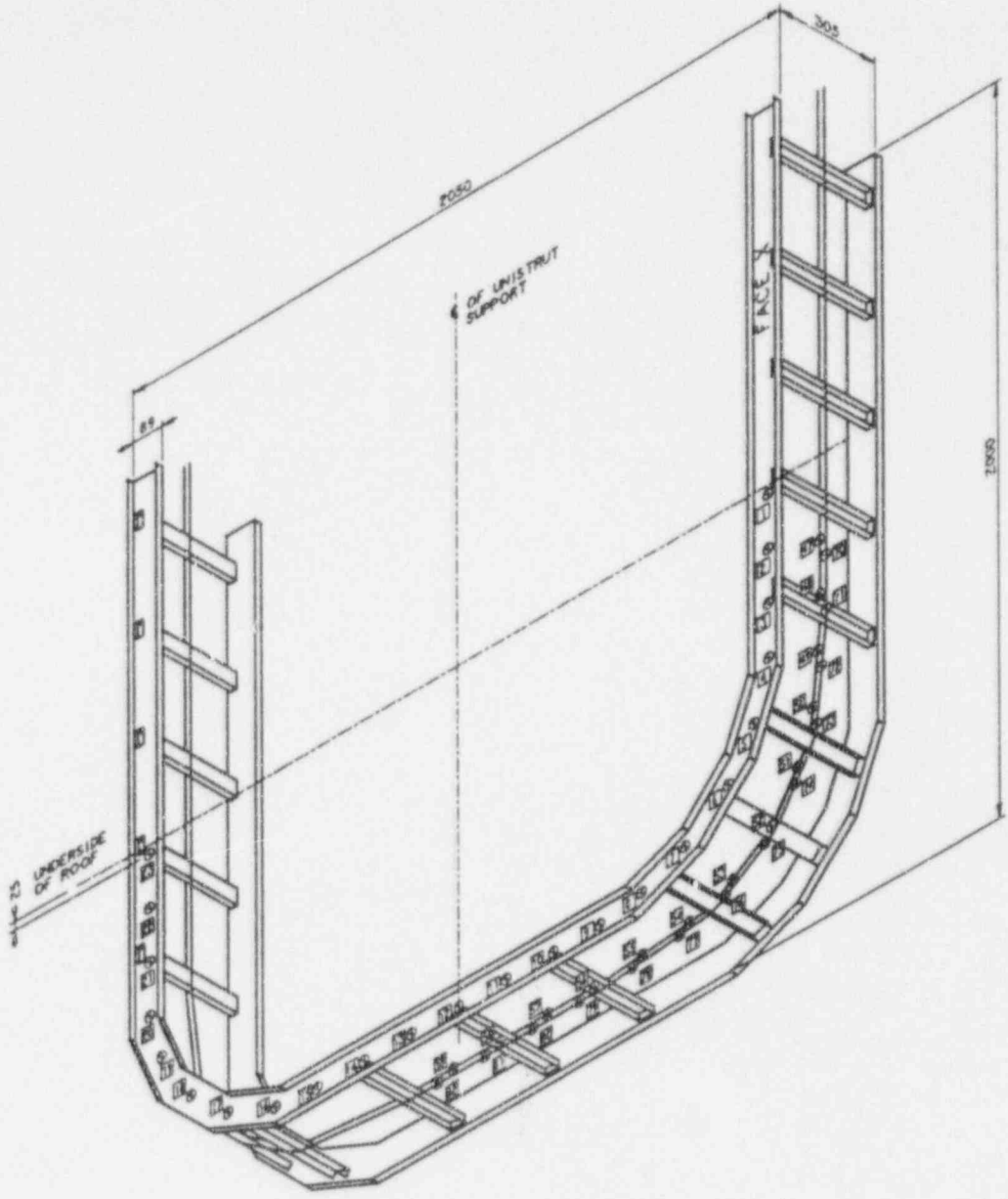
customer D.E.I.

customers allocated drg no

appr'd

Any errors on this drawing are to be reported to the drawing office immediately/ if in doubt,ask

TC No	DATA RECORDER CHANNEL No	TC No
1	1	31
2	2	32
3	3	33
4	4	34
5	5	35
6	6	36
7	7	37
8	8	38
9	9	39
10	10	40
11	11	41
12	12	42
13	13	43
14	14	44
15	15	45
16	16	46
17	17	47
18	18	48
19	19	49
20	20	50
21	21	51
22	22	52
23	23	53
24	24	54
25	25	55
26	26	56
27	27	57
28	28	58
29	29	59
30	30	60

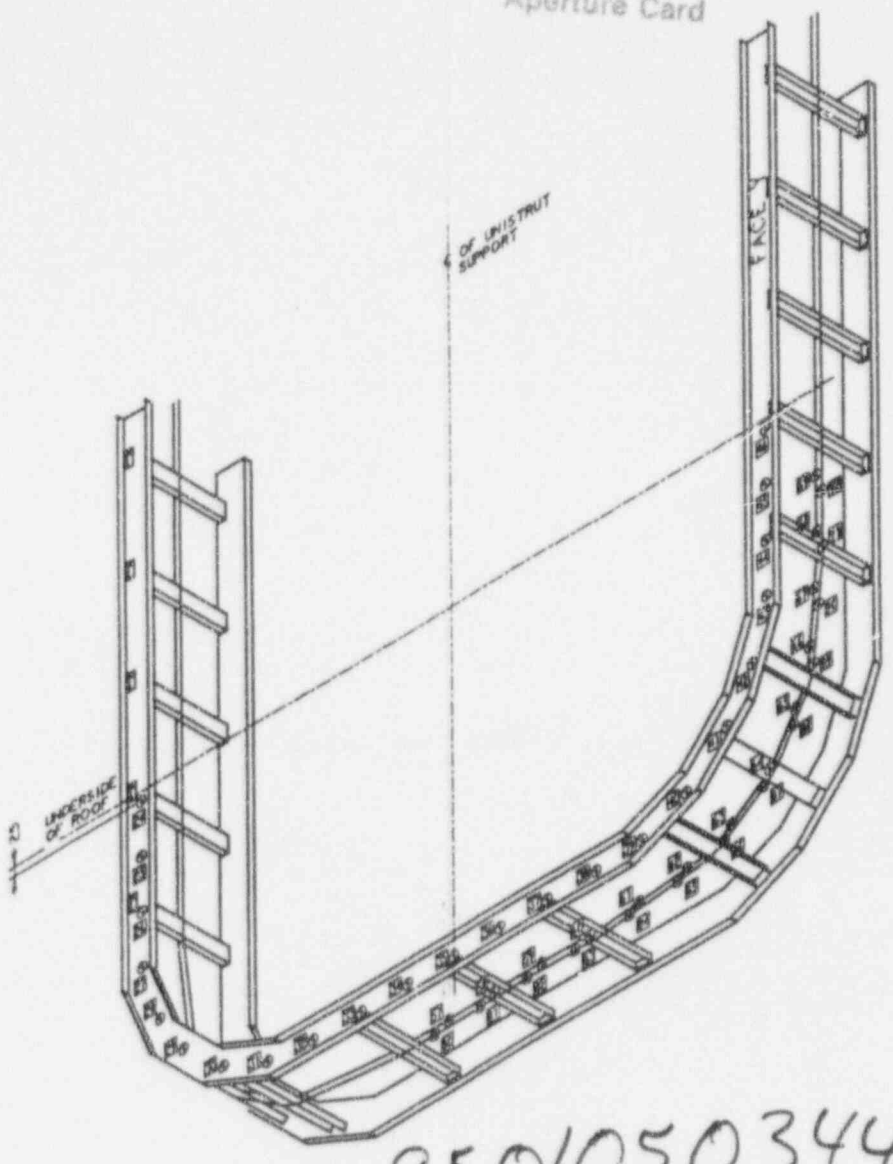


ISOMETRIC VIEW ON FACE X SHOWING THERMOCOUPLE POSITIONS

	issue	drawn	chk'd	appr'd	issue	drawn	chk'd	appr'd	issue	drawn	chk'd	appr'd	issue	drawn	chk'd	appr'd	issue	drawn	chk'd	appr'd	issue	drawn	chk'd
A																							
INITIAL ISSUE																							

original frame size 554 x 801. A1

DATA RECORDER CHANNEL No	TC No	DATA RECORDER CHANNEL No	TC No	DATA RECORDER CHANNEL No
31	61	61	91	91
32	62	62	92	92
33	63	63		
34	64	64		
35	65	65		
36	66	66		
37	67	67		
38	68	68		
39	69	69		
40	70	70		
41	71	71		
42	72	72		
43	73	73		
44	74	74		
45	75	75		
46	76	76		
47	77	77		
48	78	78		
49	79	79		
50	80	80		
51	81	81		
52	82	82		
53	83	83		
54	84	84		
55	85	85		
56	86	86		
57	87	87		
58	88	88		
59	89	89		
60	90	90		



9501050344-04

ISOMETRIC VIEW ON FACE Y SHOWING THERMOCOUPLE POSITIONS

NOTE

THERMOCOUPLES ARE AT 6" PITCH APPROX
Nos 1 - 23 ARE ON FACE X
Nos 24 - 46 ARE ON FACE Y
Nos 47 - 69 ARE ON INNER COPPER WIRE
Nos 70 - 92 ARE ON OUTER COPPER WIRE

Darchem Engineering Ltd
Stillington
Stockton-on-Tees
Cleveland TS21 1LB
England

DARCHEM

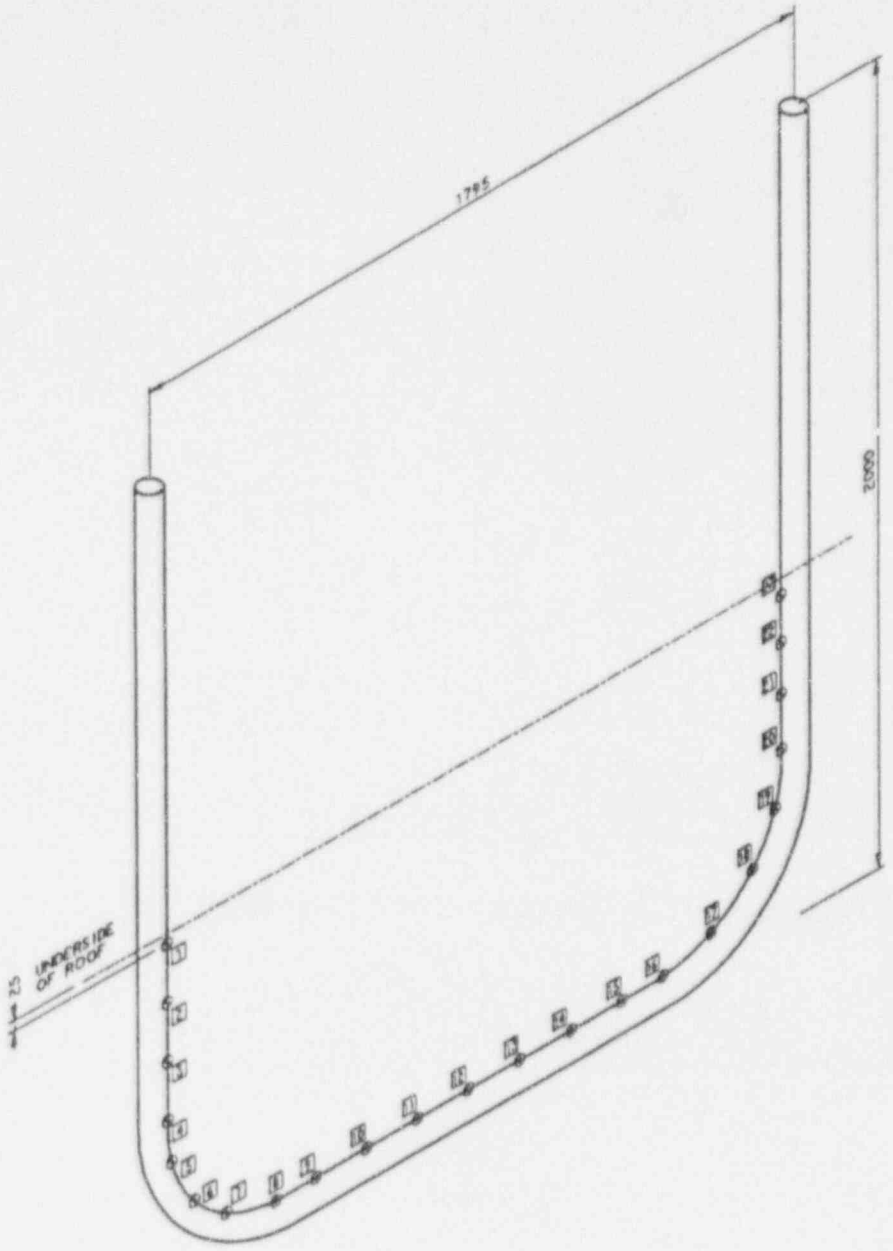
title

THERMOCOUPLE POSITIONS ON 12" WIDE x 3.5" DEEP CABLE LADDER

appr'd		original scale		name	date	drawing no
	This drawing is the property of Darchem Engineering Ltd and must not be disclosed to a third party without permission	N.T.S.	drawn	B.W.	25.3.94	310076-DSK4
			checked	[illegible]	25.3.94	
		dimensions mm	approved	K.J.M.	25.3.94	issue A B
		do not scale from drawing	order no 310075			
		third angle projection	customer D.E.I.			customers allocated drg no

5 6 7 8

Any errors on this drawing are to be reported to the drawing office immediately/If in doubt,ask



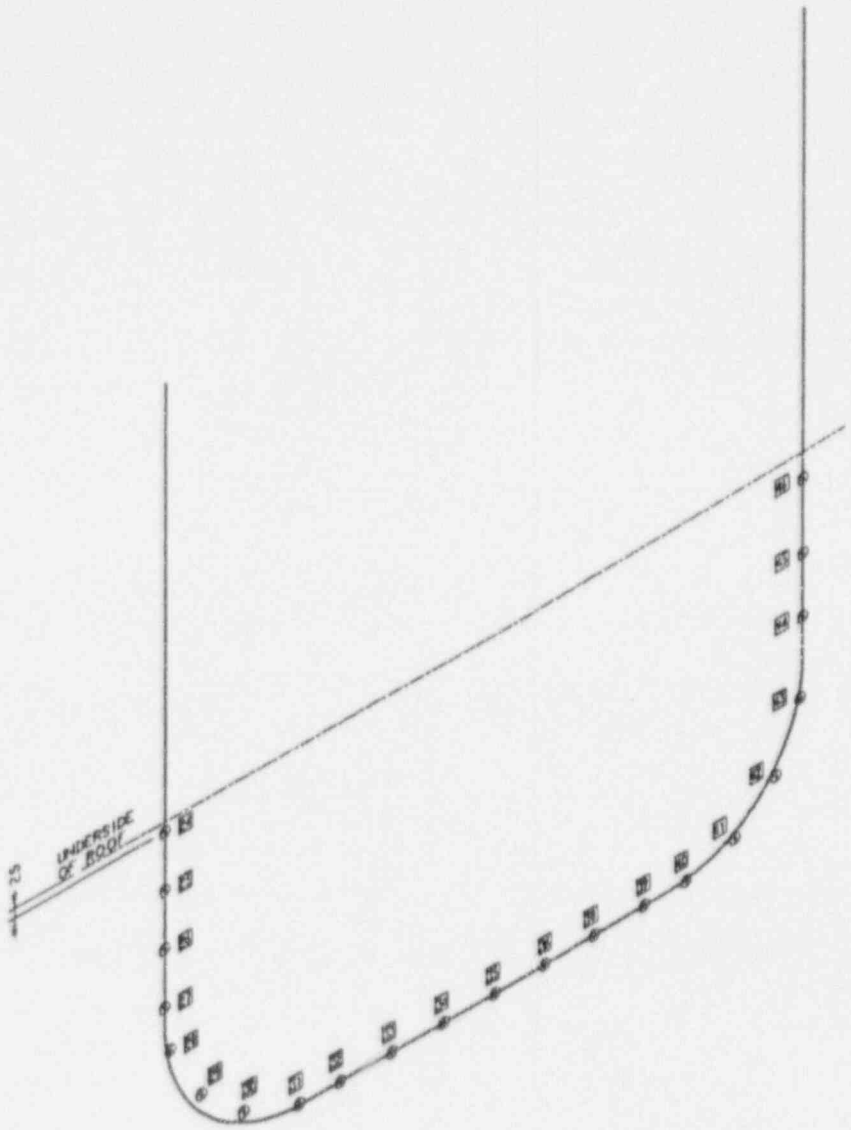
CONDUIT THERMOCOUPLE POSITIONS

TC No	D C
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	

	issue	drawn	chkd	apprd	issue	drawn	chkd	apprd	issue	drawn	chkd	apprd	issue	drawn	chkd	apprd	issue	drawn	chkd	apprd	issue	drawn	chk
A	A																						

INITIAL ISSUE

DATA RECORDER CHANNEL No	TC No	DATA RECORDER CHANNEL No
93	26	122
94	27	123
95	28	124
96	29	125
97	30	126
98	31	127
99	32	128
100	33	129
101	34	130
102	35	131
103	36	132
104	37	133
105	38	134
106	39	135
107	40	136
108	41	137
109	42	138
110	43	139
111	44	140
112	45	141
113	46	142
114	47	
115	48	
116	49	
121	50	



INTERNAL THERMOCOUPLE POSITIONS

9501050344-05

NOTE

THERMOCOUPLES ARE AT 6" PITCH APPROX
Nos 1 - 23 ARE ON CONDUIT
Nos 24 - 46 ARE ON BARE CONDUCTOR

Darchem Engineering Ltd
Stillington
Stockton-on-Tees
Cleveland TS21 1LB
England

DARCHEM

title: THERMOCOUPLE POSITIONS ON CONDUIT

	name	date
drawn	B.W.	16.2.94
checked	K.J.M.	16.2.94
approved	K.J.M.	16.2.94

drawing no: 310076-DSK5

issue: A

original scale: N.T.S.

dimensions: mm

do not scale from drawing

order no: 310075

APPENDIX B

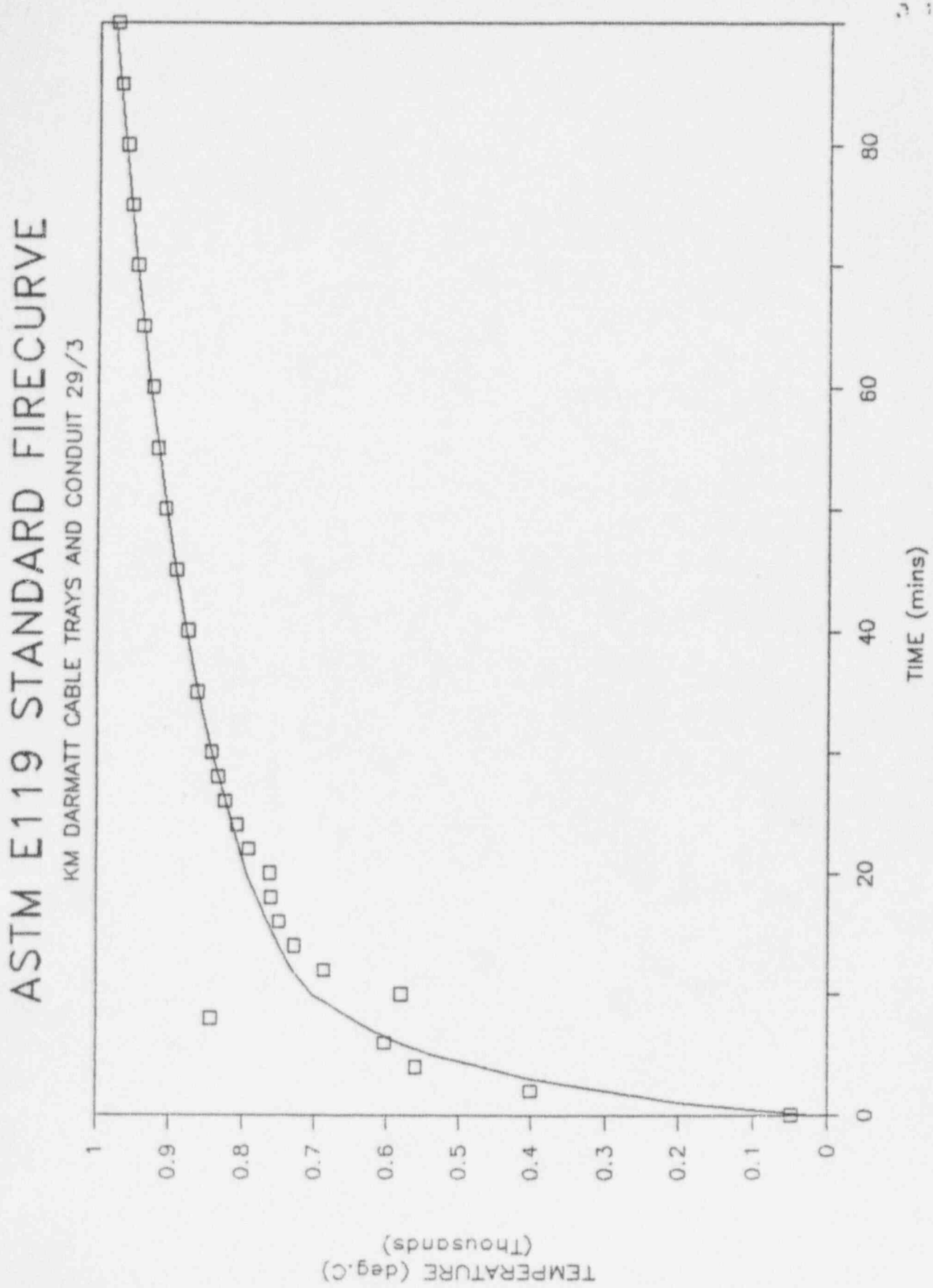
APPENDIX C

Graphs of the UL 1724 Fire Curve and Achieved Furnace Temperature

Fire Curve Accuracy Check Data

Summary Tables of Mean Sample Temperatures

Graphs of Mean Unexposed Face Temperatures against Time


ASTM E119 STANDARD FIRECURVE
KM DARMATT CABLE TRAYS AND CONDUIT 29/3
TIME (mins)
0
20
40
60
80
TEMPERATURE (deg.C)
(Thousands)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

29/03/94 DARMATT CABLE TRAYS PLUS CONDUIT 31-0076

Simpson's Rule Numerical Integration

Time, min.	TEST DATA Temp.	TEST DATA Cum. °C-min.	ASTM E119 Firecurve Temp.	ASTM E119 Firecurve Cum. °C-min.	ASTM E119 Firecurve limits
0	48		20		
1	225		200		
2	401		300		
3	480		400		
4	560		470		
5	581		538		
6	602		582		
7	723		618		
8	844		650		
9	712		675		4095
10	580	5442	704	4817	
12	688		732		5540
14	729		750		
16	750		767		
18	762		781		
20	763		795		
22	792		805		
24	808		814		
26	825		824		
28	834		833		18515
30	843	20783	843	20572	
35	863		862		22629
40	876		878		
45	892		892		36200
50	907	38319	905	38105	
55	918		916		40011
60	924		927		
65	938		937		53802
70	946	56861	946	56634	
75	954		955		59465
80	960		963		
85	969		971		72096
90	975	76083	978	75890	
95			985		79685

KM1 DARMATT - TEST DATE 29-03-94

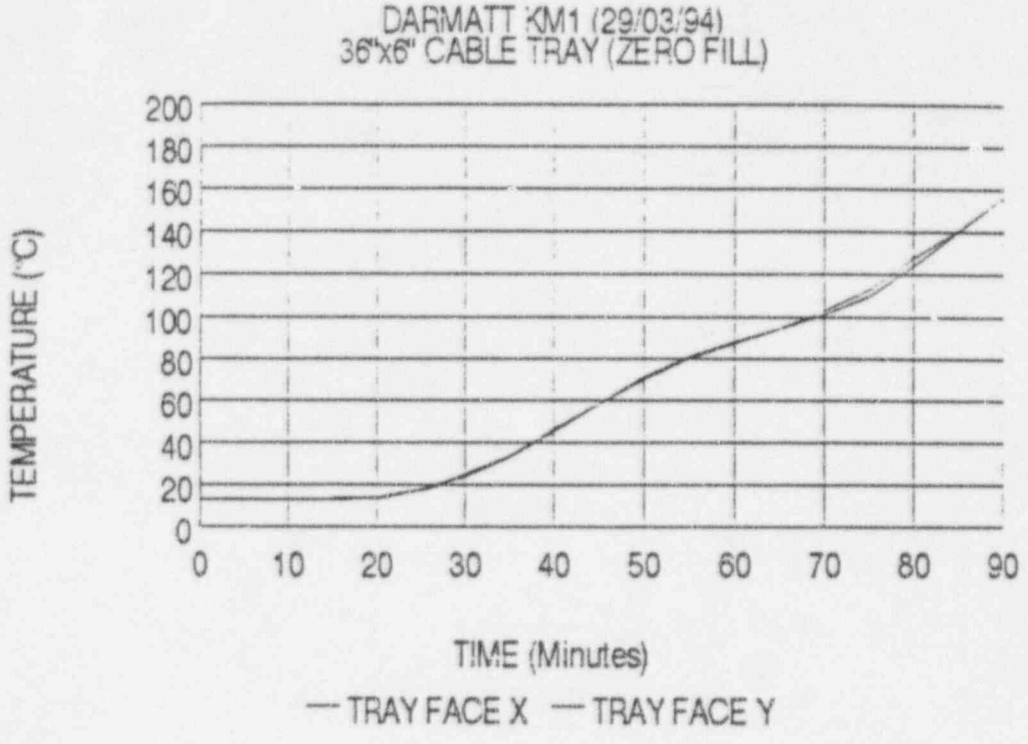
36"x6" CABLE TRAY PLUS CONDUIT

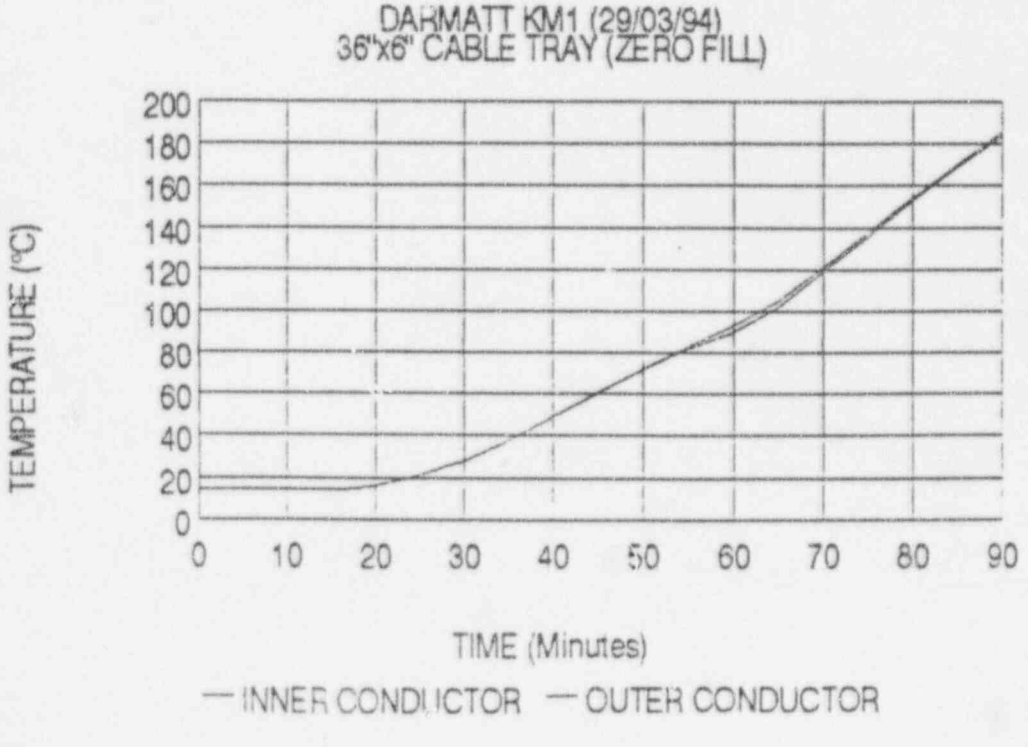
TIME (MINS)	TRAY A SIDE X	TRAY A SIDE Y	INNER CONDUCT	OUTER CONDUCT	CONDUIT OUTER	CONDUIT INNER
0	13	13	14	14	14	15
2	13	13	14	14	14	14
4	13	13	14	14	14	14
6	13	13	14	14	14	14
8	13	13	14	14	15	14
10	13	13	14	14	20	16
12	13	13	14	14	28	19
14	13	13	14	14	46	26
16	14	13	14	14	69	39
18	14	14	15	15	87	58
20	14	14	16	16	98	76
22	16	15	18	18	99	87
24	17	17	20	20	99	93
26	19	18	22	22	99	96
28	22	21	25	25	99	98
30	25	24	28	28	99	99
35	34	33	38	38	99	99
40	46	45	49	49	99	99
45	58	58	60	61	99	100
50	70	71	72	72	100	100
55	80	81	83	82	103	100
60	87	88	93	90	109	101
65	94	94	105	102	123	103
70	101	103	121	119	140	113
75	110	113	138	136	156	128
80	124	128	154	153	173	146
85	140	141	170	169	192	165
90	156	156	186	184	212	186

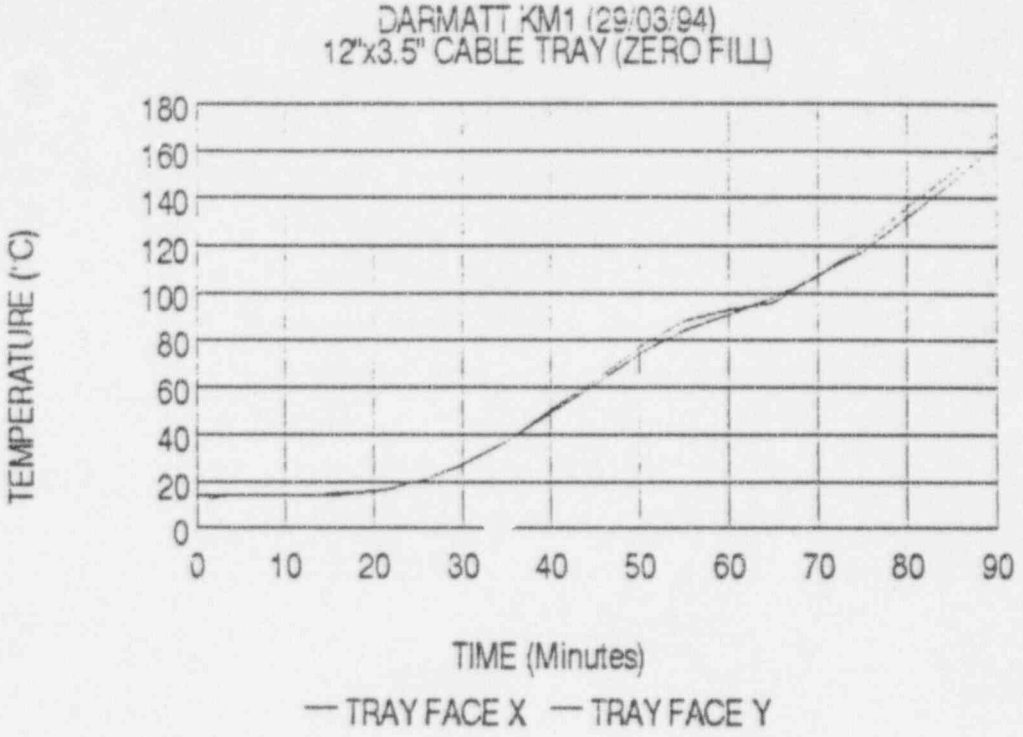
KM1 DARMATT - TEST DATE 29-03-94

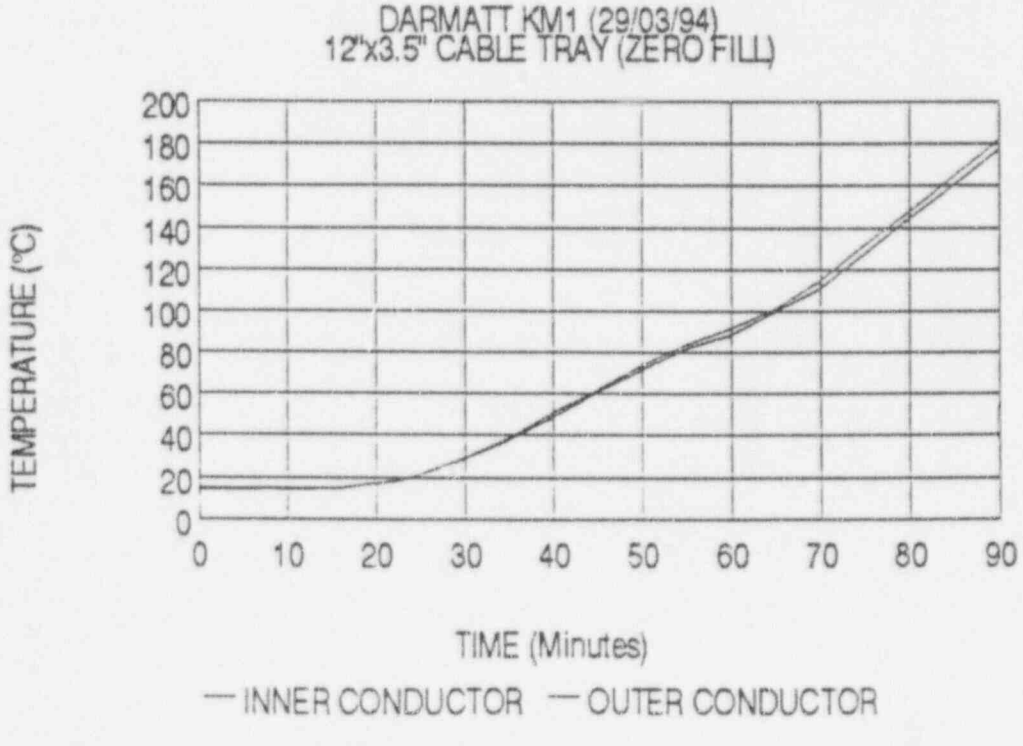
12"x3.5" CABLE TRAY

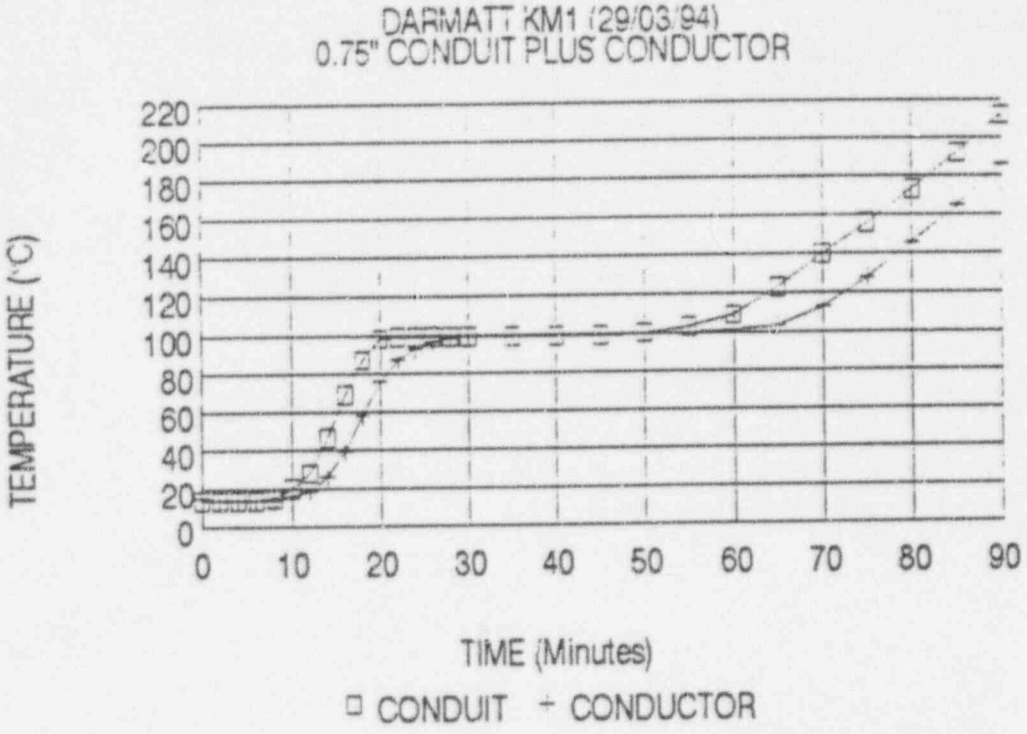
TIME (MINS)	TRAY B SIDE X	TRAY B SIDE Y	INNER CONDUCT	OUTER CONDUCT
0	14	14	14	15
2	14	13	14	15
4	14	14	14	15
6	14	14	14	15
8	14	14	15	15
10	14	14	14	15
12	14	14	14	15
14	14	14	15	15
16	14	15	15	15
18	15	15	16	16
20	16	16	17	17
22	17	17	18	18
24	19	19	20	20
26	21	21	23	23
28	24	24	26	26
30	27	27	29	29
35	37	37	39	38
40	49	50	51	49
45	61	63	62	61
50	74	77	74	72
55	84	88	84	82
60	91	93	92	89
65	98	96	101	100
70	107	108	115	111
75	120	118	132	128
80	136	132	148	145
85	151	147	165	161
90	168	163	182	178


DARMATT KM1 (29/03/94)
36"x6" CABLE TRAY (ZERO FILL)
TEMPERATURE (°C)
200
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
TIME (Minutes)
— TRAY FACE X — TRAY FACE Y


DARMATT KM1 (29/03/94)
36"x6" CABLE TRAY (ZERO FILL)
TEMPERATURE (°C)
200
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
TIME (Minutes)
— INNER CONDUCTOR — OUTER CONDUCTOR


DARMATT KM1 (29/03/94)
12"x3.5" CABLE TRAY (ZERO FILL)
TEMPERATURE (°C)
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
TIME (Minutes)
— TRAY FACE X — TRAY FACE Y


DARMATT KM1 (29/03/94)
12"x3.5" CABLE TRAY (ZERO FILL)
TEMPERATURE (°C)
200
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
TIME (Minutes)
— INNER CONDUCTOR — OUTER CONDUCTOR


DARMATT KM1 (29/03/94)
0.75" CONDUIT PLUS CONDUCTOR
TEMPERATURE (°C)
220
200
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
TIME (Minutes)
□ CONDUIT + CONDUCTOR

