



TraceCalc Pro

User Guide



TraceCalc Pro™

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Welcome To TraceCalc Pro 2



TraceCalc® Pro design software brings you the latest advances in automated heat-tracing design capabilities. It sets new standards in the features you need for simple or sophisticated designs. With its new intuitive user-friendly interface, you can create a heat-tracing design quickly and accurately.

TraceCalc Pro provides design calculations such as pipe heat loss, number of circuits, electrical loads and maximum temperatures; and automated heating cable and component selection; and recommendations for control and monitoring selection, and much more. It provides easy-to-use standard reports; and last but not least, its powerful features help you obtain the best heat-tracing solution for your particular project.

With TraceCalc Pro, Pentair Thermal Management provides you with an unprecedented design tool that lets you select heat-tracing products from world-class brands such as Raychem, DigiTrace, Tracer, and Pyrotenax—giving you an optimal heat-tracing solution.

What Is TraceCalc Pro?

Easy-to-use user interface – Designed for ease-of-use, TraceCalc Pro’s user interface is intuitive, easy to navigate, user friendly, and employs state-of-the-art technology. The project window displays three panes at a glance: the Project Explorer Pane for managing your design elements, the Design Pane for entering line parameters and design data, and the Calculated Results Pane for a quick view of calculated results. TraceCalc Pro is built on a database compatible with Microsoft Access, which simplifies the exchange of data to other applications.

Various heater technologies in a single design program – TraceCalc Pro supports designs using self-regulating, power-limiting, and series heating cables, such as polymer and mineral insulated, in a single design program. It also supports the selection of more sophisticated control and monitoring devices.

Complex circuit connectivity – TraceCalc Pro supports heat tracing for complex piping configurations and their electrical connectivity, such as tees, loops, splices, line continuations, and so on. Using the easy-to-manage Project Explorer Pane,

TraceCalc Pro now lets you create complex circuits with the ability to drag-and-drop pipe segments and their related attributes to other lines and associated areas. A pipe can now also have changing design parameters for the same heater circuit, for example, changes to diameters, insulation thickness, or other parameters.

Multi-user design input – TraceCalc Pro allows multiple users to work simultaneously on a design project, which is very useful for large projects.

Multiple valve and support types on a single line – TraceCalc Pro supports up to three different valve and support types on a single line that more accurately reflects real piping configurations.

Automatically displays calculated design results – TraceCalc Pro lets you quickly view your design's calculated results in the always-visible Calculated Results Pane.

1 Vital Information

This help manual has been compiled based on version 2.0. As Pentair Thermal Management is continuously improving this software, the software you are using may include new features which are not documented in this help manual. Always refer to the release notes (readme.txt) which are shown during the installation process and also permanently stored in the directory of TraceCalc Pro (typically C:\Program Files\Pentair Thermal Management\TraceCalc Pro). You may direct questions about this software to PTM-info@pentair.com.

Important: All information, including illustrations, is believed to be reliable. Users, however, should independently evaluate the suitability of each product for their particular application. Pentair Thermal Management makes no warranties as to the accuracy or completeness of the information, and disclaims any liability regarding its use. Pentair Thermal Management's only obligations are those in the Pentair Thermal Management Standard Terms and Conditions of Sale for this product, and in no case will Pentair Thermal Management or its distributors be liable for any incidental, indirect, or consequential damages arising from the sale, resale, use, or misuse of the product. Specifications are subject to change without notice. In addition, Pentair Thermal Management reserves the right to make changes—without notification to Buyer—to processing or materials that do not affect compliance with any applicable specification.

License Agreement

TraceCalc Pro Program License Agreement

This agreement is a legal agreement between you, "the end user" and Pentair Thermal Management, LLC ("Pentair Thermal Management"). BY INSTALLING OR OTHERWISE ACCESSING THIS PROGRAM, YOU ARE AGREEING TO BECOME BOUND BY THE TERMS OF THIS AGREEMENT. IF YOU DO NOT AGREE TO THE TERMS OF THIS AGREEMENT, DO NOT INSTALL OR ACCESS THIS PROGRAM, AND PROMPTLY RETURN THE DISK AND ALL OTHER ITEMS RECEIVED WITH THE DISK (INCLUDING WRITTEN MATERIALS OR OTHER CONTAINERS) TO THE PLACE WHERE YOU OBTAINED THEM.

1. **GRANT OF LICENSE** The TraceCalc Pro program is licensed, not sold, to you for use only under the terms of this Agreement, and Pentair Thermal Management reserves any rights not expressly granted to you. Pentair Thermal Management grants to you, the end user, the right to use this copy, including written materials if any, of the TraceCalc Pro program on a single computer at the location (company and address) to which Pentair Thermal Management issued this copy of the TraceCalc

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2. OTHER RESTRICTIONS

- You may not sublicense, rent or lease the TraceCalc Pro program to anyone.
- You agree to notify Pentair Thermal Management promptly if “bugs” or seemingly incorrect or anomalous results are discovered or produced by the use of the TraceCalc Pro program.
- You agree that the TraceCalc Pro program, including written materials (if any) and all copies in whole or in part, will be destroyed or returned to Pentair Thermal Management at the written request of the Pentair Thermal Management Product Manager.
- By installing or otherwise accessing the TraceCalc Pro program, you acknowledge that you have read and understood Pentair Thermal Management’s Disclaimer of Warranty and Limitation of Liability, set forth below.
- You agree to use reasonable efforts to protect against the unauthorized copying and use the TraceCalc Pro program by others.
- You agree to register the TraceCalc Pro program within 30 days following its installation. If the trial period expires, you understand that until the registration process is completed the program will no longer function and you will not receive updates, patches, and correspondence which may affect the reliability of the program or the validity of its output. You further understand that if registration is not completed within 60 days following the expiration of the 30-day trial period the license granted herein will terminate.

3. **DISCLAIMER OF WARRANTY** THE TRACECALC PRO PROGRAM AND ACCOMPANYING WRITTEN MATERIALS ARE PROVIDED “AS IS” WITHOUT WARRANTY OF ANY KIND. THE ENTIRE RISK AS TO THE RESULTS AND PERFORMANCE OF THE TRACECALC PRO PROGRAM IS ASSUMED BY YOU. PENTAIR THERMAL MANAGEMENT DOES NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE TRACECALC PRO PROGRAM WILL MEET YOUR REQUIREMENTS OR THAT THE OPERATION OF THE TRACECALC PRO PROGRAM WILL BE UNINTERRUPTED OR ERROR-FREE, OR THAT PROGRAM DEFECTS WILL BE CORRECTED. It is assumed that the user of the TraceCalc Pro program is an expert in the engineering design of heat-tracing systems. Pentair Thermal Management has not verified the results produced by the TraceCalc Pro program for all conceivable design or analysis cases. You must judge the reasonableness of the results obtained by using your engineering expertise, and should

independently evaluate the suitability of each calculated result for your specific application.

4. **LIMITED WARRANTY – MEDIA** THE MEDIUM ON WHICH THE PROGRAM IS ENCODED IS WARRANTED TO BE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP UNDER NORMAL USE FOR A PERIOD OF SIXTY (60) DAYS FROM THE DATE OF DELIVERY TO YOU AS EVIDENCED BY A COPY OF YOUR RECEIPT. ALTHOUGH PENTAIR THERMAL MANAGEMENT BELIEVES THE MEDIA AND THE PROGRAM TO BE FREE OF VIRUSES, THE MEDIUM AND THE PROGRAM ARE NOT WARRANTED TO BE VIRUS FREE. PENTAIR THERMAL MANAGEMENT’S LIABILITY AND YOUR EXCLUSIVE REMEDY IF THE MEDIUM IS DEFECTIVE OR INCLUDES ANY VIRUS SHALL BE PROMPT REPLACEMENT OF THE MEDIUM WITH A NEW TRACECALC PRO-ENCODED DISC.
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7. **TERMINATION** The license granted herein will automatically terminate without notice from Pentair Thermal Management if you fail to comply with any term or condition of this Agreement or fail to register the TraceCalc Pro program as required by paragraph 2(f). You agree, upon such termination, to remove the TraceCalc Pro program from any memory and/or storage media or device, and to return the TraceCalc Pro program, including all media and written materials, or destroy the same and certify such destruction to Pentair Thermal Management, along with any backup or other copies in your possession.
8. **COMPLETE AGREEMENT – MODIFICATION IN WRITING** This Agreement constitutes the sole and complete understanding between the parties with respect to the TraceCalc Pro program and its use, and may not be varied except by a writing signed by an officer of Pentair Thermal Management. You agree that you may not rely on any representations concerning the TraceCalc Pro program to the extent

they vary from this Agreement, and such representations, if any, will neither add to nor vary the terms of this Agreement.

9. **CHOICE OF LAWS** This Agreement is governed by the laws of the State of Texas and the United States, including U.S. Copyright Laws.
10. **EXPORT LAWS** The TraceCalc Pro program may require a license from the U.S. Department of Commerce or other governmental agency before it may be exported. The term “export” includes many acts (such as transferring the TraceCalc Pro program to a foreign citizen within the United States), in addition to sending or taking the TraceCalc Pro program outside the United States. You agree to ascertain the necessary licensing procedures and obtain any required licenses before exporting the TraceCalc Pro program. You also agree to indemnify Pentair Thermal Management and assume all financial responsibility for any losses it may suffer if you do not comply with this paragraph.
11. **Government Restricted Rights.** User acknowledges that the TraceCalc Pro program has been developed at private expense and is provided with “Restricted Rights.” Use, duplication or disclosure by the Government is subject to restrictions as set forth in subparagraph (b)(3) and paragraph (c) of the Rights in Technical Data clause at 48 C.F.R. 252.227-7013, or subparagraphs (c)(1) and (2) of the Commercial Computer Software – Restricted Rights clause at 48 C.F.R. 52.227-19, as applicable. This provision applies to the TraceCalc Pro program acquired directly or indirectly by or on behalf of any government. The TraceCalc Pro program is a commercial product, licensed on the open market at market prices, and was developed entirely at private expense and without the use of any government funds. Any use, modification, reproduction, release, performance, display, or disclosure of the TraceCalc Pro program by any government shall be governed solely by the terms of this Agreement and shall be prohibited except to the extent expressly permitted by the terms of this Agreement, and no license to the TraceCalc Pro program is granted to any government requiring different terms.
12. **ASSIGNMENT** You may neither assign any right nor delegate any obligation under this Agreement and attempted assignment or delegation shall be void. Pentair Thermal Management may freely assign this agreement and its rights and obligations thereunder to any third party.
13. **INVALID PROVISIONS** If any of the provisions of this License Agreement are invalid under any applicable statute or rule of law, they are to that extent deemed omitted.