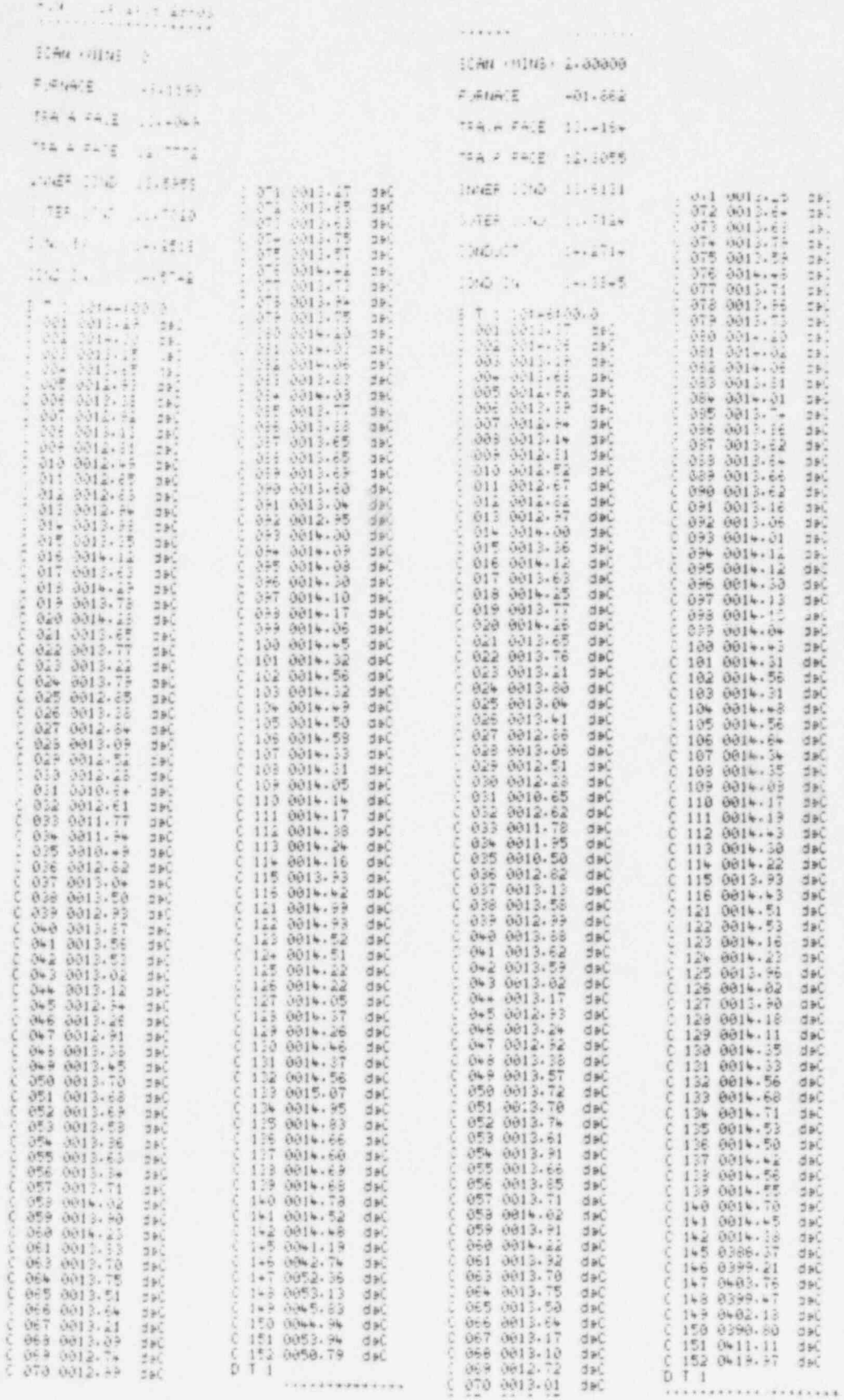
APPENDIX D

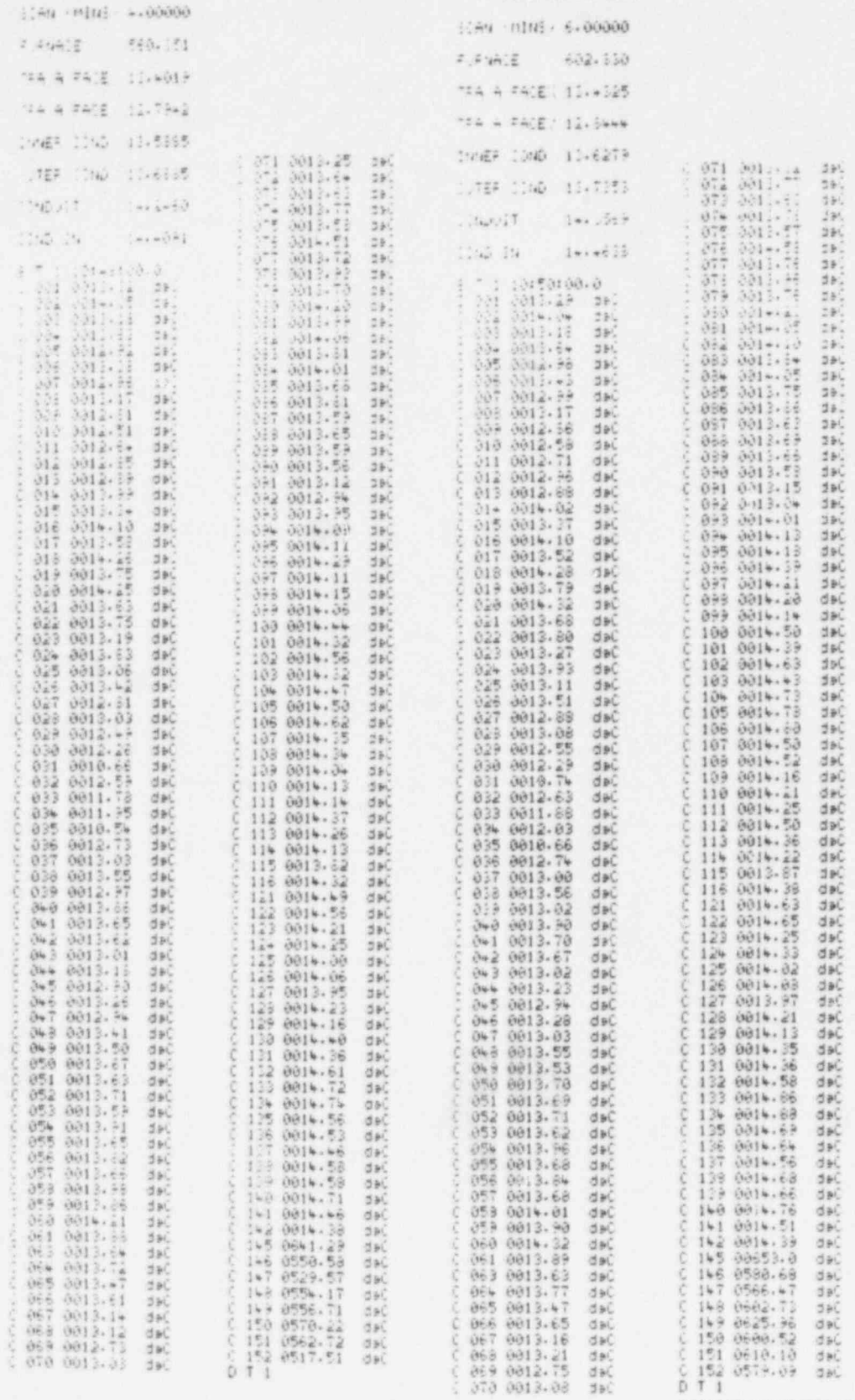
Complete data printouts of thermocouple readings

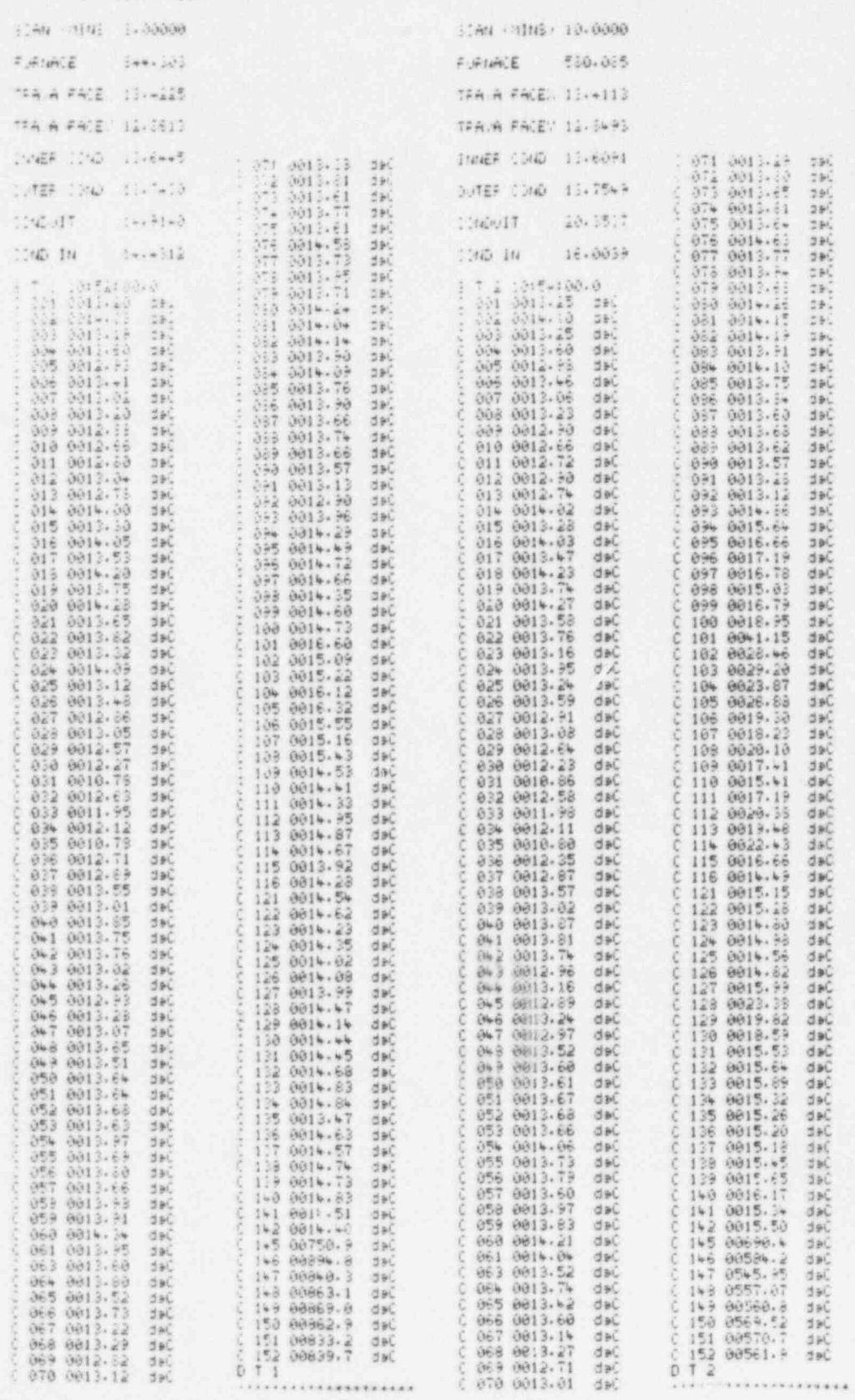
36" x 6" Cable Tray plus Conduit

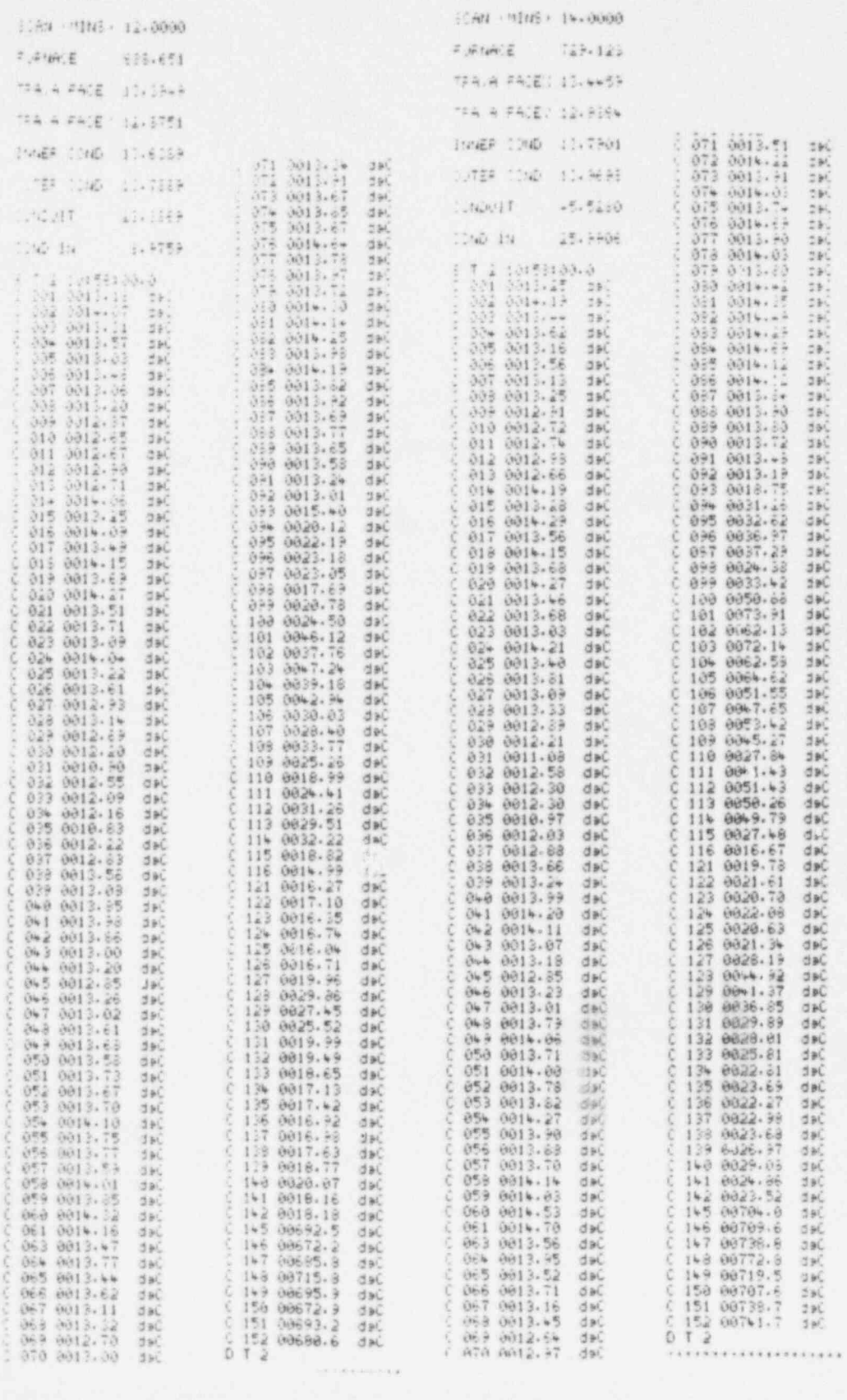
Channel No.	Position
1 - 23	Tray A - Face X
23 - 46	Tray A - Face Y
47 - 69	Inner Conductor
70 - 92	Outer Conductor
93 - 115	Conduit
116, 121 - 142	Inner Conductor
145 - 152	Furnace

Thermocouple 62 removed from mean valve.








SCAN MINS 12.0000
FURNACE 998.651
TRA/A FACE 10.1944
TRA/A FACE 12.8751
INNER COND 11.6259
OUTER COND 11.7559
CNCURT 10.1559
COND IN 5.4759
SCAN MINS 14.0000
FURNACE 1029.125
TRA/A FACE 13.4459
TRA/A FACE 12.8194
INNER COND 11.7501
OUTER COND 11.4695
CNCURT -5.5250
COND IN 25.7906

```
ICAN -MIN- 16.0000
FURNACE     749.778
TRA A FACE  11.6722
TRA A FACEV 11.6201
INNER COND  14.1749
 TER COND   14.1291
CONDUIT     13.8446
COND IN     13.4124

 T A 11102100.0
 001 0013.47  DAC
 002 0014.27  DAC
 003 0013.79  DAC
 004 0013.13  DAC
 005 0013.49  DAC
 006 0013.77  DAC
 007 0013.10  DAC
 008 0013.19  DAC
 009 0013.05  DAC
 010 0012.89  DAC
 011 0012.86  DAC
 012 0013.13  DAC
 013 0012.77  DAC
 014 0014.52  DAC
 015 0013.53  DAC
 016 0014.82  DAC
 017 0013.90  DAC
 018 0014.44  DAC
 019 0013.86  DAC
 020 0014.44  DAC
 021 0013.63  DAC
 022 0013.81  DAC
 023 0013.06  DAC
 024 0014.52  DAC
 025 0013.63  DAC
 026 0014.19  DAC
 027 0013.42  DAC
 028 0013.69  DAC
 029 0013.21  DAC
 030 0012.32  DAC
 031 0011.34  DAC
 032 0012.68  DAC
 033 0012.69  DAC
 034 0012.57  DAC
 035 0011.18  DAC
 036 0012.02  DAC
 037 0013.01  DAC
 038 0013.89  DAC
 039 0013.54  DAC
 040 0014.21  DAC
 041 0014.59  DAC
 042 0014.44  DAC
 043 0013.25  DAC
 044 0013.40  DAC
 045 0012.88  DAC
 046 0013.24  DAC
 047 0013.10  DAC
 048 0014.30  DAC
 049 0014.69  DAC
 050 0014.06  DAC
 051 0014.53  DAC
 052 0014.08  DAC
 053 0014.11  DAC
 054 0014.61  DAC
 055 0014.21  DAC
 056 0014.16  DAC
 057 0013.99  DAC
 058 0014.48  DAC
 059 0014.68  DAC
 060 0015.15  DAC
 061 0015.51  DAC
 063 0013.96  DAC
 064 0014.40  DAC
 065 0013.86  DAC
 066 0014.10  DAC
 067 0013.44  DAC
 068 0013.71  DAC
 069 0012.65  DAC
 070 0013.02  DAC
 071 0013.66  DAC
 072 0014.63  DAC
 073 0014.19  DAC
 074 0014.40  DAC
 075 0014.02  DAC
 076 0014.85  DAC
 077 0014.11  DAC
 078 0014.47  DAC
 079 0014.04  DAC
 080 0014.74  DAC
 081 0014.64  DAC
 082 0014.98  DAC
 083 0014.47  DAC
 084 0015.48  DAC
 085 0014.68  DAC
 086 0014.62  DAC
 087 0014.40  DAC
 088 0014.20  DAC
 089 0014.17  DAC
 090 0014.06  DAC
 091 0013.81  DAC
 092 0013.29  DAC
 093 0026.68  DAC
 094 0049.63  DAC
 095 0049.40  DAC
 096 0058.76  DAC
 097 0061.25  DAC
 098 3042.04  DAC
 099 0084.96  DAC
 100 0090.99  DAC
 101 0085.80  DAC
 102 0078.01  DAC
 103 0088.44  DAC
 104 0091.07  DAC
 105 0088.93  DAC
 106 0087.74  DAC
 107 0078.36  DAC
 108 0076.43  DAC
 109 0075.74  DAC
 110 0066.65  DAC
 111 0064.63  DAC
 112 0072.10  DAC
 113 0073.81  DAC
 114 0068.79  DAC
 115 0042.53  DAC
 116 0021.01  DAC
 121 0027.34  DAC
 122 0030.78  DAC
 123 0030.57  DAC
 124 0032.97  DAC
 125 0030.84  DAC
 126 0039.73  DAC
 127 0052.85  DAC
 128 0062.99  DAC
 129 0059.02  DAC
 130 0052.70  DAC
 131 0047.35  DAC
 132 0044.18  DAC
 133 0040.36  DAC
 134 0035.87  DAC
 135 0036.15  DAC
 136 0033.76  DAC
 137 0036.17  DAC
 138 0036.53  DAC
 139 0041.74  DAC
 140 0043.70  DAC
 141 0037.26  DAC
 142 0033.01  DAC
 145 00728.1  DAC
 146 00728.1  DAC
 147 00759.4  DAC
 148 00788.8  DAC
 149 00746.5  DAC
 150 00737.6  DAC
 151 00756.0  DAC
 152 00761.3  DAC
D T 2
```

```
ICAN -MIN- 18.0000
FURNACE     762.475
TRA A FACE  11.9156
TRA A FACEV 13.6070
INNER COND  14.8122
OUTER COND  14.8601
CONDUIT     17.2285
COND IN     17.7618

 T A 11102100.0
 001 0013.12  DAC
 002 0014.57  DAC
 003 0014.25  DAC
 004 0014.11  DAC
 005 0013.91  DAC
 006 0014.07  DAC
 007 0013.56  DAC
 008 0013.58  DAC
 009 0013.23  DAC
 010 0013.13  DAC
 011 0013.00  DAC
 012 0013.28  DAC
 013 0012.95  DAC
 014 0014.99  DAC
 015 0013.29  DAC
 016 0015.83  DAC
 017 0014.60  DAC
 018 0014.81  DAC
 019 0014.11  DAC
 020 0014.66  DAC
 021 0013.84  DAC
 022 0013.94  DAC
 023 0013.03  DAC
 024 0014.72  DAC
 025 0013.83  DAC
 026 0014.72  DAC
 027 0013.88  DAC
 028 0014.30  DAC
 029 0013.76  DAC
 030 0012.59  DAC
 031 0011.70  DAC
 032 0012.99  DAC
 033 0013.28  DAC
 034 0012.98  DAC
 035 0011.39  DAC
 036 0012.02  DAC
 037 0013.21  DAC
 038 0014.26  DAC
 039 0014.22  DAC
 040 0014.98  DAC
 041 0015.33  DAC
 042 0015.13  DAC
 043 0013.81  DAC
 044 0013.83  DAC
 045 0012.89  DAC
 046 0013.14  DAC
 047 0013.18  DAC
 048 0014.99  DAC
 049 0015.53  DAC
 050 0014.75  DAC
 051 0015.32  DAC
 052 0014.68  DAC
 053 0014.64  DAC
 054 0015.15  DAC
 055 0014.79  DAC
 056 0014.64  DAC
 057 0014.50  DAC
 058 0015.03  DAC
 059 0015.48  DAC
 060 0016.20  DAC
 061 0017.12  DAC
 063 0014.85  DAC
 064 0015.20  DAC
 065 0014.56  DAC
 066 0014.83  DAC
 067 0014.00  DAC
 068 0014.16  DAC
 069 0012.64  DAC
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 071 0014.54  DAC
 072 0015.85  DAC
 073 0015.10  DAC
 074 0015.07  DAC
 075 0014.55  DAC
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 077 0014.55  DAC
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 079 0014.44  DAC
 080 0015.25  DAC
 081 0015.01  DAC
 082 0015.65  DAC
 083 0015.62  DAC
 084 0016.65  DAC
 085 0015.76  DAC
 086 0015.16  DAC
 087 0014.88  DAC
 088 0015.09  DAC
 089 0014.95  DAC
 090 0014.71  DAC
 091 0014.39  DAC
 092 0013.22  DAC
 093 0042.07  DAC
 094 0073.84  DAC
 095 0076.70  DAC
 096 0086.98  DAC
 097 0091.39  DAC
 098 0086.07  DAC
 099 0095.46  DAC
 100 0095.17  DAC
 101 0091.39  DAC
 102 0087.79  DAC
 103 0096.45  DAC
 104 0099.16  DAC
 105 0099.03  DAC
 106 0099.47  DAC
 107 0097.54  DAC
 108 0096.94  DAC
 109 0097.33  DAC
 110 0078.27  DAC
 111 0087.91  DAC
 112 0087.45  DAC
 113 0088.92  DAC
 114 0086.49  DAC
 115 0063.24  DAC
 116 0029.03  DAC
 121 0039.97  DAC
 122 0046.69  DAC
 123 0048.15  DAC
 124 0055.94  DAC
 125 0062.57  DAC
 126 0070.76  DAC
 127 0071.98  DAC
 128 0076.28  DAC
 129 0072.66  DAC
 130 0068.39  DAC
 131 0066.91  DAC
 132 0064.61  DAC
 133 0060.57  DAC
 134 0057.68  DAC
 135 0055.69  DAC
 136 0051.91  DAC
 137 0057.60  DAC
 138 0056.85  DAC
 139 0059.84  DAC
 140 0059.76  DAC
 141 0052.78  DAC
 142 0046.12  DAC
 145 00727.7  DAC
 146 00741.9  DAC
 147 00769.9  DAC
 148 00805.5  DAC
 149 00757.1  DAC
 150 00742.6  DAC
 151 00771.6  DAC
 152 00781.6  DAC
D T 2
```

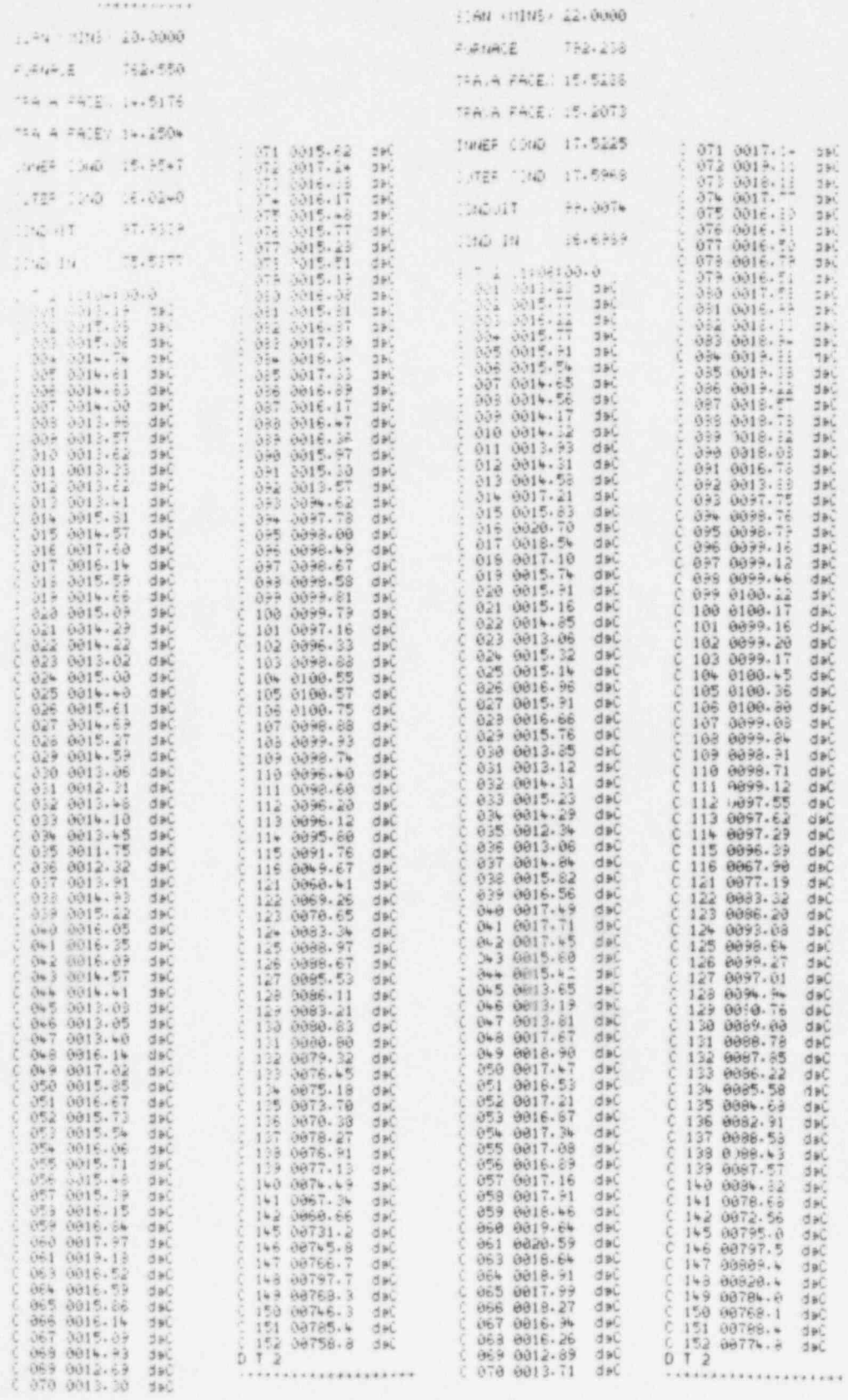

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SCAN TIME  24.0000
FURNACE    838.26T
TRACE FACE 17.0611
TRACE FACE 16.5487
INNER COND 14.5287
OUTER COND 14.5415
CONDUIT    88.1475
COND IN    82.7454

S T A 11101100.0
  001 0013.10  DAC
  002 0015.66  DAC
  003 0017.77  DAC
  004 0017.09  DAC
  005 0017.46  DAC
  006 0015.75  DAC
  007 0015.55  DAC
  008 0015.46  DAC
  009 0015.01  DAC
  010 0015.43  DAC
  011 0015.11  DAC
  012 0015.61  DAC
  013 0016.30  DAC
  014 0019.48  DAC
  015 0018.04  DAC
C 016 0025.16  DAC
C 017 0021.73  DAC
  018 0019.62  DAC
C 019 0017.60  DAC
C 020 0017.24  DAC
C 021 0016.75  DAC
C 022 0015.99  DAC
C 023 0013.19  DAC
C 024 0015.66  DAC
C 025 0016.25  DAC
C 026 0018.68  DAC
C 027 0017.52  DAC
C 028 0018.43  DAC
C 029 0017.36  DAC
C 030 0014.99  DAC
C 031 0014.21  DAC
C 032 0015.45  DAC
C 033 0016.69  DAC
C 034 0015.42  DAC
C 035 0013.33  DAC
C 036 0014.09  DAC
C 037 0016.41  DAC
C 038 0017.20  DAC
C 039 0018.55  DAC
C 040 0019.57  DAC
C 041 0019.70  DAC
C 042 0019.13  DAC
C 043 0017.12  DAC
  044 0016.61  DAC
C 045 0014.56  DAC
C 046 0013.32  DAC
C 047 0014.26  DAC
C 048 0019.52  DAC
C 049 0021.25  DAC
C 050 0019.57  DAC
C 051 0020.85  DAC
C 052 0019.16  DAC
C 053 0018.65  DAC
C 054 0019.20  DAC
C 055 0019.19  DAC
  056 0018.88  DAC
C 057 0019.07  DAC
C 058 0019.70  DAC
C 059 0020.36  DAC
C 060 0021.63  DAC
C 061 0022.96  DAC
C 063 0021.08  DAC
C 064 0021.42  DAC
C 065 0020.62  DAC
C 066 0021.15  DAC
C 067 0019.74  DAC
C 068 0018.20  DAC
C 069 0013.11  DAC
C 070 0014.24  DAC
  071 0018.09  DAC
  072 0021.52  DAC
  073 0020.59  DAC
  074 0019.86  DAC
  075 0018.67  DAC
  076 0017.85  DAC
  077 0018.14  DAC
  078 0016.76  DAC
  079 0018.35  DAC
  080 0019.47  DAC
  081 0018.42  DAC
  082 0020.01  DAC
  083 0020.90  DAC
  084 0022.02  DAC
  085 0021.68  DAC
  086 0021.46  DAC
  087 0020.92  DAC
  088 0021.50  DAC
  089 0021.62  DAC
  090 0020.79  DAC
  091 0019.10  DAC
C 092 0014.34  DAC
C 093 0097.85  DAC
C 094 0098.85  DAC
C 095 0098.84  DAC
C 096 0099.17  DAC
C 097 0099.17  DAC
C 098 0099.61  DAC
C 099 0100.02  DAC
C 100 0100.12  DAC
C 101 0099.79  DAC
C 102 0099.80  DAC
C 103 0099.27  DAC
C 104 0100.20  DAC
C 105 0100.09  DAC
C 106 0100.92  DAC
C 107 0099.24  DAC
C 108 0099.92  DAC
C 109 0099.06  DAC
C 110 0099.10  DAC
C 111 0099.18  DAC
C 112 0097.82  DAC
C 113 0097.66  DAC
C 114 0097.48  DAC
C 115 0096.96  DAC
C 116 0076.49  DAC
C 121 0096.06  DAC
C 122 0098.68  DAC
C 123 0092.70  DAC
C 124 0095.65  DAC
C 125 0099.93  DAC
C 126 0101.19  DAC
C 127 0100.91  DAC
C 128 0101.04  DAC
C 129 0098.47  DAC
C 130 0097.81  DAC
C 131 0095.81  DAC
C 132 0093.14  DAC
C 133 0091.94  DAC
C 134 0091.42  DAC
C 135 0091.00  DAC
C 136 0090.25  DAC
C 137 0093.81  DAC
C 138 0094.23  DAC
C 139 0093.08  DAC
C 140 0090.89  DAC
C 141 0086.22  DAC
C 142 0088.33  DAC
C 145 00810.3  DAC
C 146 00807.6  DAC
C 147 00826.9  DAC
C 148 00842.7  DAC
C 149 00795.9  DAC
C 150 00782.2  DAC
C 151 00803.9  DAC
C 152 00796.3  DAC
D T 2
.....

SCAN TIME  26.0000
FURNACE    824.506
TRACE FACE 19.2249
TRACE FACE 18.4159
INNER COND 22.0199
OUTER COND 21.9333
CONDUIT    88.2814
COND IN    86.1343

S T A 11110100.0
C 001 0013.45  DAC
C 002 0018.26  DAC
C 003 0020.03  DAC
C 004 0019.03  DAC
C 005 0019.71  DAC
C 006 0018.48  DAC
C 007 0016.94  DAC
C 008 0016.83  DAC
C 009 0016.45  DAC
C 010 0017.26  DAC
C 011 0016.92  DAC
C 012 0017.67  DAC
C 013 0018.84  DAC
C 014 0022.54  DAC
C 015 0021.00  DAC
C 016 0029.64  DAC
C 017 0025.90  DAC
C 018 0022.97  DAC
C 019 0020.33  DAC
C 020 0019.39  DAC
C 021 0019.13  DAC
C 022 0017.76  DAC
C 023 0013.46  DAC
C 024 0016.21  DAC
C 025 0017.83  DAC
C 026 0021.00  DAC
C 027 0019.60  DAC
C 028 0020.63  DAC
C 029 0019.38  DAC
C 030 0016.51  DAC
C 031 0016.00  DAC
C 032 0017.01  DAC
C 033 0018.56  DAC
C 034 0017.14  DAC
C 035 0014.91  DAC
C 036 0015.93  DAC
C 037 0018.58  DAC
C 038 0019.10  DAC
C 039 0021.29  DAC
C 040 0022.41  DAC
C 041 0022.52  DAC
C 042 0021.62  DAC
C 043 0019.21  DAC
C 044 0018.77  DAC
C 045 0015.77  DAC
C 046 0013.42  DAC
C 047 0014.89  DAC
C 048 0021.91  DAC
C 049 0024.10  DAC
C 050 0022.13  DAC
C 051 0023.64  DAC
C 052 0021.64  DAC
C 053 0020.96  DAC
C 054 0021.55  DAC
C 055 0021.70  DAC
C 056 0021.27  DAC
C 057 0021.39  DAC
C 058 0021.95  DAC
C 059 0022.62  DAC
C 060 0023.97  DAC
C 061 0025.62  DAC
C 063 0023.74  DAC
C 064 0024.53  DAC
C 065 0024.02  DAC
C 066 0024.81  DAC
C 067 0023.39  DAC
C 068 0020.96  DAC
C 069 0013.59  DAC
C 070 0015.05  DAC
C 071 0021.57  DAC
C 072 0024.47  DAC
C 073 0023.52  DAC
C 074 0022.71  DAC
C 075 0021.04  DAC
C 076 0018.64  DAC
C 077 0020.56  DAC
C 078 0021.19  DAC
C 079 0020.60  DAC
C 080 0021.62  DAC
C 081 0020.05  DAC
C 082 0021.34  DAC
C 083 0023.02  DAC
C 084 0024.38  DAC
C 085 0024.12  DAC
C 086 0024.06  DAC
C 087 0023.92  DAC
C 088 0024.93  DAC
C 089 0025.31  DAC
C 090 0024.34  DAC
C 091 0022.20  DAC
C 092 0015.12  DAC
C 093 0097.95  DAC
C 094 0098.88  DAC
C 095 0098.88  DAC
C 096 0099.13  DAC
C 097 0099.21  DAC
C 098 0099.63  DAC
C 099 0099.96  DAC
C 100 0100.14  DAC
C 101 0100.03  DAC
C 102 0100.01  DAC
C 103 0099.34  DAC
C 104 0100.24  DAC
C 105 0100.18  DAC
C 106 0101.02  DAC
C 107 0099.25  DAC
C 108 0099.98  DAC
C 109 0099.18  DAC
C 110 0099.22  DAC
C 111 0099.16  DAC
C 112 0097.97  DAC
C 113 0097.97  DAC
C 114 0097.50  DAC
C 115 0097.16  DAC
C 116 0098.78  DAC
C 121 0096.57  DAC
C 122 0094.61  DAC
C 123 0096.06  DAC
C 124 0097.69  DAC
C 125 0099.87  DAC
C 126 0101.30  DAC
C 127 0101.64  DAC
C 128 0101.66  DAC
C 129 0100.36  DAC
C 130 0100.01  DAC
C 131 0101.34  DAC
C 132 0102.36  DAC
C 133 0098.48  DAC
C 134 0095.33  DAC
C 135 0094.69  DAC
C 136 0094.44  DAC
C 137 0096.27  DAC
C 138 0097.17  DAC
C 139 0095.85  DAC
C 140 0094.22  DAC
C 141 0090.77  DAC
C 142 0085.32  DAC
C 145 00811.4  DAC
C 146 00832.3  DAC
C 147 00822.3  DAC
C 148 00832.4  DAC
C 149 00819.0  DAC
C 150 00845.0  DAC
C 151 00826.9  DAC
C 152 00807.1  DAC
D T 2
.....
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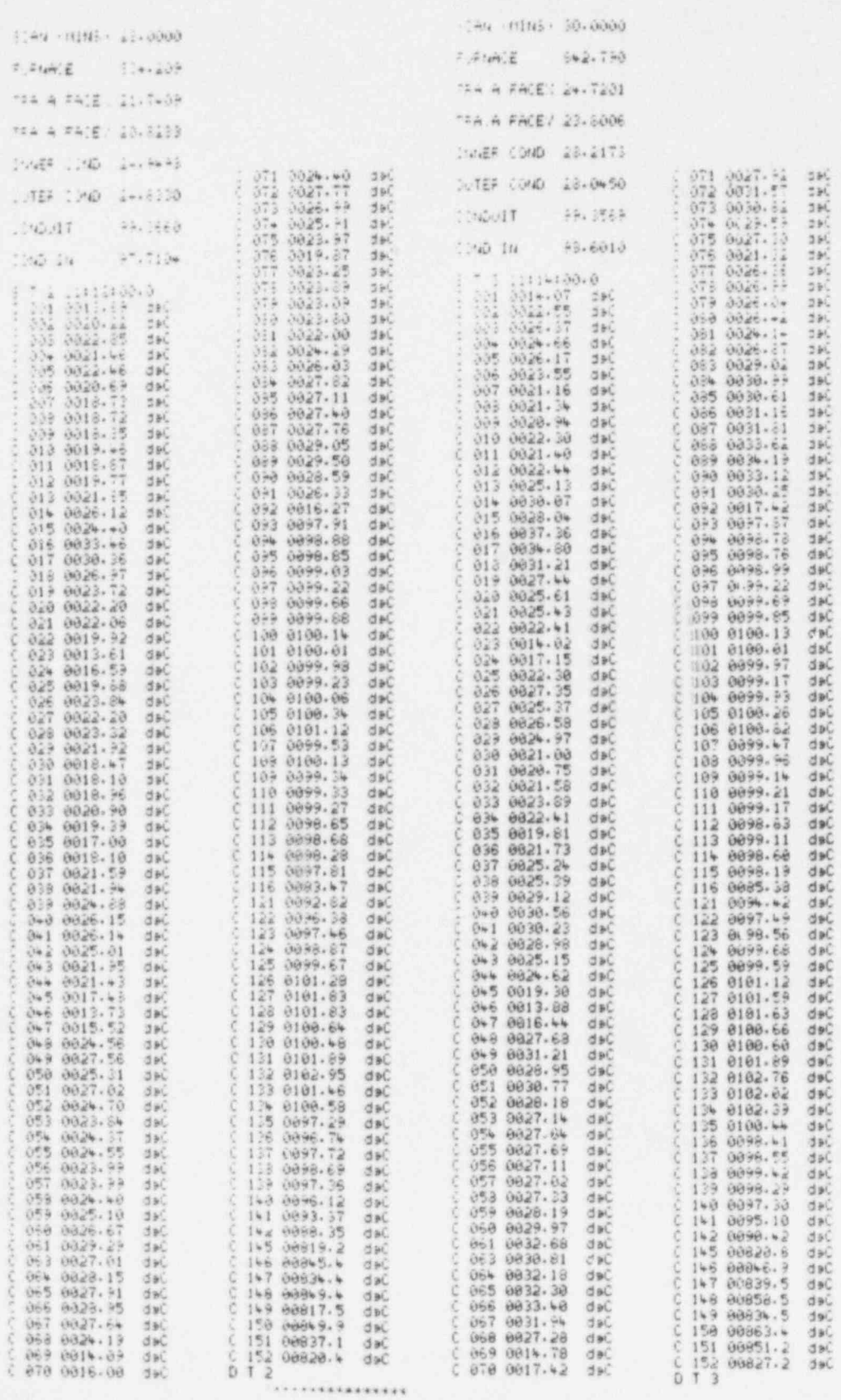

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 ********  ********

 IIHN  MINE:  15.3000

 FURNACE      181.104

 TRA.A FACE:  14.1119

 TRA.A FACE:  11.1456

 INNER COND   17.6619

 OUTER COND   17.5931

 COND.OUT     AA.1+81

 COND IN      AA.1795

 T I  1114+00.0
  001  0015.71  dBC
  002  0010.50  dBC
  003  0037.49  dBC
  004  0014.83  dBC
  005  0037.46  dBC
  006  0033.35  dBC
  007  0010.39  dBC
  008  0030.79  dBC
  009  0029.96  dBC
C 010  0031.24  dBC
C 011  0029.85  dBC
C 012  0030.97  dBC
C 013  0035.34  dBC
C 014  0042.13  dBC
C 015  0039.48  dBC
C 016  0047.64  dBC
C 017  0046.27  dBC
C 018  0043.34  dBC
C 019  0038.65  dBC
C 020  0036.60  dBC
C 021  0035.79  dBC
C 022  0030.88  dBC
C 023  0015.30  dBC
C 024  0018.88  dBC
C 025  0030.75  dBC
C 026  0037.84  dBC
C 027  0035.17  dBC
C 028  0036.63  dBC
C 029  0034.79  dBC
C 030  0030.02  dBC
C 031  0030.37  dBC
C 032  0030.60  dBC
C 033  0034.30  dBC
C 034  0032.45  dBC
C 035  0029.15  dBC
C 036  0031.63  dBC
C 037  0036.53  dBC
C 038  0036.26  dBC
C 039  0040.50  dBC
C 040  0042.22  dBC
C 041  0042.17  dBC
C 042  0040.70  dBC
C 043  0035.25  dBC
C 044  0034.55  dBC
C 045  0026.64  dBC
C 046  0016.87  dBC
C 047  0019.27  dBC
C 048  0037.09  dBC
C 049  0042.20  dBC
C 050  0039.52  dBC
C 051  0041.57  dBC
C 052  0038.64  dBC
C 053  0037.66  dBC
C 054  0037.91  dBC
C 055  0037.59  dBC
C 056  0036.72  dBC
C 057  0036.30  dBC
C 058  0036.30  dBC
C 059  0036.94  dBC
C 060  0039.04  dBC
C 061  0042.25  dBC
C 063  0041.15  dBC
C 064  0043.57  dBC
C 065  0043.51  dBC
C 066  0044.67  dBC
C 067  0042.99  dBC
C 068  0039.65  dBC
C 069  0016.77  dBC
C 070  0022.30  dBC
C 071  0038.39  dBC
C 072  0042.62  dBC
C 073  0041.69  dBC
C 074  0040.34  dBC
C 075  0037.73  dBC
C 076  0025.91  dBC
C 077  0036.53  dBC
C 078  0036.66  dBC
C 079  0035.42  dBC
C 080  0034.76  dBC
C 081  0031.44  dBC
C 082  0034.93  dBC
C 083  0038.02  dBC
C 084  0040.36  dBC
C 085  0040.21  dBC
C 086  0041.60  dBC
C 087  0043.27  dBC
C 088  0046.04  dBC
C 089  0046.55  dBC
C 090  0044.91  dBC
C 091  0042.09  dBC
C 092  0022.15  dBC
C 093  0097.82  dBC
C 094  0098.67  dBC
C 095  0098.63  dBC
C 096  0098.75  dBC
C 097  0099.12  dBC
C 098  0099.62  dBC
C 099  0099.74  dBC
C 100  0100.05  dBC
C 101  0099.91  dBC
C 102  0099.92  dBC
C 103  0099.04  dBC
C 104  0099.62  dBC
C 105  0100.31  dBC
C 106  0100.62  dBC
C 107  0099.36  dBC
C 108  0099.10  dBC
C 109  0099.09  dBC
C 110  0098.98  dBC
C 111  0099.15  dBC
C 112  0099.44  dBC
C 113  0099.72  dBC
C 114  0099.14  dBC
C 115  0098.45  dBC
C 116  0088.10  dBC
C 121  0095.65  dBC
C 122  0099.41  dBC
C 123  0099.01  dBC
C 124  0100.02  dBC
C 125  0099.39  dBC
C 126  0100.75  dBC
C 127  0101.57  dBC
C 128  0101.21  dBC
C 129  0100.10  dBC
C 130  0099.91  dBC
C 131  0101.19  dBC
C 132  0101.31  dBC
C 133  0101.65  dBC
C 134  0102.17  dBC
C 135  0101.50  dBC
C 136  0101.19  dBC
C 137  0099.56  dBC
C 138  0099.97  dBC
C 139  0098.99  dBC
C 140  0038.62  dBC
C 141  0097.01  dBC
C 142  0092.76  dBC
C 145  00842.8  dBC
C 146  00871.2  dBC
C 147  00858.8  dBC
C 148  00883.8  dBC
C 149  00852.3  dBC
C 150  00884.2  dBC
C 151  00859.8  dBC
C 152  00851.7  dBC
D T 3

 ********  ********

 IIHN  MINE:  -0.0000

 FURNACE      176.602

 TRA.A FACE:  15.6034

 TRA.A FACE:  14.7678

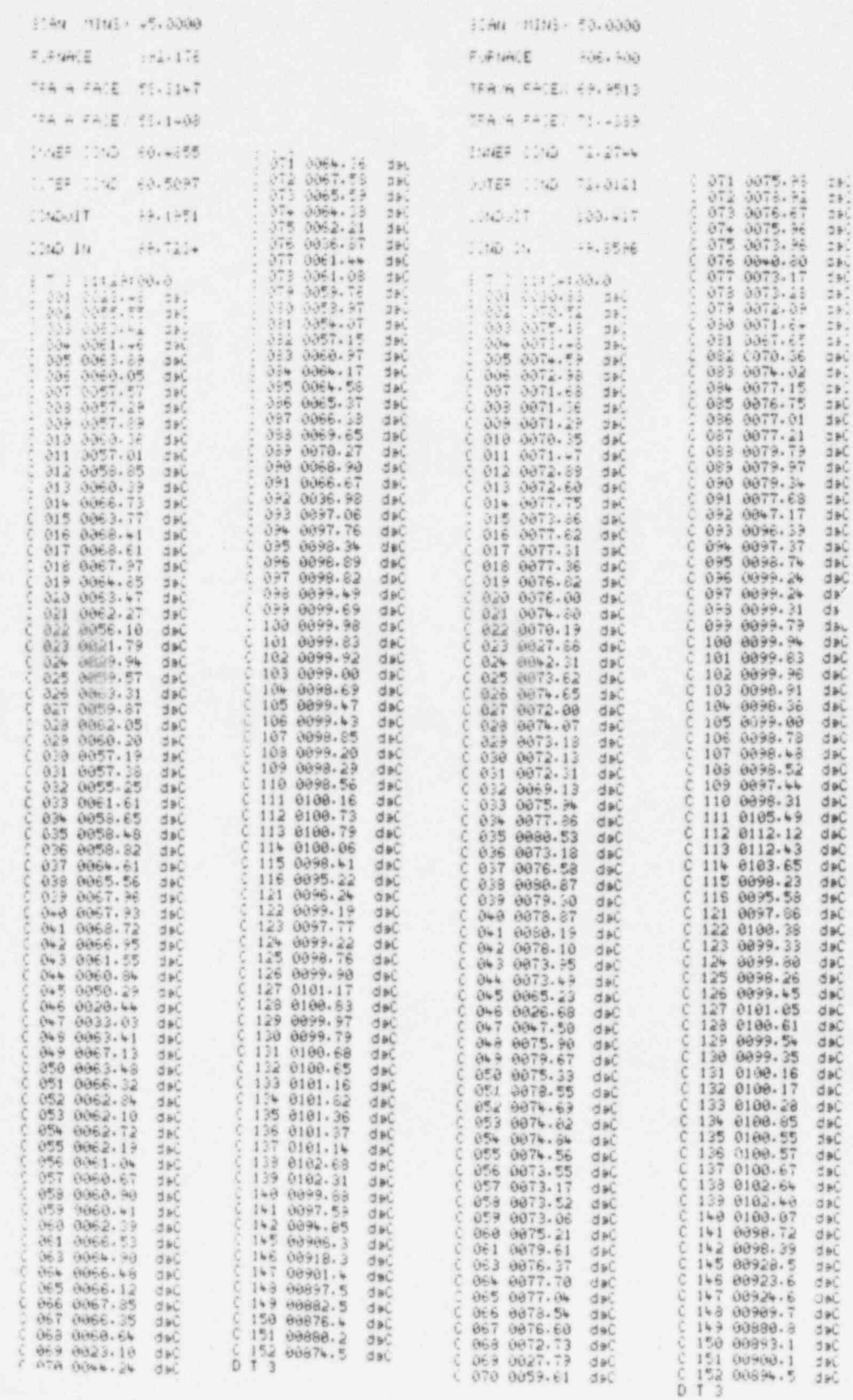
 INNER COND   16.6791

 OUTER COND   16.5636

 COND.OUT     AA.2110

 COND IN      AA.9767

 T I  1114+00.0
  001  0013.75  dBC
  002  0041.51  dBC
  003  0050.38  dBC
  004  0047.66  dBC
C 005  0050.02  dBC
C 006  0046.11  dBC
C 007  0043.06  dBC
C 008  0043.45  dBC
C 009  0042.28  dBC
C 010  0044.63  dBC
C 011  0042.45  dBC
C 012  0043.64  dBC
C 013  0047.58  dBC
C 014  0055.12  dBC
C 015  0052.18  dBC
C 016  0058.74  dBC
C 017  0058.72  dBC
C 018  0056.44  dBC
C 019  0051.72  dBC
C 020  0049.64  dBC
C 021  0048.76  dBC
C 022  0042.52  dBC
C 023  0017.94  dBC
C 024  0022.98  dBC
C 025  0043.34  dBC
C 026  0050.51  dBC
C 027  0047.13  dBC
C 028  0048.79  dBC
C 029  0046.98  dBC
C 030  0042.56  dBC
C 031  0042.76  dBC
C 032  0042.26  dBC
C 033  0047.09  dBC
C 034  0044.62  dBC
C 035  0041.03  dBC
C 036  0044.37  dBC
C 037  0050.04  dBC
C 038  0049.60  dBC
C 039  0053.50  dBC
C 040  0055.11  dBC
C 041  0055.55  dBC
C 042  0053.69  dBC
C 043  0047.72  dBC
C 044  0046.73  dBC
C 045  0037.19  dBC
C 046  0016.80  dBC
C 047  0023.95  dBC
C 048  0049.39  dBC
C 049  0054.49  dBC
C 050  0051.22  dBC
C 051  0053.67  dBC
C 052  0050.41  dBC
C 053  0049.69  dBC
C 054  0050.09  dBC
C 055  0049.62  dBC
C 056  0048.40  dBC
C 057  0047.94  dBC
C 058  0047.98  dBC
C 059  0047.96  dBC
C 060  0050.06  dBC
C 061  0054.81  dBC
C 063  0052.91  dBC
C 064  0054.84  dBC
C 065  0054.99  dBC
C 066  0056.37  dBC
C 067  0055.05  dBC
C 068  0047.96  dBC
C 069  0019.42  dBC
C 070  0030.97  dBC
C 071  0050.67  dBC
C 072  0055.01  dBC
C 073  0053.40  dBC
C 074  0052.14  dBC
C 075  0049.60  dBC
C 076  0031.26  dBC
C 077  0046.67  dBC
C 078  0046.41  dBC
C 079  0046.45  dBC
C 080  0046.05  dBC
C 081  0041.50  dBC
C 082  0045.04  dBC
C 083  0046.65  dBC
C 084  0051.65  dBC
C 085  0051.98  dBC
C 086  0052.97  dBC
C 087  0054.44  dBC
C 088  0058.14  dBC
C 089  0058.66  dBC
C 090  0057.16  dBC
C 091  0054.56  dBC
C 092  0028.70  dBC
C 093  0097.43  dBC
C 094  0098.31  dBC
C 095  0098.35  dBC
C 096  0098.61  dBC
C 097  0098.93  dBC
C 098  0099.54  dBC
C 099  0099.69  dBC
C 100  0100.01  dBC
C 101  0099.92  dBC
C 102  0099.95  dBC
C 103  0099.17  dBC
C 104  0099.57  dBC
C 105  0099.98  dBC
C 106  0099.76  dBC
C 107  0099.03  dBC
C 108  0099.53  dBC
C 109  0098.61  dBC
C 110  0098.65  dBC
C 111  0099.23  dBC
C 112  0099.74  dBC
C 113  0100.09  dBC
C 114  0099.23  dBC
C 115  0098.53  dBC
C 116  0090.01  dBC
C 121  0095.26  dBC
C 122  0099.54  dBC
C 123  0098.89  dBC
C 124  0100.21  dBC
C 125  0099.62  dBC
C 126  0100.46  dBC
C 127  0101.59  dBC
C 128  0101.10  dBC
C 129  0099.99  dBC
C 130  0099.88  dBC
C 131  0100.93  dBC
C 132  0101.85  dBC
C 133  0101.69  dBC
C 134  0101.61  dBC
C 135  0100.96  dBC
C 136  0101.12  dBC
C 137  0100.56  dBC
C 138  0100.84  dBC
C 139  0099.46  dBC
C 140  0099.23  dBC
C 141  0093.92  dBC
C 142  0089.04  dBC
C 145  00880.2  dBC
C 146  00902.8  dBC
C 147  00884.7  dBC
C 148  00897.7  dBC
C 149  00860.2  dBC
C 150  00855.7  dBC
C 151  00864.3  dBC
C 152  00867.0  dBC
D T 3
```


FURNACE
FURNACE
INNER
OUTER
OUTPUT
INPUT

```
...
TIME (MINS) 55.0000
FURNACE     417.510
TRA.A FACE( 79.7031
TRA.A FACE  81.2413
INNER COND  82.5661
OUTER COND  81.4894
INOUT       101.410
COND IN     98.4917
D T 1 11:13:00.0
C 001 0040.19  DAC
C 002 0051.10  DAC
C 003 0061.99  DAC
C 004 0061.30  DAC
C 005 0062.52  DAC
C 006 0062.56  DAC
C 007 0062.10  DAC
C 008 0061.44  DAC
C 009 0061.68  DAC
C 010 0066.42  DAC
C 011 0061.03  DAC
C 012 0063.14  DAC
C 013 0065.07  DAC
C 014 0068.72  DAC
C 015 0063.60  DAC
C 016 0066.48  DAC
C 017 0064.60  DAC
C 018 0065.28  DAC
C 019 0064.89  DAC
C 020 0065.24  DAC
C 021 0064.06  DAC
C 022 0060.87  DAC
C 023 0035.64  DAC
C 024 0055.17  DAC
C 025 0062.74  DAC
C 026 0063.48  DAC
C 027 0062.37  DAC
C 028 0064.01  DAC
C 029 0063.70  DAC
C 030 0061.17  DAC
C 031 0061.91  DAC
C 032 0060.77  DAC
C 033 0063.90  DAC
C 034 0106.22  DAC
C 035 0061.20  DAC
C 036 0062.47  DAC
C 037 0065.66  DAC
C 038 0065.35  DAC
C 039 0067.51  DAC
C 040 0066.47  DAC
C 041 0068.11  DAC
C 042 0067.06  DAC
C 043 0068.25  DAC
C 044 0062.52  DAC
C 045 0077.89  DAC
C 046 0035.44  DAC
C 047 0061.40  DAC
C 048 0064.73  DAC
C 049 0069.11  DAC
C 050 0066.05  DAC
C 051 0040.30  DAC
C 052 0064.56  DAC
C 053 0063.68  DAC
C 054 0064.62  DAC
C 055 0064.64  DAC
C 056 0063.99  DAC
C 057 0063.91  DAC
C 058 0063.87  DAC
C 059 0065.23  DAC
C 060 0068.24  DAC
C 061 0062.06  DAC
C 063 0067.06  DAC
C 064 0068.42  DAC
C 065 0066.64  DAC
C 066 0067.72  DAC
C 067 0064.53  DAC
C 068 0061.42  DAC
C 069 0033.32  DAC
C 070 0071.70  DAC
C 071 0064.79  DAC
C 072 0068.63  DAC
C 073 0065.96  DAC
C 074 0065.14  DAC
C 075 0063.80  DAC
C 076 0063.72  DAC
C 077 0063.04  DAC
C 078 0063.63  DAC
C 079 0062.37  DAC
C 080 0062.29  DAC
C 081 0078.75  DAC
C 082 0062.41  DAC
C 083 0066.20  DAC
C 084 0069.64  DAC
C 085 0068.62  DAC
C 086 0066.62  DAC
C 087 0065.54  DAC
C 088 0066.78  DAC
C 089 0066.58  DAC
C 090 0067.19  DAC
C 091 0065.37  DAC
C 092 0057.79  DAC
C 093 0095.80  DAC
C 094 0097.51  DAC
C 095 0104.93  DAC
C 096 0107.13  DAC
C 097 0105.89  DAC
C 098 0099.10  DAC
C 099 0099.71  DAC
C 100 0099.87  DAC
C 101 0099.65  DAC
C 102 0099.88  DAC
C 103 0098.76  DAC
C 104 0098.84  DAC
C 105 0100.53  DAC
C 106 0099.40  DAC
C 107 0098.60  DAC
C 108 0099.82  DAC
C 109 0098.49  DAC
C 110 0098.23  DAC
C 111 0111.37  DAC
C 112 0126.44  DAC
C 113 0127.98  DAC
C 114 0109.42  DAC
C 115 0097.92  DAC
C 116 0094.52  DAC
C 121 0098.58  DAC
C 122 0101.22  DAC
C 123 0100.46  DAC
C 124 0101.26  DAC
C 125 0098.88  DAC
C 126 0099.10  DAC
C 127 0100.98  DAC
C 128 0100.28  DAC
C 129 0099.19  DAC
C 130 0098.92  DAC
C 131 0099.79  DAC
C 132 0099.84  DAC
C 133 0100.24  DAC
C 134 0100.60  DAC
C 135 0100.49  DAC
C 136 0100.53  DAC
C 137 0100.64  DAC
C 138 0102.21  DAC
C 139 0101.67  DAC
C 140 0100.07  DAC
C 141 0099.63  DAC
C 142 0099.68  DAC
C 145 0094.5   DAC
C 146 0093.5   DAC
C 147 0093.0   DAC
C 148 0092.5   DAC
C 149 0089.2   DAC
C 150 0092.0   DAC
C 151 0090.3   DAC
C 152 0090.7   DAC
D T 3
...
TIME (MINS) 60.0000
FURNACE     424.207
TRA.A FACE( 87.2867
TRA.A FACEY 87.5827
INNER COND  92.7992
OUTER COND  90.3772
INOUT       109.412
COND IN     100.759
D T 1 11:44:00.0
C 001 0050.60  DAC
C 002 0069.05  DAC
C 003 0091.66  DAC
C 004 0089.26  DAC
C 005 0088.80  DAC
C 006 0088.10  DAC
C 007 0088.92  DAC
C 008 0088.17  DAC
C 009 0087.80  DAC
C 010 0093.79  DAC
C 011 0088.35  DAC
C 012 0090.79  DAC
C 013 0097.22  DAC
C 014 0098.25  DAC
C 015 0092.35  DAC
C 016 0095.34  DAC
C 017 0093.18  DAC
C 018 0093.56  DAC
C 019 0090.83  DAC
C 020 0090.33  DAC
C 021 0090.15  DAC
C 022 0087.17  DAC
C 023 0044.65  DAC
C 024 0065.35  DAC
C 025 0086.81  DAC
C 026 0089.65  DAC
C 027 0089.34  DAC
C 028 0093.71  DAC
C 029 0089.97  DAC
C 030 0086.68  DAC
C 031 0088.37  DAC
C 032 0090.28  DAC
C 033 0092.48  DAC
C 034 0088.98  DAC
C 035 0093.45  DAC
C 036 0089.05  DAC
C 037 0092.44  DAC
C 038 0093.94  DAC
C 039 0091.44  DAC
C 040 0093.01  DAC
C 041 0093.88  DAC
C 042 0094.64  DAC
C 043 0090.42  DAC
C 044 0087.88  DAC
C 045 0085.03  DAC
C 046 0045.52  DAC
C 047 0071.66  DAC
C 048 0092.71  DAC
C 049 0102.50  DAC
C 050 0098.09  DAC
C 051 0103.49  DAC
C 052 0094.88  DAC
C 053 0092.33  DAC
C 054 0092.13  DAC
C 055 0093.57  DAC
C 056 0093.66  DAC
C 057 0094.66  DAC
C 058 0094.10  DAC
C 059 0097.13  DAC
C 060 0102.11  DAC
C 061 0106.25  DAC
C 063 0100.40  DAC
C 064 0100.27  DAC
C 065 0097.31  DAC
C 066 0097.96  DAC
C 067 0091.57  DAC
C 068 0086.16  DAC
C 069 0038.56  DAC
C 070 0098.22  DAC
C 071 0091.42  DAC
C 072 0099.43  DAC
C 073 0096.89  DAC
C 074 0094.21  DAC
C 075 0091.71  DAC
C 076 0048.78  DAC
C 077 0090.46  DAC
C 078 0092.58  DAC
C 079 0091.11  DAC
C 080 0092.35  DAC
C 081 0087.88  DAC
C 082 0091.41  DAC
C 083 0099.20  DAC
C 084 0101.18  DAC
C 085 0101.07  DAC
C 086 0097.51  DAC
C 087 0093.36  DAC
C 088 0092.85  DAC
C 089 0091.36  DAC
C 090 0092.89  DAC
C 091 0089.32  DAC
C 092 0066.44  DAC
C 093 0095.35  DAC
C 094 0100.74  DAC
C 095 0117.43  DAC
C 096 0119.13  DAC
C 097 0117.65  DAC
C 098 0099.27  DAC
C 099 0099.45  DAC
C 100 0099.61  DAC
C 101 0099.44  DAC
C 102 0099.87  DAC
C 103 0099.12  DAC
C 104 0106.34  DAC
C 105 0109.85  DAC
C 106 0108.05  DAC
C 107 0102.11  DAC
C 108 0107.67  DAC
C 109 0101.55  DAC
C 110 0099.75  DAC
C 111 0120.54  DAC
C 112 0148.75  DAC
C 113 0148.37  DAC
C 114 0114.44  DAC
C 115 0097.11  DAC
C 116 0094.35  DAC
C 121 0100.93  DAC
C 122 0102.88  DAC
C 123 0102.62  DAC
C 124 0102.53  DAC
C 125 0099.20  DAC
C 126 0099.00  DAC
C 127 0101.09  DAC
C 128 0100.59  DAC
C 129 0099.07  DAC
C 130 0098.95  DAC
C 131 0100.69  DAC
C 132 0101.07  DAC
C 133 0101.66  DAC
C 134 0101.89  DAC
C 135 0102.15  DAC
C 136 0102.32  DAC
C 137 0101.69  DAC
C 138 0104.60  DAC
C 139 0100.69  DAC
C 140 0100.38  DAC
C 141 0100.01  DAC
C 142 0099.69  DAC
C 145 0094.7   DAC
C 146 0093.2   DAC
C 147 0091.4   DAC
C 148 0090.7   DAC
C 149 0090.3   DAC
C 150 0091.8   DAC
C 151 0092.8   DAC
C 152 0093.8   DAC
D T 3
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                .........

EXH  MIN:  65.0000

FURNACE     108.445

TRA A FACE: 91.8420

TRA A FACE: 94.1417

INNER COND  104.704

OUTER COND  101.708

CONDUIT     122.501

COND IN     103.208

 T 1 111=100.0
 001 0082.45  DAC
 002 0096.50  DAC
 003 0095.49  DAC
 004 0095.08  DAC
 005 0094.49  DAC
 006 0094.12  DAC
 007 0091.57  DAC
 008 0092.55  DAC
 009 0091.50  DAC
 010 0100.91  DAC
 011 0095.97  DAC
 012 0097.00  DAC
 013 0106.93  DAC
 014 0105.46  DAC
 015 0099.96  DAC
 016 0104.19  DAC
 017 0101.73  DAC
 018 0100.77  DAC
 019 0096.76  DAC
 020 0095.61  DAC
C 021 0094.68  DAC
C 022 0092.07  DAC
C 023 0052.19  DAC
C 024 0059.66  DAC
C 025 0092.65  DAC
C 026 0097.31  DAC
C 027 0094.66  DAC
C 028 0102.54  DAC
C 029 0096.98  DAC
C 030 0090.35  DAC
C 031 0091.83  DAC
C 032 0092.99  DAC
C 033 0099.13  DAC
C 034 0092.79  DAC
C 035 0099.55  DAC
C 036 0097.38  DAC
C 037 0104.21  DAC
C 038 0103.35  DAC
C 039 0098.25  DAC
C 040 0100.29  DAC
C 041 0102.66  DAC
C 042 0103.50  DAC
C 043 0098.37  DAC
C 044 0094.65  DAC
C 045 0090.64  DAC
C 046 0055.82  DAC
C 047 0076.63  DAC
C 048 0100.04  DAC
C 049 0116.33  DAC
C 050 0113.61  DAC
C 051 0119.57  DAC
C 052 0108.55  DAC
C 053 0104.58  DAC
C 054 0102.38  DAC
C 055 0104.32  DAC
C 056 0106.02  DAC
C 057 0106.33  DAC
C 058 0104.46  DAC
C 059 0108.53  DAC
C 060 0115.30  DAC
C 061 0121.59  DAC
C 063 0116.14  DAC
C 064 0117.73  DAC
C 065 0113.02  DAC
C 066 0112.95  DAC
C 067 0102.42  DAC
C 068 0090.35  DAC
C 069 0043.01  DAC
C 070 0084.55  DAC
C 071 0101.42  DAC
C 072 0117.12  DAC
C 073 0112.15  DAC
C 074 0107.53  DAC
C 075 0102.12  DAC
C 076 0052.59  DAC
C 077 0098.78  DAC
C 078 0102.95  DAC
C 079 0103.44  DAC
C 080 0103.56  DAC
C 081 0095.51  DAC
C 082 0103.80  DAC
C 083 0112.83  DAC
C 084 0118.88  DAC
C 085 0118.01  DAC
C 086 0114.29  DAC
C 087 0108.12  DAC
C 088 0107.96  DAC
C 089 0104.28  DAC
C 090 0103.28  DAC
C 091 0093.89  DAC
C 092 0072.13  DAC
C 093 0097.47  DAC
C 094 0105.86  DAC
C 095 0142.79  DAC
C 096 0144.74  DAC
C 097 0139.91  DAC
C 098 0101.61  DAC
C 099 0099.45  DAC
C 100 0099.73  DAC
C 101 0099.33  DAC
C 102 0099.80  DAC
C 103 0103.01  DAC
C 104 0124.52  DAC
C 105 0135.45  DAC
C 106 0140.74  DAC
C 107 0130.40  DAC
C 108 0138.28  DAC
C 109 0113.23  DAC
C 110 0103.68  DAC
C 111 0132.97  DAC
C 112 0170.20  DAC
C 113 0172.36  DAC
C 114 0124.82  DAC
C 115 0097.08  DAC
C 116 0098.22  DAC
C 121 0101.52  DAC
C 122 0109.36  DAC
C 123 0110.75  DAC
C 124 0107.67  DAC
C 125 0100.44  DAC
C 126 0099.31  DAC
C 127 0102.28  DAC
C 128 0100.41  DAC
C 129 0099.16  DAC
C 130 0099.13  DAC
C 131 0102.04  DAC
C 132 0103.76  DAC
C 133 0108.96  DAC
C 134 0106.58  DAC
C 135 0109.14  DAC
C 136 0107.26  DAC
C 137 0103.99  DAC
C 138 0102.99  DAC
C 139 0100.25  DAC
C 140 0100.38  DAC
C 141 0100.34  DAC
C 142 0099.78  DAC
C 145 0096.6   DAC
C 146 0095.7   DAC
C 147 0093.1   DAC
C 148 0094.9   DAC
C 149 0091.8.4 DAC
C 150 0092.3   DAC
C 151 0093.1   DAC
C 152 0092.2   DAC
D T 3
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                ............