Should you have any questions concerning this Agreement, or if you desire to contact Pentair Thermal Management for any reason, please write to:

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User Responsibilities

The performance, reliability and safety of your heat-tracing system depend on proper design, selection and installation. The TraceCalc Pro program will help you design a system that meets your requirements, but it is only a tool. It assumes that your input is accurate, that you are familiar with heat-tracing design, and that you will ensure that all components of the heat-tracing system are installed, maintained and used as intended. The output of TraceCalc Pro should be reviewed by a knowledgeable engineer to ensure it is appropriate for your application. Additional information relating to safety, design and installation is contained in Design Guides, Installation Manuals, Data Sheets, and other literature available from Pentair Thermal Management. Be sure to consult these documents as needed or send email to Technical Support at PTM-info@pentair.com.

Safety Warnings

There are important safety warnings shipped with our products and printed in our literature. Be sure to read and follow them to reduce the risk of fire, shock or personal injury. If you have any questions, send email to Technical Support at PTM-info@pentair.com.

Warning and Error Messages

The TraceCalc Pro program will alert you with a warning or an error message under certain circumstances. These are typically either because the program cannot find an acceptable answer based on your input or because the user may need to take some additional action to ensure the design requirements are completely met. These warnings and error messages are detailed in Appendix A.

If you have any questions, send email to Technical Support at PTM-info@pentair.com.

Technical Support

Local Representatives – Contact your local Pentair Thermal Management representative for help. For the most up-to-date and complete listing, go to www.pentairthermal.com, click **Support > Where To Buy**.

Email – You can request help by sending email to PTM-info@pentair.com.

FAQ – To view Frequently Asked Questions, visit www.pentairthermal.com, click on **Support > Frequently Asked Questions**.

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2 Getting Started

The following sections will help you get started with TraceCalc Pro.

System Requirements

The minimum software and hardware required to run TraceCalc Pro includes the following:

- Windows 98, 2000, NT4-SP5, ME, XP
- At least 25MB of free hard disk space
- CD-ROM drive (if installing from CD)
- Internet Explorer 4.01-SP1 or later
- Screen resolution at least 1024x768

Recommended (but not required) equipment:

- Pentium class computer, or better
- 500 MHZ, 128 MB RAM or more
- Internet Explorer 5.5 or later
- Adobe Acrobat Reader 5.0 or later, to view the PDF print version of User Guide

Installing TraceCalc Pro

Installation will normally start automatically after placing the TraceCalc Pro CD in your CD-ROM drive. Just follow the on-screen instructions.

If installation doesn't automatically begin:

- Double-click the "My Computer" icon on your desktop.
- Right-click the CD-ROM drive icon that holds the TraceCalc Pro CD.
- Select "Explore" from the pop-up menu.
- Double-click on Setup.exe to launch TraceCalc Pro installation.

Learning TraceCalc Pro

TraceCalc Pro includes a variety of resources to help you learn the program quickly and become proficient in creating heat-tracing designs. These resources include online help and a printable book that includes a Tutorial chapter. You can also find up-to-date Frequently Asked Questions (FAQ) on www.pentairthermal.com.

If you are a new user, start by reviewing the following chapters: “[3 Basics](#)” on page 11 to get a good understanding of the program interface, and “[4 Tutorial](#)” on page 23 to learn the basics of entering project data.

TraceCalc Pro Online Help

The TraceCalc Pro program contains Online Help, a quick and convenient way to look up information about a task or an input field. Help is available at most steps in the design process.

To access Online Help, press **F1** from anywhere in the application. For best results viewing TraceCalc Pro Online Help, use Microsoft Internet Explorer 4.01-SP1 or later.

TraceCalc Pro User Guide (printable book)

We also provide a printable version of the Online Help in the form of an Adobe Acrobat PDF file.

To access and eventually print this version of the User Guide, click **Start > Program Files > Pentair Thermal Management > TraceCalc Pro User Guide**. For best results viewing the PDF version of the User Guide, use Acrobat Reader 5.0 or later. A free version of Acrobat Reader 5.0 is included on the TraceCalc Pro CD for your convenience.


Basic Assumptions

We assume you are familiar with using a PC computer with the Microsoft Windows environment and know how to:

- Launch an application
- Open, save, and close files
- Use menus and dialog boxes
- Use the mouse
- Design a basic heat-tracing system
 - Manually select heating cables, components and accessories
 - Understand and apply the fundamentals of electrical design
 - Understand the special requirements of hazardous area designs

Document Conventions

The following typographical conventions are used throughout the User Guide.

- **Bold** – used for menu command names and field names. For example, **File** menu, and **Line ID** field.
-  (Ellipsis button) – click the **ellipsis** button next to a field to access a dialog box related to that field. For example, in the Pipe segment of the Basic tab screen, if you click the ellipsis next to the **Type** field, the program takes you to the Customize Pipe Types dialog box where you can add, modify or delete **Pipe Types**.
- **Navigation drilldown >** – used to depict a navigation path in which the user must drill down in order to reach the final destination; for example, **Setup > Program Settings > Advanced** indicates that the user must go to **Setup** on the main menu, drill down to **Program Settings**, and choose the **Advanced** tab.
- **Data Entry Example** – Arial Red font used for project entry data in the samples and tutorial content, such as **Water Line 02**.

3 Basics

This section tells you how to start TraceCalc Pro and then explains the menu bar, tool bar, and the purpose of the Design Pane, the Calculated Results Pane, and the Project Explorer Pane. This section is intended for the first-time user who needs to become familiar with the basic navigation structure, and does not attempt to explain the details of entering design data or calculations. If you are an advanced user, you may prefer to go directly to “[5 Designing Your Project](#)” on page 29.

Starting TraceCalc Pro

To start the TraceCalc Pro program, double-click on the TraceCalc Pro icon on your desktop, or click **Start > Programs > Pentair Thermal Management > TraceCalc Pro**.

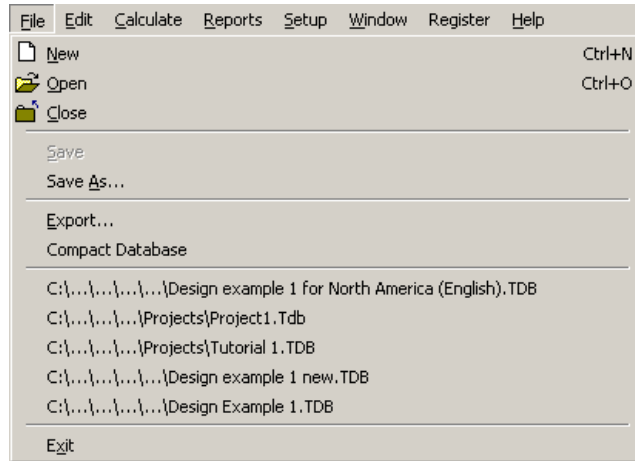
When you launch TraceCalc Pro, you have the option to use **File > New** to start a new project or **File > Open** to open an existing project. A project is simply a TraceCalc Pro database file that contains the design parameters, specifications and calculated results for the heat-traced application you are designing. From this database, you can generate useful reports for building/implementing your heat-traced application.

Menu Bar

The Menu bar options are organized for creating new, or opening existing projects, defining project and program settings, setting up reporting criteria, and other useful functions. Each menu is discussed in more detail below.

File

This menu lets you create new projects, open existing ones, and save or export project data.



New

This command displays the Enter New Project Name dialog box, which lets you define a new project name. In the File Name box, type a name for your project, and click **Save**. The file will be saved in the Project folder by default; however, you can save the project to a different folder if you wish.

Open

This command displays the Select TraceCalc Pro Project dialog box, which lets you open an existing TraceCalc Pro project. Click on the file you wish to open. For easy project management, you can have more than one project file opened at one time.

Close

This command closes an active project.

Save

By default, TraceCalc Pro will open project files in “single-user” mode. In this mode, you are free to work with all aspects of the project and make as many changes as you like and nothing will be saved to the project file until you explicitly choose **Save**. At that time, all changes that you have made will be written to the project file. If you don’t choose to **Save** or there is a computer malfunction that interrupts your work session, then all changes will be lost.








When working in “multi-user” mode, any changes to the data for a pipe segment are automatically saved as you move from segment to segment. In this mode, the Save menu item and the toolbar icon will not usually be enabled, because TraceCalc Pro is saving the data as you work. For more information on opening projects in “multi-user” mode, please see “[Advanced Tab](#)” on page 97.

Save As

This command lets you save your project under a different project name. When prompted, enter the new project name and click **Save**.

Export

This command exports all, or some field names and their values for lines in your project in CSV (comma-separated values) format, which can be read by other programs, such as Microsoft Excel.

- Select Pipe Only, Vessel Only or Both from the drop-down list to export pipe data, vessel data, or data for both pipes and vessels. Your selection affects which fields may be exported. If you select Pipe Only, only pipe data will be exported; ‘vessel-only’ fields such as vessel diameter will not be exported. Similarly, if you select Vessel Only, only vessel data will be exported. Data for pipe-only fields such as pipe diameter will not be exported. If you select Both (Common Fields Only), then both pipe and vessel data can be exported, but only data for fields used by both pipes and vessels can be exported.
- Export all field names by clicking on the **double right arrow** button  to move the field names from the left to the right list for export.
- Export some field names by highlighting the fields you want and clicking the single right arrow . Fields may only be selected and moved one at a time or all at once. Alternatively, if all the field names are on the right, you can click any of the field names and click the single left arrow  to remove it from the export list.
- Fields will be exported in the order they appear in the right-hand list. You may change the order with the up and down arrows that appear to the right of the list box. To move a field name to the top or bottom of the list, use the top arrow  or bottom arrow . To move a field name up or down, click on the field name and then click on the up arrow  or down arrow .
- To select which lines and / or vessels to export, click the **Filter** button. The Filter and Sort Settings dialog box appears. For more information, please see [“Using the Filter and Sort Settings Dialog Box”](#) on page 87.
- Once you have chosen the type of export (Pipes Only, Vessels Only, or Both), selected the names of the fields that you wish to export, and set a filter (if desired), click the **Export** button.
- Specify a file name for your exported data file. This file will be saved in the Project folder by default, unless you specify a different location. The CSV format can be read by many applications, including Microsoft Excel. The horizontal array of field names and values (all fields on row 1 and values on row 2) can be transposed to a vertical list (all fields in column 1 and values in column 2) using Microsoft Excel’s Paste Special – Transpose feature, if required.

Export -> Saving and Recalling Field Lists

You can also save the list of fields chosen above and recall those settings in subsequent export operations. This makes it easy to export just the fields necessary for a particular operation.

To recall a previously saved list, just select it from the **Saved Field Lists** drop down list. If you edit a saved list and want to save the new settings under the same name, click on the **Save List** button. To save under a different name, click on the **Save List As...** button and then enter a new name. Finally, to delete a saved list, click on the **Delete Saved List** button.

Note: field lists are specific to the export type. For example, if you save a field list during a Pipe Only export, it will be available for Pipe Only exports, but not for Vessel Only exports or Both (Pipe and Vessel) exports.

Export → Filter

Use this command to apply filter criteria to a selection of lines prior to exporting the data. Select the field names for the values you wish to export. Then, click the **Filter** button. The Filter and Sort Settings dialog box appears. For more information, please see “[Using the Filter and Sort Settings Dialog Box](#)” on page 87.

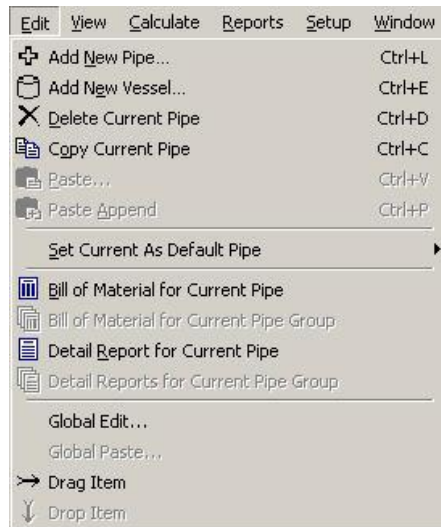
Compact Database

This menu command will optimize the project database structure, removing wasted space and potentially reducing the file size. As you add, delete, modify and recalculate pipe segments, it is likely that “unused” space will be created within the project file structure.

For smaller projects, wasted space will normally be inconsequential and can be ignored. However, for larger projects, after making many changes, you may be able to reduce the project file size by several megabytes using this command.

Edit

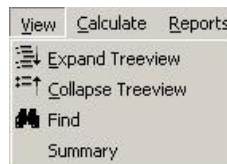
This menu lets you add and remove project lines, generate various reports, and edit variables that will affect all lines in your project.



For more information, see “[Working with Project Lines and Vessels](#)” on page 82.

View

This menu lets you navigate around the Project Explorer Pane and the Summary Pane.



For more information, see “[Find a Line or Vessel](#)” on page 79 or “[Summary Data](#)” on page 77.

Calculate

This menu lets you calculate results of your design parameters on the current record or all records that are open. You can also calculate only the records that have been changed since the last calculation.



For complete details about these menu options, see “[Viewing Calculated Results](#)” on page 73.

Reports

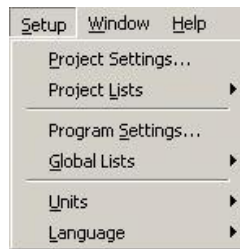
The menu lets you generate reports. You can filter and sort information, modify filter and sort settings, and preview the report prior to printing.



For complete details about these menu options, see “[8 Reports](#)” on page 105.

Setup

This menu lets you add information that is specific to a project, like project name, product preferences, design preferences, units of measure, and so on. It also lets you identify the location of the product reference data file that contains the data for heating cables, components and control devices. Attributes selected in the Setup menu will be saved when you close the Setup window.



For complete details about these menu options, see “[6 Advanced Settings](#)” on page 91.

Window

From the Window menu option you can arrange multiple project windows, and activate and hide project windows when more than one project is open at a time.

Register

From the Register menu option you can launch the Registration popup window that lets you connect to an online or offline registration form. When you register, you will

receive a validation code that you must enter on the Registration popup window in order to retain TraceCalc Pro beyond the 30-day trial period.

Help

From the Help menu option you can launch the online Help tool. Select **Contents**, **Index**, or **Search** depending on which part of Online Help you wish to access. You can also access Online Help by pressing the **F1** key.

Tool Bar

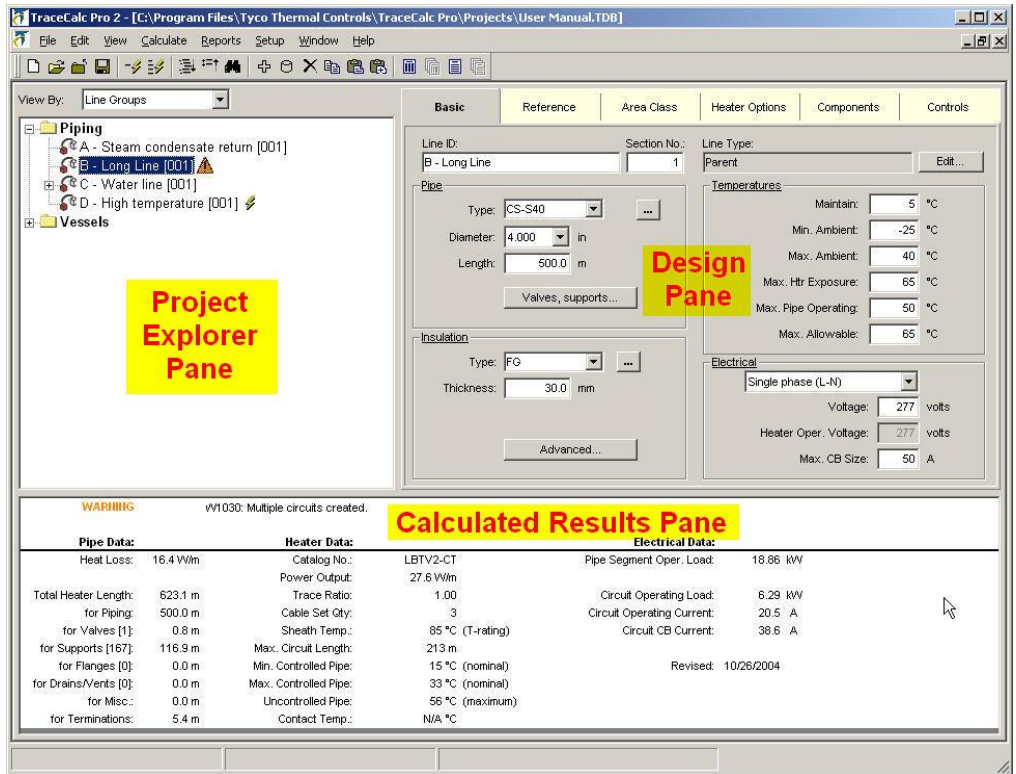
You can use the Tool Bar buttons as shortcuts to some of the commands available from the Menu bar's File, Edit, View, Calculate, and Reports menus. Simply click on the button to use frequently used features such as **New**, **Open**, **Close**, **Save**, **Calculate Records**, **Find**, **Copy**, **Paste**, and **Detail Report for Current Pipe**. To see what function each button represents, simply place your cursor over the button to display the 'tool tip'.



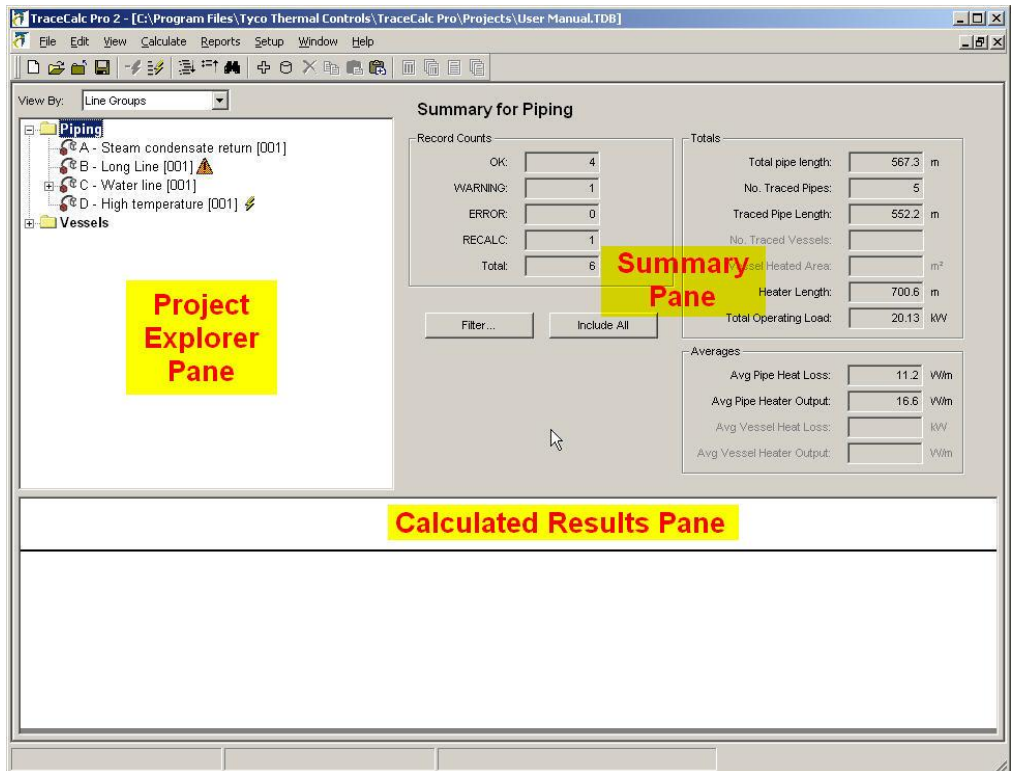
Project Window

TraceCalc Pro's Project Window has two views: the Design View and the Summary View. In Design view, the Project Window contains three panes—each serves a critical function for the design and calculation of your project data. The three panes are:

- Design Pane
- Calculated Results Pane
- Project Explorer Pane



Summary View is similar to Design View, except that the Design Pane is replaced by a Summary Pane.