EXH  MIN:  70.0000

FURNACE     945.616

TRA A FACE: 101.331

TRA A FACE: 102.959

INNER COND  120.575

OUTER COND  118.585

CONDUIT     119.504

COND IN     111.111

 T 1 111=100.0
 001 0074.11  DAC
 002 0097.93  DAC
 003 0098.81  DAC
 004 0104.71  DAC
 005 0103.46  DAC
 006 0100.39  DAC
 007 0097.50  DAC
 008 0098.49  DAC
 009 0095.96  DAC
 010 0104.95  DAC
C 011 0106.13  DAC
C 012 0099.89  DAC
C 013 0109.93  DAC
C 014 0121.44  DAC
C 015 0108.63  DAC
C 016 0114.82  DAC
C 017 0113.43  DAC
C 018 0109.97  DAC
C 019 0102.82  DAC
C 020 0099.06  DAC
C 021 0099.48  DAC
C 022 0097.10  DAC
C 023 0058.44  DAC
C 024 0071.54  DAC
C 025 0095.14  DAC
C 026 0100.02  DAC
C 027 0108.56  DAC
C 028 0112.37  DAC
C 029 0107.24  DAC
C 030 0098.42  DAC
C 031 0099.26  DAC
C 032 0099.58  DAC
C 033 0110.19  DAC
C 034 0100.39  DAC
C 035 0098.94  DAC
C 036 0105.66  DAC
C 037 0118.24  DAC
C 038 0112.33  DAC
C 039 0110.27  DAC
C 040 0112.27  DAC
C 041 0116.35  DAC
C 042 0114.42  DAC
C 043 0102.68  DAC
C 044 0098.76  DAC
C 045 0095.94  DAC
C 046 0071.46  DAC
C 047 0079.18  DAC
C 048 0113.08  DAC
C 049 0136.09  DAC
C 050 0132.10  DAC
C 051 0138.11  DAC
C 052 0127.61  DAC
C 053 0122.47  DAC
C 054 0119.45  DAC
C 055 0120.83  DAC
C 056 0122.13  DAC
C 057 0121.95  DAC
C 058 0117.57  DAC
C 059 0122.71  DAC
C 060 0131.62  DAC
C 061 0139.35  DAC
C 063 0138.06  DAC
C 064 0139.51  DAC
C 065 0136.04  DAC
C 066 0132.91  DAC
C 067 0119.34  DAC
C 068 0095.43  DAC
C 069 0047.04  DAC
C 070 0086.78  DAC
C 071 0121.15  DAC
C 072 0137.35  DAC
C 073 0133.63  DAC
C 074 0128.45  DAC
C 075 0121.44  DAC
C 076 0058.23  DAC
C 077 0116.18  DAC
C 078 0120.16  DAC
C 079 0119.11  DAC
C 080 0117.--  DAC
C 081 0104.61  DAC
C 082 0115.50  DAC
C 083 0128.98  DAC
C 084 0137.30  DAC
C 085 0139.40  DAC
C 086 0138.21  DAC
C 087 0135.46  DAC
C 088 0135.86  DAC
C 089 0130.36  DAC
C 090 0122.15  DAC
C 091 0102.52  DAC
C 092 0075.35  DAC
C 093 0098.99  DAC
C 094 0107.21  DAC
C 095 0167.69  DAC
C 096 0174.84  DAC
C 097 0166.79  DAC
C 098 0120.75  DAC
C 099 0103.89  DAC
C 100 0099.86  DAC
C 101 0099.29  DAC
C 102 0099.78  DAC
C 103 0115.66  DAC
C 104 0149.79  DAC
C 105 0165.69  DAC
C 106 0179.31  DAC
C 107 0174.27  DAC
C 108 0173.90  DAC
C 109 0139.26  DAC
C 110 0122.97  DAC
C 111 0138.18  DAC
C 112 0179.63  DAC
C 113 0193.63  DAC
C 114 0140.82  DAC
C 115 0097.04  DAC
C 116 0099.31  DAC
C 121 0101.55  DAC
C 122 0132.93  DAC
C 123 0143.57  DAC
C 124 0135.09  DAC
C 125 0114.79  DAC
C 126 0101.01  DAC
C 127 0099.04  DAC
C 128 0098.89  DAC
C 129 0098.55  DAC
C 130 0101.18  DAC
C 131 0113.32  DAC
C 132 0123.58  DAC
C 133 0137.12  DAC
C 134 0135.91  DAC
C 135 0137.48  DAC
C 136 0123.04  DAC
C 137 0104.19  DAC
C 138 0102.34  DAC
C 139 0100.14  DAC
C 140 0100.33  DAC
C 141 0100.16  DAC
C 142 0099.64  DAC
C 145 0097.6.9  DAC
C 146 0096.5.3  DAC
C 147 0093.7.2  DAC
C 148 0094.9.9  DAC
C 149 0092.4.6  DAC
C 150 0093.6.1  DAC
C 151 0093.7.7  DAC
C 152 0093.6.8  DAC
D T 3
```

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.....

SCAN (MINS) 75.0000

FURNACE     956.+98

TRA/A FACE: 110.113

TRA/A FACE: 110.1+4

INNER COND  107.689

OUTER COND  116.148

CONDUIT     155.769

COND IN     128.478

S T 3 1115/100.0
: 001 0079.87  DAC
: 002 0044.05  DAC
: 003 0106.26  DAC
: 004 0119.49  DAC
: 005 0128.12  DAC
: 006 0110.38  DAC
: 007 0105.16  DAC
: 008 0107.23  DAC
C 009 0103.65  DAC
C 010 0113.39  DAC
C 011 0109.77  DAC
: 012 0106.16  DAC
C 013 0111.45  DAC
: 014 0134.21  DAC
: 015 0123.23  DAC
: 016 0130.26  DAC
: 017 0128.62  DAC
C 018 0122.93  DAC
C 019 0112.43  DAC
: 020 0108.68  DAC
C 021 0106.32  DAC
C 022 0099.32  DAC
C 023 0084.38  DAC
C 024 0072.61  DAC
C 025 0097.46  DAC
C 026 0122.22  DAC
C 027 0125.70  DAC
C 028 0129.65  DAC
C 029 0122.72  DAC
C 030 0111.60  DAC
C 031 0112.01  DAC
C 032 0110.67  DAC
C 033 0122.77  DAC
C 034 0107.93  DAC
C 035 0101.73  DAC
C 036 0104.20  DAC
C 037 0126.38  DAC
C 038 0124.13  DAC
C 039 0126.75  DAC
C 040 0129.89  DAC
C 041 0133.11  DAC
C 042 0129.54  DAC
C 043 0108.96  DAC
C 044 0100.70  DAC
C 045 0098.06  DAC
C 046 0087.99  DAC
C 047 0080.64  DAC
C 048 0131.44  DAC
: 049 0155.05  DAC
C 050 0151.66  DAC
C 051 0157.17  DAC
C 052 0148.12  DAC
C 053 0143.13  DAC
C 054 0140.57  DAC
C 055 0141.43  DAC
C 056 0141.40  DAC
C 057 0140.35  DAC
C 058 0135.39  DAC
C 059 0139.53  DAC
C 060 0148.94  DAC
C 061 0157.22  DAC
C 063 0158.41  DAC
C 064 0160.40  DAC
C 065 0156.57  DAC
C 066 0152.11  DAC
C 067 0137.27  DAC
C 068 0101.90  DAC
C 069 0050.38  DAC
C 070 0089.87  DAC
: 071 0139.94  DAC
: 072 0157.75  DAC
: 073 0154.72  DAC
C 074 0150.10  DAC
C 075 0143.18  DAC
C 076 0065.02  DAC
C 077 0137.46  DAC
C 078 0139.81  DAC
C 079 0138.37  DAC
C 080 0133.81  DAC
C 081 0117.18  DAC
C 082 0130.19  DAC
C 083 0146.46  DAC
C 084 0155.43  DAC
C 085 0158.69  DAC
C 086 0159.73  DAC
C 087 0159.06  DAC
C 088 0159.97  DAC
C 089 0154.25  DAC
C 090 0144.43  DAC
C 091 0116.43  DAC
C 092 0079.28  DAC
C 093 0098.90  DAC
C 094 0108.67  DAC
C 095 0172.00  DAC
C 096 0203.11  DAC
C 097 0194.25  DAC
C 098 0150.80  DAC
C 099 0117.62  DAC
C 100 0099.98  DAC
C 101 0099.33  DAC
C 102 0099.76  DAC
C 103 0134.56  DAC
C 104 0177.89  DAC
C 105 0199.38  DAC
C 106 0215.50  DAC
C 107 0212.13  DAC
C 108 0208.88  DAC
C 109 0174.02  DAC
C 110 0150.30  DAC
C 111 0150.54  DAC
C 112 0171.03  DAC
C 113 0197.28  DAC
C 114 0148.57  DAC
C 115 0097.28  DAC
C 116 0100.33  DAC
C 121 0101.33  DAC
C 122 0126.61  DAC
C 123 0173.74  DAC
C 124 0167.96  DAC
C 125 0142.69  DAC
C 126 0114.23  DAC
C 127 0099.77  DAC
C 128 0097.95  DAC
C 129 0099.31  DAC
C 130 0110.96  DAC
C 131 0141.14  DAC
C 132 0161.68  DAC
C 133 0178.05  DAC
C 134 0182.90  DAC
C 135 0179.49  DAC
C 136 0155.40  DAC
C 137 0117.29  DAC
C 138 0102.72  DAC
C 139 0100.13  DAC
C 140 0100.26  DAC
C 141 0099.99  DAC
C 142 0099.45  DAC
C 145 00985.6  DAC
C 146 00974.9  DAC
C 147 00945.2  DAC
C 148 00955.9  DAC
C 149 00943.3  DAC
C 150 00943.4  DAC
C 151 00945.6  DAC
C 152 00941.6  DAC
D T 3

.....

SCAN (MINS) 60.0000

FURNACE     960.+31

TRA/A FACE: 123.864

TRA/A FACE: 127.5+3

INNER COND  154.251

OUTER COND  152.840

CONDUIT     173.+49

COND IN     145.87+

S T 3 1210/100.0
: 001 0084.75  DAC
: 002 0044.87  DAC
: 003 0145.25  DAC
: 004 0127.18  DAC
: 005 0147.73  DAC
: 006 0129.37  DAC
: 007 0117.55  DAC
: 008 0120.36  DAC
C 009 0120.21  DAC
C 010 0130.49  DAC
C 011 0115.36  DAC
C 012 0115.49  DAC
C 013 0125.36  DAC
C 014 0152.15  DAC
C 015 0142.15  DAC
C 016 0150.27  DAC
C 017 0148.49  DAC
C 018 0142.43  DAC
C 019 0129.44  DAC
C 020 0125.02  DAC
C 021 0118.47  DAC
C 022 0100.97  DAC
C 023 0069.92  DAC
C 024 0076.20  DAC
C 025 0099.28  DAC
C 026 0139.75  DAC
C 027 0143.71  DAC
C 028 0148.26  DAC
C 029 0141.82  DAC
C 030 0138.40  DAC
C 031 0128.78  DAC
C 032 0127.01  DAC
C 033 0142.61  DAC
C 034 0124.78  DAC
C 035 0115.74  DAC
C 036 0119.38  DAC
C 037 0146.85  DAC
C 038 0142.78  DAC
C 039 0142.86  DAC
C 040 0148.90  DAC
C 041 0152.15  DAC
C 042 0146.07  DAC
C 043 0121.25  DAC
C 044 0102.95  DAC
C 045 0098.03  DAC
C 046 0095.98  DAC
C 047 0084.60  DAC
C 048 0146.52  DAC
C 049 0172.46  DAC
C 050 0170.15  DAC
C 051 0175.31  DAC
C 052 0167.26  DAC
C 053 0163.07  DAC
C 054 0160.80  DAC
C 055 0161.27  DAC
C 056 0160.43  DAC
C 057 0158.06  DAC
C 058 0151.74  DAC
C 059 0156.47  DAC
C 060 0166.31  DAC
C 061 0174.90  DAC
C 063 0177.54  DAC
C 064 0179.47  DAC
C 065 0175.85  DAC
C 066 0170.11  DAC
C 067 0153.44  DAC
C 068 0113.29  DAC
C 069 0054.42  DAC
C 070 0094.22  DAC
C 071 0156.11  DAC
C 072 0175.87  DAC
C 073 0172.7+  DAC
C 074 0164.+4  DAC
C 075 0163.76  DAC
C 076 0072.7+  DAC
C 077 0158.15  DAC
C 078 0159.62  DAC
C 079 0157.71  DAC
C 080 0151.05  DAC
C 081 0130.62  DAC
C 082 0145.19  DAC
C 083 0162.+1  DAC
C 084 0172.+6  DAC
C 085 0177.26  DAC
C 086 0179.12  DAC
C 087 0179.59  DAC
C 088 0180.31  DAC
C 089 0174.44  DAC
C 090 0162.76  DAC
C 091 0132.29  DAC
C 092 0083.14  DAC
C 093 0099.10  DAC
C 094 0110.23  DAC
C 095 0183.03  DAC
C 096 0226.72  DAC
C 097 0219.88  DAC
C 098 0184.29  DAC
C 099 0138.76  DAC
C 100 0105.30  DAC
C 101 0099.81  DAC
C 102 0100.01  DAC
C 103 0157.19  DAC
C 104 0207.25  DAC
C 105 0231.67  DAC
C 106 0247.31  DAC
C 107 0244.52  DAC
C 108 0239.81  DAC
C 109 0206.79  DAC
C 110 0176.64  DAC
C 111 0168.95  DAC
C 112 0189.44  DAC
C 113 0203.67  DAC
C 114 0152.77  DAC
C 115 0096.97  DAC
C 116 0101.03  DAC
C 121 0101.14  DAC
C 122 0138.66  DAC
C 123 0195.43  DAC
C 124 0196.71  DAC
C 125 0172.42  DAC
C 126 0138.86  DAC
C 127 0106.59  DAC
C 128 0099.07  DAC
C 129 0103.09  DAC
C 130 0128.44  DAC
C 131 0169.85  DAC
C 132 0197.40  DAC
C 133 0216.57  DAC
C 134 0222.67  DAC
C 135 0217.92  DAC
C 136 0191.67  DAC
C 137 0153.12  DAC
C 138 0103.24  DAC
C 139 0100.29  DAC
C 140 0100.43  DAC
C 141 0100.23  DAC
C 142 0099.71  DAC
C 145 00996.4  DAC
C 146 00981.9  DAC
C 147 00952.4  DAC
C 148 00970.0  DAC
C 149 00938.0  DAC
C 150 0094?.?  DAC
C 151 0094?.6  DAC
C 152 00951.0  DAC
D T 3
```

```
[FAN - KUNI - 17.0000

FURNACE     443.727

TRA A PAIEV 139.735

TRA A PAIEV 141.184

INNER COND  170.312

 NTER COND  168.570

CONDUIT     181.888

COND IN     185.017

D T 2 12:09:00.0
C 001 0086.03  DBC
C 002 0104.23  DBC
C 003 0142.84  DBC
C 004 0155.74  DBC
C 005 0157.00  DBC
C 006 0151.65  DBC
C 007 0138.82  DBC
C 008 0139.65  DBC
C 009 0139.69  DBC
C 010 0149.45  DBC
C 011 0130.40  DBC
C 012 0126.99  DBC
C 013 0140.99  DBC
C 014 0171.02  DBC
C 015 0160.51  DBC
C 016 0169.26  DBC
C 017 0160.52  DBC
C 018 0162.25  DBC
C 019 0150.60  DBC
C 020 0142.44  DBC
C 021 0133.52  DBC
C 022 0106.93  DBC
C 023 0074.25  DBC
C 024 0074.61  DBC
C 025 0104.97  DBC
C 026 0156.40  DBC
C 027 0161.55  DBC
C 028 0166.88  DBC
C 029 0161.23  DBC
C 030 0150.69  DBC
C 031 0148.79  DBC
C 032 0146.24  DBC
C 033 0161.65  DBC
C 034 0140.93  DBC
C 035 0125.67  DBC
C 036 0132.75  DBC
C 037 0164.14  DBC
C 038 0160.75  DBC
C 039 0161.28  DBC
C 040 0167.06  DBC
C 041 0170.86  DBC
C 042 0163.12  DBC
C 043 0133.09  DBC
C 044 0102.44  DBC
C 045 0098.76  DBC
C 046 0097.24  DBC
C 047 0087.59  DBC
C 048 0159.81  DBC
C 049 0189.61  DBC
C 050 0138.53  DBC
C 051 0193.05  DBC
C 052 0186.30  DBC
C 053 0182.58  DBC
C 054 0180.13  DBC
C 055 0180.63  DBC
C 056 0178.94  DBC
C 057 0176.63  DBC
C 058 0167.25  DBC
C 059 0172.13  DBC
C 060 0183.03  DBC
C 061 0192.38  DBC
C 062 0195.18  DBC
C 064 0197.80  DBC
C 065 0194.30  DBC
C 066 0187.91  DBC
C 067 0169.91  DBC
C 068 0125.98  DBC
C 069 0058.83  DBC
C 070 0097.47  DBC
C 071 0170.87  DBC
C 072 0193.42  DBC
C 073 0192.45  DBC
C 074 0189.25  DBC
C 075 0183.61  DBC
C 076 0077.14  DBC
C 077 0178.23  DBC
C 078 0179.06  DBC
C 079 0176.34  DBC
C 080 0167.73  DBC
C 081 0144.40  DBC
C 082 0160.57  DBC
C 083 0190.31  DBC
C 084 0191.23  DBC
C 085 0195.25  DBC
C 086 0196.99  DBC
C 087 0197.92  DBC
C 088 0199.40  DBC
C 089 0192.64  DBC
C 090 0190.47  DBC
C 091 0145.54  DBC
C 092 0086.73  DBC
C 093 0098.80  DBC
C 094 0109.69  DBC
C 095 0196.78  DBC
C 096 0246.50  DBC
C 097 0242.96  DBC
C 098 0214.12  DBC
C 099 0168.04  DBC
C 100 0130.04  DBC
C 101 0103.24  DBC
C 102 0111.69  DBC
C 103 0182.74  DBC
C 104 0236.07  DBC
C 105 0261.15  DBC
C 106 0274.62  DBC
C 107 0270.99  DBC
C 108 0266.45  DBC
C 109 0235.57  DBC
C 110 0196.81  DBC
C 111 0188.93  DBC
C 112 0209.76  DBC
C 113 0215.43  DBC
C 114 0155.77  DBC
C 115 0096.76  DBC
C 116 0100.90  DBC
C 121 0101.37  DBC
C 122 0153.60  DBC
C 123 0216.81  DBC
C 124 0224.13  DBC
C 125 0201.62  DBC
C 126 0165.82  DBC
C 127 0125.09  DBC
C 128 0106.39  DBC
C 129 0112.21  DBC
C 130 0149.89  DBC
C 131 0198.81  DBC
C 132 0230.41  DBC
C 133 0250.09  DBC
C 134 0255.56  DBC
C 135 0250.69  DBC
C 136 0228.06  DBC
C 137 0199.21  DBC
C 138 0124.57  DBC
C 139 0100.24  DBC
C 140 0100.43  DBC
C 141 0099.94  DBC
C 142 0099.50  DBC
C 145 01000.2  DBC
C 146 00989.7  DBC
C 147 00959.6  DBC
C 148 00973.9  DBC
C 149 00950.5  DBC
C 150 00960.4  DBC
C 151 00961.5  DBC
C 152 00953.8  DBC
D T 3
```

```
TAY TIME:  30.0000

TRAY E     274.475

TRAY FACE: 155.872

TRAY FACE: 155.960

INNER COND  186.131

OUTER COND  183.962

CONDUIT     212.052

COND IN     185.717

D T 3 12:14:00.0
C 001 0099.12  DBC
C 002 0103.10  DBC
C 003 0150.16  DBC
C 004 0174.10  DBC
C 005 0186.19  DBC
C 006 0170.19  DBC
C 007 0161.47  DBC
C 008 0160.58  DBC
C 009 0158.43  DBC
C 010 0168.72  DBC
C 011 0148.77  DBC
C 012 0140.08  DBC
C 013 0156.73  DBC
C 014 0108.24  DBC
C 015 0178.12
C 016 0188.87  DBC
C 017 0188.09  DBC
C 018 0182.14  DBC
C 019 0171.41  DBC
C 020 0160.88  DBC
C 021 0149.53  DBC
C 022 0113.85  DBC
C 023 0078.82  DBC
C 024 0075.84  DBC
C 025 0113.97  DBC
C 026 0172.32  DBC
C 027 0178.86  DBC
C 028 0184.90  DBC
C 029 0180.58  DBC
C 030 0170.90  DBC
C 031 0169.70  DBC
C 032 0167.32  DBC
C 033 0181.80  DBC
C 034 0159.81  DBC
C 035 0140.62  DBC
C 036 0147.50  DBC
C 037 0181.23  DBC
C 038 0178.49  DBC
C 039 0180.28  DBC
C 040 0185.84  DBC
C 041 0183.92  DBC
C 042 0181.07  DBC
C 043 0144.93  DBC
C 044 0103.50  DBC
C 045 0099.80  DBC
C 046 0098.02  DBC
C 047 0098.82  DBC
C 048 0173.50  DBC
C 049 0206.07  DBC
C 050 0206.65  DBC
C 051 0210.49  DBC
C 052 0205.00  DBC
C 053 0201.25  DBC
C 054 0199.72  DBC
C 055 0199.58  DBC
C 056 0197.17  DBC
C 057 0191.95  DBC
C 058 0183.43  DBC
C 059 0188.50  DBC
C 060 0199.71  DBC
C 061 0209.29  DBC
C 063 0212.15  DBC
C 064 0214.77  DBC
C 065 0211.64  DBC
C 066 0205.04  DBC
C 067 0186.30  DBC
C 068 0138.39  DBC
C 069 0062.57  DBC
C 070 0101.19  DBC
C 071 0185.76  DBC
C 072 0210.70  DBC
C 073 0210.26  DBC
C 074 0208.06  DBC
C 075 0202.92  DBC
C 076 0079.37  DBC
C 077 0197.91  DBC
C 078 0198.13  DBC
C 079 0194.62  DBC
C 080 0185.14  DBC
C 081 0159.16  DBC
C 082 0176.47  DBC
C 083 0197.29  DBC
C 084 0208.24  DBC
C 085 0212.19  DBC
C 086 0213.88  DBC
C 087 0215.18  DBC
C 088 0216.76  DBC
C 089 0209.96  DBC
C 090 0197.19  DBC
C 091 0158.40  DBC
C 092 0089.79  DBC
C 093 0098.84  DBC
C 094 0110.49  DBC
C 095 0217.27  DBC
C 096 0263.56  DBC
C 097 0262.85  DBC
C 098 0239.89  DBC
C 099 0199.63  DBC
C 100 0163.53  DBC
C 101 0119.78  DBC
C 102 0147.35  DBC
C 103 0212.41  DBC
C 104 0263.35  DBC
C 105 0286.67  DBC
C 106 0297.42  DBC
C 107 0292.69  DBC
C 108 0289.26  DBC
C 109 0261.03  DBC
C 110 0227.52  DBC
C 111 0209.03  DBC
C 112 0227.00  DBC
C 113 0227.01  DBC
C 114 0184.27  DBC
C 115 0096.29  DBC
C 116 0100.51  DBC
C 121 0101.50  DBC
C 122 0174.77  DBC
C 123 0206.69  DBC
C 124 0247.08  DBC
C 125 0228.52  DBC
C 126 0195.33  DBC
C 127 0154.46  DBC
C 128 0126.18  DBC
C 129 0133.45  DBC
C 130 0178.04  DBC
C 131 0220.38  DBC
C 132 0259.94  DBC
C 133 0277.84  DBC
C 134 0281.72  DBC
C 135 0276.84  DBC
C 136 0257.36  DBC
C 137 0231.15  DBC
C 138 0180.80  DBC
C 139 0100.37  DBC
C 140 0100.55  DBC
C 141 0100.38  DBC
C 142 0099.53  DBC
C 145 01004.2  DBC
C 146 00992.8  DBC
C 147 00965.9  DBC
C 148 00985.5  DBC
C 149 00955.1  DBC
C 150 00960.4  DBC
C 151 00967.8  DBC
C 152 00967.7  DBC
D T 3
HALT  12:16:01 29-03
```

TEST RECORD FAVERDALE TECHNOLOGY CENTRAL LTD

ABSTRACT No: 31 - 0076

RIG NAME: DARMATT KM1 - CABLE TRAY A (36") PLUS 4" CONDUIT.

TEST SPECIFICATION: BS476 PART 20 (TDS/31 - 0076/1) ISSUE

SIGNATURE:

DATE: 29/3/94.

12" x 3½" Cable Tray

Channel No.	Position
1 - 23	Face X
24 - 46	Face Y
47 - 69	Inner conductor
70 - 92	Outer conductor
93 - 100	O/L Furnace T/Cs

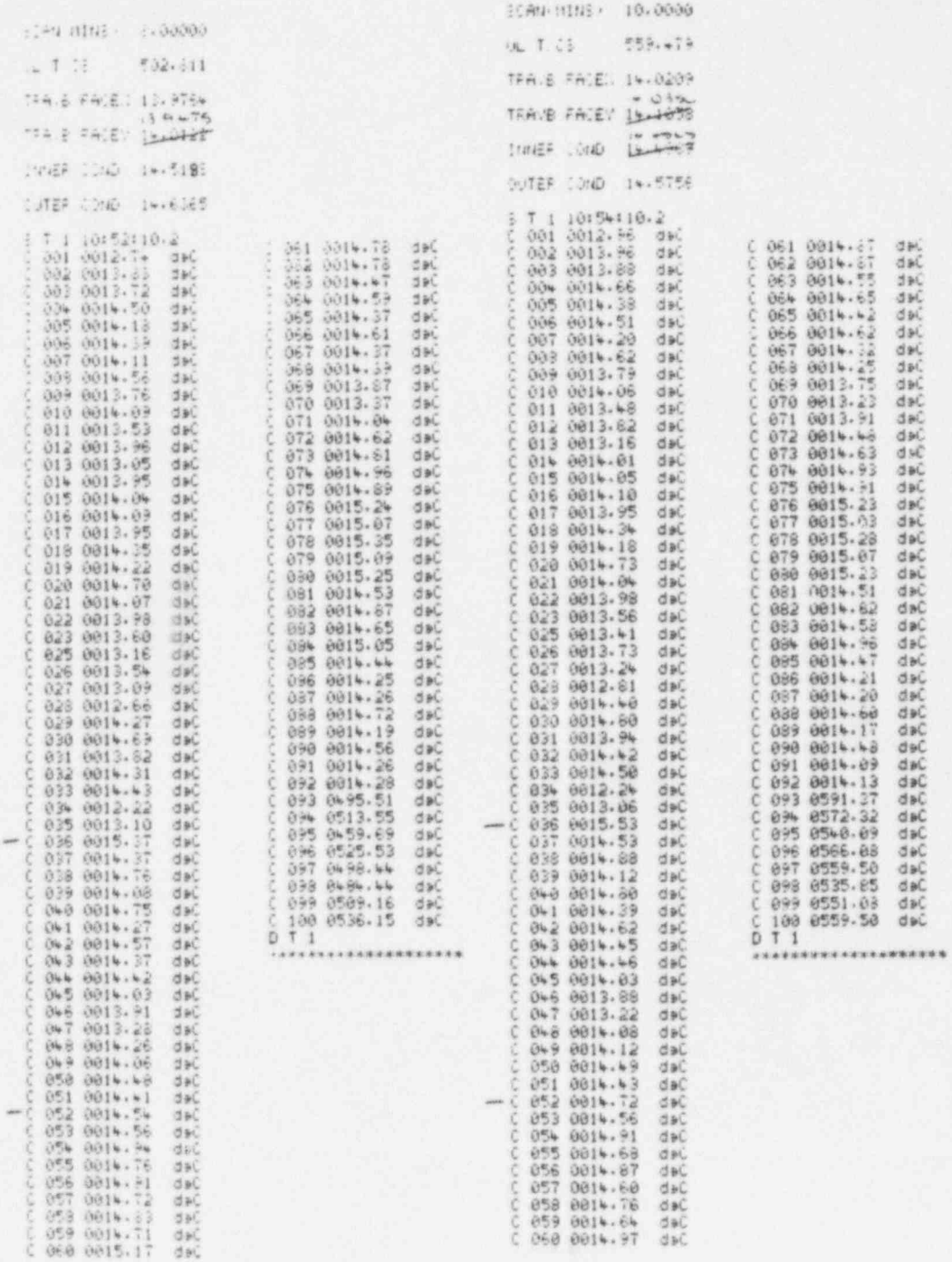
Thermocouples 24, 36 and 52 removed from mean valves.

```
RUN   10:44:10 29-03
********************

SCANNING   0

CAL T.C3     17.2922

TRA/B FACE  13.9611
             13.9671
TRA/B FACE  ~~[struck out]~~
             14.6104
INNER COND  ~~[struck out]~~

OUTER COND  14.5157

E T 1 10:44:10.2
C 001 0012.50  degC
C 002 0013.96  degC
C 003 0013.76  degC
C 004 0014.56  degC
C 005 0014.16  degC
C 006 0014.46  degC
C 007 0014.06  degC
C 008 0014.51  degC
C 009 0013.76  degC
C 010 0013.93  degC
C 011 0013.47  degC
C 012 0013.79  degC
C 013 0013.07  degC
C 014 0013.94  degC
C 015 0013.98  degC
C 016 0014.10  degC
C 017 0013.91  degC
C 018 0014.35  degC
C 019 0014.14  degC
C 020 0014.64  degC
C 021 0014.01  degC
C 022 0013.95  degC
C 023 0013.55  degC
C 025 0013.28  degC
C 026 0013.61  degC
C 027 0013.14  degC
C 028 0012.67  degC
C 029 0014.31  degC
C 030 0014.73  degC
C 031 0013.83  degC
C 032 0014.30  degC
C 033 0014.41  degC
C 034 0012.20  degC
C 035 0013.05  degC
C 036 0015.26  degC
C 037 0014.44  degC
C 038 0014.61  degC
C 039 0014.15  degC
C 040 0014.76  degC
C 041 0014.31  degC
C 042 0014.54  degC
C 043 0014.34  degC
C 044 0014.34  degC
C 045 0014.01  degC
C 046 0013.87  degC
C 047 0013.12  degC
C 048 0013.99  degC
C 049 0014.03  degC
C 050 0014.43  degC
C 051 0014.34  degC
C 052 0014.07  degC
C 053 0014.48  degC
C 054 0014.60  degC
C 055 0014.66  degC
C 056 0014.81  degC
C 057 0014.56  degC
C 058 0014.70  degC
C 059 0014.55  degC
C 060 0014.99  degC
C 061 0014.76  degC
C 062 0014.77  degC
C 063 0014.40  degC
C 064 0014.55  degC
C 065 0014.32  degC
C 066 0014.53  degC
C 067 0014.26  degC
C 068 0014.23  degC
C 069 0013.67  degC
C 070 0013.21  degC
C 071 0013.83  degC
C 072 0014.44  degC
C 073 0014.53  degC
C 074 0014.86  degC
C 075 0014.77  degC
C 076 0015.14  degC
C 077 0014.99  degC
C 078 0015.29  degC
C 079 0014.98  degC
C 080 0015.17  degC
C 081 0014.42  degC
C 082 0014.73  degC
C 083 0014.55  degC
C 084 0014.85  degC
C 085 0014.43  degC
C 086 0014.25  degC
C 087 0014.17  degC
C 088 0014.52  degC
C 089 0014.06  degC
C 090 0014.43  degC
C 091 0014.11  degC
C 092 0014.09  degC
C 093 0016.44  degC
C 094 0017.61  degC
C 095 0017.13  degC
C 096 0017.58  degC
C 097 0017.17  degC
C 098 0017.11  degC
C 099 0017.37  degC
C 100 0017.90  degC
D T 1
********************
```

```
SCANNING   2.00000

CAL T.C3     -6.5144

TRA/B FACE  13.9952
             13.3748
TRA/B FACE  ~~[struck out]~~
             14.4422
INNER COND  ~~[struck out]~~

OUTER COND  14.5285

E T 1 10:46:10.2
C 001 0013.30  degC
C 002 0013.96  degC
C 003 0013.80  degC
C 004 0014.53  degC
C 005 0014.23  degC
C 006 0014.47  degC
C 007 0014.10  degC
C 008 0014.56  degC
C 009 0013.82  degC
C 010 0014.02  degC
C 011 0013.52  degC
C 012 0013.84  degC
C 013 0013.14  degC
C 014 0013.97  degC
C 015 0014.01  degC
C 016 0014.08  degC
C 017 0013.89  degC
C 018 0014.34  degC
C 019 0014.18  degC
C 020 0014.68  degC
C 021 0014.04  degC
C 022 0013.97  degC
C 023 0013.58  degC
C 025 0013.37  degC
C 026 0013.67  degC
C 027 0013.15  degC
C 028 0012.68  degC
C 029 0014.33  degC
C 030 0014.74  degC
C 031 0013.83  degC
C 032 0014.35  degC
C 033 0014.42  degC
C 034 0012.23  degC
C 035 0013.06  degC
— C 036 0015.14  degC
C 037 0014.48  degC
C 038 0014.83  degC
C 039 0014.15  degC
C 040 0014.79  degC
C 041 0014.30  degC
C 042 0014.58  degC
C 043 0014.37  degC
C 044 0014.38  degC
C 045 0014.01  degC
C 046 0013.89  degC
C 047 0013.18  degC
C 048 0014.06  degC
C 049 0014.07  degC
C 050 0014.43  degC
C 051 0014.35  degC
— C 052 0014.47  degC
C 053 0014.50  degC
C 054 0014.85  degC
C 055 0014.65  degC
C 056 0014.82  degC
C 057 0014.58  degC
C 058 0014.71  degC
C 059 0014.61  degC
C 060 0015.04  degC
C 061 0014.60  degC
C 062 0014.82  degC
C 063 0014.46  degC
C 064 0014.57  degC
C 065 0014.33  degC
C 066 0014.56  degC
C 067 0014.30  degC
C 068 0014.25  degC
C 069 0013.73  degC
C 070 0013.24  degC
C 071 0013.82  degC
C 072 0014.50  degC
C 073 0014.56  degC
C 074 0014.85  degC
C 075 0014.81  degC
C 076 0015.15  degC
C 077 0014.99  degC
C 078 0015.28  degC
C 079 0014.97  degC
C 080 0015.20  degC
C 081 0014.43  degC
C 082 0014.77  degC
C 083 0014.56  degC
C 084 0014.93  degC
C 085 0014.45  degC
C 086 0014.10  degC
C 087 0014.19  degC
C 088 0014.59  degC
C 089 0014.03  degC
C 090 0014.42  degC
C 091 0014.11  degC
C 092 0014.11  degC
C 093 0037.76  degC
C 094 0060.62  degC
C 095 0 46.15  degC
C 096 0u52.91  degC
C 097 0043.46  degC
C 098 0037.20  degC
C 099 0048.16  degC
C 100 0061.82  degC
D T 1
********************
```

```
SCAN-MINS)  0.00000
AL T.CI     100.680
TRA/B FACE: 13.9825
TRA/B FACE: 14.0020
INNER COND  14.0131
OUTER COND  14.5185

S T 1 10:50:10.2
C 001 0012.87  deC
C 002 0013.93  deC
C 003 0013.77  deC
C 004 0014.56  deC
C 005 0014.22  deC
C 006 0014.45  deC
C 007 0014.11  deC
C 008 0014.56  deC
C 009 0013.77  deC
C 010 0014.05  deC
C 011 0013.50  deC
C 012 0013.87  deC
C 013 0013.11  deC
C 014 0013.95  deC
C 015 0014.03  deC
C 016 0014.11  deC
C 017 0013.91  deC
C 018 0014.34  deC
C 019 0014.17  deC
C 020 0014.67  deC
C 021 0014.07  deC
C 022 0013.95  deC
C 023 0013.56  deC
C 025 0013.31  deC
C 026 0013.60  deC
C 027 0013.15  deC
C 028 0012.69  deC
C 029 0014.32  deC
C 030 0014.73  deC
C 031 0013.83  deC
C 032 0014.33  deC
C 033 0014.47  deC
C 034 0012.24  deC
C 035 0013.10  deC
C 036 0015.11  deC
C 037 0014.46  deC
C 038 0014.84  deC
C 039 0014.13  deC
C 040 0014.60  deC
C 041 0014.32  deC
C 042 0014.59  deC
C 043 0014.35  deC
C 044 0014.38  deC
C 045 0014.01  deC
C 046 0013.89  deC
C 047 0013.25  deC
C 048 0014.06  deC
C 049 0014.04  deC
C 050 0014.44  deC
C 051 0014.35  deC
C 052 0014.13  deC
C 053 0014.49  deC
C 054 0014.87  deC
C 055 0014.71  deC
C 056 0014.86  deC
C 057 0014.60  deC
C 058 0014.70  deC
C 059 0014.58  deC
C 060 0015.01  deC
C 061 0014.60  deC
C 062 0014.77  deC
C 063 0014.42  deC
C 064 0014.58  deC
C 065 0014.33  deC
C 066 0014.57  deC
C 067 0014.50  deC
C 068 0014.26  deC
C 069 0013.75  deC
C 070 0013.24  deC
C 071 0013.65  deC
C 072 0014.45  deC
C 073 0014.57  deC
C 074 0014.87  deC
C 075 0014.79  deC
C 076 0015.14  deC
C 077 0015.04  deC
C 078 0015.30  deC
C 079 0014.99  deC
C 080 0015.19  deC
C 081 0014.44  deC
C 082 0014.76  deC
C 083 0014.53  deC
C 084 0014.92  deC
C 085 0014.35  deC
C 086 0013.93  deC
C 087 0014.17  deC
C 088 0014.60  deC
C 089 0014.07  deC
C 090 0014.40  deC
C 091 0014.13  deC
C 092 0014.12  deC
C 093 0162.65  deC
C 094 0323.46  deC
C 095 0279.79  deC
C 096 0317.12  deC
C 097 0300.10  deC
C 098 0261.98  deC
C 099 0306.12  deC
C 100 0318.06  deC
D T 1
```

```
SCAN-MINS)  -.00000
AL T.CI     100.693
TRA/B FACE: 13.9561
TRA/B FACE: 14.0021
INNER COND  14.0134
OUTER COND  14.5166

S T 1 10:48:10.2
C 001 0012.66  deC
C 002 0013.90  deC
C 003 0013.73  deC
C 004 0014.53  deC
C 005 0014.18  deC
C 006 0014.41  deC
C 007 0014.09  deC
C 008 0014.53  deC
C 009 0013.77  deC
C 010 0013.98  deC
C 011 0013.47  deC
C 012 0013.80  deC
C 013 0013.07  deC
C 014 0013.93  deC
C 015 0013.99  deC
C 016 0014.09  deC
C 017 0013.88  deC
C 018 0014.31  deC
C 019 0014.15  deC
C 020 0014.68  deC
C 021 0014.04  deC
C 022 0013.98  deC
C 023 0013.55  deC
C 025 0013.28  deC
C 026 0013.59  deC
C 027 0013.11  deC
C 028 0012.68  deC
C 029 0014.31  deC
C 030 0014.72  deC
C 031 0013.83  deC
C 032 0014.32  deC
C 033 0014.45  deC
C 034 0012.22  deC
C 035 0013.06  deC
C 036 0015.14  deC
C 037 0014.46  deC
C 038 0014.83  deC
C 039 0014.14  deC
C 040 0014.79  deC
C 041 0014.30  deC
C 042 0014.57  deC
C 043 0014.36  deC
C 044 0014.39  deC
C 045 0014.00  deC
C 046 0013.89  deC
C 047 0013.20  deC
C 048 0014.05  deC
C 049 0014.03  deC
C 050 0014.42  deC
C 051 0014.35  deC
C 052 0014.33  deC
C 053 0014.49  deC
C 054 0014.83  deC
C 055 0014.67  deC
C 056 0014.82  deC
C 057 0014.58  deC
C 058 0014.71  deC
C 059 0014.59  deC
C 060 0015.01  deC
C 061 0014.78  deC
C 062 0014.79  deC
C 063 0014.46  deC
C 064 0014.54  deC
C 065 0014.31  deC
C 066 0014.56  deC
C 067 0014.30  deC
C 068 0014.24  deC
C 069 0013.73  deC
C 070 0013.24  deC
C 071 0013.83  deC
C 072 0014.44  deC
C 073 0014.52  deC
C 074 0014.83  deC
C 075 0014.80  deC
C 076 0015.13  deC
C 077 0015.00  deC
C 078 0015.26  deC
C 079 0014.98  deC
C 080 0015.20  deC
C 081 0014.45  deC
C 082 0014.81  deC
C 083 0014.56  deC
C 084 0014.91  deC
C 085 0014.45  deC
C 086 0014.31  deC
C 087 0014.20  deC
C 088 0014.59  deC
C 089 0014.07  deC
C 090 0014.40  deC
C 091 0014.11  deC
C 092 0014.13  deC
C 093 0158.51  deC
C 094 0173.37  deC
C 095 0144.43  deC
C 096 0166.30  deC
C 097 0143.60  deC
C 098 0119.48  deC
C 099 0150.42  deC
C 100 0175.41  deC
D T 1
```


SCAN MINS : 0.0000
AL T CS 502.611
TRA:B FACE: 13.9754
TRA B FACEV 13.0167
INNER COND 14.5185
OUTER COND 14.6365
S T 1 10:52:10.2
C 001 0012.74 dBC
C 002 0013.85 dBC
C 003 0013.72 dBC
C 004 0014.50 dBC
C 005 0014.13 dBC
C 006 0014.39 dBC
C 007 0014.11 dBC
C 008 0014.56 dBC
C 009 0013.76 dBC
C 010 0014.09 dBC
C 011 0013.53 dBC
C 012 0013.96 dBC
C 013 0013.05 dBC
C 014 0013.85 dBC
C 015 0014.04 dBC
C 016 0014.09 dBC
C 017 0013.95 dBC
C 018 0014.35 dBC
C 019 0014.22 dBC
C 020 0014.78 dBC
C 021 0014.07 dBC
C 022 0013.98 dBC
C 023 0013.60 dBC
C 025 0013.16 dBC
C 026 0013.54 dBC
C 027 0013.09 dBC
C 028 0012.66 dBC
C 029 0014.27 dBC
C 030 0014.69 dBC
C 031 0013.82 dBC
C 032 0014.31 dBC
C 033 0014.43 dBC
C 034 0012.22 dBC
C 035 0013.10 dBC
C 036 0015.37 dBC
C 037 0014.37 dBC
C 038 0014.76 dBC
C 039 0014.08 dBC
C 040 0014.75 dBC
C 041 0014.27 dBC
C 042 0014.57 dBC
C 043 0014.37 dBC
C 044 0014.42 dBC
C 045 0014.03 dBC
C 046 0013.91 dBC
C 047 0013.28 dBC
C 048 0014.26 dBC
C 049 0014.06 dBC
C 050 0014.48 dBC
C 051 0014.41 dBC
C 052 0014.54 dBC
C 053 0014.56 dBC
C 054 0014.94 dBC
C 055 0014.76 dBC
C 056 0014.81 dBC
C 057 0014.72 dBC
C 058 0014.63 dBC
C 059 0014.71 dBC
C 060 0015.17 dBC
C 061 0014.78 dBC
C 062 0014.78 dBC
C 063 0014.47 dBC
C 064 0014.59 dBC
C 065 0014.37 dBC
C 066 0014.61 dBC
C 067 0014.37 dBC
C 068 0014.39 dBC
C 069 0013.87 dBC
C 070 0013.37 dBC
C 071 0014.04 dBC
C 072 0014.62 dBC
C 073 0014.81 dBC
C 074 0014.96 dBC
C 075 0014.89 dBC
C 076 0015.24 dBC
C 077 0015.07 dBC
C 078 0015.35 dBC
C 079 0015.09 dBC
C 080 0015.25 dBC
C 081 0014.53 dBC
C 082 0014.87 dBC
C 083 0014.65 dBC
C 084 0015.05 dBC
C 085 0014.44 dBC
C 086 0014.25 dBC
C 087 0014.26 dBC
C 088 0014.72 dBC
C 089 0014.19 dBC
C 090 0014.56 dBC
C 091 0014.26 dBC
C 092 0014.28 dBC
C 093 0495.51 dBC
C 094 0513.55 dBC
C 095 0459.69 dBC
C 096 0525.53 dBC
C 097 0498.44 dBC
C 098 0486.44 dBC
C 099 0509.16 dBC
C 100 0536.15 dBC
D T 1
SCAN MINS : 10.0000
AL T CS 559.479
TRA:B FACE: 14.0209
TRA B FACEV 13.1038
INNER COND 14.7047
OUTER COND 14.8758
S T 1 10:54:10.2
C 001 0012.96 dBC
C 002 0013.96 dBC
C 003 0013.88 dBC
C 004 0014.66 dBC
C 005 0014.38 dBC
C 006 0014.51 dBC
C 007 0014.20 dBC
C 008 0014.62 dBC
C 009 0013.79 dBC
C 010 0014.06 dBC
C 011 0013.48 dBC
C 012 0013.82 dBC
C 013 0013.16 dBC
C 014 0014.01 dBC
C 015 0014.05 dBC
C 016 0014.10 dBC
C 017 0013.95 dBC
C 018 0014.34 dBC
C 019 0014.18 dBC
C 020 0014.73 dBC
C 021 0014.04 dBC
C 022 0013.98 dBC
C 023 0013.56 dBC
C 025 0013.41 dBC
C 026 0013.73 dBC
C 027 0013.24 dBC
C 028 0012.81 dBC
C 029 0014.40 dBC
C 030 0014.80 dBC
C 031 0013.94 dBC
C 032 0014.42 dBC
C 033 0014.50 dBC
C 034 0012.24 dBC
C 035 0013.06 dBC
C 036 0015.53 dBC
C 037 0014.53 dBC
C 038 0014.88 dBC
C 039 0014.12 dBC
C 040 0014.80 dBC
C 041 0014.39 dBC
C 042 0014.62 dBC
C 043 0014.45 dBC
C 044 0014.46 dBC
C 045 0014.03 dBC
C 046 0013.88 dBC
C 047 0013.22 dBC
C 048 0014.08 dBC
C 049 0014.12 dBC
C 050 0014.49 dBC
C 051 0014.43 dBC
C 052 0014.72 dBC
C 053 0014.56 dBC
C 054 0014.91 dBC
C 055 0014.68 dBC
C 056 0014.87 dBC
C 057 0014.60 dBC
C 058 0014.76 dBC
C 059 0014.64 dBC
C 060 0014.97 dBC
C 061 0014.67 dBC
C 062 0014.67 dBC
C 063 0014.55 dBC
C 064 0014.65 dBC
C 065 0014.42 dBC
C 066 0014.62 dBC
C 067 0014.32 dBC
C 068 0014.25 dBC
C 069 0013.75 dBC
C 070 0013.23 dBC
C 071 0013.91 dBC
C 072 0014.46 dBC
C 073 0014.63 dBC
C 074 0014.93 dBC
C 075 0014.81 dBC
C 076 0015.23 dBC
C 077 0015.03 dBC
C 078 0015.28 dBC
C 079 0015.07 dBC
C 080 0015.23 dBC
C 081 0014.51 dBC
C 082 0014.82 dBC
C 083 0014.58 dBC
C 084 0014.96 dBC
C 085 0014.47 dBC
C 086 0014.21 dBC
C 087 0014.20 dBC
C 088 0014.66 dBC
C 089 0014.17 dBC
C 090 0014.48 dBC
C 091 0014.09 dBC
C 092 0014.13 dBC
C 093 0591.27 dBC
C 094 0572.32 dBC
C 095 0540.09 dBC
C 096 0566.08 dBC
C 097 0559.50 dBC
C 098 0535.85 dBC
C 099 0551.08 dBC
C 100 0559.50 dBC
D T 1

SCAN-MIN: 12.0000

AL T.C8 537.280

TRA/B FACE: 14.0476

TRA/B FACE: [illegible]

INNER COND [illegible]

OUTER COND 14.6242

```
S T 1 10:58:10.2
C 001 0012.76  dBC
C 002 0013.87  dBC
C 003 0013.85  dBC
C 004 0014.57  dBC
C 005 0014.34  dBC
C 006 0014.51  dBC
C 007 0014.23  dBC
C 008 0014.66  dBC
C 009 0013.85  dBC
C 010 0014.08  dBC
C 011 0013.58  dBC
C 012 0013.92  dBC
C 013 0013.16  dBC
C 014 0014.03  dBC
C 015 0014.10  dBC
C 016 0014.17  dBC
C 017 0014.02  dBC
C 018 0014.45  dBC
C 019 0014.29  dBC
C 020 0014.79  dBC
C 021 0014.17  dBC
C 022 0014.01  dBC
C 023 0013.59  dBC
C 025 0013.29  dBC
C 026 0013.73  dBC
C 027 0013.30  dBC
C 028 0012.91  dBC
C 029 0014.47  dBC
C 030 0014.84  dBC
C 031 0013.96  dBC
C 032 0014.47  dBC
C 033 0014.52  dBC
C 034 0012.29  dBC
C 035 0013.04  dBC
C 036 0015.88  dBC
C 037 0014.47  dBC
C 038 0014.81  dBC
C 039 0014.14  dBC
C 040 0014.85  dBC
C 041 0014.60  dBC
C 042 0014.13  dBC
C 043 0014.55  dBC
C 044 0014.51  dBC
C 045 0014.06  dBC
C 046 0013.84  dBC
C 047 0013.25  dBC
C 048 0014.17  dBC
C 049 0014.09  dBC
C 050 0014.51  dBC
C 051 0014.48  dBC
C 052 0014.90  dBC
C 053 0014.62  dBC
C 054 0014.93  dBC
C 055 0014.71  dBC
C 056 0014.87  dBC
C 057 0014.60  dBC
C 058 0014.60  dBC
C 059 0014.66  dBC
C 060 0015.07  dBC
C 061 0014.77  dBC
C 062 0014.84  dBC
C 063 0014.53  dBC
C 064 0014.65  dBC
C 065 0014.39  dBC
C 066 0014.62  dBC
C 067 0014.31  dBC
C 068 0014.29  dBC
C 069 0013.75  dBC
C 070 0013.21  dBC
C 071 0014.00  dBC
C 072 0014.61  dBC
C 073 0014.68  dBC
C 074 0014.99  dBC
C 075 0014.99  dBC
C 076 0015.27  dBC
C 077 0015.06  dBC
C 078 0015.30  dBC
C 079 0015.12  dBC
C 080 0015.24  dBC
C 081 0014.56  dBC
C 082 0014.84  dBC
C 083 0014.61  dBC
C 084 0015.00  dBC
C 085 0014.42  dBC
C 086 0014.62  dBC
C 087 0014.27  dBC
C 088 0014.61  dBC
C 089 0014.24  dBC
C 090 0014.50  dBC
C 091 0014.09  dBC
C 092 0014.12  dBC
C 093 0636.87  dBC
C 094 0596.22  dBC
C 095 0571.64  dBC
C 096 0593.92  dBC
C 097 0583.59  dBC
C 098 0558.56  dBC
C 099 0576.09  dBC
C 100 0582.13  dBC
D T 1
**********
```

SCAN-MIN: 14.0000

AL T.C8 650.[illegible]

TRA/B FACE: 14.1627

TRA/B FACE: [illegible]

INNER COND [illegible]

OUTER COND 14.7991

```
S T 1 10:58:10.2
C 001 0012.81  dBC
C 002 0014.00  dBC
C 003 0014.06  dBC
C 004 0014.74  dBC
C 005 0014.63  dBC
C 006 0014.68  dBC
C 007 0014.60  dBC
C 008 0014.77  dBC
C 009 0013.92  dBC
C 010 0014.20  dBC
C 011 0013.68  dBC
C 012 0013.93  dBC
C 013 0013.32  dBC
C 014 0014.22  dBC
C 015 0014.22  dBC
C 016 0014.27  dBC
C 017 0014.12  dBC
C 018 0014.61  dBC
C 019 0014.45  dBC
C 020 0014.98  dBC
C 021 0014.44  dBC
C 022 0014.13  dBC
C 023 0013.54  dBC
C 025 0013.44  dBC
C 026 0014.02  dBC
C 027 0013.54  dBC
C 028 0013.19  dBC
C 029 0014.78  dBC
C 030 0015.11  dBC
C 031 0014.17  dBC
C 032 0014.67  dBC
C 033 0014.66  dBC
C 034 0012.38  dBC
C 035 0013.10  dBC
C 036 0015.96  dBC
C 037 0014.58  dBC
C 038 0014.90  dBC
C 039 0014.22  dBC
C 040 0015.00  dBC
C 041 0015.02  dBC
C 042 0015.01  dBC
C 043 0014.79  dBC
C 044 0014.77  dBC
C 045 0014.21  dBC
C 046 0013.89  dBC
C 047 0013.27  dBC
C 048 0014.23  dBC
C 049 0014.25  dBC
C 050 0014.73  dBC
C 051 0014.69  dBC
C 052 0015.05  dBC
C 053 0014.78  dBC
C 054 0015.07  dBC
C 055 0014.78  dBC
C 056 0014.94  dBC
C 057 0014.70  dBC
C 058 0014.91  dBC
C 059 0014.80  dBC
C 060 0015.15  dBC
C 061 0014.95  dBC
C 062 0015.01  dBC
C 063 0014.73  dBC
C 064 0014.89  dBC
C 065 0014.64  dBC
C 066 0014.85  dBC
C 067 0014.51  dBC
C 068 0014.53  dBC
C 069 0013.86  dBC
C 070 0013.23  dBC
C 071 0014.17  dBC
C 072 0014.80  dBC
C 073 0014.86  dBC
C 074 0015.22  dBC
C 075 0015.24  dBC
C 076 0015.48  dBC
C 077 0015.22  dBC
C 078 0015.38  dBC
C 079 0015.29  dBC
C 080 0015.32  dBC
C 081 0014.67  dBC
C 082 0014.94  dBC
C 083 0014.76  dBC
C 084 0015.14  dBC
C 085 0014.64  dBC
C 086 0014.85  dBC
C 087 0014.53  dBC
C 088 0014.93  dBC
C 089 0014.57  dBC
C 090 0014.76  dBC
C 091 0014.40  dBC
C 092 0014.30  dBC
C 093 0666.1   dBC
C 094 0646.44  dBC
C 095 0645.93  dBC
C 096 0687.3   dBC
C 097 0635.96  dBC
C 098 0618.89  dBC
C 099 0640.34  dBC
C 100 0662.08  dBC
D T 1
**********
```

```
 ICAN-MINS:  15.0000

 AL T CE     419.672

 TRA/B FACE: 14.4464

 TRA/B FACE: 15.0155

 INNER COND  15.0697

 OUTER COND  15.1674

 S T 1 11:00:10.2
 C 001 0012.88  dBC
 C 002 0014.13  dBC
 C 003 0014.47  dBC
 C 004 0015.09  dBC
 C 005 0015.10  dBC
 C 006 0015.07  dBC
 C 007 0014.74  dBC
 C 008 0015.02  dBC
 C 009 0014.20  dBC
 C 010 0014.53  dBC
 C 011 0013.98  dBC
 C 012 0014.15  dBC
 C 013 0013.65  dBC
 C 014 0014.59  dBC
 C 015 0014.56  dBC
 C 016 0014.47  dBC
 C 017 0014.46  dBC
 C 018 0014.89  dBC
 C 019 0014.89  dBC
 C 020 0015.48  dBC
 C 021 0015.02  dBC
 C 022 0014.40  dBC
 C 023 0013.57  dBC
 C 025 0013.65  dBC
 C 026 0014.56  dBC
 C 027 0014.04  dBC
 C 028 0013.64  dBC
 C 029 0015.27  dBC
 C 030 0015.58  dBC
 C 031 0014.53  dBC
 C 032 0015.02  dBC
 C 033 0014.93  dBC
 C 034 0012.63  dBC
 C 035 0013.16  dBC
 C 036 0015.95  dBC
 C 037 0014.86  dBC
 C 038 0015.12  dBC
 C 039 0014.40  dBC
 C 040 0015.29  dBC
 C 041 0015.70  dBC
 C 042 0015.49  dBC
 C 043 0015.30  dBC
 C 044 0015.29  dBC
 C 045 0014.48  dBC
 C 046 0013.91  dBC
 C 047 0013.33  dBC
 C 048 0014.60  dBC
 C 049 0014.61  dBC
 C 050 0015.16  dBC
 C 051 0015.15  dBC
 C 052 0015.32  dBC
 C 053 0015.12  dBC
 C 054 0015.41  dBC
 C 055 0015.01  dBC
 C 056 0015.22  dBC
 C 057 0014.96  dBC
 C 058 0015.17  dBC
 C 059 0015.09  dBC
 C 060 0015.55  dBC
 C 061 0015.22  dBC
 C 062 0015.37  dBC
 C 063 0015.13  dBC
 C 064 0015.20  dBC
 C 065 0015.08  dBC
 C 066 0015.35  dBC
 C 067 0014.95  dBC
 C 068 0014.99  dBC
 C 069 0014.82  dBC
 C 070 0013.29  dBC
 C 071 0014.55  dBC
 C 072 0015.27  dBC
 C 073 0015.36  dBC
 C 074 0015.75  dBC
 C 075 0015.70  dBC
 C 076 0015.91  dBC
 C 077 0015.59  dBC
 C 078 0015.67  dBC
 C 079 0015.56  dBC
 C 080 0015.55  dBC
 C 081 0014.94  dBC
 C 082 0015.15  dBC
 C 083 0015.12  dBC
 C 084 0015.49  dBC
 C 085 0014.96  dBC
 C 086 0014.87  dBC
 C 087 0015.01  dBC
 C 088 0015.32  dBC
 C 089 0015.13  dBC
 C 090 0015.24  dBC
 C 091 0014.86  dBC
 C 092 0014.50  dBC
 C 093 00685.5  dBC
 C 094 00682.9  dBC
 C 095 00693.8  dBC
 C 096 00732.5  dBC
 C 097 00673.6  dBC
 C 099 0664.67  dBC
 C 099 00682.0  dBC
 C 100 00702.0  dBC
 D T 1
```

```
 ICAN-MINS:  19.0000

 AL T CE     711.467

 TRA/B FACE: 15.0181

 TRA/B FACE: 15.2247

 INNER COND  15.6406

 OUTER COND  15.8249

 S T 1 11:02:10.2
 C 001 0012.65  dBC
 C 002 0014.29  dBC
 C 003 0015.09  dBC
 C 004 0015.63  dBC
 C 005 0015.82  dBC
 C 006 0015.63  dBC
 C 007 0015.25  dBC
 C 008 0015.47  dBC
 C 009 0014.64  dBC
 C 010 0015.08  dBC
 C 011 0014.53  dBC
 C 012 0014.44  dBC
 C 013 0014.18  dBC
 C 014 0015.25  dBC
 C 015 0015.20  dBC
 C 016 0014.94  dBC
 C 017 0015.03  dBC
 C 018 0015.69  dBC
 C 019 0015.62  dBC
 C 020 0016.32  dBC
 C 021 0015.99  dBC
 C 022 0014.93  dBC
 C 023 0013.65  dBC
 C 025 0013.97  dBC
 C 026 0015.38  dBC
 C 027 0014.65  dBC
 C 028 0014.34  dBC
 C 029 0016.10  dBC
 C 030 0016.37  dBC
 C 031 0015.11  dBC
 C 032 0015.66  dBC
 C 033 0015.50  dBC
 C 034 0013.10  dBC
 C 035 0013.39  dBC
 C 036 0015.94  dBC
 C 037 0015.35  dBC
 C 038 0015.56  dBC
 C 039 0014.67  dBC
 C 040 0015.83  dBC
 C 041 0016.70  dBC
 C 042 0016.33  dBC
 C 043 0016.16  dBC
 C 044 0016.28  dBC
 C 045 0015.05  dBC
 C 046 0013.95  dBC
 C 047 0013.40  dBC
 C 048 0015.18  dBC
 C 049 0015.25  dBC
 C 050 0015.96  dBC
 C 051 0015.94  dBC
 C 052 0015.73  dBC
 C 053 0015.76  dBC
 C 054 0016.04  dBC
 C 055 0015.51  dBC
 C 056 0015.77  dBC
 C 057 0015.46  dBC
 C 058 0015.73  dBC
 C 059 0015.67  dBC
 C 060 0016.18  dBC
 C 061 0015.82  dBC
 C 062 0016.07  dBC
 C 063 0015.86  dBC
 C 064 0016.08  dBC
 C 065 0015.90  dBC
 C 066 0016.23  dBC
 C 067 0015.76  dBC
 C 068 0015.79  dBC
 C 069 0014.30  dBC
 C 070 0013.27  dBC
 C 071 0015.26  dBC
 C 072 0016.07  dBC
 C 073 0016.15  dBC
 C 074 0016.57  dBC
 C 075 0016.52  dBC
 C 076 0016.56  dBC
 C 077 0016.24  dBC
 C 078 0016.16  dBC
 C 079 0016.17  dBC
 C 080 0016.01  dBC
 C 081 0015.39  dBC
 C 082 0015.55  dBC
 C 083 0015.76  dBC
 C 084 0016.13  dBC
 C 085 0015.62  dBC
 C 086 0015.01  dBC
 C 087 0015.91  dBC
 C 088 0016.24  dBC
 C 089 0016.20  dBC
 C 090 0016.22  dBC
 C 091 0015.81  dBC
 C 092 0014.97  dBC
 C 093 00702.4  dBC
 C 094 00704.6  dBC
 C 095 00718.6  dBC
 C 096 00753.5  dBC
 C 097 00695.3  dBC
 C 098 00689.4  dBC
 C 099 00704.9  dBC
 C 100 00722.7  dBC
 D T 1
```

SCAN MINS: 20.0000

AMBIENT: T22.196

TRA/B FACE1: 15.8715

TRA/B FACE2: 15.4727

INNER COND 15.4750

OUTER COND 16.8415

S T 1 11:04:10.2
C 001 0012.72 dbC
C 002 0014.61 dbC
C 003 0016.45 dbC
C 004 0016.60 dbC
C 005 0016.92 dbC
C 006 0016.63 dbC
C 007 0016.16 dbC
C 008 0016.19 dbC
C 009 0015.46 dbC
C 010 0016.01 dbC
C 011 0015.42 dbC
C 012 0014.98 dbC
C 013 0015.14 dbC
C 014 0016.21 dbC
C 015 0016.18 dbC
C 016 0015.69 dbC
C 017 0015.89 dbC
C 018 0016.69 dbC
C 019 0016.67 dbC
C 020 0017.53 dbC
C 021 0017.39 dbC
C 022 0015.69 dbC
C 023 0013.67 dbC
C 025 0014.70 dbC
C 026 0016.70 dbC
C 027 0016.08 dbC
C 028 0015.37 dbC
C 029 0017.38 dbC
C 030 0017.57 dbC
C 031 0016.06 dbC
C 032 0016.64 dbC
C 033 0016.37 dbC
C 034 0013.87 dbC
C 035 0013.80 dbC
C 036 0015.34 dbC
C 037 0016.27 dbC
C 038 0016.34 dbC
C 039 0015.21 dbC
C 040 0016.68 dbC
C 041 0018.10 dbC
C 042 0017.51 dbC
C 043 0017.39 dbC
C 044 0017.67 dbC
C 045 0015.82 dbC
C 046 0014.01 dbC
C 047 0013.67 dbC
C 048 0016.03 dbC
C 049 0016.38 dbC
C 050 0017.29 dbC
C 051 0017.25 dbC
C 052 0015.95 dbC
C 053 0016.77 dbC
C 054 0017.05 dbC
C 055 0016.35 dbC
C 056 0016.74 dbC
C 057 0016.26 dbC
C 058 0016.57 dbC
C 059 0016.57 dbC
C 060 0017.18 dbC
C 061 0016.82 dbC
C 062 0017.27 dbC
C 063 0017.04 dbC
C 064 0017.30 dbC
C 065 0017.22 dbC
C 066 0017.70 dbC
C 067 0017.62 dbC
C 068 0016.95 dbC
C 069 0014.70 dbC
C 070 0013.48 dbC
C 071 0016.26 dbC
C 072 0017.38 dbC
C 073 0017.49 dbC
C 074 0017.91 dbC
C 075 0017.75 dbC
C 076 0017.64 dbC
C 077 0017.24 dbC
C 078 0017.05 dbC
C 079 0017.12 dbC
C 080 0016.77 dbC
C 081 0016.13 dbC
C 082 0016.27 dbC
C 083 0016.82 dbC
C 084 0017.16 dbC
C 085 0016.77 dbC
C 086 0015.37 dbC
C 087 0017.12 dbC
C 088 0017.52 dbC
C 089 0017.80 dbC
C 090 0017.63 dbC
C 091 0017.07 dbC
C 092 0015.53 dbC
C 093 00712.1 dbC
C 094 00716.5 dbC
C 095 00729.7 dbC
C 096 00761.7 dbC
C 097 00705.7 dbC
C 098 00704.3 dbC
C 099 00719.2 dbC
C 100 00729.7 dbC
D T 1

SCAN MINS: 22.0000

AMBIENT: T40.373

TRA/B FACE1: 17.0800

TRA/B FACE2: 17.2775

INNER COND 18.0517

OUTER COND 18.2844

S T 1 11:06:10.2
C 001 0012.70 dbC
C 002 0015.52 dbC
C 003 0017.67 dbC
C 004 0017.96 dbC
C 005 0018.39 dbC
C 006 0018.05 dbC
C 007 0017.27 dbC
C 008 0017.14 dbC
C 009 0016.69 dbC
C 010 0017.43 dbC
C 011 0016.68 dbC
C 012 0015.89 dbC
C 013 0016.46 dbC
C 014 0017.83 dbC
C 015 0017.57 dbC
C 016 0016.80 dbC
C 017 0017.16 dbC
C 018 0018.20 dbC
C 019 0018.19 dbC
C 020 0019.25 dbC
C 021 0019.33 dbC
C 022 0018.82 dbC
C 023 0013.76 dbC
C 025 0015.60 dbC
C 026 0018.31 dbC
C 027 0017.62 dbC
C 028 0016.45 dbC
C 029 0018.97 dbC
C 030 0019.12 dbC
C 031 0017.22 dbC
C 032 0017.85 dbC
C 033 0017.63 dbC
C 034 0014.94 dbC
C 035 0014.58 dbC
C 036 0014.50 dbC
C 037 0017.44 dbC
C 038 0017.37 dbC
C 039 0015.99 dbC
C 040 0017.83 dbC
C 041 0019.81 dbC
C 042 0019.01 dbC
C 043 0018.95 dbC
C 044 0019.53 dbC
C 045 0016.93 dbC
C 046 0014.08 dbC
C 047 0013.98 dbC
C 048 0017.40 dbC
C 049 0017.94 dbC
C 050 0019.15 dbC
C 051 0019.06 dbC
C 052 0015.99 dbC
C 053 0018.20 dbC
C 054 0018.60 dbC
C 055 0017.88 dbC
C 056 0018.34 dbC
C 057 0017.71 dbC
C 058 0017.76 dbC
C 059 0017.85 dbC
C 060 0018.84 dbC
C 061 0018.32 dbC
C 062 0018.88 dbC
C 063 0018.63 dbC
C 064 0019.05 dbC
C 065 0019.11 dbC
C 066 0019.75 dbC
C 067 0018.79 dbC
C 068 0018.56 dbC
C 069 0015.30 dbC
C 070 0013.67 dbC
C 071 0017.69 dbC
C 072 0019.16 dbC
C 073 0019.55 dbC
C 074 0019.81 dbC
C 075 0019.41 dbC
C 076 0019.14 dbC
C 077 0018.80 dbC
C 078 0018.45 dbC
C 079 0018.44 dbC
C 080 0017.79 dbC
C 081 0017.11 dbC
C 082 0017.27 dbC
C 083 0018.36 dbC
C 084 0018.68 dbC
C 085 0018.43 dbC
C 086 0015.73 dbC
C 087 0018.79 dbC
C 088 0019.34 dbC
C 089 0019.92 dbC
C 090 0019.57 dbC
C 091 0018.82 dbC
C 092 0016.35 dbC
C 093 00743.7 dbC
C 094 00739.4 dbC
C 095 00757.3 dbC
C 096 00775.2 dbC
C 097 00720.2 dbC
C 098 00719.8 dbC
C 099 00738.3 dbC
C 100 00736.6 dbC
D T 1

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**********

SCAN-MINS:  24.0000

AL T.CS     762.816

TRA:B FACE: 18.7199

TRA:B FACE: 18.1877

INNER COND  18.3910

OUTER COND  20.1512

S T 1 11:08:10.2
C 001 0012.61  d▶C
C 002 0016.70  d▶C
C 003 0019.61  d▶C
C 004 0019.85  d▶C
C 005 0020.43  d▶C
C 006 0019.97  d▶C
C 007 0018.97  d▶C
C 008 0018.58  d▶C
C 009 0018.36  d▶C
C 010 0019.39  d▶C
C 011 0018.35  d▶C
C 012 0016.95  d▶C
C 013 0018.38  d▶C
C 014 0019.92  d▶C
C 015 0019.45  d▶C
C 016 0018.29  d▶C
C 017 0018.86  d▶C
C 018 0020.14  d▶C
C 019 0020.26  d▶C
C 020 0021.57  d▶C
C 021 0021.71  d▶C
C 022 0018.50  d▶C
C 023 0013.91  d▶C
C 025 0017.07  d▶C
C 026 0020.40  d▶C
C 027 0019.62  d▶C
C 028 0018.08  d▶C
C 029 0021.16  d▶C
C 030 0021.20  d▶C
C 031 0018.89  d▶C
C 032 0019.63  d▶C
C 033 0019.40  d▶C
C 034 0016.37  d▶C
C 035 0015.59  d▶C
C 036 0012.95  d▶C —
C 037 0019.22  d▶C
C 038 0018.92  d▶C
C 039 0017.20  d▶C
C 040 0019.49  d▶C
C 041 0022.05  d▶C
C 042 0021.05  d▶C
C 043 0021.08  d▶C
C 044 0022.06  d▶C
C 045 0018.53  d▶C
C 046 0014.19  d▶C
C 047 0014.42  d▶C
C 048 0019.06  d▶C
C 049 0020.07  d▶C
C 050 0021.46  d▶C
C 051 0021.43  d▶C
C 052 0016.36  d▶C —
C 053 0020.10  d▶C
C 054 0020.61  d▶C
C 055 0019.76  d▶C
C 056 0020.41  d▶C
C 057 0019.48  d▶C
C 058 0019.40  d▶C
C 059 0019.62  d▶C
C 060 0020.84  d▶C
C 061 0020.41  d▶C
C 062 0021.07  d▶C
C 063 0020.88  d▶C
C 064 0021.31  d▶C
C 065 0021.55  d▶C
C 066 0022.37  d▶C
C 067 0021.10  d▶C
C 068 0020.58  d▶C
C 069 0016.05  d▶C
C 070 0014.23  d▶C
C 071 0019.45  d▶C
C 072 0021.34  d▶C
C 073 0022.01  d▶C
C 074 0022.18  d▶C
C 075 0021.58  d▶C
C 076 0021.09  d▶C
C 077 0020.69  d▶C
C 078 0020.25  d▶C
C 079 0020.30  d▶C
C 080 0019.27  d▶C
C 081 0018.61  d▶C
C 082 0018.74  d▶C
C 083 0020.49  d▶C
C 084 0020.72  d▶C
C 085 0020.51  d▶C
C 086 0016.08  d▶C
C 087 0020.94  d▶C
C 088 0021.72  d▶C
C 089 0022.65  d▶C
C 090 0022.04  d▶C
C 091 0021.01  d▶C
C 092 0017.50  d▶C
C 093 00773.6  d▶C
C 094 00763.7  d▶C
C 095 00784.8  d▶C
C 096 00796.4  d▶C
C 097 00740.8  d▶C
C 098 00738.7  d▶C
C 099 00748.3  d▶C
C 100 00755.9  d▶C
D T 1
**********

SCAN-MINS:  26.0000

AL T.CS     784.203

TRA:B FACE: 21.0884

TRA:B FACE: 20.5878

INNER COND  18.5147

OUTER COND  22.7814

S T 1 11:10:10.2
C 001 0012.98  d▶C
C 002 0018.46  d▶C
C 003 0022.13  d▶C
C 004 0022.27  d▶C
C 005 0023.09  d▶C
C 006 0022.65  d▶C
C 007 0021.41  d▶C
C 008 0020.78  d▶C
C 009 0020.88  d▶C
C 010 0022.18  d▶C
C 011 0020.70  d▶C
C 012 0018.94  d▶C
C 013 0021.01  d▶C
C 014 0022.73  d▶C
C 015 0022.10  d▶C
C 016 0020.54  d▶C
C 017 0021.31  d▶C
C 018 0022.92  d▶C
C 019 0023.16  d▶C
C 020 0024.71  d▶C
C 021 0024.91  d▶C
C 022 0020.74  d▶C
C 023 0014.36  d▶C
C 025 0019.07  d▶C
C 026 0022.98  d▶C
C 027 0022.29  d▶C
C 028 0020.12  d▶C
C 029 0024.09  d▶C
C 030 0023.99  d▶C
C 031 0021.17  d▶C
C 032 0022.12  d▶C
C 033 0021.84  d▶C
C 034 0018.48  d▶C
C 035 0017.29  d▶C
C 036 0010.98  d▶C —
C 037 0021.63  d▶C
C 038 0021.12  d▶C
C 039 0018.96  d▶C
C 040 0021.88  d▶C
C 041 0024.97  d▶C
C 042 0023.70  d▶C
C 043 0023.82  d▶C
C 044 0025.23  d▶C
C 045 0020.72  d▶C
C 046 0014.61  d▶C
C 047 0015.31  d▶C
C 048 0021.70  d▶C
C 049 0022.98  d▶C
C 050 0024.59  d▶C
C 051 0024.64  d▶C
C 052 0015.70  d▶C —
C 053 0022.83  d▶C
C 054 0023.45  d▶C
C 055 0022.53  d▶C
C 056 0023.32  d▶C
C 057 0022.06  d▶C
C 058 0021.80  d▶C
C 059 0022.16  d▶C
C 060 0023.76  d▶C
C 061 0023.24  d▶C
C 062 0024.00  d▶C
C 063 0023.76  d▶C
C 064 0024.36  d▶C
C 065 0024.79  d▶C
C 066 0025.63  d▶C
C 067 0024.22  d▶C
C 068 0023.39  d▶C
C 069 0017.34  d▶C
C 070 0014.98  d▶C
C 071 0022.01  d▶C
C 072 0024.48  d▶C
C 073 0025.45  d▶C
C 074 0025.49  d▶C
C 075 0024.60  d▶C
C 076 0023.85  d▶C
C 077 0023.46  d▶C
C 078 0022.89  d▶C
C 079 0022.92  d▶C
C 080 0021.55  d▶C
C 081 0020.74  d▶C
C 082 0020.88  d▶C
C 083 0023.36  d▶C
C 084 0023.57  d▶C
C 085 0023.39  d▶C
C 086 0016.87  d▶C
C 087 0023.85  d▶C
C 088 0024.91  d▶C
C 089 0026.17  d▶C
C 090 0025.37  d▶C
C 091 0023.94  d▶C
C 092 0019.17  d▶C
C 093 00788.2  d▶C
C 094 00791.9  d▶C
C 095 00799.3  d▶C
C 096 00815.1  d▶C
C 097 00772.4  d▶C
C 098 00768.8  d▶C
C 099 00769.2  d▶C
C 100 00776.4  d▶C
D T 1
**********
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SCAN-MINS-  28.0000

UL T.C#     TP6.228

TRA/B FACE( 20.7689

TRA/B FACEV 24 [illegible]
            25

INNER COND  24 8253
            25

OUTER COND  25.6184

$ T 1 11:12:13.2
C 001 0013.27  d#C
C 002 0020.69  d#C
C 003 0025.37  d#C
C 004 0027.13  d#C
C 005 0026.16  d#C
C 006 0025.71  d#C
C 007 0024.26  d#C
C 008 0023.26  d#C
C 009 0023.78  d#C
C 010 0025.09  d#C
C 011 0023.34  d#C
C 012 0020.82  d#C
C 013 0024.20  d#C
C 014 0025.95  d#C
C 015 0025.13  d#C
C 016 0023.11  d#C
C 017 0024.19  d#C
C 018 0026.07  d#C
C 019 0026.35  d#C
C 020 0028.17  d#C
C 021 0028.45  d#C
C 022 0023.37  d#C
C 023 0014.70  d#C
C 025 0021.73  d#C
C 026 0026.03  d#C
C 027 0025.39  d#C
C 028 0022.52  d#C
C 029 0027.45  d#C
C 030 0027.24  d#C
C 031 0023.77  d#C
C 032 0025.07  d#C
C 033 0024.66  d#C
C 034 0020.90  d#C
C 035 0019.29  d#C
C 036 0008.12  d#C
C 037 0024.57  d#C
C 038 0023.79  d#C
C 039 0021.13  d#C
C 040 0024.56  d#C
C 041 0028.24  d#C
C 042 0026.73  d#C
C 043 0026.85  d#C
C 044 0028.70  d#C
C 045 0023.29  d#C
C 046 0014.90  d#C
C 047 0016.15  d#C
C 048 0024.59  d#C
C 049 0026.54  d#C
C 050 0028.07  d#C
C 051 0028.16  d#C
C 052 0016.89  d#C
C 053 0025.91  d#C
C 054 0026.49  d#C
C 055 0025.46  d#C
C 056 0026.43  d#C
C 057 0024.79  d#C
C 058 0024.45  d#C
C 059 0024.93  d#C
C 060 0026.76  d#C
C 061 0026.47  d#C
C 062 0027.28  d#C
C 063 0026.99  d#C
C 064 0027.68  d#C
C 065 0028.34  d#C
C 066 0029.59  d#C
C 067 0027.66  d#C
C 068 0026.56  d#C
C 069 0018.78  d#C
C 070 0015.78  d#C
C 071 0024.92  d#C
C 072 0027.92  d#C
C 073 0029.13  d#C
C 074 0029.02  d#C
C 075 0027.91  d#C
C 076 0026.77  d#C
C 077 0026.39  d#C
C 078 0025.74  d#C
C 079 0025.92  d#C
C 080 0024.14  d#C
C 081 0023.18  d#C
C 082 0023.27  d#C
C 083 0026.36  d#C
C 084 0026.56  d#C
C 085 0026.53  d#C
C 086 0017.62  d#C
C 087 0026.96  d#C
C 088 0028.21  d#C
C 089 0029.96  d#C
C 090 0028.88  d#C
C 091 0027.04  d#C
C 092 0021.02  d#C
C 093 00793.5  d#C
C 094 00818.5  d#C
C 095 00802.2  d#C
C 096 00820.4  d#C
C 097 00796.9  d#C
C 098 00775.7  d#C
C 099 00783.5  d#C
C 100 00786.9  d#C
D T 1
```

```
SCAN-MINS-  30.0000

UL T.C#     806.022

TRA/B FACE( 26.9262

TRA/B FACEV 27 3611
            28

INNER COND  24 2205
            28

OUTER COND  28.6857

$ T 2 11:14:10.2
C 001 0013.61  d#C
C 002 0023.34  d#C
C 003 0028.74  d#C
C 004 0028.48  d#C
C 005 0029.56  d#C
C 006 0029.30  d#C
C 007 0027.61  d#C
C 008 0026.25  d#C
C 009 0027.28  d#C
C 010 0028.62  d#C
C 011 0026.56  d#C
C 012 0023.54  d#C
C 013 0027.90  d#C
C 014 0029.56  d#C
C 015 0028.66  d#C
C 016 0026.26  d#C
C 017 0027.61  d#C
C 018 0029.86  d#C
C 019 0030.11  d#C
C 020 0032.19  d#C
C 021 0032.48  d#C
C 022 0026.47  d#C
C 023 0015.25  d#C
C 025 0024.71  d#C
C 026 0029.40  d#C
C 027 0028.84  d#C
C 028 0025.09  d#C
C 029 0031.26  d#C
C 030 0030.91  d#C
C 031 0026.83  d#C
C 032 0028.42  d#C
C 033 0028.00  d#C
C 034 0023.80  d#C
C 035 0022.85  d#C
C 036 0005.08  d#C
C 037 0027.96  d#C
C 038 0026.97  d#C
C 039 0023.85  d#C
C 040 0027.87  d#C
C 041 0031.94  d#C
C 042 0030.12  d#C
C 043 0030.31  d#C
C 044 0032.51  d#C
C 045 0026.23  d#C
C 046 0015.34  d#C
C 047 0017.22  d#C
C 048 0028.18  d#C
C 049 0030.68  d#C
C 050 0032.13  d#C
C 051 0032.08  d#C
C 052 0016.78  d#C
C 053 0029.44  d#C
C 054 0029.92  d#C
C 055 0028.92  d#C
C 056 0029.96  d#C
C 057 0028.14  d#C
C 058 0027.39  d#C
C 059 0027.95  d#C
C 060 0030.24  d#C
C 061 0029.94  d#C
C 062 0030.84  d#C
C 063 0030.46  d#C
C 064 0031.37  d#C
C 065 0032.23  d#C
C 066 0033.57  d#C
C 067 0031.50  d#C
C 068 0030.14  d#C
C 069 0020.58  d#C
C 070 0016.69  d#C
C 071 0028.56  d#C
C 072 0032.69  d#C
C 073 0033.40  d#C
C 074 0033.04  d#C
C 075 0031.63  d#C
C 076 0030.24  d#C
C 077 0029.77  d#C
C 078 0029.83  d#C
C 079 0029.26  d#C
C 080 0027.81  d#C
C 081 0025.81  d#C
C 082 0025.97  d#C
C 083 0029.64  d#C
C 084 0029.87  d#C
C 085 0030.81  d#C
C 086 0018.67  d#C
C 087 0030.61  d#C
C 088 0032.12  d#C
C 089 0034.61  d#C
C 090 0032.85  d#C
C 091 0030.74  d#C
C 092 0023.27  d#C
C 093 00801.1  d#C
C 094 00821.8  d#C
C 095 00809.7  d#C
C 096 00828.5  d#C
C 097 00809.8  d#C
C 098 00787.8  d#C
C 099 00793.8  d#C
C 100 00796.1  d#C
D T 2
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SCAN MINS   15.0000

ALT CE      830.634

TRA/B FACEX 36.860T
            37.3205
TRA/B FACEY 25.[illegible]
            39.1914
INNER COND  38.[illegible]

OUTER COND  38.4805

S T 2 11:19:10.2
C 001 0015.02  dBC
C 002 0032.67  dBC
C 003 0039.93  dBC
C 004 0039.21  dBC
C 005 0040.35  dBC
C 006 0040.11  dBC
C 007 0038.51  dBC
C 008 0036.47  dBC
C 009 0038.03  dBC
C 010 0039.25  dBC
C 011 0036.50  dBC
C 012 0032.23  dBC
C 013 0039.13  dBC
C 014 0040.38  dBC
C 015 0039.76  dBC
C 016 0036.18  dBC
C 017 0038.48  dBC
C 018 0041.22  dBC
C 019 0041.58  dBC
C 020 0044.04  dBC
C 021 0044.48  dBC
C 022 0036.55  dBC
C 023 0017.74  dBC
C 025 0034.69  dBC
C 026 0040.00  dBC
C 027 0039.71  dBC
C 028 0033.06  dBC
C 029 0043.05  dBC
C 030 0042.27  dBC
C 031 0036.76  dBC
C 032 0039.17  dBC
C 033 0038.94  dBC
C 034 0033.95  dBC
C 035 0031.45  dBC
C 036-0006.23  dBC
C 037 0039.33  dBC
C 038 0037.70  dBC
C 039 0032.80  dBC
C 040 0038.59  dBC
C 041 0042.67  dBC
C 042 0040.91  dBC
C 043 0041.27  dBC
C 044 0043.99  dBC
C 045 0036.01  dBC
C 046 0017.36  dBC
C 047 0021.06  dBC
C 048 0039.04  dBC
C 049 0042.78  dBC
C 050 0043.76  dBC
C 051 0043.33  dBC
C 052 0016.38  dBC
C 053 0040.15  dBC
C 054 0040.18  dBC
C 055 0038.78  dBC
C 056 0040.24  dBC
C 057 0037.61  dBC
C 058 0036.40  dBC
C 059 0037.21  dBC
C 060 0040.06  dBC
C 061 0040.08  dBC
C 062 0040.86  dBC
C 063 0040.63  dBC
C 064 0041.66  dBC
C 065 0043.04  dBC
C 066 0044.60  dBC
C 067 0042.61  dBC
C 068 0041.08  dBC
C 069 0026.79  dBC
C 070 0020.20  dBC
C 071 0039.51  dBC
C 072 0044.25  dBC
C 073 0045.38  dBC
C 074 0044.46  dBC
C 075 0042.70  dBC
C 076 0040.69  dBC
C 077 0039.65  dBC
C 078 0038.82  dBC
C 079 0039.26  dBC
C 080 0036.[illegible]  dBC
C 081 0034.26  dBC
C 082 0034.49  dBC
C 083 0039.27  dBC
C 084 0039.70  dBC
C 085 0039.94  dBC
C 086 0020.14  dBC
C 087 0041.06  dBC
C 088 0042.93  dBC
C 089 0045.25  dBC
C 090 0044.10  dBC
C 091 0041.70  dBC
C 092 0030.89  dBC
C 093 00821.8  dBC
C 094 0045.7   dBC
C 095 00833.1  dBC
C 096 0085[illegible].5  dBC
C 097 00823.8  dBC
C 098 00813.5  dBC
C 099 00817.7  dBC
C 100 00824.6  dBC
D T 2

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SCAN MINS   40.0000

ALT CE      844.546

TRA/B FACEX 48.7515
            49.2662
TRA/B FACEY 46.[illegible]
            50.5162
INNER COND  43.[illegible]