Design Pane

This pane displays whenever a line or vessel is selected in the Project Explorer Pane. The Design Pane contains several tabs: Basic, Reference, Area Class, Heater Options, Components (optional), and Controls. Each tab represents a screen where the user enters specific design data for the selected pipe segment or vessel.

For instance, the Basic tab will collect line ID, line type, pipe, insulation, temperature, and electrical information. The Reference tab will collect area, fluid, and location data. The Area Class tab will collect information that defines the specific hazardous location, including class, division/zone, gas/dust groups, design parameters, and sheath temperature calculation modes. The Heater Options tab will collect information that helps define the type of cable to be considered and whether spiraling will be allowed. The Components tab will collect information that specifies system components, such as power, splice, tee and end seal. Lastly, the Controls tab will collect data for selecting an appropriate temperature control method such as Standard ambient sensing, proportional ambient sensing, line sensing with no failure alarm, and line sensing with failure alarm.

If you click on a folder in the Project Explorer Pane or select **View > Summary**, the Design Pane is replaced by the Summary Pane.

For complete details about entering line and vessel data, see “[Entering Design Data](#)” on page 31.

Calculated Results Pane

The Calculated Results Pane displays an online preview of calculated results for the selected pipe segment or vessel when you choose any option from the Calculate menu. This window lists specific information related to heating cable lengths, type, performance, and electrical operating requirements.

If no pipe segment or vessel is selected in the Project Explorer Pane, then the Calculated Results Pane will be blank.

For complete details about calculating results, see “[Viewing Calculated Results](#)” on page 73.

Project Explorer Pane

The Project Explorer Pane is where you manage all the pipe lines and the electrical panels for your project. Use the Project Explorer Pane to do the following:

- Select how you wish to view your project elements (by Line Groups or Panel Groups)
- Edit (add, modify, delete, etc.) the list of project pipes.
- Right-click on a **Line ID** for more editing (copy, paste, etc.) and reporting options.
- Double-click on a **Line ID** to edit the **Line Type** (pipes) or Vessel Properties (vessels).
- Click on any folder to see a Summary of data for lines and vessels in that folder.

For complete details about the Project Explorer Pane, see “[Managing Project Elements](#)” on page 78.

Summary Pane

The Summary Pane is not visible when you are viewing or editing line or vessel data. The Summary Pane appears if you click **View > Summary** from the Main Menu, or if you select (click) a folder in the Project Explorer Pane.

The Summary Pane shows summary data for your project, such as the number of pipe segments needing recalculation, the total length of pipes, and so on.

You may select the lines to be included in the summary.

For complete details about the Summary Pane, see “[Summary Data](#)” on page 77.

4 Tutorial

This section is a tutorial for the novice TraceCalc Pro user. It leads the user through the steps of starting a project, entering data, generating reports, and saving and modifying data. Intended as a Fast Start for the novice user, this section does not attempt to explain all the capabilities of the TraceCalc Pro program. For a detailed explanation of capabilities, refer to “[5 Designing Your Project](#)” on page 29.

Starting a New Project

To start the TraceCalc Pro program, double-click on the TraceCalc Pro icon on your desktop. As an alternative, click on **Start > Programs > Pentair Thermal Management > TraceCalc Pro**.

Click on **File > New**. In the Enter New Project Name dialog box, the File Name box will be highlighted. Type **Tutorial 1** or other suitable file name, and click **Save**. The file will be saved in the Projects folder by default; however, you can save the project to a different folder if you wish.

Entering New Project Data

In the Project Explorer Pane, one line is already entered called **New Line [001]** under a folder called **Piping**. In this tutorial we will rename the default line and then use that line as a shortcut to enter two new additional lines.

Just above the Project Explorer Pane you will notice a heading **View By:** with **Line Groups** highlighted. Leave this setting as **Line Groups**. You can read more about Panel Groups in the section “[5 Designing Your Project](#)” on page 29.

Before you start entering data, let’s set a few project settings:

- **Units** – Set units by clicking **Setup > Units > Metric** if it has not already been selected for this tutorial.
- **Project Name** – The project name, along with other information entered in the Project Information Window, will show up on all reports and can be anything that is meaningful to the designer. Give the project a name by clicking **Setup > Project Settings**. In the Project Information window, type a Project Name such as **Tutorial** and add any other reference information like customer name, project description, and so on that you would like to see on a report. The other tabs in the Project Information are described in “[Project Settings](#)” on page 91.

Basic Tab Data

The Basic tab is in the Design Pane, just to the right of the Project Explorer Pane. Use the Basic tab to enter information and data specific to a particular line. A line may consist of a single pipe segment or many, depending on the design conditions.

Each pipe segment is identified by a unique combination of a Line ID and a Section Number. Enter line data as follows:

- **Line ID** – In the **Line ID** field, highlight the words **New Line** and replace them by typing **Water Line 01**, then press **Enter** or **Tab** to another field. You can enter a maximum of 30 characters in this field.
- **Section No.** – Leave the Section Number field as 1—you use this section number only to differentiate different sections of a pipe with the same **Line ID**.

Enter Pipe data as follows:

Note that although pipe sizes are commonly supplied in English units, some pipe types use metric units by default. If you want to specify a metric pipe size, select a Pipe Type such as TC-DN (METRIC).

- **Pipe Type** – Select **CS-S40** from the drop-down list to specify that the piping is Carbon Steel, Schedule 40.
- **Diameter** – Select **1.000** inch from the drop-down list.
- **Length** – Click on the data in this field and replace it by entering **15 m**.
- **Valve and Supports** – This section is optional. For this example, we will presume that this 1" pipe has typical supports, there are no flanges and one typical valve on this section of pipe. To view the valves, supports and flanges defined for a pipe segment, click **Valves, Supports...** to bring up the HeatSinks dialog box. Click **Cancel** to close the HeatSinks dialog box without saving changes to the heat sink definitions.

Enter Insulation data as follows:

- **Insulation Type** – Select **CS** from the drop-down list to specify **Calcium Silicate** insulation.
- **Thickness** – Enter **20** mm. (Note: You can enter any value, as there is no table of standard sizes for insulation thickness.)
- **Advanced** – This button provides a way of selecting Two Layer Insulation Systems or Over size Insulation. Ignore this button for now.
- **Line Type** – This field shows this line type to be **Parent**. You cannot change this, as the first line has to be a **Parent**, i.e. it will need a power connection. Lines branching off this line can be loops, tees, etc. For a more detailed information, see "[Line Type](#)" on page 32.

Enter temperature data as follows:

- **Maintain** – The desired pipe temperature at the Minimum Ambient temperature. Enter **5** °C.
- **Min. Ambient** – The lowest anticipated Ambient temperature. Enter **–20** °C.
- **Max. Ambient** – The highest anticipated Ambient temperature. Enter **35** °C.

- **Max. Htr. Exposure** – The highest anticipated pipe or fluid temperature to which the heating cable will be exposed intermittently. Enter **65** °C.
- **Max. Operating** – The highest anticipated pipe or fluid temperature to which the heating cable will be exposed continuously. Enter **50** °C.
- **Max. Allowable** – The highest acceptable fluid temperature generated by the heating cable. The program uses this temperature to determine whether temperature controls are required. Enter **80** °C.

Enter Electrical data as follows:

- **Voltage Configuration** – Select **Single phase (phase-neutral)** from the drop-down list.
- **Voltage** – Enter 120 volts.
- **Max. CB Size** – The highest circuit breaker rating the user desires to use. Enter **20** amps.

Reference Tab Data

Click the Reference tab at the top of the Design Pane.

This information will appear in reports and can be used to help organize the output. Enter reference data as follows:

- **Area** – Accept the default for this tutorial.
- **Fluid** – Should already be set at **WATER** by default. Accept this default. The selected fluid appears for reference purposes only.
- **Drawing No.** – Accept the default for this tutorial.

Enter location data as follows:

- **Indoor/Outdoor** – Identifies whether the ambient is indoors or outdoors. Outdoor locations consider the effect of wind on heat loss. Indoor locations assume no wind. Set the location to **Outdoor**.
- **Wind Speed** – Enter **10** meters per second. Wind is not considered for indoor locations.
- **Chemical Exposure** – Identifies whether significant exposure to chemicals is anticipated and limits heating cable selection to those having the appropriate outer jacket or sheath. Select **None**.
- **Startup Temperature** – The lowest anticipated temperature of the heat-traced pipe or equipment (not necessarily with ambient) at which the heating cable circuit will be energized. Lower startup temperature may reduce allowable circuit lengths and might increase the cost of electrical supply. Enter **5** °C.
- **HL Safety Factor** – Increases the calculated heat loss to ensure the cable provides extra heat. It is one way to compensate for important variables that cannot be controlled or quantified. Enter **10** %.

You may wish to save your data at this point. Click the Save button, or click **File > Save** from the main menu.

Area Class Tab Data

Click the Area Class tab at the top of the Design Pane.

Enter the information as follows:

- **Standards Body** – Select **US** from the drop-down list.
- **Class/ Area Classification** – Select **Non-hazardous**.

Ignore the rest of the screen for this tutorial.

Click the **Save** button, or click **File > Save** from the main menu, to save your changes.

Heater Options Tab Data

Click the Heater Options tab at the top of the Design Pane.

Enter heater technology data as follows:

- **Category** – Limits the types of heating cables considered by the program based on whether the design employs series or parallel electrical circuitry in its construction. Select **Parallel**.
- **Manual Select Attachment** – Leave this box unchecked to allow the program to select the default method of attaching the heating cable to the pipe.
- **Allow Spiraling** – Leave this box unchecked to disallow spiraling, as it is more convenient to use a straight run of heating cable, if that gives suitable results.
- **Force Trace Ratio** – Leave this box unchecked to let the program calculate if more than one straight run of heating cable is necessary to provide sufficient heat.