OUTER COND  49.4467

S T 2 11:24:10.2
C 001 0017.40  dBC
C 002 0045.10  dBC
C 003 0052.60  dBC
C 004 0052.31  dBC
C 005 0052.95  dBC
C 006 0053.06  dBC
C 007 0051.69  dBC
C 008 0048.76  dBC
C 009 0050.51  dBC
C 010 0051.92  dBC
C 011 0048.48  dBC
C 012 0044.67  dBC
C 013 0052.24  dBC
C 014 0052.39  dBC
C 015 0052.99  dBC
C 016 0048.32  dBC
C 017 0051.40  dBC
C 018 0054.26  dBC
C 019 0054.69  dBC
C 020 0057.06  dBC
C 021 0057.48  dBC
C 022 0049.08  dBC
C 023 0021.88  dBC
C 025 0046.60  dBC
C 026 0051.85  dBC
C 027 0052.61  dBC
C 028 0042.78  dBC
C 029 0056.48  dBC
C 030 0055.19  dBC
C 031 0049.89  dBC
C 032 0051.90  dBC
C 033 0052.54  dBC
C 034 0049.77  dBC
C 035 0045.65  dBC
C 036-0018.40  dBC
C 037 0052.63  dBC
C 038 0050.22  dBC
C 039 0044.53  dBC
C 040 0051.19  dBC
C 041 0054.55  dBC
C 042 0053.62  dBC
C 043 0053.96  dBC
C 044 0056.74  dBC
C 045 0048.15  dBC
C 046 0020.76  dBC
C 047 0026.66  dBC
C 048 0051.83  dBC
C 049 0055.41  dBC
C 050 0055.89  dBC
C 051 0055.43  dBC
C 052 0018.02  dBC
C 053 0052.08  dBC
C 054 0051.72  dBC
C 055 0050.21  dBC
C 056 0051.87  dBC
C 057 0048.96  dBC
C 058 0047.22  dBC
C 059 0048.27  dBC
C 060 0051.52  dBC
C 061 0051.56  dBC
C 062 0052.18  dBC
C 063 0052.01  dBC
C 064 0053.56  dBC
C 065 0054.76  dBC
C 066 0056.19  dBC
C 067 0054.77  dBC
C 068 0053.58  dBC
C 069 0035.58  dBC
C 070 0025.58  dBC
C 071 0052.37  dBC
C 072 0057.22  dBC
C 073 0057.87  dBC
C 074 0056.63  dBC
C 075 0054.92  dBC
C 076 0052.62  dBC
C 077 0051.40  dBC
C 078 0050.08  dBC
C 079 0050.47  dBC
C 080 0046.97  dBC
C 081 0044.65  dBC
C 082 0044.93  dBC
C 083 0050.15  dBC
C 084 0051.03  dBC
C 085 0051.05  dBC
C 086 0022.87  dBC
C 087 0052.77  dBC
C 088 0054.91  dBC
C 089 0057.05  dBC
C 090 0056.28  dBC
C 091 0054.13  dBC
C 092 0041.46  dBC
C 093 00852.2  dBC
C 094 00858.2  dBC
C 095 00865.9  dBC
C 096 00868.4  dBC
C 097 00827.9  dBC
C 098 00826.1  dBC
C 099 00824.6  dBC
C 100 00832.8  dBC
D T 2
```

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SCAN-MIN>  45.0000

AL T.C8    873.507

TRA/B FACE: 61.3675

TRA/B FACE: 62.2246
            62.3029

INNER COND  60.1429

OUTER COND  60.6068

E T 2 11:29:10.2
C 001 0021.01  d▶C
C 002 0059.28  d▶C
C 003 0065.75  d▶C
C 004 0066.09  d▶C
C 005 0066.39  d▶C
C 006 0066.89  d▶C
C 007 0066.29  d▶C
C 008 0063.00  d▶C
C 009 0063.77  d▶C
C 010 0065.37  d▶C
C 011 0061.52  d▶C
C 012 0058.54  d▶C
C 013 0066.82  d▶C
C 014 0065.07  d▶C
C 015 0065.78  d▶C
C 016 0061.29  d▶C
C 017 0064.54  d▶C
C 018 0067.19  d▶C
C 019 0067.78  d▶C
C 020 0069.75  d▶C
C 021 0069.85  d▶C
C 022 0062.07  d▶C
C 023 0027.34  d▶C
C 025 0060.01  d▶C
C 026 0064.82  d▶C
C 027 0067.18  d▶C
C 028 0053.19  d▶C
C 029 0070.10  d▶C
C 030 0068.46  d▶C
C 031 0063.95  d▶C
C 032 0065.68  d▶C
C 033 0065.54  d▶C
C 034 0072.27  d▶C
C 035 0067.00  d▶C
C 036 0031.78  d▶C
C 037 0066.06  d▶C
C 038 0063.48  d▶C
C 039 0058.24  d▶C
C 040 0064.30  d▶C
C 041 0067.18  d▶C
C 042 0067.63  d▶C
C 043 0067.05  d▶C
C 044 0068.89  d▶C
C 045 0061.28  d▶C
C 046 0025.53  d▶C
C 047 0033.80  d▶C
C 048 0064.73  d▶C
C 049 0067.58  d▶C
C 050 0068.01  d▶C
C 051 0067.48  d▶C
C 052 0018.37  d▶C
C 053 0064.56  d▶C
C 054 0063.58  d▶C
C 055 0062.19  d▶C
C 056 0063.83  d▶C
C 057 0061.30  d▶C
C 058 0059.35  d▶C
C 059 0060.27  d▶C
C 060 0063.41  d▶C
C 061 0063.40  d▶C
C 062 0063.92  d▶C
C 063 0063.91  d▶C
C 064 0065.54  d▶C
C 065 0066.76  d▶C
C 066 0067.63  d▶C
C 067 0066.74  d▶C
C 068 0065.89  d▶C
C 069 0046.51  d▶C
C 070 0032.94  d▶C
C 071 0065.52  d▶C
C 072 0069.14  d▶C
C 073 0068.80  d▶C
C 074 0068.31  d▶C
C 075 0067.12  d▶C
C 076 0065.05  d▶C
C 077 0063.40  d▶C
C 078 0062.04  d▶C
C 079 0062.25  d▶C
C 080 0058.87  d▶C
C 081 0056.62  d▶C
C 082 0056.98  d▶C
C 083 0061.68  d▶C
C 084 0062.58  d▶C
C 085 0062.61  d▶C
C 086 0025.99  d▶C
C 087 0064.73  d▶C
C 088 0066.91  d▶C
C 089 0068.50  d▶C
C 090 0068.09  d▶C
C 091 0066.34  d▶C
C 092 0054.01  d▶C
C 093 00887.3  d▶C
C 094 00889.3  d▶C
C 095 00895.7  d▶C
C 096 00891.0  d▶C
C 097 00857.9  d▶C
C 098 00854.0  d▶C
C 099 00852.5  d▶C
C 100 00860.1  d▶C
D T 2
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SCAN-MIN>  50.0000

AL T.C8    885.708

TRA/B FACE: 73.8218

TRA/B FACE: 77.0533
            77.1070

INNER COND  73.5023

OUTER COND  72.0072

E T 2 11:34:10.2
C 001 0025.79  d▶C
C 002 0072.37  d▶C
C 003 0077.87  d▶C
C 004 0078.78  d▶C
C 005 0078.84  d▶C
C 006 0079.30  d▶C
C 007 0080.61  d▶C
C 008 0077.06  d▶C
C 009 0077.03  d▶C
C 010 0080.63  d▶C
C 011 0075.42  d▶C
C 012 0073.82  d▶C
C 013 0083.34  d▶C
C 014 0079.31  d▶C
C 015 0077.41  d▶C
C 016 0075.60  d▶C
C 017 0076.47  d▶C
C 018 0078.75  d▶C
C 019 0079.57  d▶C
C 020 0080.73  d▶C
C 021 0080.73  d▶C
C 022 0074.29  d▶C
C 023 0034.09  d▶C
C 025 0072.91  d▶C
C 026 0077.48  d▶C
C 027 0083.12  d▶C
C 028 0062.03  d▶C
C 029 0081.66  d▶C
C 030 0080.27  d▶C
C 031 0079.36  d▶C
C 032 0080.44  d▶C
C 033 0077.34  d▶C
C 034 0101.00  d▶C
C 035 0091.82  d▶C
C 036 0047.60  d▶C
C 037 0079.36  d▶C
C 038 0076.44  d▶C
C 039 0072.71  d▶C
C 040 0076.75  d▶C
C 041 0079.27  d▶C
C 042 0081.44  d▶C
C 043 0078.98  d▶C
C 044 0080.09  d▶C
C 045 0073.83  d▶C
C 046 0031.76  d▶C
C 047 0042.54  d▶C
C 048 0076.21  d▶C
C 049 0077.90  d▶C
C 050 0079.17  d▶C
C 051 0079.17  d▶C
C 052 0018.60  d▶C
C 053 0077.52  d▶C
C 054 0075.26  d▶C
C 055 0074.05  d▶C
C 056 0075.62  d▶C
C 057 0073.77  d▶C
C 058 0072.09  d▶C
C 059 0072.85  d▶C
C 060 0075.47  d▶C
C 061 0075.19  d▶C
C 062 0075.72  d▶C
C 063 0075.97  d▶C
C 064 0077.30  d▶C
C 065 0078.20  d▶C
C 066 0078.40  d▶C
C 067 0077.42  d▶C
C 068 0077.19  d▶C
C 069 0058.88  d▶C
C 070 0041.85  d▶C
C 071 0076.65  d▶C
C 072 0078.94  d▶C
C 073 0078.92  d▶C
C 074 0079.98  d▶C
C 075 0078.21  d▶C
C 076 0077.27  d▶C
C 077 0075.31  d▶C
C 078 0074.09  d▶C
C 079 0074.33  d▶C
C 080 0071.74  d▶C
C 081 0070.01  d▶C
C 082 0070.25  d▶C
C 083 0073.74  d▶C
C 084 0074.35  d▶C
C 085 0074.22  d▶C
C 086 0028.55  d▶C
C 087 0076.70  d▶C
C 088 0078.37  d▶C
C 089 0079.47  d▶C
C 090 0078.94  d▶C
C 091 0077.57  d▶C
C 092 0067.54  d▶C
C 093 00907.8  d▶C
C 094 00899.0  d▶C
C 095 00918.0  d▶C
C 096 00897.7  d▶C
C 097 00870.4  d▶C
C 098 00859.1  d▶C
C 099 00866.9  d▶C
C 100 00875.3  d▶C
D T 2
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SCAN MINS:  55.0000

AL T CE     197.789

TRA/B FACE: 84.4826
            87.7626
TRA/B FACEV 80.0047
            83.0497
INNER COND  80.0093

OUTER COND  81.6209

S T 2 11:39:10.2
C 001 0031.66  deC
C 002 0082.40  deC
C 003 0087.41  deC
C 004 0087.93  deC
C 005 0087.41  deC
C 006 0088.95  deC
C 007 0091.83  deC
C 008 0088.42  deC
C 009 0089.38  deC
C 010 0098.73  deC
C 011 0088.12  deC
C 012 0089.89  deC
C 013 0094.05  deC
C 014 0093.31  deC
C 015 0089.07  deC
C 016 0086.87  deC
C 017 0087.02  deC
C 018 0087.97  deC
C 019 0088.66  deC
C 020 0089.47  deC
C 021 0089.14  deC
C 022 0083.71  deC
C 023 0041.70  deC
C 025 0083.67  deC
C 026 0088.59  deC
C 027 0094.42  deC
C 028 0068.10  deC
C 029 0090.03  deC
C 030 0089.15  deC
C 031 0090.59  deC
C 032 0094.41  deC
C 033 0088.74  deC
C 034 0116.14  deC
C 035 0109.16  deC
C 036-0063.22  deC *
C 037 0092.39  deC
C 038 0085.54  deC
C 039 0085.48  deC
C 040 0086.58  deC
C 041 0089.31  deC
C 042 0089.78  deC
C 043 0088.52  deC
C 044 0089.98  deC
C 045 0083.70  deC
C 046 0038.77  deC
C 047 0051.84  deC
C 048 0084.93  deC
C 049 0085.60  deC
C 050 0087.85  deC
C 051 0087.85  deC
C 052 0019.52  deC *
C 053 0086.62  deC
C 054 0085.91  deC
C 055 0084.35  deC
C 056 0085.72  deC
C 057 0084.45  deC
C 058 0083.50  deC
C 059 0083.68  deC
C 060 0086.68  deC
C 061 0085.89  deC
C 062 0086.33  deC
C 063 0087.01  deC
C 064 0086.99  deC
C 065 0086.56  deC
C 066 0086.57  deC
C 067 0085.98  deC
C 068 0085.91  deC
C 069 0071.07  deC
C 070 0051.39  deC
C 071 0084.96  deC
C 072 0096.48  deC
C 073 0086.76  deC
C 074 0087.48  deC
C 075 0087.58  deC
C 076 0087.53  deC
C 077 0086.03  deC
C 078 0086.74  deC
C 079 0085.43  deC
C 080 0083.39  deC
C 081 0082.16  deC
C 082 0082.07  deC
C 083 0085.08  deC
C 084 0085.07  deC
C 085 0084.98  deC
C 086 0030.86  deC
C 087 0086.84  deC
C 088 0087.15  deC
C 089 0088.24  deC
C 090 0087.69  deC
C 091 0086.93  deC
C 092 0078.44  deC
C 093 00917.9  deC
C 094 00909.1  deC
C 095 00928.4  deC
C 096 00908.4  deC
C 097 00882.0  deC
C 098 00870.9  deC
C 099 00878.7  deC
C 100 00886.6  deC
D T 2

**********

SCAN MINS:  60.0000

AL T CE     206.163

TRA/B FACEX 91.2589
            93.2304
TRA/B FACEV 90.6501
            92.0074
INNER COND  89.0004

OUTER COND  89.4242

S T 2 11:44:10.2
C 001 0038.24  deC
C 002 0088.78  deC
C 003 0094.58  deC
C 004 0095.11  deC
C 005 0094.20  deC
C 006 0095.50  deC
C 007 0095.37  deC
C 008 0093.35  deC
C 009 0096.58  deC
C 010 0107.11  deC
C 011 0094.44  deC
C 012 0095.48  deC
C 013 0102.19  deC
C 014 0101.60  deC
C 015 0097.40  deC
C 016 0094.38  deC
C 017 0093.57  deC
C 018 0094.34  deC
C 019 0095.45  deC
C 020 0095.79  deC
C 021 0096.56  deC
C 022 0089.47  deC
C 023 0049.37  deC
C 025 0098.43  deC
C 026 0097.48  deC
C 027 0098.27  deC
C 028 0070.84  deC
C 029 0096.75  deC
C 030 0095.98  deC
C 031 0095.65  deC
C 032 0098.77  deC
C 033 0098.73  deC
C 034 0108.96  deC
C 035 0111.60  deC
C 036-0073.37  deC *
C 037 0095.16  deC
C 038 0091.47  deC
C 039 0092.91  deC
C 040 0091.86  deC
C 041 0097.24  deC
C 042 0094.17  deC
C 043 0095.68  deC
C 044 0098.44  deC
C 045 0091.14  deC
C 046 0046.12  deC
C 047 0062.83  deC
C 048 0098.49  deC
C 049 0091.38  deC
C 050 0094.99  deC
C 051 0096.43  deC
C 052 0019.57  deC *
C 053 0093.32  deC
C 054 0094.32  deC
C 055 0092.66  deC
C 056 0094.38  deC
C 057 0092.99  deC
C 058 0092.48  deC
C 059 0094.05  deC
C 060 0097.21  deC
C 061 0095.71  deC
C 062 0096.34  deC
C 063 0095.56  deC
C 064 0094.66  deC
C 065 0093.62  deC
C 066 0094.32  deC
C 067 0092.23  deC
C 068 0092.07  deC
C 069 0080.99  deC
C 070 0062.52  deC
C 07' 0089.79  deC
C 072 0091.26  deC
C 073 0093.23  deC
C 074 0093.99  deC
C 075 0094.17  deC
C 076 0094.89  deC
C 077 0093.54  deC
C 078 0092.53  deC
C 079 0096.09  deC
C 080 0092.00  deC
C 081 0091.29  deC
C 082 0090.85  deC
C 083 0095.64  deC
C 084 0094.90  deC
C 085 0094.41  deC
C 086 0032.43  deC
C 087 0094.69  deC
C 088 0095.12  deC
C 089 0097.85  deC
C 090 0095.66  deC
C 091 0094.56  deC
C 092 0086.86  deC
C 093 00934.6  deC
C 094 00917.6  deC
C 095 00913.2  deC
C 096 00920.3  deC
C 097 00892.5  deC
C 098 00884.6  deC
C 099 00888.3  deC
C 100 00898.1  deC
D T 2
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SCAN MINS:  65.0000

UL T C1     419.368

TRA/B FACE: 98.3349

TRA/B FACEV 96.6772

INNER COND  101.3696

OUTER COND  99.5268

$ T 2 11:49:10.2
C 001 0048.16  deC
C 002 0097.79  deC
C 003 0100.08  deC
C 004 0102.58  deC
C 005 0101.59  deC
C 006 0103.61  deC
C 007 0101.97  deC
C 008 0097.96  deC
C 009 0105.20  deC
C 010 0115.60  deC
C 011 0100.16  deC
C 012 0103.48  deC
C 013 0109.41  deC
C 014 0110.17  deC
C 015 0103.57  deC
C 016 0099.24  deC
C 017 0099.10  deC
C 018 0100.08  deC
C 019 0101.75  deC
C 020 0102.58  deC
C 021 0102.77  deC
C 022 0097.67  deC
C 023 0057.09  deC
C 025 0099.55  deC
C 026 0103.30  deC
C 027 0104.00  deC
C 028 0074.20  deC
C 029 0102.45  deC
C 030 0103.08  deC
C 031 0103.09  deC
C 032 0105.01  deC
C 033 0106.20  deC
C 034 0115.39  deC
C 035 0117.79  deC
C 036 0079.53  deC
C 037 0107.86  deC
C 038 0099.75  deC
C 039 0097.13  deC
C 040 0097.30  deC
C 041 0104.27  deC
C 042 0103.12  deC
C 043 0103.27  deC
C 044 0106.01  deC
C 045 0097.39  deC
C 046 0053.99  deC
C 047 0073.79  deC
C 048 0094.48  deC
C 049 0096.30  deC
C 050 0104.23  deC
C 051 0107.30  deC
C 052 0020.15  deC
C 053 0102.24  deC
C 054 0103.73  deC
C 055 0101.93  deC
C 056 0105.09  deC
C 057 0102.90  deC
C 058 0102.44  deC
C 059 0104.38  deC
C 060 0108.75  deC
C 061 0107.12  deC
C 062 0106.79  deC
C 063 0105.20  deC
C 064 0103.61  deC
C 065 0104.26  deC
C 066 0106.76  deC
C 067 0101.70  deC
C 068 0097.95  deC
C 069 0087.79  deC
C 070 0072.80  deC
C 071 0093.40  deC
C 072 0096.92  deC
C 073 0102.89  deC
C 074 0104.66  deC
C 075 0103.53  deC
C 076 0102.00  deC
C 077 0102.06  deC
C 078 0100.73  deC
C 079 0104.72  deC
C 080 0100.07  deC
C 081 0100.21  deC
C 082 0099.61  deC
C 083 0106.72  deC
C 084 0106.13  deC
C 085 0103.94  deC
C 086 0067.66  deC
C 087 0103.55  deC
C 088 0105.98  deC
C 089 0110.47  deC
C 090 0107.11  deC
C 091 0103.51  deC
C 092 0098.39  deC
C 093 00951.1  deC
C 094 00933.4  deC
C 095 00920.0  deC
C 096 00933.3  deC
C 097 00907.5  deC
C 098 00899.3  deC
C 099 00900.8  deC
C 100 00909.3  deC
D T 2
```

```
SCAN MINS:  70.0000

UL T C1     430.844

TRA/B FACE: 107.215

TRA/B FACEV 107.667

INNER COND  111.035

OUTER COND  110.782

$ T 2 11:54:10.2
C 001 0070.84  deC
C 002 0099.56  deC
C 003 0102.74  deC
C 004 0110.98  deC
C 005 0109.18  deC
C 006 0112.99  deC
C 007 0110.35  deC
C 008 0104.67  deC
C 009 0115.78  deC
C 010 0126.36  deC
C 011 0107.59  deC
C 012 0104.68  deC
C 013 0118.15  deC
C 014 0123.39  deC
C 015 0114.88  deC
C 016 0106.74  deC
C 017 0108.77  deC
C 018 0110.88  deC
C 019 0113.97  deC
C 020 0116.03  deC
C 021 0112.05  deC
C 022 0100.41  deC
C 023 0067.05  deC
C 025 0099.78  deC
C 026 0105.53  deC
C 027 0108.87  deC
C 028 0079.39  deC
C 029 0110.54  deC
C 030 0113.16  deC
C 031 0110.80  deC
C 032 0113.68  deC
C 033 0111.36  deC
C 034 0124.20  deC
C 035 0122.41  deC
C 036 0114.04  deC
C 037 0119.02  deC
C 038 0108.25  deC
C 039 0101.28  deC
C 040 0106.06  deC
C 041 0114.10  deC
C 042 0112.55  deC
C 043 0113.16  deC
C 044 0117.74  deC
C 045 0100.82  deC
C 046 0063.48  deC
C 047 0079.64  deC
C 048 0101.57  deC
C 049 0114.44  deC
C 050 0121.39  deC
C 051 0123.79  deC
C 052 0020.32  deC
C 053 0114.95  deC
C 054 0117.51  deC
C 055 0116.16  deC
C 056 0118.37  deC
C 057 0116.41  deC
C 058 0114.70  deC
C 059 0116.65  deC
C 060 0122.63  deC
C 061 0121.92  deC
C 062 0122.09  deC
C 063 0119.00  deC
C 064 0119.69  deC
C 065 0122.86  deC
C 066 0126.19  deC
C 067 0121.59  deC
C 068 0112.00  deC
C 069 0089.91  deC
C 070 0078.65  deC
C 071 0100.98  deC
C 072 0110.34  deC
C 073 0121.67  deC
C 074 0124.52  deC
C 075 0120.38  deC
C 076 0115.16  deC
C 077 0114.54  deC
C 078 0113.90  deC
C 079 0117.02  deC
C 080 0112.35  deC
C 081 0111.16  deC
C 082 0110.12  deC
C 083 0121.05  deC
C 084 0120.54  deC
C 085 0118.17  deC
C 086 0023.87  deC
C 087 0118.97  deC
C 088 0125.05  deC
C 089 0128.62  deC
C 090 0125.78  deC
C 091 0121.20  deC
C 092 0093.37  deC
C 093 00966.0  deC
C 094 00946.7  deC
C 095 00931.0  deC
C 096 00941.0  deC
C 097 00919.2  deC
C 098 00910.2  deC
C 099 00911.9  deC
C 100 00920.3  deC
D T 2
```

```
(CAN-MIN)  75.0000

UL T.C8    138.424

TRA/B FACE 119.882

TRA/B FACEV 117.942

INNER COND 131.744

OUTER COND 128.105

$ T 2 11:59:10.2
C 001 0084.54  deC
C 002 0100.35  deC
C 003 0107.48  deC
C 004 0125.68  deC
C 005 0124.10  deC
C 006 0128.49  deC
C 007 0122.76  deC
C 008 0113.49  deC
C 009 0131.47  deC
C 010 0141.67  deC
C 011 0118.24  deC
C 012 0106.22  deC
C 013 0131.95  deC
C 014 0141.59  deC
C 015 0132.03  deC
C 016 0119.37  deC
C 017 0124.21  deC
C 018 0130.04  deC
C 019 0132.48  deC
C 020 0134.45  deC
C 021 0125.08  deC
C 022 0102.19  deC
C 023 0079.34  deC
C 025 0100.36  deC
C 026 0108.69  deC
C 027 0114.08  deC
C 028 0086.81  deC
C 029 0125.50  deC
C 030 0128.92  deC
C 031 0121.68  deC
C 032 0121.28  deC
C 033 0121.78  deC
C 034 0131.80  deC
C 035 0124.09  deC
C 036 0125.74  deC
C 037 0133.29  deC
C 038 0120.97  deC
C 039 0109.43  deC
C 040 0119.19  deC
C 041 0130.58  deC
C 042 0126.82  deC
C 043 0130.04  deC
C 044 0135.13  deC
C 045 0105.57  deC
C 046 0073.01  deC
C 047 0081.87  deC
C 048 0114.11  deC
C 049 0132.90  deC
C 050 0142.19  deC
C 051 0143.29  deC
C 052 0021.49  deC
C 053 0135.03  deC
C 054 0134.61  deC
C 055 0132.06  deC
C 056 0134.95  deC
C 057 0131.29  deC
C 058 0128.24  deC
C 059 0130.23  deC
C 060 0138.78  deC
C 061 0139.75  deC
C 062 0140.16  deC
C 063 0138.70  deC
C 064 0141.92  deC
C 065 0144.17  deC
C 066 0146.71  deC
C 067 0142.60  deC
C 068 0132.39  deC
C 069 0092.60  deC
C 070 0081.69  deC
C 071 0119.63  deC
C 072 0135.78  deC
C 073 0143.85  deC
C 074 0145.91  deC
C 075 0143.65  deC
C 076 0138.43  deC
C 077 0135.02  deC
C 078 0131.23  deC
C 079 0133.50  deC
C 080 0127.58  deC
C 081 0124.81  deC
C 082 0122.84  deC
C 083 0137.70  deC
C 084 0138.86  deC
C 085 0138.16  deC
C 086 0025.90  deC
C 087 0141.78  deC
C 088 0145.88  deC
C 089 0149.08  deC
C 090 0146.21  deC
C 091 0138.73  deC
C 092 0100.11  deC
C 093 00975.9  deC
C 094 00954.9  deC
C 095 00938.2  deC
C 096 00946.6  deC
C 097 00927.4  deC
C 098 00918.6  deC
C 099 00919.2  deC
C 100 00926.2  deC
D T 2
```

```
(CAN-MIN)  80.0000

UL T.C8    145.618

TRA/B FACE 135.569

TRA/B FACEV 131.783

INNER COND 145.472

OUTER COND 145.008

$ T 2 12:04:10.2
C 001 0093.95  deC
C 002 0101.36  deC
C 003 0117.32  deC
C 004 0144.89  deC
C 005 0143.93  deC
C 006 0148.64  deC
C 007 0142.30  deC
C 008 0129.82  deC
C 009 0149.14  deC
C 010 0159.90  deC
C 011 0133.38  deC
C 012 0116.38  deC
C 013 0147.67  deC
C 014 0161.15  deC
C 015 0151.19  deC
C 016 0137.00  deC
C 017 0145.51  deC
C 018 0151.16  deC
C 019 0153.08  deC
C 020 0154.78  deC
C 021 0140.73  deC
C 022 0106.22  deC
C 023 0088.51  deC
C 025 0100.87  deC
C 026 0112.31  deC
C 027 0124.64  deC
C 028 0096.81  deC
C 029 0146.84  deC
C 030 0148.50  deC
C 031 0137.04  deC
C 032 0136.04  deC
C 033 0138.01  deC
C 034 0139.60  deC
C 035 0129.36  deC
C 036 0141.98  deC
C 037 0151.68  deC
C 038 0139.11  deC
C 039 0124.67  deC
C 040 0138.04  deC
C 041 0149.96  deC
C 042 0145.19  deC
C 043 0149.92  deC
C 044 0153.80  deC
C 045 0112.11  deC
C 046 0082.68  deC
C 047 0085.61  deC
C 048 0133.12  deC
C 049 0150.78  deC
C 050 0160.29  deC
C 051 0161.29  deC
C 052 0022.27  deC
C 053 0153.64  deC
C 054 0153.35  deC
C 055 0150.53  deC
C 056 0152.89  deC
C 057 0147.81  deC
C 058 0142.89  deC
C 059 0144.91  deC
C 060 0156.03  deC
C 061 0158.51  deC
C 062 0159.36  deC
C 063 0153.64  deC
C 064 0161.64  deC
C 065 0163.84  deC
C 066 0166.82  deC
C 067 0161.19  deC
C 068 0148.38  deC
C 069 0095.60  deC
C 070 0086.02  deC
C 071 0133.86  deC
C 072 0153.79  deC
C 073 0162.98  deC
C 074 0164.85  deC
C 075 0162.84  deC
C 076 0159.35  deC
C 077 0155.92  deC
C 078 0151.28  deC
C 079 0152.04  deC
C 080 0143.73  deC
C 081 0139.05  deC
C 082 0137.00  deC
C 083 0155.17  deC
C 084 0158.40  deC
C 085 0158.75  deC
C 086 0032.91  deC
C 087 0162.77  deC
C 088 0166.14  deC
C 089 0168.42  deC
C 090 0165.23  deC
C 091 0155.98  deC
C 092 0110.61  deC
C 093 00984.7  deC
C 094 00962.1  deC
C 095 00945.7  deC
C 096 00954.2  deC
C 097 00934.5  deC
C 098 00925.2  deC
C 099 00924.9  deC
C 100 00933.3  deC
D T 2
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SCAN-MIN>  85.0000

UL T.C5    953.917

TRAVB FACEX 151.375

TRAVB FACEY 147.246

INNER COND  165.35

OUTER COND  151.646

B T 2 12:09:10.2
C 001 0097.22  deC
C 002 0102.35  deC
C 003 0132.69  deC
C 004 0161.76  deC
C 005 0163.94  deC
C 006 0168.61  deC
C 007 0162.17  deC
C 008 0149.99  deC
C 009 0167.15  deC
C 010 0177.14  deC
C 011 0149.12  deC
C 012 0124.93  deC
C 013 0163.18  deC
C 014 0180.63  deC
C 015 0171.29  deC
C 016 0157.81  deC
C 017 0167.06  deC
C 018 0171.57  deC
C 019 0173.01  deC
C 020 0173.70  deC
C 021 0156.39  deC
C 022 0114.75  deC
C 023 0095.09  deC
C 025 0106.14  deC
C 026 0121.31  deC
C 027 0137.14  deC
C 028 0107.81  deC
C 029 0167.19  deC
C 030 0168.19  deC
C 031 0154.66  deC
C 032 0155.21  deC
C 033 0155.48  deC
C 034 0151.73  deC
C 035 0137.71  deC
C 036 0158.89  deC
C 037 0170.21  deC
C 038 0159.01  deC
C 039 0144.74  deC
C 040 0157.73  deC
C 041 0168.38  deC
C 042 0164.99  deC
C 043 0169.05  deC
C 044 0171.60  deC
C 045 0119.84  deC
C 046 0091.53  deC
C 047 0098.11  deC
C 048 0146.95  deC
C 049 0166.52  deC
C 050 0177.34  deC
C 051 0179.10  deC
C 052 0020.50  deC
C 053 0173.43  deC
C 054 0172.52  deC
C 055 0168.70  deC
C 056 0170.50  deC
C 057 0163.96  deC
C 058 0157.98  deC
C 059 0161.21  deC
C 060 0173.92  deC
C 061 0177.87  deC
C 062 0179.22  deC
C 063 0178.77  deC
C 064 0181.23  deC
C 065 0183.22  deC
C 066 0184.99  deC
C 067 0179.44  deC
C 068 0163.90  deC
C 069 0102.06  deC
C 070 0091.15  deC
C 071 0147.20  deC
C 072 0169.86  deC
C 073 0179.68  deC
C 074 0182.93  deC
C 075 0182.33  deC
C 076 0179.38  deC
C 077 0175.57  deC
C 078 0170.54  deC
C 079 0170.81  deC
C 080 0160.63  deC
C 081 0154.29  deC
C 082 0152.84  deC
C 083 0173.24  deC
C 084 0177.86  deC
C 085 0178.90  deC
C 086 0035.89  deC
C 087 0182.73  deC
C 088 0185.69  deC
C 089 0187.80  deC
C 090 0184.17  deC
C 091 0172.19  deC
C 092 0122.10  deC
C 093 00990.1  deC
C 094 00970.3  deC
C 095 00953.7  deC
C 096 00962.4  deC
C 097 0094.3.7  deC
C 098 00935.4  deC
C 099 00934.8  deC
C 100 00940.5  deC
D T 2
```

SCAN(MINS) 90.0000

UL T/CS 960.877

TRAVB FACEH 167.642

TRAVB FACEV 163.150

INNER COND 182.360

OUTER COND 178.067

T 2 12:14:10.2

C 001	0098.00	deC
C 002	0103.68	deC
C 003	0149.30	deC
C 004	0180.00	deC
C 005	0184.91	deC
C 006	0188.49	deC
C 007	0183.05	deC
C 008	0172.02	deC
C 009	0185.83	deC
C 010	0195.25	deC
C 011	0165.79	deC
C 012	0138.17	deC
C 013	0180.40	deC
C 014	0200.29	deC
C 015	0191.50	deC
C 016	0176.95	deC
C 017	0188.08	deC
C 018	0193.21	deC
C 019	0193.44	deC
C 020	0193.72	deC
C 021	0172.74	deC
C 022	0121.73	deC
C 023	0099.17	deC
C 025	0109.39	deC
C 026	0132.32	deC
C 027	0151.75	deC
C 028	0118.03	deC
C 029	0187.16	deC
C 030	0188.42	deC
C 031	0173.43	deC
C 032	0174.23	deC
C 033	0173.00	deC
C 034	0166.93	deC
C 035	0149.55	deC
C 036	0176.44	deC
C 037	0189.30	deC
C 038	0178.41	deC
C 039	0165.41	deC
C 040	0177.96	deC
C 041	0188.85	deC
C 042	0184.04	deC
C 043	0189.29	deC
C 044	0189.91	deC
C 045	0128.79	deC
C 046	0096.63	deC
C 047	0096.18	deC
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C 049	0182.20	deC
C 050	0193.86	deC
C 051	0196.79	deC
C 052	0020.50	deC
C 053	0193.25	deC
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C 055	0187.46	deC
C 056	0188.69	deC
C 057	0180.78	deC
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C 059	0178.75	deC
C 060	0192.69	deC
C 061	0197.08	deC
C 062	0199.20	deC
C 063	0198.81	deC
C 064	0201.11	deC
C 065	0202.48	deC
C 066	0203.64	deC
C 067	0197.31	deC
C 068	0179.36	deC
C 069	0114.20	deC
C 070	0095.17	deC
C 071	0160.20	deC
C 072	0185.61	deC
C 073	0196.22	deC
C 074	0200.71	deC
C 075	0201.65	deC
C 076	0199.28	deC
C 077	0195.33	deC
C 078	0189.87	deC
C 079	0189.31	deC
C 080	0178.12	deC
C 081	0170.65	deC
C 082	0169.52	deC
C 083	0191.76	deC
C 084	0197.61	deC
C 085	0198.64	deC
C 086	0037.50	deC
C 087	0202.47	deC
C 088	0205.14	deC
C 089	0206.53	deC
C 090	0202.38	deC
C 091	0188.38	deC
C 092	0133.49	deC
C 093	00995.2	deC
C 094	00976.4	deC
C 095	00961.2	deC
C 096	00971.6	deC
C 097	00950.2	deC
C 098	00942.8	deC
C 099	00941.2	deC
C 100	00948.2	deC

D T 2

TEST RECORD FAVERDALE TECHNOLOGY CENTRE LTD

ABSTRACT No: 31- 0076

RIG NAME: DARMATT KM1 - CABLE TRAY B (12')

TEST SPECIFICATION: ASTM E119 (T96/31 - 0076/1)

SIGNATURE: [signature] ISSUE

DATE: 29/3/94

APPENDIX E

Photographic Record

Frame 1 - 36" x 6" Cable Tray - side insulation

Frame 2 - 36" x 6" Cable Tray - partially insulated

Frame 3 - 36" x 6" Cable Tray - central support (Unistrut)

Frame 4 - 36" x 6" Cable Tray - installed in furnace prior to test

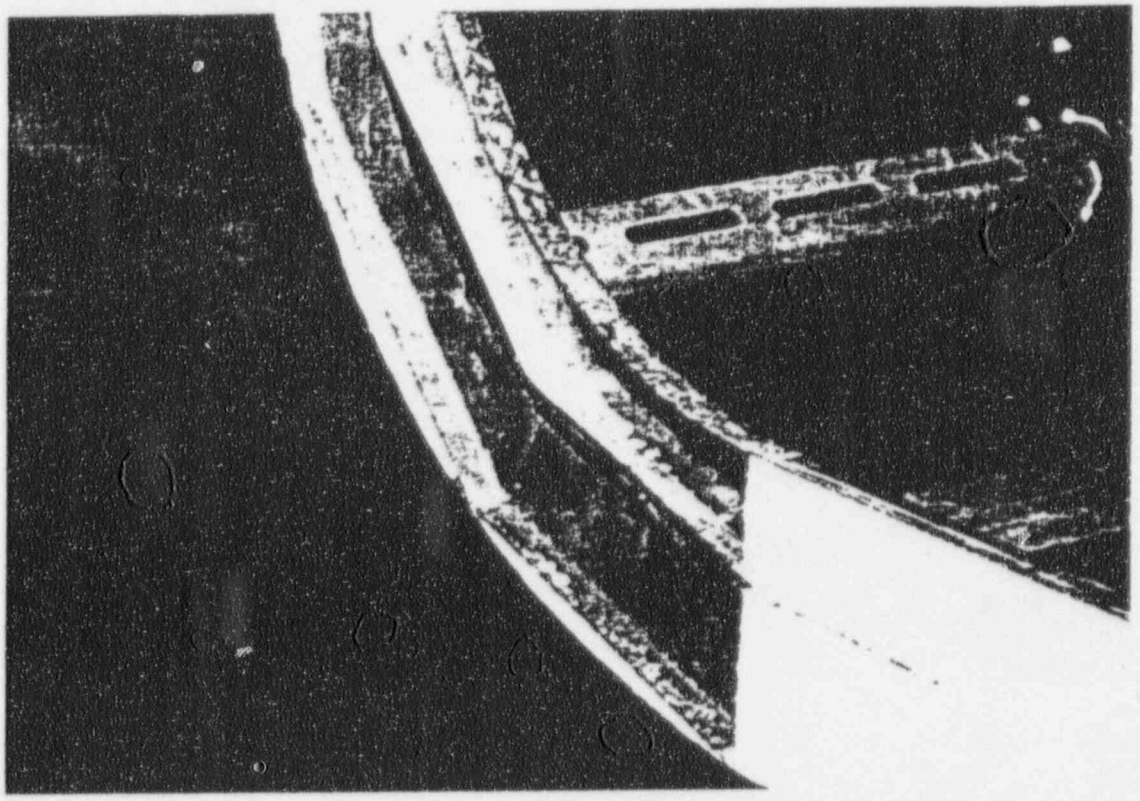
Frame 5 - 12" x 3½" Cable Tray - partially insulated

Frame 6 - 12" x 3½" Cable Tray - outer cover being applied

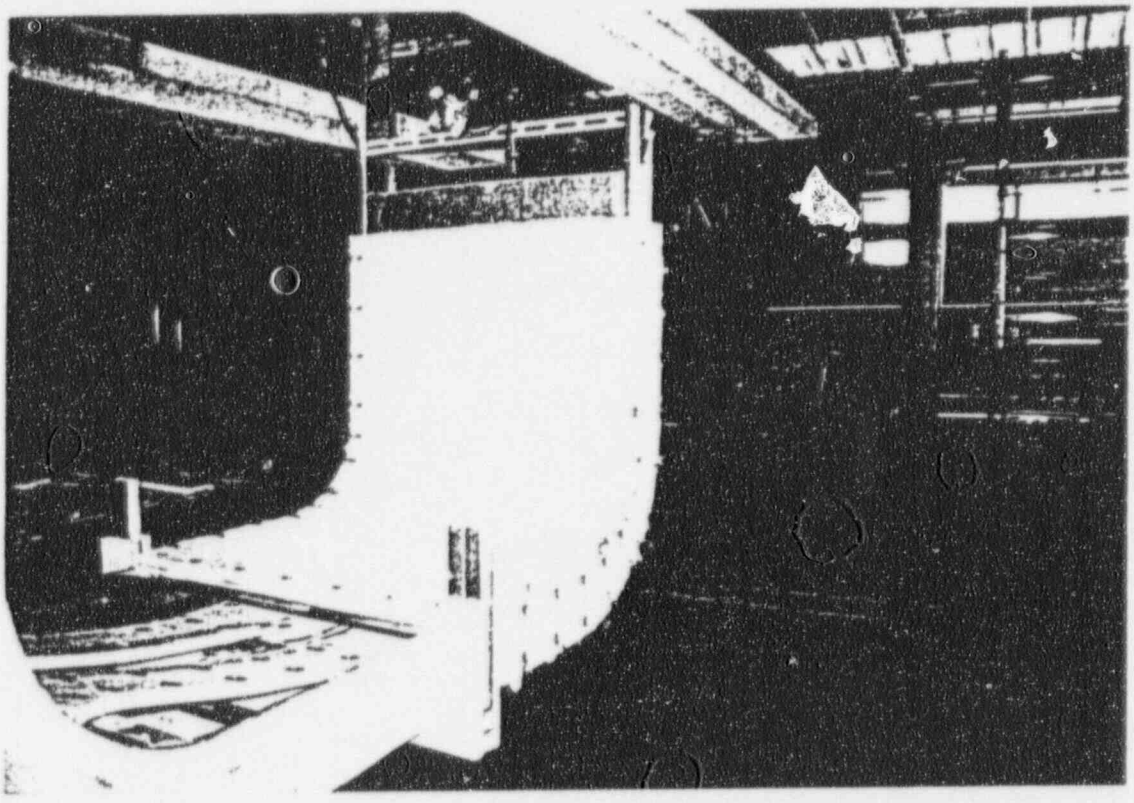
Frame 7 - 3/4" Conduit - premoulded insulation applied to bend

Frame 8 - 12" x 3½" Cable Tray plus 3/4" Conduit installed in furnace

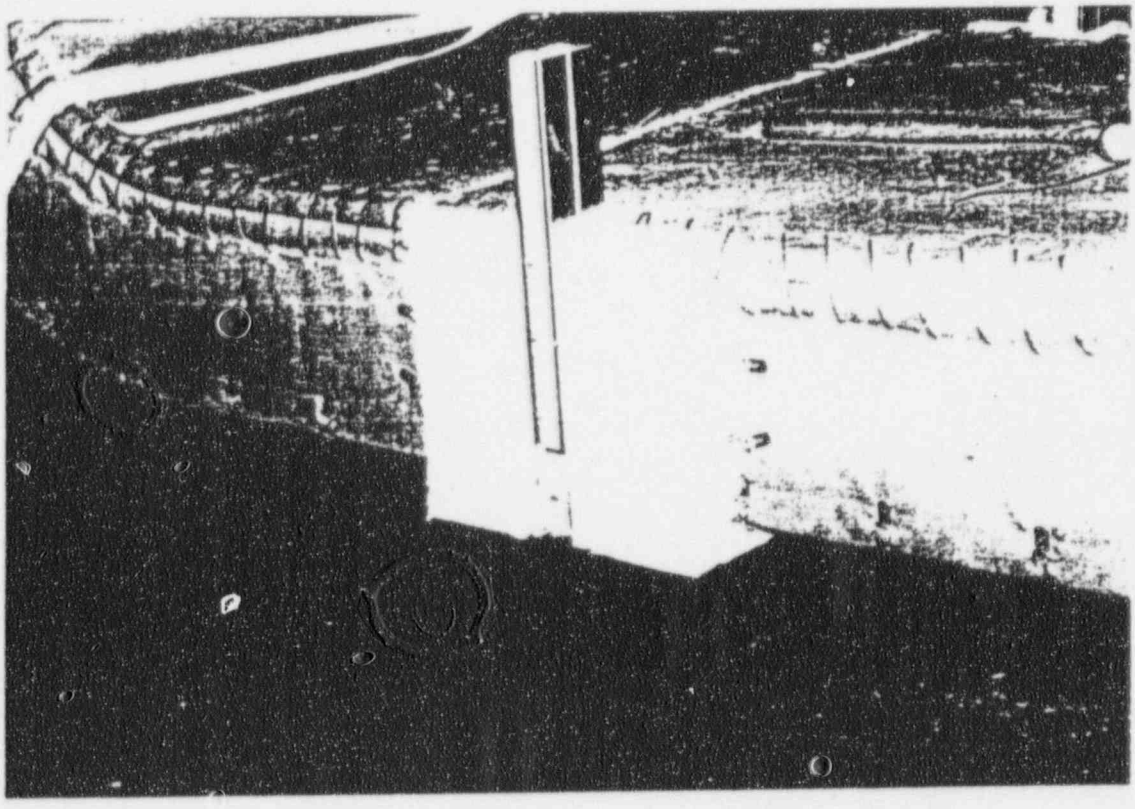
Frame 9 - General view of Cable Trays sited in furnace.



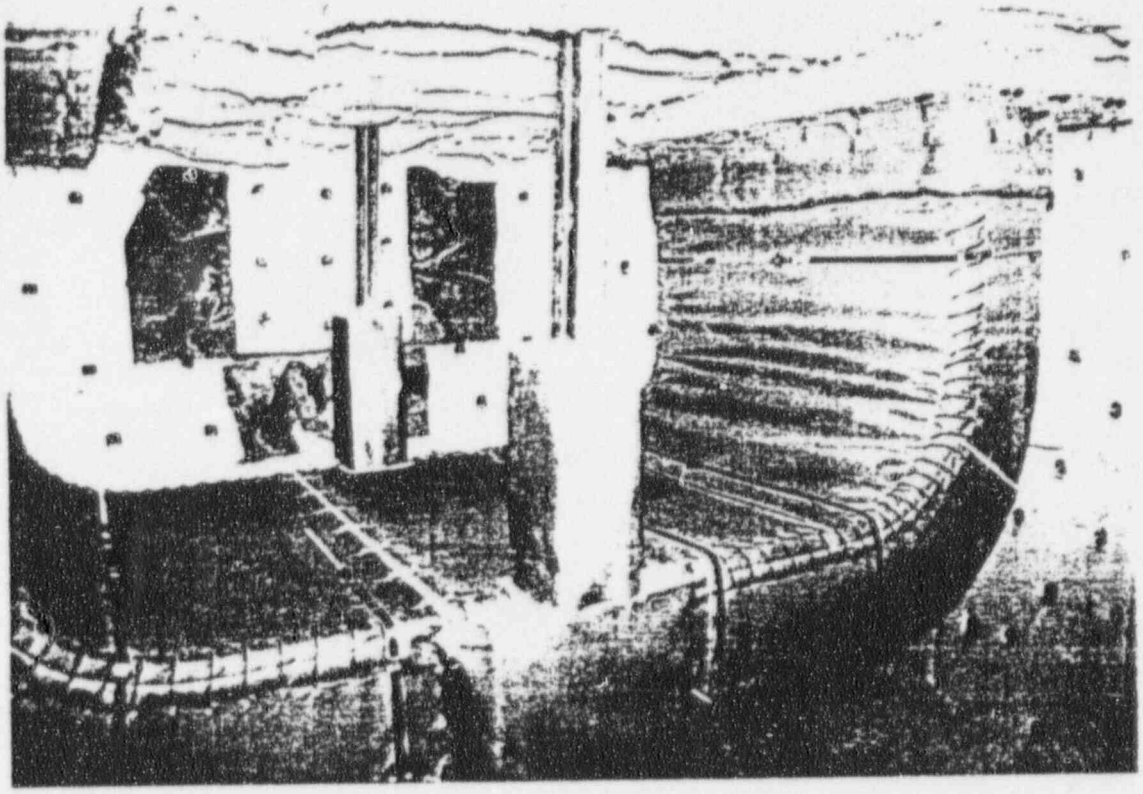
Frame 1 - 36' x 6" Cable Tray - side insulation



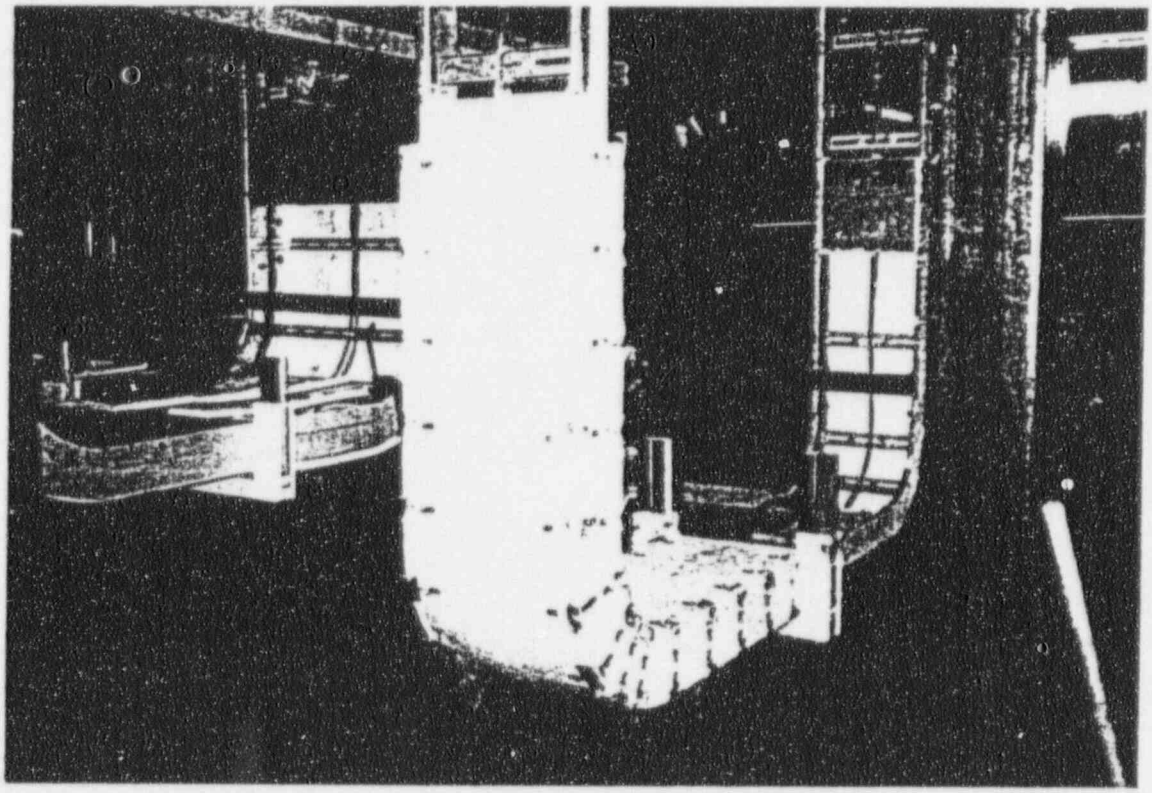
Frame 2 - 36" x 6" Cable Tray - partially insulated



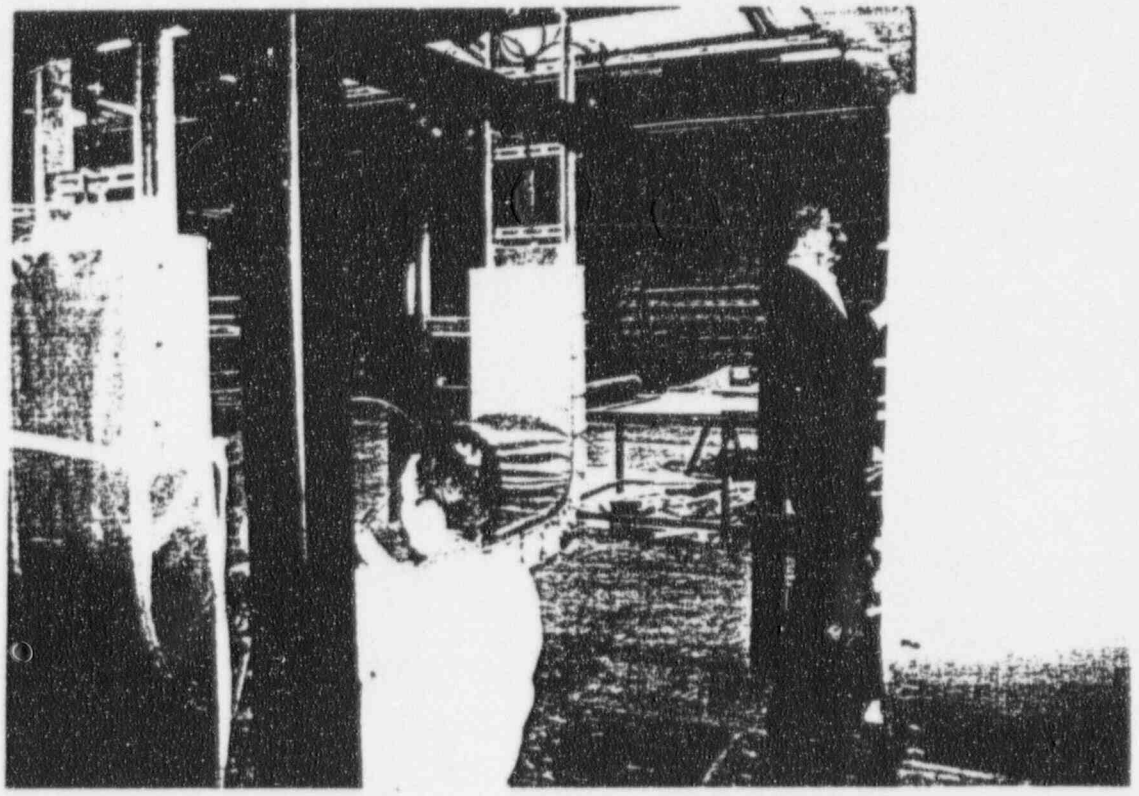
Frame 3 - 36" x 6" Cable Tray - central support (Unistrut)



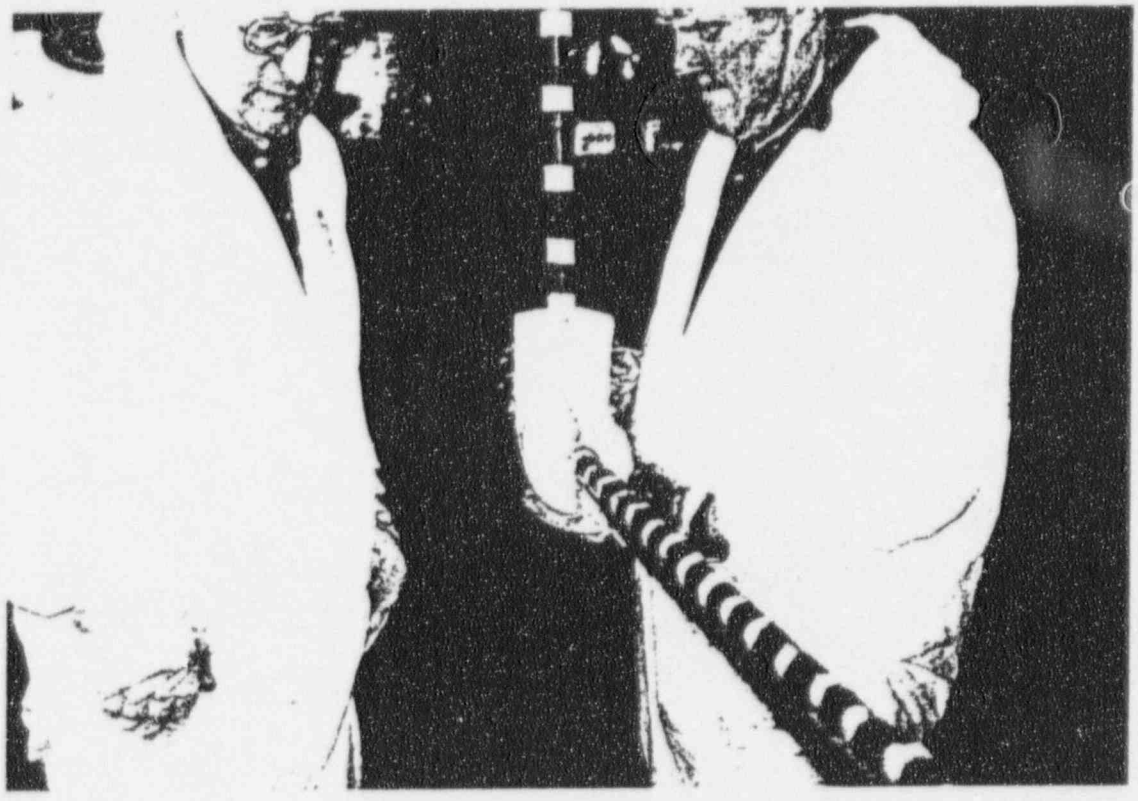
Frame 4 - 36" x 6" Cable Tray - installed in furnace prior to test



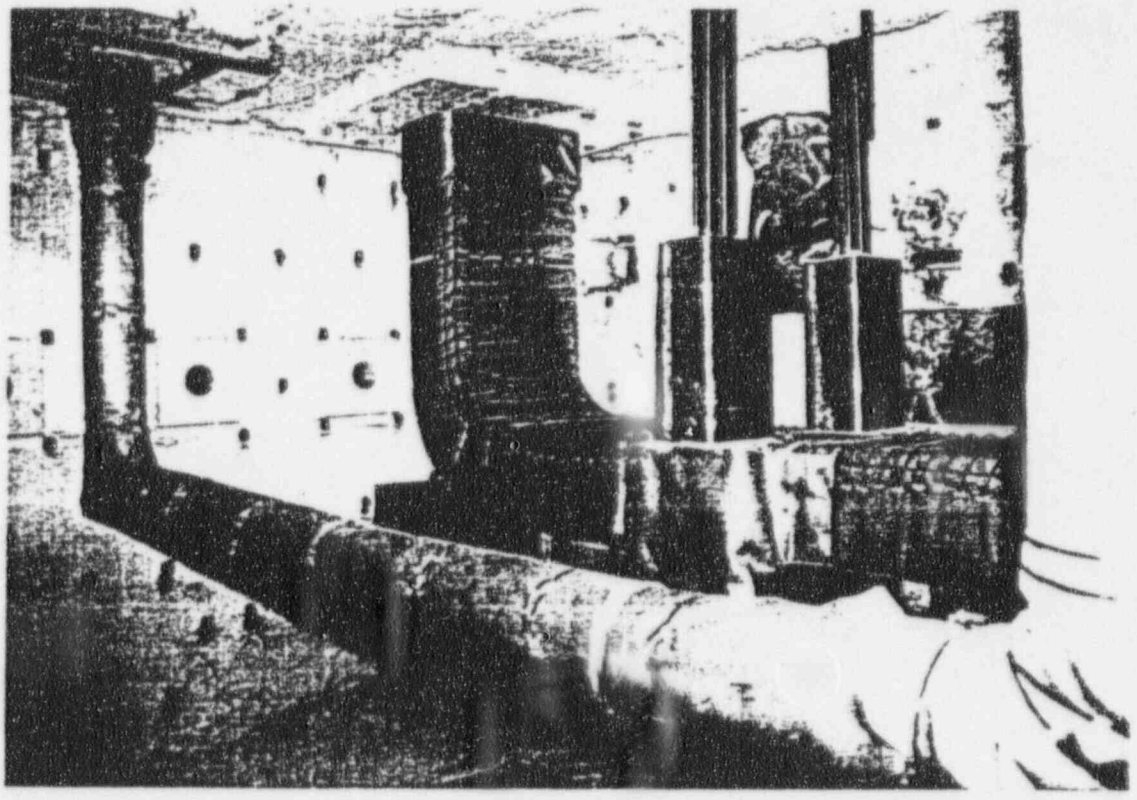
Frame 5 - 12" x 3½" Cable Tray - partially insulated



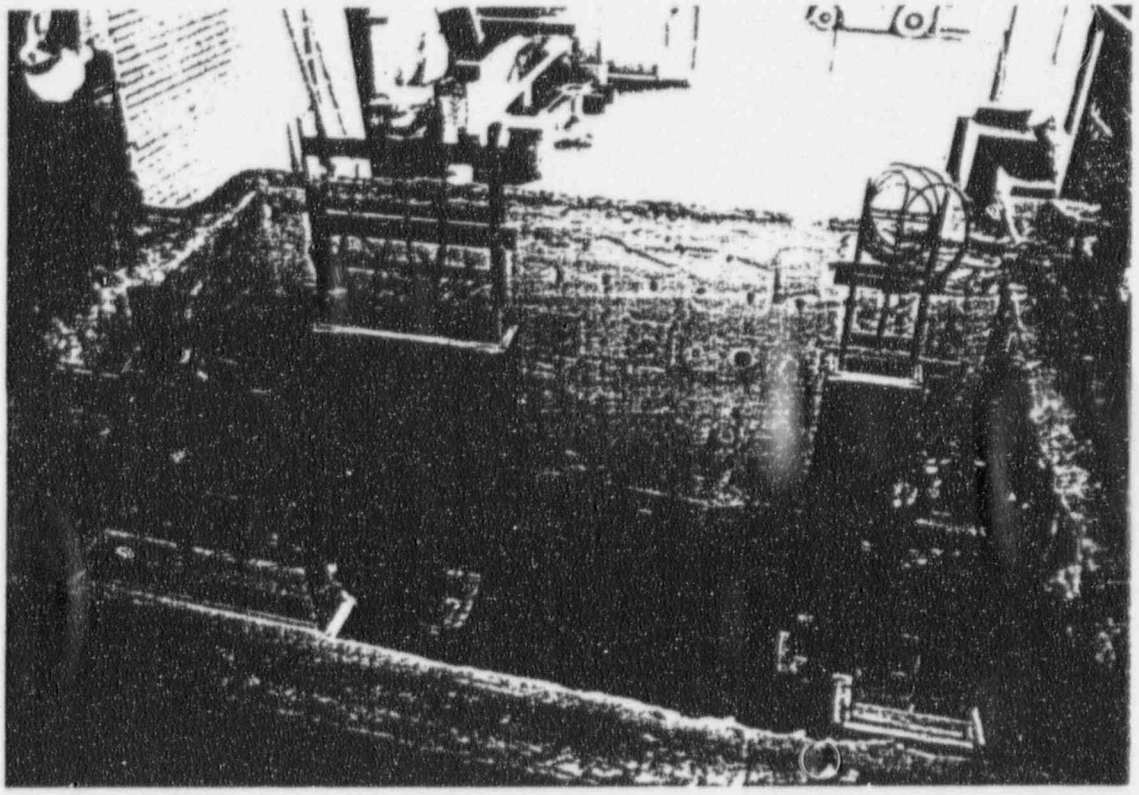
Frame 6 - 12" x 3½" Cable Tray - outer cover being applied



Frame 7 - 3/4" Conduit - pre-moulded insulation applied to bend



Frame 8 - 12" x 3½" Cable Tray - plus ¾" Conduit installed in furnace



Frame 9 - General view of Cable Trays sited in Furnace

ADDENDUM 1

WATER HOSE STREAM TEST

1 INTRODUCTION

This addendum describes the performance of the developed Darmatt electrical circuit protective system when subjected to fire test conditions followed by a water hose stream test.

The Darmatt KM1 system was heated according to the UL 1724 (ASTM E119) time/temperature curve and then subjected to a water hose stream as detailed in ASTM E119 NRC GL 86-10 Supplement 1.

2 DESCRIPTION OF THE TEST EQUIPMENT

2.1 Furnace

The fire test furnace consisted of a mild steel outer shell measuring approximately 2.0 metres high by 1.8 metres wide by 1.6 metres deep, and was lined to the inside with ceramic fibre.

The furnace is fired by 16 forced air/natural gas burners individually controlled at each burner, and collectively controlled at the control panel.

2.2 Raceway

The raceway was constructed from carbon steel and measured 915 mm wide by 150 mm deep (36" x 6").

2.3 Cables

The raceway had a 0% solid area cable fill.

3 SAMPLE DETAILS

The insulation applied to the raceway was of the same specification as that applied to the samples prepared for the fire test reported in Document No. FTCR/94/0060 ie 2 layers at nominal 16 mm thick.

The ends of the insulated raceway were protected by a 100 mm thick layer of ceramic fibre.

4 INSTRUMENTATION

4.1 Data Recorder

The data recorder used was a Solartron Scorpio Delta model. This is a multi-task data processing and recording device with an accuracy of 0.05°C.

4.2 Furnace Thermocouples

The furnace temperature was monitored and controlled with 4 symmetrically positioned thermocouples 1.6 mm diameter, metal sheathed type K, to BS 1041 and BS 4937 Part 4.

4.3 Test Sample Thermocouples

No sample thermocouples were employed.

4.4 Differential Pressure Measurement

The differential pressure was measured by an electrical manometer capable of reading pressure within an accuracy of 0.01 inch (2.5 Pa) of water.

The pressure measuring probe tips were manufactured from stainless steel or equivalent material.

5 CONTROL OF FIRE TESTS

The furnace was controlled to follow the ASTM E119 standard fire curve, the limits imposed were those stated in BS 476 part 20 1987.

The percentage deviation (p) of the mean furnace temperature/time curve from the standard temperature/time curve is given by:-

$$p = \frac{A - B}{x} \times 100$$

Where A is the area under the mean furnace temperature/time curve, B is the area under the specified standard temperature/time curve.

A computer programme using Simpsons Rule was used to show the limits on deviation between the measured temperature and the standard temperature/time curve.

(i) Tolerance

Measured furnace temperature deviations were within the following limits.

(a) Less than 15% to the end of the first 10 minutes of the heating period or to the end of the test if this is less than 10 minutes.

(b) Less than 10% from 10 minutes into the test to the end of 30 minutes into the heating period.

(c) Less than 5% from 30 minutes into the test to the end of the fire test.

(ii) Uniformity of Temperature Distribution

At any time after the first 10 minutes of the heating period, the temperature rise indicated by any of the thermocouples used to determine the mean furnace temperatures did not differ from the corresponding temperature rise given by the standard temperature/time curve by more than 100°C.

6 TEST PROCEDURE

6.1 Installation of the Raceway and Protective System

The raceway was supported from a free-standing steel wall which was lined with ceramic fibre. After the electrical circuit protective system was applied, the free ends were protected with 100 mm thickness of ceramic fibre.

The periphery of the test sample was no closer than 305 mm from the furnace edge.

The furnace was positioned against the free-standing wall, enclosing the test sample.

6.2 Furnace Ignition and Control

After all instrumentation had been checked for functionality, the burners were ignited and the mean of the four furnace thermocouples controlled to match as closely as possible the UL 1724 (ASTM E119) standard fire curve.

6.3 Test Readings

The mean furnace temperature was displayed to screen continuously, and the mean and individual thermocouple readings were printed to paper at the following intervals:-

0 - 10 minutes	1 minute intervals
10 - 30 minutes	2 minute intervals
30 minutes on	5 minute intervals

6.4 Duration of the Fire Test

The sample was subjected to two heating/hose stream tests; a 30 minute duration heating test on 29 March 1994 followed by a hose stream test and a 60 minute duration heating test on 16 May 1994 followed by a hose stream test. The test sample was dried between the two tests.

6.5 Hose Stream Test

Immediately following the fire test, the furnace surrounding the test sample was removed and the sample subjected to a hose stream. The hose steam was directed at the centre of the cable tray then slowly traversed over the whole sample for a period of 5 minutes.

The hose stream was discharged from a 2½" hose with a 1½" nozzle at a 30° divergent angle, at a distance of 5 ft from the centre point of the sample. The pressure at the base of the nozzle was maintained at 75 psi and had a discharge rate of at least 75 gpm.

The nozzle pressure was monitored at the start and cessation of the hose stream test and the spray angle and discharge rate were verified by Mr J Behn (Commonwealth Edison) for the test carried out on 29 March 1994.

6.6 Pass/Failure Criteria

The electrical circuit protective system must retain its integrity after the hose stream test.

7 TEST RESULTS

7.1 A 30 minute heating test followed by a 5 minute hose stream test was conducted on 29 March 1994 and was witnessed by Mr J Behn (Commonwealth Edison).

7.2 The sample was dried and a 60 minute heating test followed by a 5 minute hose stream test was conducted on 16 May 1994.

8 OBSERVATIONS

The test sample had retained its integrity after both hose stream tests and was deemed to have satisfied the criteria detailed in ASTM E119 NRC GL 86-10 Supplement 1.

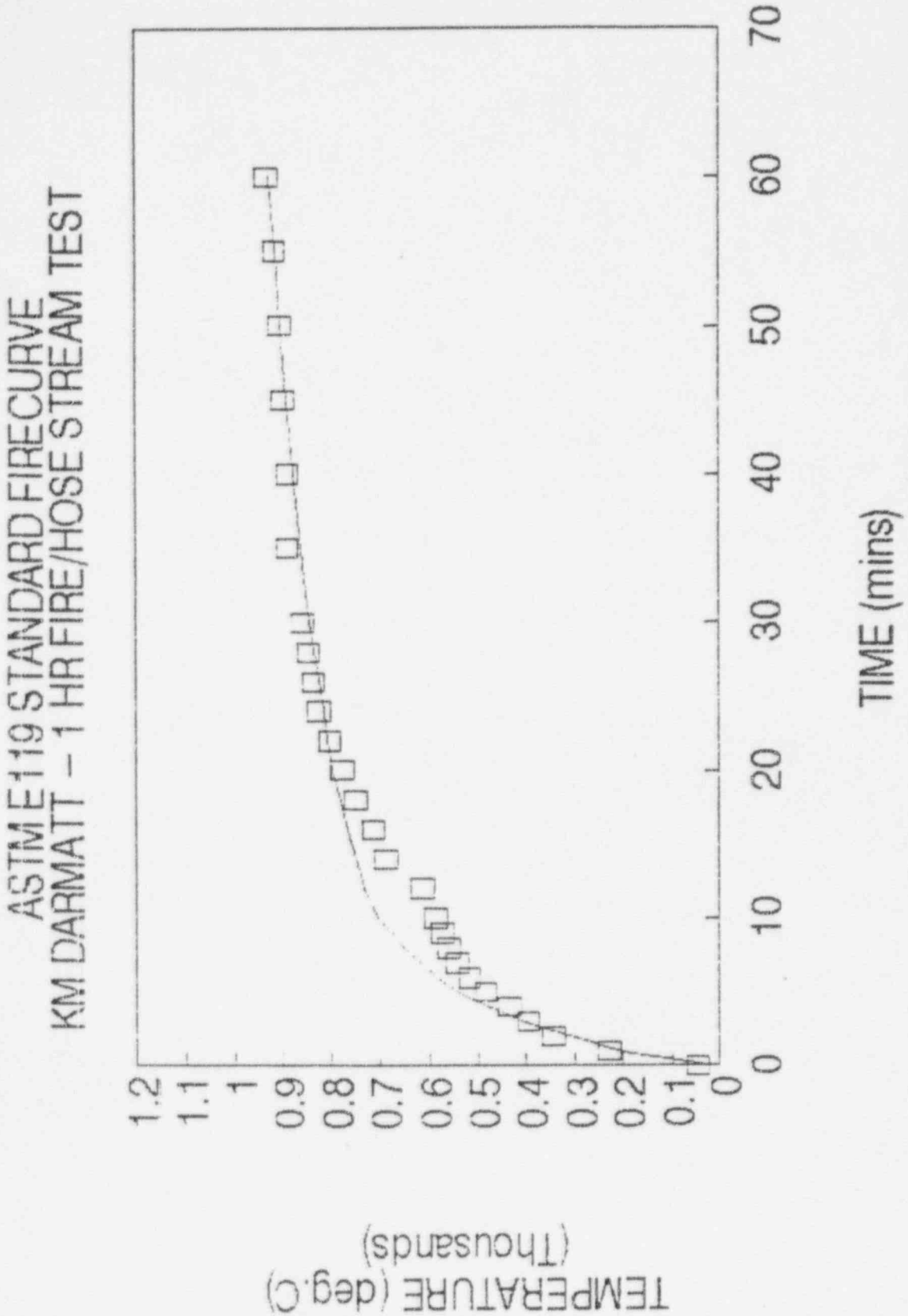
FIRE ACCURACY CHECK DATA

GRAPH OF MEAN FURNACE TEMPERATURE AGAINST TIME

91-0106 KM1 DARMATT - HOSE STREAM TEST 16/05/94

Simpson's Rule Numerical Integration

Time, min.	TEST DATA Temp.	TEST DATA Cum. °C-min.	ASTM E119 Firecurve Temp.	ASTM E119 Firecurve Cum. °C-min.	limits
0	45		20		
1	227		200		
2	344		300		
3	396		400		
4	434		470		
5	483		538		
6	517		582		
7	542		618		
8	560		650		
9	573		675		4095
10	587	4409	704	4817	
12	614		732		5540
14	689		760		
16	724		767		
18	749		781		
20	777		795		
22	801		805		
24	823		814		
26	835		824		
28	845		833		18514
30	858	19532	843	20571	
35	880		862		22628
40	889		878		
45	898		892		36199
50	905	37354	905	38105	
55	916		916		40010
60	931		927		


ASTM E119 STANDARD FIRECURVE
KM DARMATT – 1 HR FIRE/HOSE STREAM TEST
TEMPERATURE (deg.C)
(Thousands)
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
TIME (mins)

COMPLETE DATA PRINTOUTS OF THERMOCOUPLE READINGS

```
RUN   13:10:30 16-05
**********************

SCAN (MINS) 0

FURNACE      45.2015

S T 1 13:12:41.3
C 001 0049.99  degC
C 002 0039.00  degC
C 003 0051.10  degC
C 004 0040.70  degC
D T 1
**********************

SCAN (MINS) 1.00000

FURNACE      227.053

S T 1 13:13:41.3
C 001 0266.01  degC
C 002 0161.27  degC
C 003 0236.99  degC
C 004 0223.93  degC
D T 1
**********************

SCAN (MINS) 2.00000

FURNACE      344.193

S T 1 13:14:41.3
C 001 0396.04  degC
C 002 0288.79  degC
C 003 0354.85  degC
C 004 0337.08  degC
D T 1
**********************

SCAN (MINS) 3.00000

FURNACE      395.677

S T 1 13:15:41.3
C 001 0445.72  degC
C 002 0344.75  degC
C 003 0407.69  degC
C 004 0384.53  degC
D T 1
**********************

SCAN (MINS) 4.00000

FURNACE      433.734

S T 1 13:16:41.3
C 001 0482.02  degC
C 002 0387.24  degC
C 003 0447.18  degC
C 004 0417.88  degC
D T 1
**********************

SCAN (MINS) 5.00000

FURNACE      462.299

S T 1 13:17:41.3
C 001 0532.44  degC
C 002 0437.29  degC
C 003 0495.25  degC
C 004 0464.20  degC
D T 1
**********************

SCAN (MINS) 6.00000

FURNACE      516.692

S T 1 13:18:41.3
C 001 0563.64  degC
C 002 0476.46  degC
C 003 0529.82  degC
C 004 0496.84  degC
D T 1
**********************

SCAN (MINS) 7.00000

FURNACE      541.885

S T 1 13:19:41.3
C 001 0585.80  degC
C 002 0504.92  degC
C 003 0554.78  degC
C 004 0522.04  degC
D T 1
**********************

SCAN (MINS) 8.00000

FURNACE      559.918

S T 1 13:20:41.3
C 001 0601.05  degC
C 002 0526.47  degC
C 003 0573.11  degC
C 004 0539.01  degC
D T 1
**********************

SCAN (MINS) 9.00000

FURNACE      572.849

S T 1 13:21:41.3
C 001 0610.05  degC
C 002 0539.44  degC
C 003 0587.53  degC
C 004 0554.17  degC
D T 1
**********************

SCAN (MINS) 10.0000

FURNACE      586.994

S T 2 13:22:41.3
C 001 0626.37  degC
C 002 0555.07  degC
C 003 0598.79  degC
C 004 0567.73  degC
D T 2
**********************

SCAN (MINS) 12.0000

FURNACE      613.982

S T 2 13:24:41.3
C 001 0647.51  degC
C 002 0583.91  degC
C 003 0629.77  degC
C 004 0594.72  degC
D T 2
**********************

SCAN (MINS) 14.0000

FURNACE      638.772

S T 2 13:26:41.3
C 001 00712.4  degC
C 002 0656.24  degC
C 003 00708.0  degC
C 004 00678.3  degC
D T 2
**********************

SCAN (MINS) 16.0000

FURNACE      714.107

S T 2 13:28:41.3
C 001 00741.1  degC
C 002 00689.0  degC
C 003 00728.3  degC
C 004 00697.8  degC
D T 2
**********************

SCAN (MINS) 18.0000

FURNACE      749.189

S T 2 13:30:41.3
C 001 00772.7  degC
C 002 00724.3  degC
C 003 00755.7  degC
C 004 00734.2  degC
D T 2
**********************
```

```
SCAN (MINS) 20.0000

FURNACE     776.838

$ T 2 13:32:41.3
C 001 00799.4  degC
C 002 00751.7  degC
C 003 00793.7  degC
C 004 00782.4  degC
D T 2
**********

SCAN (MINS) 22.0000

FURNACE     800.732

$ T 2 13:34:41.3
C 001 00823.3  degC
C 002 00777.5  degC
C 003 00816.4  degC
C 004 00785.6  degC
D T 2
**********

SCAN (MINS) 24.0000

FURNACE     823.339

$ T 2 13:36:41.3
C 001 00844.3  degC
C 002 00800.2  degC
C 003 00839.8  degC
C 004 00808.8  degC
D T 2
**********

SCAN (MINS) 26.0000

FURNACE     835.283

$ T 2 13:38:41.3
C 001 00852.5  degC
C 002 00811.8  degC
C 003 00850.5  degC
C 004 00824.2  degC
D T 2
**********

SCAN (MINS) 28.0000

FURNACE     845.084

$ T 2 13:40:41.3
C 001 00860.2  degC
C 002 00819.4  degC
C 003 00858.8  degC
C 004 00835.0  degC
D T 2
```

```
SCAN (MINS) 30.0000

FURNACE     857.789

$ T 3 13:42:41.3
C 001 00869.4  degC
C 002 00835.2  degC
C 003 00877.2  degC
C 004 00849.3  degC
D T 3
**********

SCAN (MINS) 35.0000

FURNACE     889.922

$ T 3 13:47:41.3
C 001 00901.5  degC
C 002 00869.0  degC
C 003 00907.3  degC
C 004 00881.7  degC
D T 3
**********

SCAN (MINS) 40.0000

FURNACE     889.409

$ T 3 13:52:41.3
C 001 00903.5  degC
C 002 00868.7  degC
C 003 00901.5  degC
C 004 00883.8  degC
D T 3
**********

SCAN (MINS) 45.0000

FURNACE     898.315

$ T 3 13:57:41.3
C 001 00902.7  degC
C 002 00878.7  degC
C 003 00912.5  degC
C 004 00899.1  degC
D T 3
**********

SCAN (MINS) 50.0000

FURNACE     904.831

$ T 3 14:02:41.3
C 001 00908.1  degC
C 002 00888.1  degC
C 003 00917.0  degC
C 004 00906.0  degC
D T 3
```

```
SCAN (MINS) 55.0000

FURNACE     916.432

$ T 3 14:07:41.3
C 001 00919.4  degC
C 002 00901.8  degC
C 003 00927.4  degC
C 004 00917.0  degC
D T 3
**********

SCAN (MINS) 60.0000

FURNACE     930.511

$ T 3 14:12:41.3
C 001 00932.7  degC
C 002 00917.2  degC
C 003 00940.6  degC
C 004 00931.4  degC
D T 3
**********
```