Leave all the boxes unchecked under **Heater Selection** to allow the program to choose from all available heating cables.

Click the **Save** button, or click **File > Save** from the main menu, to save your changes.

Components Tab Data

If you are not familiar with the component selection, you should skip this section and go to the Controls tab.

Click the Components tab at the top of the Design Pane.

Click the Power and End Seal tabs, and ensure that all boxes on each tab are unchecked, to allow the program to make suitable selections.

Controls Tab Data

Click the Controls tab at the top of the Design Pane.

Select a control method as follows:

- **Control Method** – Select **Uncontrolled** from the drop-down list.

Leave all the boxes unchecked and leave the other data fields at their default settings. For this tutorial, we will see if the temperature conditions can be met without the use of a thermostat or more sophisticated temperature controls.

Click the **Save** button, or click **File > Save** from the main menu, to save your changes.

Review the Results

You can now allow the program to calculate the heat loss of the pipe and select the appropriate heating cable and components. Click the **Calculate toolbar** icon, or click **Calculate** on the main menu and select **Current Record**, or press the **F9** key.

The Calculated Results Pane at the bottom of the screen will show the heat loss from the pipe on the coldest and windiest day (worse case condition), the catalog number of the heating cable, and a summary of other calculated values.

If the program is unable to select a suitable heating cable for the data you entered, you will see an ERROR message at the top of the Calculated Results Pane.

If the program encounters conditions that require further consideration, you will see a WARNING message at the top of the Calculated Results Pane. Warning messages should not be ignored as they may be identifying conditions that pose a safety risk or reduction in system performance.

TIP: You can change the height of the Calculated Results Pane by dragging the border that separates it from the other windows.

Copy Data to a New Line

You can now quickly add a new line by using the first line as a template. There are two ways of doing this:

- Set the current line as the default – When you set the current line as a default, you can copy all the data for that line to a new line.
- Copy an existing line – When you copy an existing line, you can copy and paste all of the attributes of that line to a new line.

We will demonstrate each way to make a second and third line respectively in our project.

Set Current Line as Default

Set the current line you already entered as the default for all new lines you enter in this project as follows.


In the Project Explorer Pane, right-click on the name of the line you have just entered (Water Line 01, for this tutorial example) and highlight **Set Current Line As Default** then select **For This Project**. Alternatively, use **Edit** on the main menu, where the same options appear.

Right-click inside the Project Explorer Pane and select **Add New Line**. Add line details as follows.

- **Line ID** – Enter **Water Line 02**.
- **Section No** – Leave as **1**.
- **Line Type** – Will be shown as **Parent**. Click **OK**.

You can now edit the data for this new line. Under the Basic tab enter new data as follows:

- **Length** – Change to **200** m.

Click the **Calculate Current Record** icon , or click **Calculate > Current Record** on the main menu. Alternatively, you can right-click on the line you wish to calculate and select **Recalculate**.

Click the **Save** icon, or click **File > Save** from the main menu to save your data and results.

The first line of the Project Explorer Pane will show a warning to indicate that Multiple Circuits have been created. This is because 200 m is too long for a single circuit based on the selected heating cable/technology. The program equally divides up the circuit and calls for two sets of components. The **Circuit Operating Load** is the load for each circuit and the **Pipe Segment Operating Load** is the total for all circuits on this line. For now we will accept this design although you may decide later to create a new line so that you can specify different lengths for the two circuits on the 200 m of piping.

Copy an Existing Line

Now copy the existing line and paste all of the attributes of the current line to a new line that you create as follows:

Right-click on the name of the second line and select **Copy Current Line**. Then, right-click again and select **Paste Append** to create an identical new line.

TIP: Once you have copied a line you can also paste some or all of the data associated with that line to an existing line using **Paste**.

Enter Line ID data as follows:

- **Line ID.** – Enter **Eyewash line**.
- **Section No.** – Enter **1**.
- **Line Type** – Will be shown as **Parent** and will not be selectable. Click **OK**.

Under the Basic tab change data as follows:

- **Pipe Type** – Change to **SS-S10** for Stainless Steel Schedule 10 piping
- **Diameter** – Change to **2.000** inches.
- **Length** – Change to **40** m.
- **Insulation Type** – Change to **FG** for Fiberglass.
- **Thickness** – Change to **30** mm.
- **Maintain** – Change to **29°C**.
- **Max. Allowable** – Change to **35°C**.

Under the Controls tab, change data as follows.

- **Control Method** – Change to Line sensing with failure alarm.
- **Use local control equipment** – Check this box since this is a temperature critical application.

Click the **Save** icon, or click **File > Save** from the main menu to save your changes.

Click the **Calculate Current Record** icon, or from the main menu click **Calculate > Current Record**.

A WARNING for the first line of the Project Explorer Pane indicates that Multiple Circuits have been created. In this case, it can be avoided if one arranges to feed the circuit from a larger circuit breaker. Click the Basic tab and enter **30** for the **Max. CB Size**.

Click the **Calculate Current Record** icon or click **Calculate** on the main menu then **Current Record**.

You will see that only one circuit is now needed.

Click the **Save** button or click **File > Save** from the main menu to save your data and results.

NOTE: The appearance of a WARNING in this example assumed all basic data are the same for your project as for the example. For instance, if different heat sinks apply to this line, then your calculated heat loss and total heater length will be different.

TIP: If you had not specified a temperature control device, you would have seen a warning message indicating that the uncontrolled temperature exceeds the maximum allowable. As we have specified a line sensing temperature control the design is acceptable and the warning is no longer shown.

Reports

You can now review and print several Piping Reports and a Bill of Materials Report.

To review the Piping Report, click **Reports > Piping Reports** from the main menu. Select **Summary Line List** from the drop-down list and click **Preview**. You will see a brief summary for all three lines. Use the **Print** icon to open the Print dialog box and select a printer if you wish to print this report.

To review the Bill of Materials Report, click **Reports > Bill of Materials** from the main menu. For now, leave the **Display By:** selection box as **All Areas**. Click on **Preview** and use the **Print** icon if you wish to print this report.

TIP: You may notice that two different types of Glass Tape are shown in the Bill of Materials. The program selected the attachment method and corresponding materials and specified different types of glass tape because the defaults are different for carbon steel and stainless steel piping.

You can print reports for selected groups of lines in a large project by using filtering conditions. For more information, "[Using the Filter and Sort Settings Dialog Box](#)" on page 87.

This is the end of the Tutorial. For more in-depth design detail see "[5 Designing Your Project](#)" on page 29 and "[6 Advanced Settings](#)" on page 91.

5 Designing Your Project

This section provides more detailed information for both the novice and experienced TraceCalc Pro user. It leads you through the steps for entering all the design parameters in order to create a complete set of reports for your project.

Entering Design Data

The TraceCalc Pro Design Pane contains various tabs for collecting line parameter and design data. Each tab represents a screen that collects a specific type of design data that you may require for your project. This section provides a more detailed description of each of the data fields and any advanced editing options.

TIP: Detailed descriptions of the input fields and menu options are also described in the Online Help. Press the **F1** function key or click on the **Help** menu item anywhere inside the TraceCalc program to obtain Online Help.

Basic Tab

For piping data entry, use the Basic tab to identify line data and to enter detailed pipe segment size and type, insulation, temperature, and electrical data.

The screenshot displays the 'Basic' tab of the TraceCalc Pro Design Pane. The interface is organized into several sections:

- Line Identification:** Line ID: Pipe 1; Section No.: 1; Line Type: Parent (with a dropdown arrow).
- Pipe Section:** Type: CS-S40 (dropdown); Diameter: 2.000 in (dropdown); Length: 30.5 m (input field); Valves, supports... (button).
- Insulation Section:** Type: FG (dropdown); Thickness: 25.4 mm (input field); Advanced... (button).
- Temperatures Section:** Maintain: 4 °C; Min. Ambient: -29 °C; Max. Ambient: 40 °C; Max. Htr Exposure: 66 °C; Max. Pipe Operating: 66 °C; Max. Allowable: 82 °C.
- Electrical Section:** Single phase (phase-neutral) (dropdown); Voltage: 120 volts; Heater Oper. Voltage: 120 volts; Max. CB Size: 30 A.

For vessel data entry, the Basic tab is used to enter insulation, temperature and electrical data, just as for pipes. Unlike pipes, however, the Basic Tab does not allow entry of vessel properties such as size or composition. Vessel data are entered using a set of pop-up dialog boxes, which are accessed by clicking the **Vessel Properties...** button on the Basic Tab (or by double-clicking on the Vessel ID in the Project Explorer Pane).

Details of pipe data entry continue below. For vessel design information, please see “[Vessel Properties Dialog Box](#)” on page 65. For information on insulation, temperature and electrical data, please see “[Basic Tab](#)” on page 31.

Line ID and Section No.

Line ID (typically a pipe identification number) is associated with a line that has been added in the Project Explorer Pane.

You can change this **Line ID** or assign a different section number in one of two ways. You can edit the data directly in the **Line ID** or the **Section No.** field. Alternatively, you can edit this data from the Line Configuration dialog box, which is accessed by clicking the ellipsis adjacent to the **Line Type** field or by double-clicking the **Line ID** in the Project Explorer Pane. For more information, please see “[Line Configuration Dialog Box](#)” on page 86.

The purpose of the **Section Number** is to allow you to use the same **Line ID** for several pipe segments and to differentiate between them by assigning different section numbers. This allows you to develop different heat-tracing designs for different segments of the same pipe. If you look in the Project Explorer Pane, you will see the **Section Number** displayed in square brackets after the **Line ID**.

Examples of when it is useful to have different section numbers is when a pipe branches off, changes diameters, or changes its environment. You can assign different section numbers to all sections while continuing to use the same Line ID.

Line Type

Line Type describes the position of the line in a heat-tracing circuit and is only important for circuits involving multiple pipe segments. You must define the **Line**

Type when you add a line because the program uses this information to determine which components to include for each segment. For example, properly assigning the line type to each of three cable segments connected to a tee kit ensures that only one tee kit and two end seals are included in the bill of materials, and not three power kits and three end seals. If you are not comfortable with this new feature, you can simply define all lines as “Parent lines” and then manually group circuits and adjust component quantities.

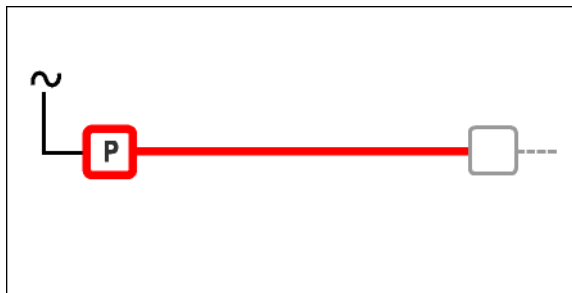
To change the **Line Type**, you must use the Line Configuration dialog box. When you create a new line, the Line Configuration dialog box comes up automatically. To use it for an existing line, you may either click the ellipsis adjacent to the **Line Type** field, or by double-clicking the **Line ID** in the Project Explorer Pane. For more information, please see “[Line Configuration Dialog Box](#)” on page 86.

In many situations, you may want to use the same heating cable to trace both the child and the parent line. When this option is technically feasible, the program will make the **Use Same Heater As Parent** check box available in the Line Configuration dialog box. For more information, please see “[Line Configuration Dialog Box](#)” on page 86.

Remember, you do not need to calculate the number of components required for your design configuration. You only need to properly define the **Line Type** for each line and TraceCalc Pro will automatically determine the number of associated components.

Parent

If you add a line, the default **Line Type** is “Parent”. A Parent line will have a power connection kit. It may or may not have an end seal kit, depending on what types of child lines it may have.



You can change the **Line Type** to better reflect more complex designs incorporating various piping configurations.

You may add the new line as a parent and then, using the mouse, simply drag and drop it to the parent line you want it associated with. This action opens the Line Configuration dialog box, where you can select from the various Line Types listed. After selecting the desired Line Type and clicking OK, the line is displayed in its new location. Alternatively, to make a parent line into a child you may simply bring up the Line Configuration dialog box and select ‘Child’ from the Line Type drop-down list.

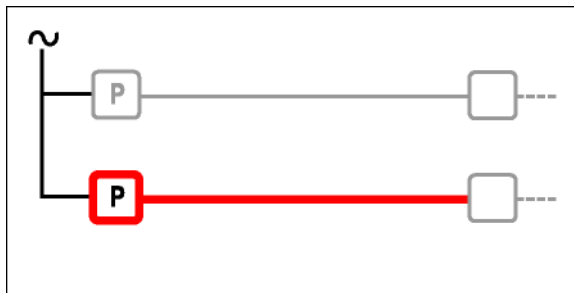
The program recognizes multiple line types. If the heat-tracing circuit consists of just one segment, i.e. a continuous length of heating cable from power point to end seal, it can be simply defined as a “Parent” **Line Type**. Each new line added to a project is also assigned a Parent Line Type by default until, and unless, you change it as described above. A parent line always includes a power kit but may or may not include an end seal depending on whether there are other lines associated with it.

If there are other lines associated with the parent, they are referred to as child lines throughout this manual. A child may be thought of as a subline. It is a user-defined identification of a pipe [segment](#) for the purposes of organizing or simplifying the heat-tracing design. It is a segment of a pipe system that is somehow connected to, and is typically downstream of, a [parent](#) segment for either electrical or flow purposes. For instance, a branch of a fire water line could be a “child” of the water line. The child takes on the design-related parameters of the parent unless you override them. For instance, while it may optionally have the same ambient conditions as the parent, it will always have the same power-related conditions as the parent, i.e., the same voltage, circuit breaker rating, etc., because it is powered through the same circuit breaker.

A wide range of circuit configurations can be created using the various child Line Types described below.

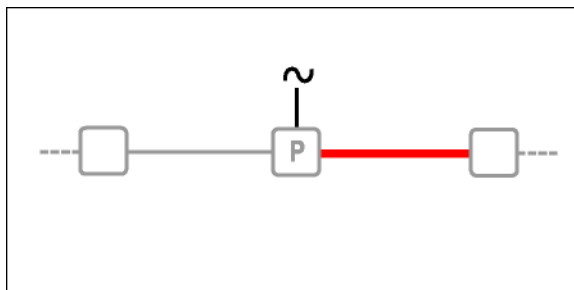
Power, Parallel

Power, Parallel is a line with its own power connection kit electrically connected to the same circuit breaker as the parent. It may also include an end seal, depending on the design (if no other lines are connected, it will include the end seal).



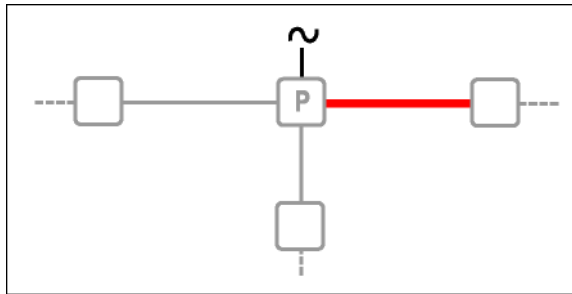
Power, Splice

Power, Splice is a line that is powered from the same power connection kit as the parent. For bill of materials purposes, it does not include a power kit but may include an end seal depending on the design (if no other lines are connected, it will include the end seal).



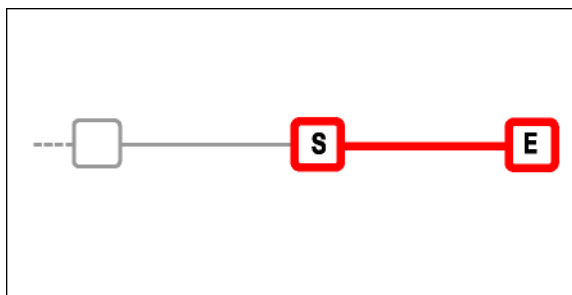
Power, Tee

Power, Tee is a line that is one of two other lines powered from the same power connection kit as the parent. For bill of materials purposes, it does not include a power kit but typically an end seal depending on the design. A powered tee box includes at least a parent line as well as two power-tees. If you don't define a complete set, TraceCalc Pro will not be able to determine a complete Bill of Materials. If you define a parent with just one power-tee child, it will be similar to a power splice and just require a power box that could also be used for a tee.



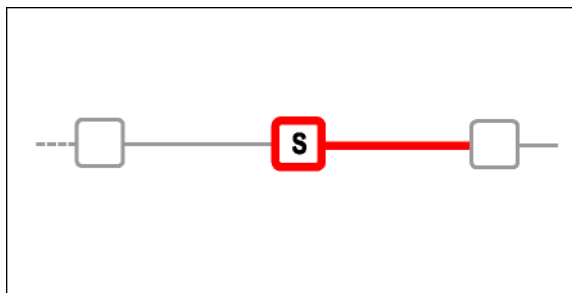
Splice, End Segment

Splice, End Segment is a line that is spliced to one other segment. Its power comes from the other segment, not directly from the power source. For bill of materials purposes, it includes a splice kit and typically includes an end seal depending on the design.



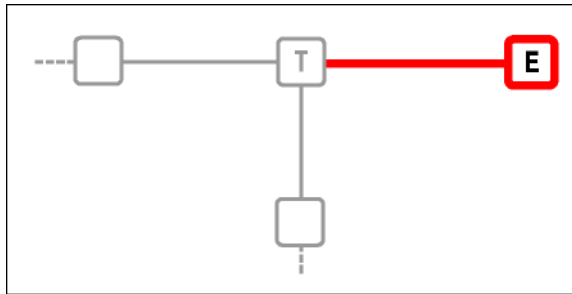
Splice, Mid Segment

Splice, Mid Segment is a line that is spliced to another segment at each end. Its power comes from one of the other segments, not directly from the power source. For bill of materials purposes, it includes a splice kit but does not include an end seal. If no other lines are connected, don't use the mid-segment, but the end-segment. Otherwise your Bill of Materials will not include the required end seal.



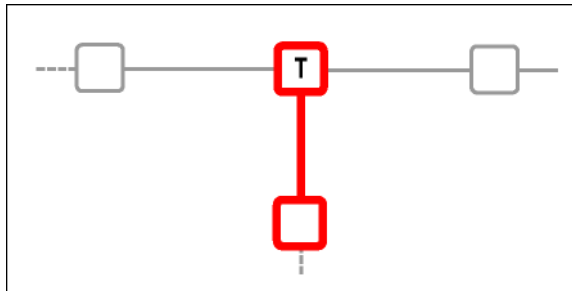
Tee, End Segment

Tee, End Segment is a line that is connected to a tee. The difference from the Tee-mid segment is that the end segment does not include the tee-kit. For Bill of Materials purposes, it typically just includes an end seal depending on the design.



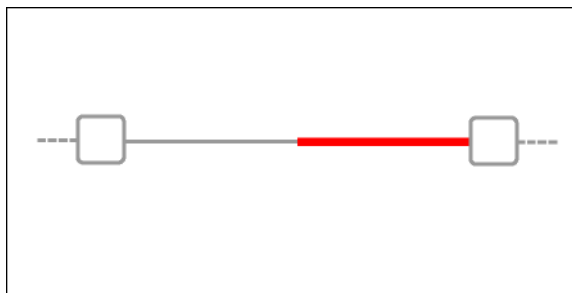
Tee, Mid Segment

Tee, Mid Segment is a line that is connected to a tee. Its power comes from its parent. For Bill of Materials purposes, it includes a tee kit and typically includes an end seal depending on the design.



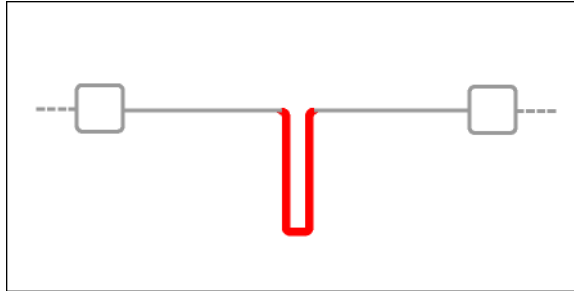
Continuation

Continuation is a line that is a segment of another line, but which needs to be identified separately for design purposes. The Bill of Materials does not include any components; they are included in its parent line. This is a very useful way to handle situations where the same pipe has changing design parameters such as diameter, insulation temperature or Ambient temperature, and the designer knows that the same cable will be used.