TEST RECORD FAVERDALE TECHNOLOGY CENTRE LTD

ABSTRACT No: 31-0106

RIG NAME: KM1 DARMATT - 1Hr fire hose stream

TEST SPECIFICATION: E119 Fire Curve ISSUE

SIGNATURE: S Pullen

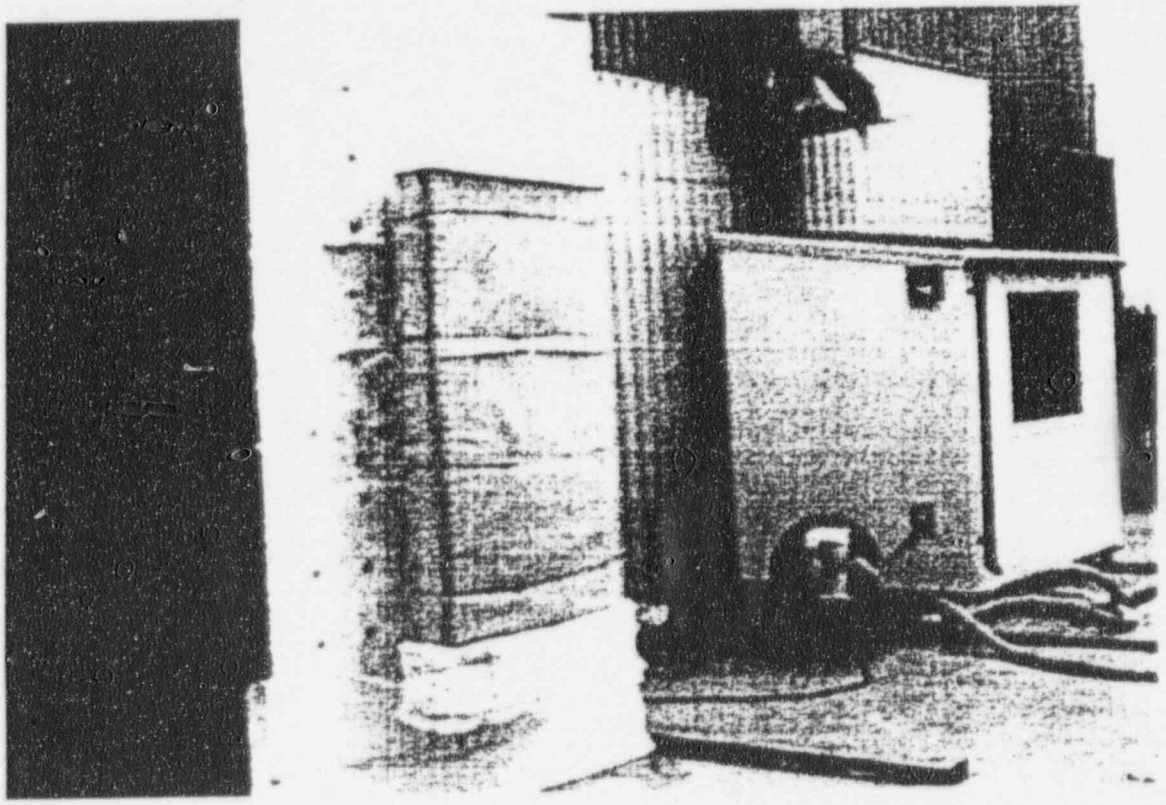
DATE: 16/5/94

PHOTOGRAPHIC RECORD

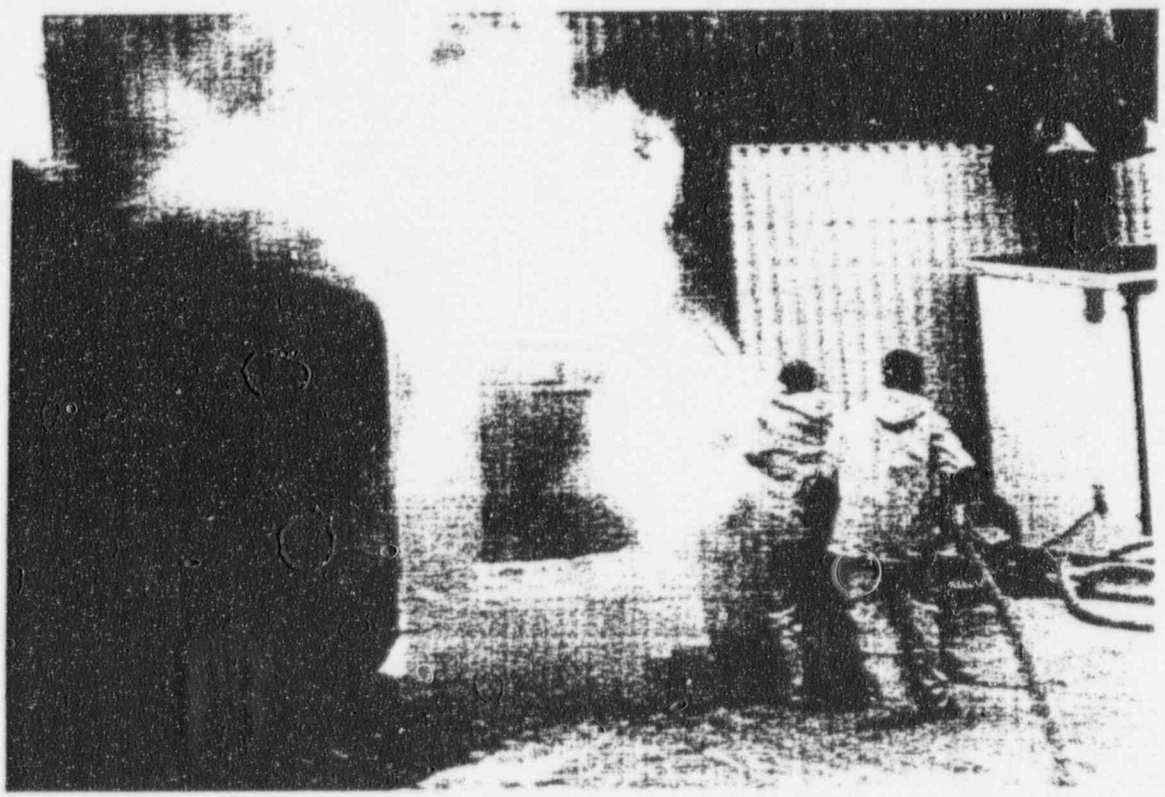
Frame 1 - Pre-test

Frame 2 - During hose stream test

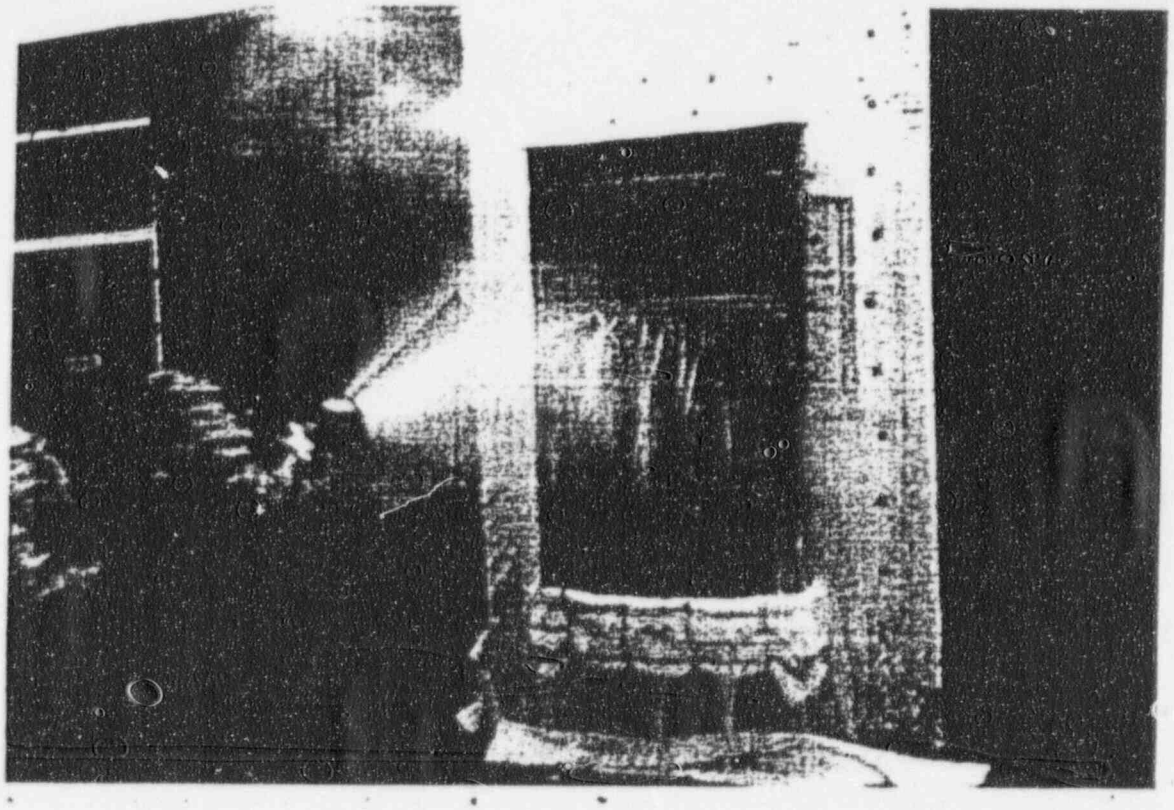
Frame 3 - During hose stream test



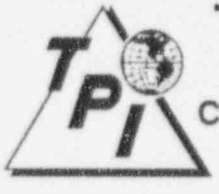
Frame 1 - Pre-test



Frame 2 - During Hose Stream Test



Frame 3 - During Hose Stream Test



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FAVERDALE TECHNOLOGY CENTRE

official issue

FAVERDALE TECHNOLOGY CENTRE LTD.

Order number	Document number
310104	FTCR/94/0073
Client: Darchem Engineering Inc	

TEST REPORT

TEST TO DETERMINE THE AMPACITY DERATING FOR ELECTRICAL CONDUCTORS INSTALLED IN CABLE TRAYS ENCAPSULATED BY DARMATT KM1 1 HOUR REPLACEMENT MATERIAL

Issue	Date	Modification	Issued by	date	Approved by	date
A	27/4/94	ORIGINAL	S Pallister		D P Ayling	
			S. Pallister	27/4/94	D.P. Ayling	27/4/94

SUMMARY

An ampacity derating test was carried on a cable tray fire protection envelope consisting of two layers of Darmatt KM1 1 hour replacement material nominally 16 mm. The outer layer was covered by a grey Silicone Rubber coated glass fibre cloth (as fire tested in report number FTCR/94/0060).

The baseline for the raceway with its associated 100% cable loading was also tested.

The tests were carried out in accordance with the procedures sated in Darchem Engineering Limited, Document number TDS/900015/AMP 001, IEEE P848, 1993, and UL 1712.

The tests were carried out on the 7, 8, 21 and 22 April 1994 at the Faverdale Technology Centre, Darlington.

These results were as follows:-

Test	Av. Room Temp. °C	Av Conductor Temp. °C	Current (Amps)	% Ampacity Derating
Baseline	39.29	89.401	21.97	
Darmatt KM1 1 hr Replacement material	41.65	90.58	14.96	31

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur.

For those reasons it is recommended that the relevance of test reports over 5 years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedure adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

REVISION SHEET

PAGES AFFECTED	SECTION	DATE	REVISION SUMMARY	REVISED BY

1 INTRODUCTION

An ampacity derating test was carried out on a cable tray fire protection envelope consisting of 2 layers of Darmatt KM1 1 hour replacement material. The outer layer was covered by a grey silicone rubber coated glass fibre cloth.

The baseline for the raceway with its associated 100% cable loading was also tested.

The tests were carried out in accordance with the procedures stated in Darchem engineering Limited Document number TDS/900015/AMP 001, IEEE P848, 1993 and UL 1712.

The aims of the test were to record the current required to keep the conductor temperature at a steady state of 90°C whilst in a controlled room environment of 40°C ± 5°C.

From this the percentage ampacity derating was derived.

3 DESCRIPTION OF THE CONTROLLED ENVIRONMENT ROOM AND TEST EQUIPMENT

3.1 General

The ampacity test was conducted in a draft free controlled temperature enclosure of a size sufficient to accommodate the test sample with a minium clearance of 610 mm between the test sample and all sides of the enclosure.

3.2 Test Enclosure Temperature

The temperature within the test enclosure was the average temperature obtained from the reading of six thermocouples symmetrically disposed and distributed to measure the temperatures at locations 305 mm directly above and directly below the test sample.

One of the thermocouples was used to monitor the temperature and then fed back to a temperature controller, which controlled heaters to ensure that an ambient temperature within the test enclosure of 40°C ± 5°C was achieved.

3.3 Raceway

The raceway used for the ampacity tests was 3 m long: 600 mm x 127 mm galvanised miid steel ladder rack tray.

3.4 Raceway Supports

The raceway was supported on an Unistrut framework providing support points at a distance of 500 mm from each end of the raceway.

3.5 Cables

The cables were 4 core, 16 mm^2 conductor 600/1000V rated, XLPE insulated with an outer sheath of PVC giving an outside diameter of nominally 20 mm. The cables are unarmoured and are described as Y-Y flex.

3.6 Power Supply

The power source used was a 240V, 45A Regavolt Variable Transformer (Type 715-G3PE) supplied by Claude Lyons Controls Ltd.

5 TEST PROCEDURE

5.1 Installation of the Raceways

The raceways were placed horizontally across the Unistrut supports 900 mm apart from each other and 600 mm plus from the walls of the enclosure.

A section of GRP pultrusion was placed between the Unistrut supports and the raceways to act as a thermal break.

5.2 Installation of the Electrical Conductor Thermocouples

The thermocouples were installed by sitting the insulation of the electrical conductor and placing the thermocouple junction in intimate contact with the electrical conductor. Following the installation of the thermocouple the slit in the insulation was sealed using electrical tape, so as to restore the electric conductor construction, as practically as possible, to its original state. To prevent the thermocouple junction from being dislodged, the thermocouple leads were additionally fixed with electrical tape to the outside of the electrical conductor construction.

Thermocouples attached to bundles of electrical conductors were located at the centre on each bundle and at the centre of the length of cable, as illustrated in Appendix 1, figures 1 and 2.

The cable tray was then filled with 14 bundles to achieve 100% visual fill.

The conductors in each cable were connected in series and all the cables in a cable bundle were then connected in series. Finally, each bundle used in the test was also connected in series forming one single series circuit.

To eliminate cold ends the length of cables protruding from the raceways was wrapped with 2 inch thick ceramic fibre blanket.

5.3 Connection to the Power Source

The two ends of the cable bundles were connected to 415 volt single phase A/C power source supplied by Union Carbide Corporation and energised with a voltage so as to reach a maximum steady-state temperature of 90°C.

5.5 Duration of the Test

The duration of each test was a minimum time of 10 hours after steady state had been reached.

5.6 Evaluation of the Results

The results were normalised to obtain Io and If values using the correction factor below (ref. IEEE P848, 1993).

$$I_n = Itest \sqrt{\left(\frac{(90 - 40) \times (\alpha + T_a)}{(T_c - T_a) \times (\alpha + T_c)}\right)}$$

where T_c is the average hottest measured cable conductor temperature.

T_a is the average room temperature

α = 234.5 for copper cable conductors.

This formula was used so that a representative current value could be obtained with respect to a steady state conductor temperature of 90°C and a steady state average room temperature of 40°C.

The percentage derating factor for each fire protection envelope was calculated using the following equation:-

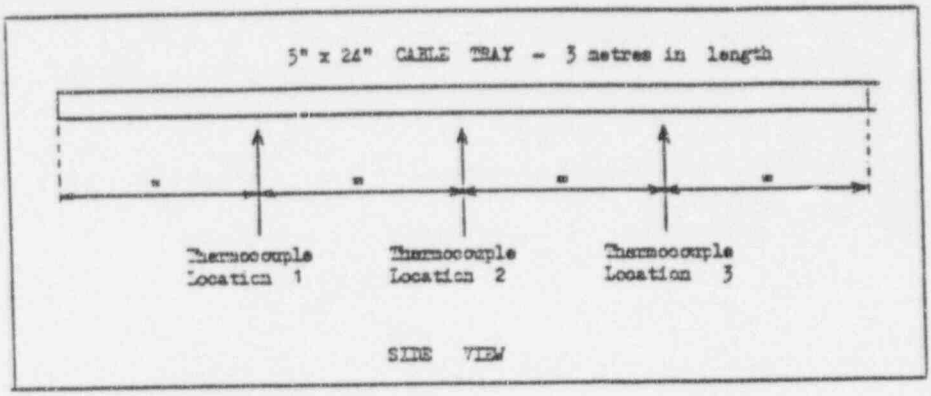
$$\% \ Ampacity \ Derating = \frac{I_o - I_f}{I_o} \times 100$$

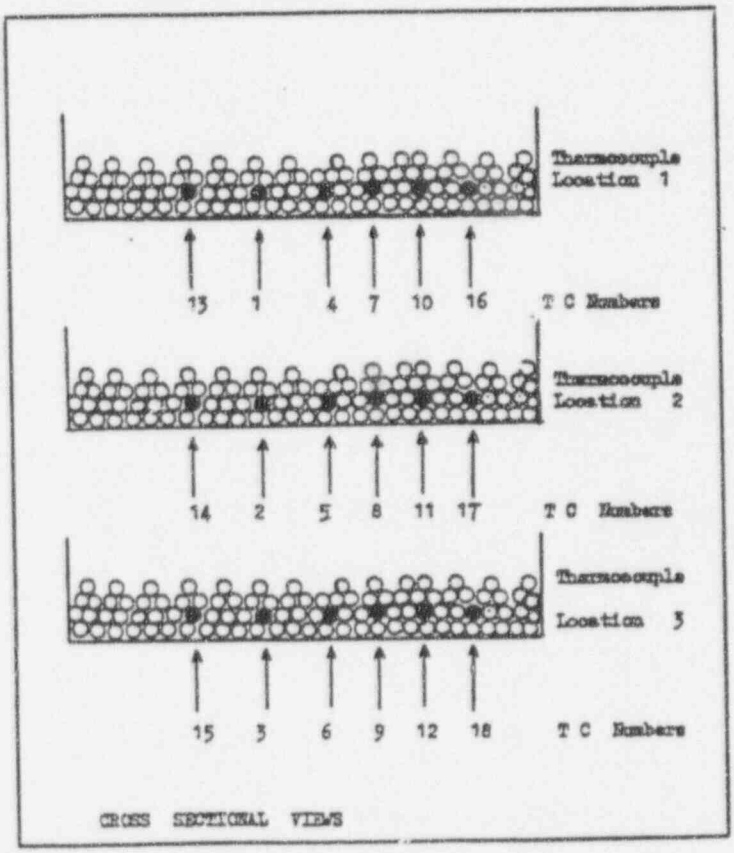
I_o = current in amps required to attain a conductor temperature of 90°C for the baseline test.

I_f = current in amps required to attain a conductor temperature of 90°C for the system encapsulated with a fire protection envelope.

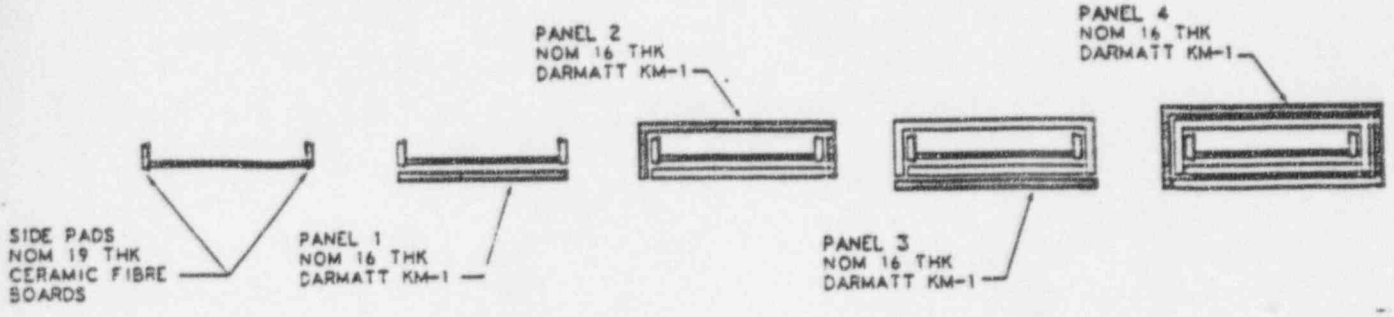
APPENDIX 1

THERMOCOUPLE POSITIONS AND SAMPLE DETAILS

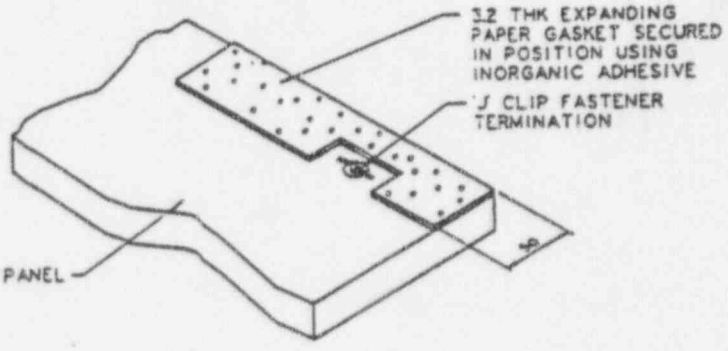




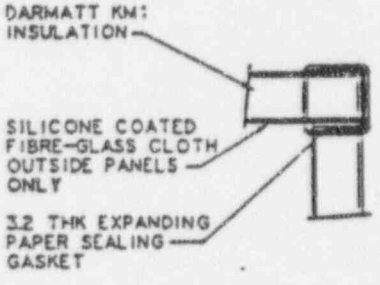
NB. Cable tray was 100% visual fill



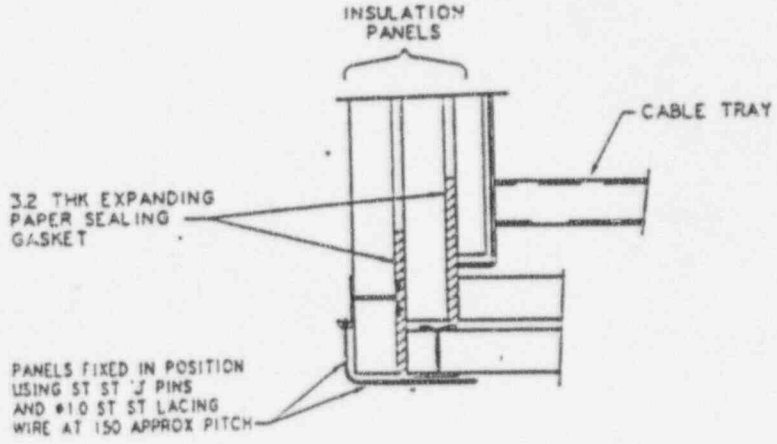
ASSEMBLY OF INSULATION AROUND 600mm CABLE LADDER



TYPICAL DETAIL OF PANEL GASKET



TYPICAL CORNER DETAIL



TYPICAL PANEL ASSEMBLY

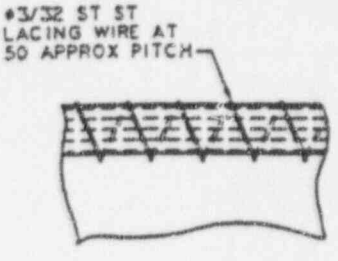


FIGURE 4

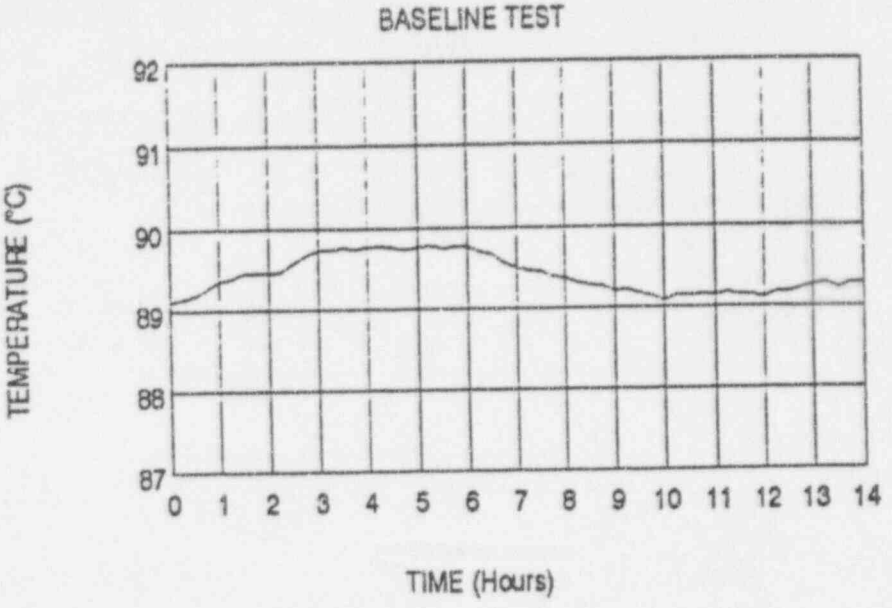
BASELINE TEST

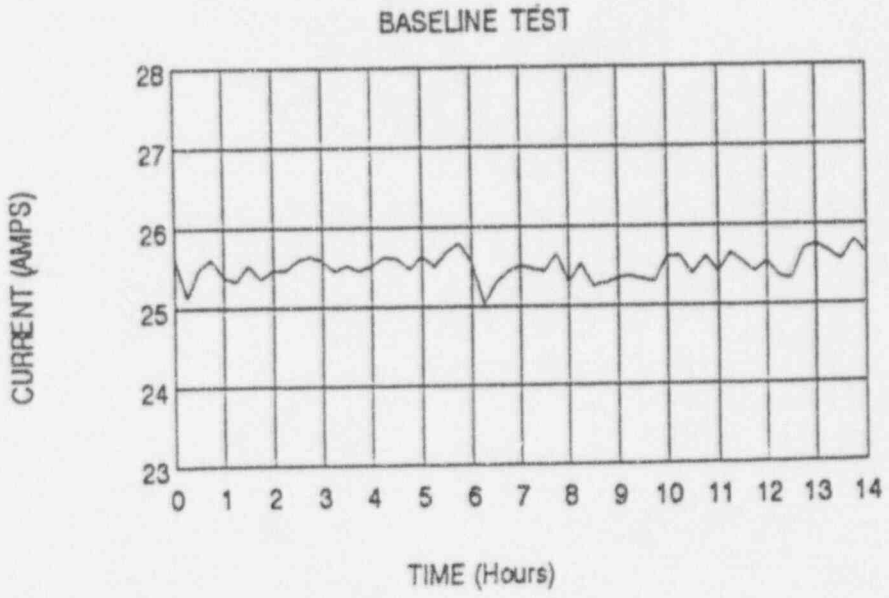
TIME (Hours)	CURRENT (Amps)	TEMP (°C)	SLOPE
0.00	25.63	89.10	
0.25	25.13	89.14	
0.50	25.50	89.18	
0.75	25.62	89.26	
1.00	25.40	89.35	0.2480
1.25	25.34	89.39	0.2680
1.50	25.54	89.45	0.2680
1.75	25.37	89.45	0.1920
2.00	25.48	89.45	0.1040
2.25	25.47	89.47	0.0640
2.50	25.60	89.57	0.1040
2.75	25.65	89.66	0.2160
3.00	25.58	89.73	0.3000
3.25	25.46	89.73	0.2720
3.50	25.53	89.76	0.1800
3.75	25.46	89.74	0.0760
4.00	25.52	89.76	0.0280
4.25	25.63	89.78	0.0400
4.50	25.62	89.76	0.0160
4.75	25.47	89.73	-0.0080
5.00	25.64	89.76	-0.0200
5.25	25.51	89.77	-0.0080
5.50	25.70	89.75	0.0080
5.75	25.81	89.76	0.0200
6.00	25.56	89.76	-0.0040
6.25	25.03	89.69	-0.0600
6.50	25.30	89.66	-0.1000
6.75	25.44	89.56	-0.2000
7.00	25.52	89.50	-0.2600
7.25	25.48	89.47	-0.2400
7.50	25.45	89.44	-0.2120
7.75	25.66	89.38	-0.1680
8.00	25.29	89.37	-0.1400
8.25	25.54	89.30	-0.1640
8.50	25.25	89.28	-0.1600
8.75	25.29	89.26	-0.1320
9.00	25.35	89.20	-0.1520
9.25	25.38	89.21	-0.1040
9.50	25.33	89.17	-0.1080
9.75	25.31	89.13	-0.1160
10.00	25.61	89.07	-0.1360
10.25	25.63	89.13	-0.1040
10.50	25.39	89.13	-0.0320
10.75	25.61	89.15	0.0400
11.00	25.41	89.14	0.0640
11.25	25.67	89.17	0.0360
11.50	25.54	89.14	0.0160
11.75	25.41	89.13	-0.0160
12.00	25.55	89.10	-0.0480
12.25	25.36	89.16	-0.0240
12.50	25.32	89.16	0.0280
12.75	25.70	89.21	0.0880
13.00	25.75	89.26	0.1480
13.25	25.67	89.28	0.1360
13.50	25.55	89.22	0.0760
13.75	25.81	89.27	0.0320
14.00	25.63	89.27	0.0040

	CURRENT	TEMP
AVERAGE	25.499	89.401

APPENDIX 3

1 Graphs of Temperature and Current against time


BASELINE TEST
TEMPERATURE (°C)
92
91
90
89
88
87
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
TIME (Hours)


BASELINE TEST
CURRENT (AMPS)
28
27
26
25
24
23
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
TIME (Hours)

APPENDIX 4

$$\% \textit{ Ampacity Derating} = \frac{I_o - I_f}{I_o} \times 100$$

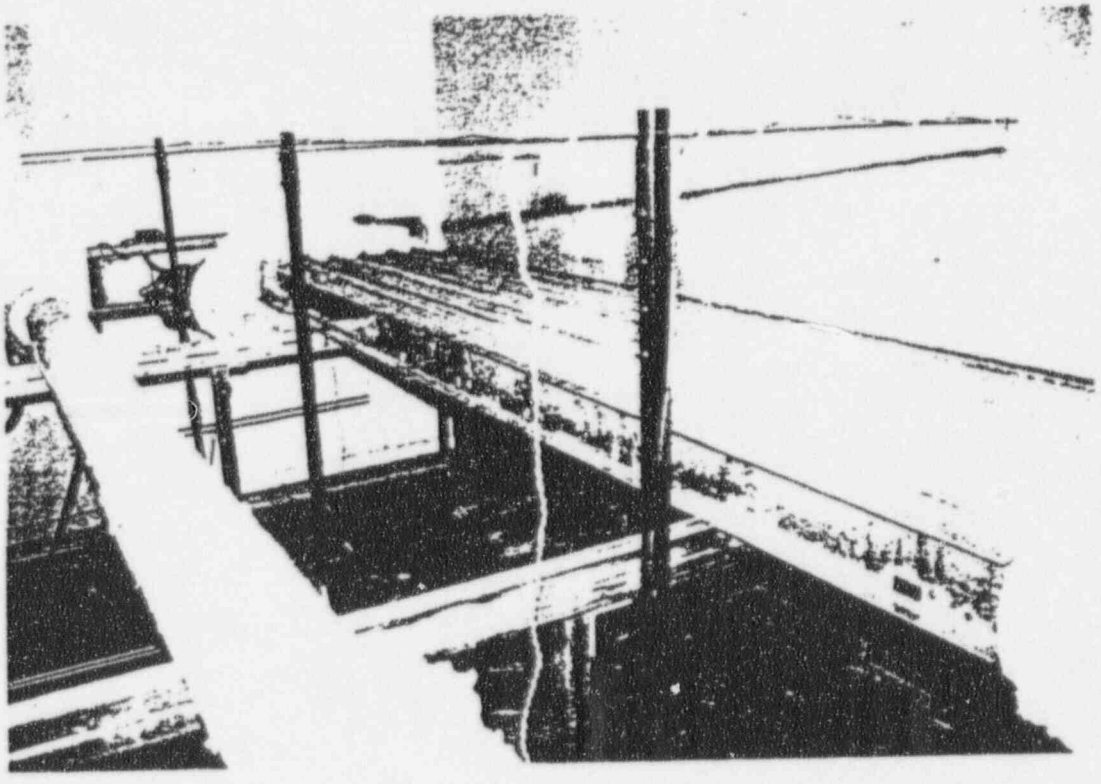
where I_o = Current in amps required to attain a conductor temperature of 90°C for the baseline test.

and I_f = Current in amps required to attain a conductor temperature of 90°C for the system encapsulated with a fire protection envelope.

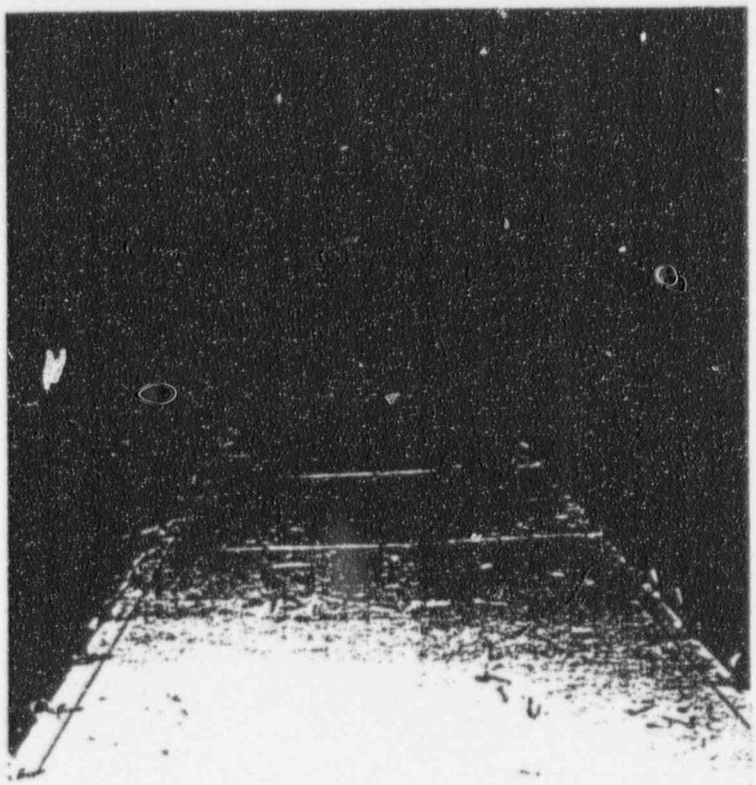
	Current (Amps)
Baseline	21.97
KM Darmatt Replacement	15.18

$$\% \textit{ Ampacity Derating} = \frac{21.97 - 15.18}{21.97} \times 100$$

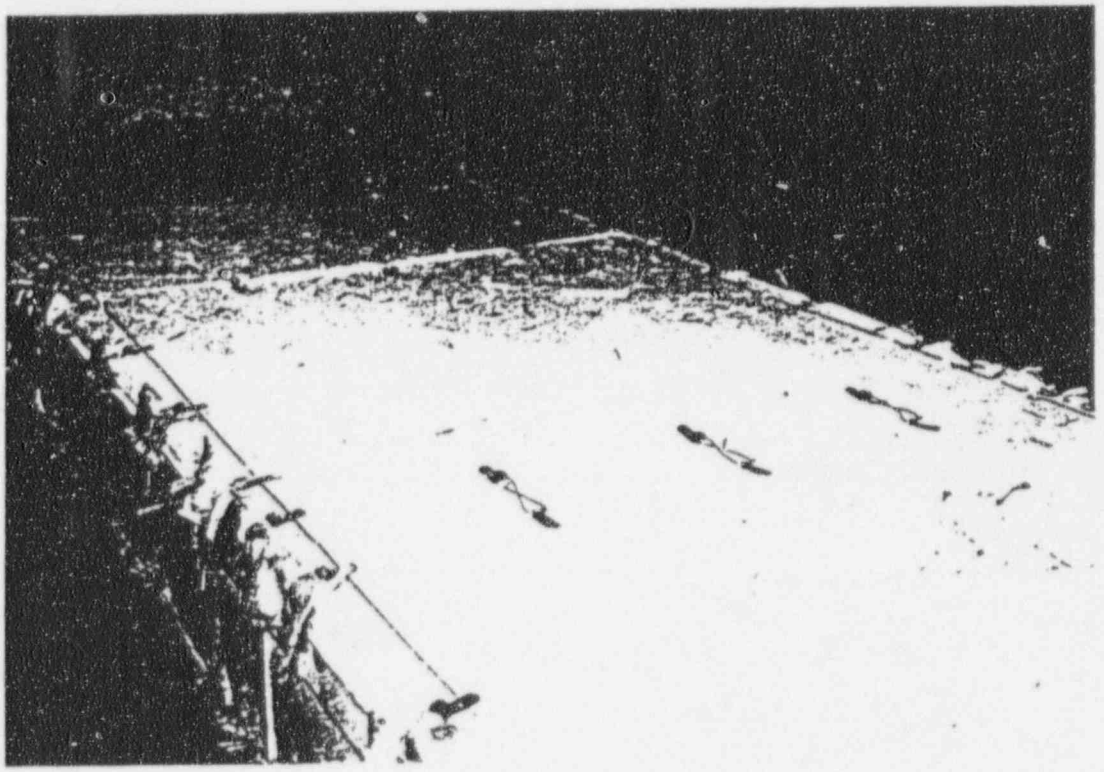
$$= 31\%$$



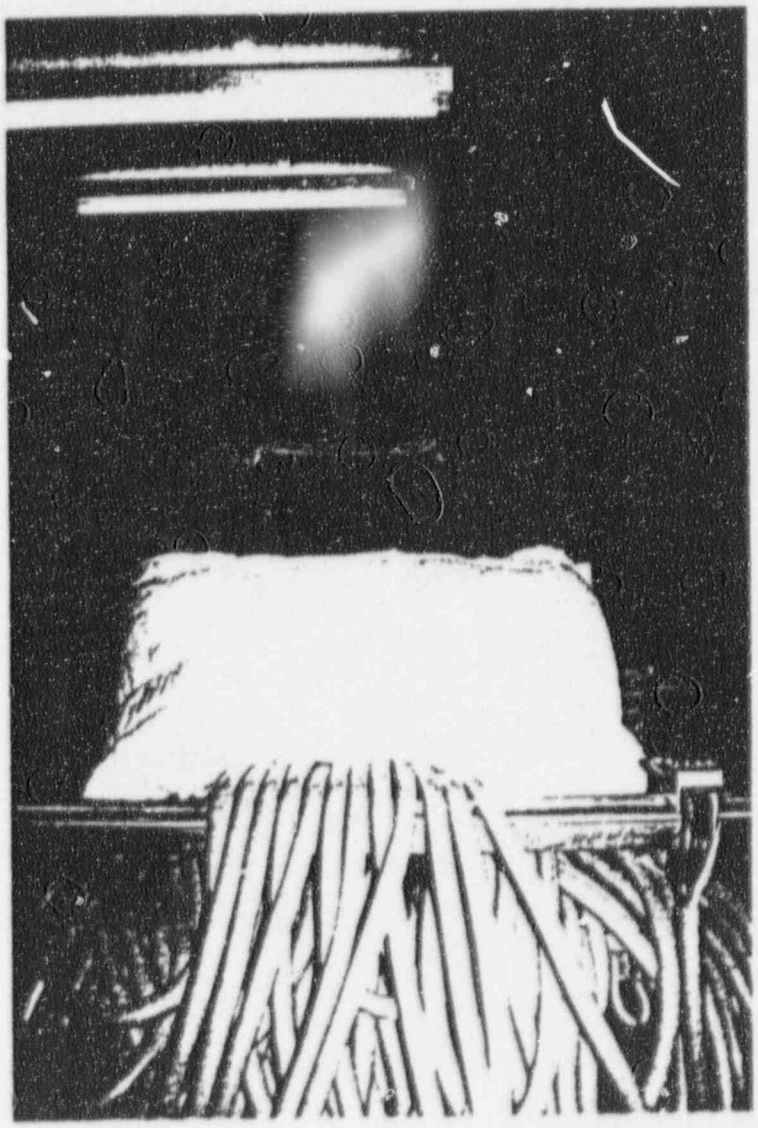
Frame 1: Cable tray baseline test showing cables



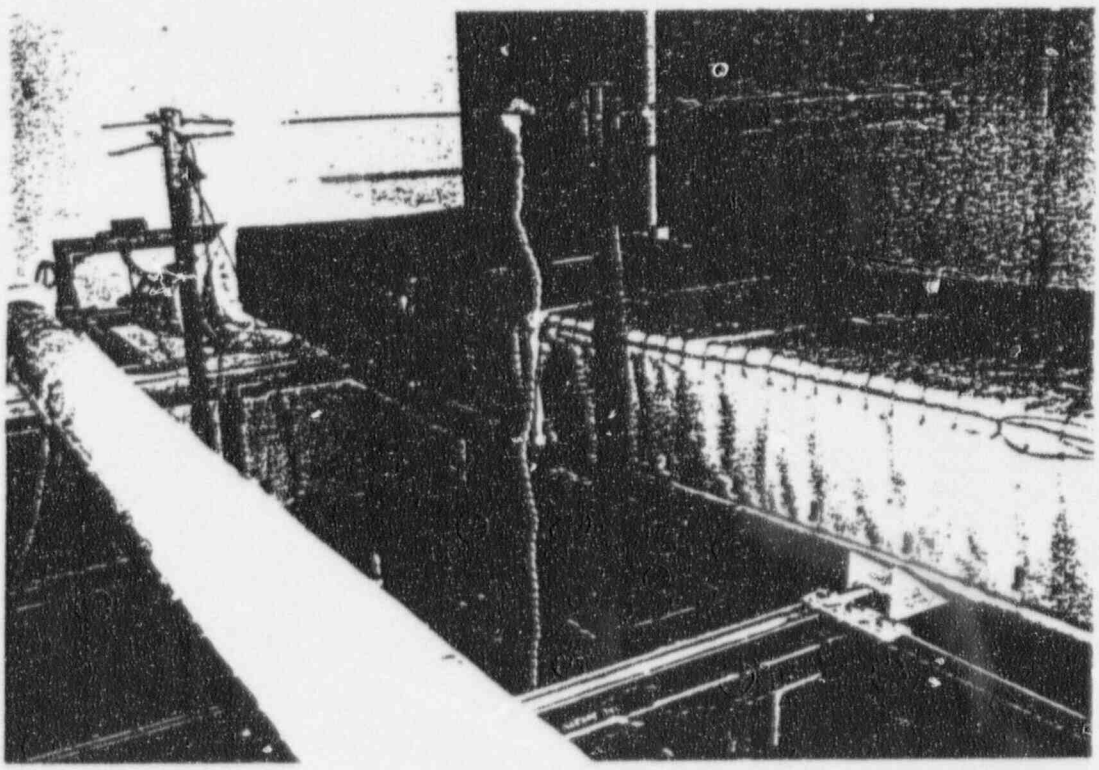
Frame 2: Darmatt KM1 Replacement - initial layer



Frame 3: Darmatt KM1 Replacement - initial layer



Frame 4: Darmatt KM1 Replacement - final layers



Frame 5: Darmatt KM1 Replacement - final layer