Loop

Loop is a line that is a segment of another line, but which needs to be identified separately for design purposes. It returns to its point of origin on the pipe segment. For bill of materials purposes, it does not include any components. This is a useful way to handle short piping tee sections.



Pipe

Pipe Type

Specify the **Type** of pipe being heated. Heating cable selection can be dependent on the properties of the particular piping material.

You can select from the several pre-defined pipe and tubing types in the **Type** drop-down list. If you do not find a suitable pipe type, you can add your own. For information on adding your own pipe type see “... [Customize Pipe Types](#)” on page 37. If you select a plastic pipe **Type**, it must be suitable for the likely exposure temperature as determined by the program.

Note: You should consider the heating cable attachment method in conjunction with the pipe material to ensure an appropriate match. Aluminum tape is commonly used with plastic piping. Also, when using glass tape, you should select a type suitable for the piping material. For more information about the attachment method and tape selection see “[Design Options](#)” on page 56 and also see “[Heater Selection](#)” on page 59.

Diameter


Select the pipe **Diameter** from the Diameter list. The schedule of standard sizes changes for different pipe types, so it is important to select the pipe **Type** first.

If the size required is not available, you will need to create a new pipe **Type** to include that specific size; see “... [Customize Pipe Types](#)” on page 37.

Length

Enter the pipe length in the **Length** field. When necessary, the program will generate multiple circuits if the calculated heating cable length (including allowances for valves, etc.) exceeds the maximum circuit length for a specific heating cable. However, you can also break up a long pipe into shorter segments manually by specifying the **Line ID** and **Section Number** for each pipe segment. This provides additional flexibility in heating cable selection and power distribution design.

... Customize Pipe Types

To add, modify, or delete a pipe type, click the  ellipsis by the **Type** field.

Identifier/Description

- **Add** – To add a custom pipe **Type**, right-click in the window, or click **Add** and enter a unique pipe type **Identifier**. This code may be one to fifteen characters and is case-insensitive. Click **OK**. You will then be

asked for pipe property information. See **Pipe Schedule Properties** below for more information.

- **Modify** – You can only **Modify** a pipe **Type** that has been previously added to the table. Default pipe Types cannot be modified. The **Read Only** column identifies whether a particular pipe **Type** may be modified. Note: If you do not see a **Read Only** column, simply enlarge the dialog box by dragging the right boundary to the right.

To modify a pipe **Type**, highlight the **Pipe Type Identifier** you wish to modify and click **Modify**, or right-click and select **Modify** from the pop-up menu. You can then edit information about the pipe type. See **Pipe Schedule Properties** below for more information.

- **Delete** – To delete a pipe **Type**, highlight the **Pipe Type Identifier** you wish to delete. Click **Delete**, or right-click and select **Delete** from the pop-up menu. You will be prompted to confirm that you really want to delete this item. Once deleted, it cannot be restored. Click **Yes** to confirm, and then **Close**. You cannot delete default pipe **Types**. These are identified with a “Yes” in the **Read Only** column.
- **Copy** (using right-click) – To copy a pipe **Type**, highlight the **Pipe Type Identifier** and then right-click and select **Copy** from the pop-up menu. You can then **Paste** or **Paste Append** the copied data.
- **Paste** (using right-click) – You can copy and paste some or all of the properties of a pipe **Type** to an existing pipe **Type**, providing it is not a default (Read Only) pipe Type. Highlight the **Pipe Type Identifier** you wish to paste the data to, right-click and select **Paste**. The Paste Pipe window shows you the source and destination of the data and gives you the opportunity to select the properties you want to paste. This will overwrite that data associated with the destination pipe **Type**. You can also select **All** to check all the groups of items or **None** to clear all the checked items.
- **Paste Append** (using right-click) – To copy all of the properties of a copied **Pipe Type** to a new **Pipe Type Identifier**, highlight any **Pipe Type Identifier** and right-click and select **Paste Append**. Enter a new **Pipe Type Identifier** name and click **OK**. You can then use **Modify** to edit the information for the new pipe **Type**. We recommend this option to create a new pipe type, as it helps you avoid retyping similar information.

Pipe Schedule Properties

In the Pipe Schedule Properties dialog box, click **Edit**. In the Description dialog box, select **New** and enter a description for the new pipe **Type** in one or all three language boxes, as applicable. Click **OK**.

In the Pipe Schedule Properties box, select one of four available **Material Types**, and then enter the **Specific Heat** and **Density** values. Then, if you wish to view pipe sizes in metric units, click the **Metric Nominal Pipe Size** box.

Pipe Size Data

To modify the pipe size range, select **Pipe Size Table**, and then modify the values and **Add Row** or **Insert Row** for additional pipe sizes. The various values are used for different purposes. The **Nominal Diameter** shows in the Pipe Diameter drop-down list and is the value you will enter to select this size. Heat transfer calculations are based on the **Actual OD** (Actual Outside Diameter) and **Actual ID** (Actual Inside Diameter) that you enter. The wall thickness is calculated automatically. The

Over size Diameter is the nominal insulation diameter used when you select the option to **Use Over size Insulation**.

When finished, click **OK** twice and **Close**.

The program adds the new or modified pipe **Type** to the drop-down list for use in your current and future projects.

Valves, Supports ...

Heat sinks are a significant source of heat loss and must not be neglected in heat-tracing system designs. You should include all Valves, Supports and Flanges to ensure that the program calculates how much additional heating cable should be applied to these items.

Click on the **Valves, Supports ...** button to open the Heat sinks dialog box.

For each pipe segment, you can select up the three valve types, three support types, and one flange type from their respective drop-down lists. Additionally, you can select the quantity of each.

Note: If the drop-down list does not contain an appropriate predefined valve, support or flange, go to **Setup > Project Settings > Advanced Tab > Heat sink Definitions ...** to add or modify definitions for valves, supports, or flanges. For more information about heat sink definitions, see "[Advanced Tab](#)" on page 94.

Valves, Supports, and Flanges

On the Heat sinks dialog box, enter valves, supports, and flanges in their respective part of the screen as follows:

- **Type** – Click the drop-down arrow adjacent to the first **Type** field (Valves, Supports, Flanges respectively) and select the appropriate type.
- **Mode** – Click the drop-down arrow adjacent to the **Mode** field and select the appropriate calculation mode for the type you entered. There can be up to four modes which depends on the way the heat sink was initially set up:
 - **Calculated heat loss** – Heat loss is calculated with a fin-equation using predefined data that includes dimensions. The program determines the length of heating cable required to replace this heat loss for each valve, support, or flange by dividing the heat loss of the heat sink through the heat loss of the pipe to accommodate possible duty cycle from temperature controls. For more information, see "[Advanced Tab](#)" on page 94.
 - **Equivalent pipe length** –The length of heating cable allocated for the valve, support or flange is the amount calculated as if it were a predefined length of equivalently sized pipe. For instance, if the predefined data specified that each valve should use an amount of heating cable equal to that needed for 0.8 m of pipe of the same size and the program calculated that each meter of pipe needed 1 m of heating cables then 0.8 m of additional heating cable would be specified for each valve.
 - **Total heater length** – A constant length of heating cable is applied to each heat sink type. The length of cable to be applied is a function of pipe size, depending on the definition of the heat sink.

- **Total wattage** – The program calculates the length of heating cable needed for all the valves, supports, or flanges, assuming the heat loss for each is as defined in the heat sink definition.
- **Specify Interval** – You can override any predefined interval. This option only applies to supports and flanges where, for example, you might want to specify a spacing of one support every 5 m of pipe.
- **Quantity** – Enter the quantity each of valve, support, and flange type.

If this line has more than one type of valve or support, select a second and third type of on the next two rows as needed.

TIP: When the predefined data was entered, it should have included specific data for each common pipe size. You should therefore see a predetermined number of supports that the program has calculated based on the length of this line. This quantity might change with pipe size, if this dependency was specified in the Heat sinks properties table. If the option Use **TCPro default interval for supports and flanges** has been checked, then TraceCalc Pro will automatically update the interval for any supports and flanges if you change the pipe size. If this option has not been checked, then the program will use the previously selected quantity for any supports and flanges.

For more information about heat sink definitions, see “[Advanced Tab](#)” on page 94.

Miscellaneous

If you know of other heat sinks that are not accounted for as **Valves, Supports, Flanges or Vents / Drains**, you can include a single allowance for all of them together. This allowance can be based on pipe length, on total wattage or on a fixed length of heater, as described below.

- **Allow percentage of pipe length** – This selection adds a user-defined percentage of the pipe length, resulting in extra cable that can be installed wherever needed. Check this button and enter a percentage value in the **Quantity (%)** field. For example, if a pipe includes several hangers and you want to allow an additional 5% of heating cable so that a small loop can be applied to each hanger, enter **5**.

Note: the percentage is applied to the pipe length, which results in more cable. It is not applied directly to the calculated heating cable length.

- **Allow lump sum watts** – This selection adds a user-defined amount of watts to the calculated heat loss. Check this button and specify the total additional heat loss in the **Quantity (W)** field. For example, if a line includes a pump with a known heat loss of 100 watts and a flow meter with an estimated heat loss of 50 watts, enter **150**. This will cause the program to specify an additional length of heating cable to provide 150 watts at the Maintain temperature and Minimum Ambient conditions.

TIP: If there are many different heat sinks, you could add their heat losses and specify a lump sum wattage. You would then want to include a note to indicate how much of the additional length of heating cable is to be applied to each additional heat sink. A useful place for entering such a note is in the Comments field, under the Reference tab.

- **Allow fixed length of heater** – This selection adds a user-defined length of heater, resulting in extra cable that can be installed wherever needed. Check this button and specify the total additional length of cable in the Quantity (m or ft) field.

- **Drains / Vents Quantity** – You can include a user-defined allowance for these items. Specify the number of drains and vents in the Drain / Vent Quantity window. The default allowance for drains/vents can be modified in **Setup > Project Settings** on the Design tab. For more information, see “[Design Tab](#)” on page 93.

Click **OK** to save this data and exit the dialog box.

Insulation

Insulation Type

TraceCalc Pro contains several standard insulation types. You can select one of these from the insulation **Type** list. If you do not find a suitable insulation **Type**, you can add a new one. See “[... Customize Insulation Types](#)” on page 41.

The efficiency and size of the thermal insulation greatly impacts the heat loss from a pipe. Therefore it is critical for proper heating cable selection. Many factors can affect the choice of the best insulation for a given application.

The insulation system often includes a cladding material over the thermal insulation. This program does not consider changes in heat loss if the cladding becomes damaged, allowing the thermal insulation to get wet, if the insulation is improperly installed, or if the thermal conductivity is reduced due to aging, water, or other factors. The thermal conductivity of the insulation is adjusted for temperature.

The temperature limitations of the insulation materials should be checked against the Maximum Heater Exposure Temperature and the Uncontrolled Temperature to verify compatibility of the selection.

... Customize Insulation Types

To add, modify, or delete an insulation **Type**, click the  ellipsis by the insulation **Type** field.

Identifier/Description

- **Add** – To add a new insulation **Type**, click **Add** and enter a unique insulation type **Identifying Code**. This code may consist of one to fifteen characters and is case-insensitive. Click **OK**.
- **Modify** – You can only modify an insulation **Type** that has been previously added to the table. Default insulation **Types** cannot be modified. The **Read Only** column identifies whether a particular insulation **Type** may be modified. To modify an insulation **Type**, click **Modify** and change the Insulation Properties as described below.
- **Delete** – To delete an insulation **Type**, highlight the name you wish to delete. Click **Delete**. You will be prompted to confirm that you really want to delete this item. Once deleted, it cannot be restored. Click **Yes** to confirm, and then **Close**. Default insulation **Types** cannot be deleted. The **Read Only** column identifies these with a “Yes” in the **Read Only** column.
- **Copy** (using right-click) – To copy an insulation **Type**, highlight the **Insulation Type Identifier** and then right-click and select **Copy** from the pop-up menu. You can then **Paste** or **Paste Append** the copied data.

- **Paste** (using right-click) – You can copy and paste some or all of the properties of a **Type** to an existing **Insulation Type**, providing it is not a default (Read Only) **Insulation Type**. Highlight the **Insulation Type Identifier** you wish to paste the data to and right-click and select **Paste**. The Paste Insulation window shows you the source and destination of the data and you are then able to select to paste the properties of the **Insulation Type**, the description of the **Insulation Type** and/or the K Factor tab. This will overwrite that data associated with the destination **Insulation Type**. You can also select **All** to check all the groups of items or **None** to clear all the checked items.
- **Paste Append** (using right-click) – All of the properties of a copied insulation **Type** can be pasted to a new **Insulation Type Identifier**. Highlight any **Insulation Type Identifier** and right-click and select **Paste Append**. Enter a new **Insulation Type Identifier** and click **OK**. You can then use **Modify** to edit the information for the new Insulation Type.

Insulation Properties

In the Insulation Properties dialog box, click **Edit** to go to the Description dialog box. You can click **Existing** to select an existing insulation **Type** description for insulation types, or click **New** to enter a new description. If you select **New**, enter a description in one or all three language boxes, as applicable. Click **OK**. This is optional text that you may use to more clearly identify the insulation **Type** on reports. It may consist of up to 30 characters.

You should then enter the maximum and minimum Operating temperatures of the insulation material and its **Specific Heat** and **Density values**.

Click the **K-Factor Table** button to enter Thermal Conductivity values for this insulation type for a range of Operating temperature. Click **OK** and **Close**. Make sure that you are confident with the K-factor data across the entire temperature range you expect to use for this insulation type.

Thickness

Enter a value for the insulation **Thickness**. Since TraceCalc Pro does not check the availability of the thickness you enter, you should consult the manufacturer's data. If the **Thickness** is grayed out, click on the **Advanced** button and make sure that two-layer insulation is deselected.

Advanced ...

To specify two layer insulation or over sized insulation click the **Advanced ...** button. This opens the Insulation Advanced Options dialog box.


Two Layer Insulation Systems

You can specify two layers of insulation to reduce costs when expensive, high temperature insulation may be required. This option allows you to select an insulation that is able to withstand high temperatures and can be installed directly on a hot pipe as well as a more economical insulation for installation on top of the first layer. It is important to provide sufficient thickness of the inner insulation so that the outer layer is not subjected to temperatures above its capability. Specifying too much thickness for the outer layer can also result in the temperature at the interface of the two layers becoming too hot for the temperature rating of the outer insulation.

To specify two layers of insulation, check the **Two Layer Insulation System** box. Once you are back on the Basic tab, you will see that the insulation properties are grayed out which indicates that a two-layer system is being used.

Inner Layer

Select the insulation type to be used in direct contact with the pipe from the list. In a two-layer system, the **Inner Layer** is often one that can withstand a high maximum pipe temperature, but may not have very good thermal properties (relatively high thermal conductivity).


You can add, modify, or delete an insulation **Type** by clicking the  ellipsis by the insulation **Type** field.

Thickness

Enter the inner layer **Thickness**. Enter a thickness sufficient to ensure that its outer surface temperature is below the temperature rating of the outer insulation.

Outer Layer

Select the insulation type to be used on top of the inner layer. In a two-layer system, the **Outer Layer** is often one that has very good thermal properties (relatively low thermal conductivity) but cannot withstand a high pipe temperature without a primary heat barrier.

You can add, modify, or delete an insulation **Type** by clicking the  ellipsis by the insulation **Type** field.

Thickness

Enter the **Thickness** of the outer layer. Be sure that the temperature gradient results in an acceptable temperature for the product's rating at the interface.

Over Size Insulation

Over size insulation applies to when the thermal insulation inner diameter must be larger than the nominal outer diameter of a particular pipe in order to accommodate the heating cable. Over sizing is not necessary if the insulation is compressible, or if the pipe is large.

Click the **Use Over Size Insulation** box if you wish to specify over sized insulation for your heat-tracing design. There is no need to enter a value in the Over Size Diameter box as the program will automatically pick the dimension specified in the Pipe Size Table, which will often be the next largest size insulation to fit your pipe diameter. To see the value that has been picked, close then reopen the Insulation Advanced Options dialog box. You can override this automatic selection by entering a value, which will only be used for this line.

The program will base its calculations on this over sized insulation.

Temperatures

For a complete design and product selection of a heat-tracing system, TraceCalc Pro must have information about the following temperatures:

Maintain

The **Maintain** temperature is the desired temperature at which you want to maintain the pipe by the use of heat tracing.

The **Maintain** temperature must be greater than the **Minimum Ambient** temperature as there is no need for heat tracing if the **Minimum Ambient** temperature is greater than the **Maintain** temperature.

Heat loss calculations are based on the **Minimum Ambient** temperature. At higher temperatures, the heating cable selected will provide more heat than is required to hold the pipe at the **Maintain** temperature. This will result in a higher actual temperature. The program will calculate the **Uncontrolled Temperature** of the pipe assuming Maximum Ambient temperature and no wind. This is reported in the Calculated Results Pane.

Minimum Ambient

The **Minimum Ambient** temperature is the lowest temperature expected at the pipe location. The **Minimum Ambient** temperature for indoor locations should be the lowest indoor temperature irrespective of the minimum outdoor temperature. The effect of wind for outdoor locations is considered in the design. The wind chill factor should not be used.

Heat-loss calculations depend on the difference between the **Minimum Ambient** temperature and the desired **Maintain** temperature. The program checks the **Minimum Ambient** temperature to ensure that it is less than the **Maintain** temperature and less than the **Maximum Ambient** temperature.

Maximum Ambient

The **Maximum Ambient** temperature is the highest temperature expected to occur at the design location. This value must be greater or equal to the **Minimum Ambient** temperature.

The **Maximum Ambient** temperature for indoor locations should be the highest indoor temperature irrespective of the maximum outdoor Ambient temperature.

The **Maximum Ambient** temperature is typically used to calculate the maximum uncontrolled pipe temperature and when necessary, to determine whether a high-temperature cut-off thermostat is required.

Maximum Heater Exposure

The **Maximum Heater Exposure** temperature is the maximum temperature to which the heating cable may be exposed intermittently. It assumes high-temperature excursions no longer than 48 hours and a total cumulative exposure of less than 1000 hours. This temperature is ignored for the purpose of predicting maximum heating cable sheath temperatures.

In many applications the **Maximum Heater Exposure** temperature will be the same as the **Maximum Operating** temperature.

Maximum Operating

The **Maximum Operating** temperature is the highest temperature of the heat-traced fluid during normal process operating conditions. Excursions of less than 1000 hours may be ignored.

The **Maximum Operating** temperature may be the same as the **Maintain** temperature, but it could be considerably higher. For example, when a process pipe operates at a high Operating temperature but the heat tracing is only required to prevent the pipe from freezing during shutdown conditions. In this case, the **Maintain** temperature is only slightly above the freezing temperature of the fluid.

TraceCalc Pro will select a suitable heating cable assuming that the **Maximum Operating** temperature is the highest continuous (for greater than 1000 hours) exposure temperature for the heating cable whether energized or de-energized (depending on the control method).

Maximum Allowable

The **Maximum Allowable** temperature is the maximum temperature permitted by the user for the process/ fluid or piping. The program uses temperature to determine whether temperature controls are required. The value you enter should be the lowest value of the fluid degradation temperature, the piping expansion temperature, or the piping material withstand temperature (especially in the case of plastic piping). For hazardous locations, the maximum temperature ratings are entered separately as an auto-ignition temperature and T-rating. Please see "[Design Parameters](#)" on page 52.

Electrical

You need to enter certain electrical data for each line so the program can make the correct product selection. (Note: the Electrical section is only active when you are editing a "Parent" line type. All "Child" line types will inherit the Electrical settings from their Parent.)

Voltage Configuration

You need to select the configuration of the voltage source used for powering the heater. This selection will determine how TraceCalc Pro interprets the value entered in the **Voltage** field below.

Voltage

For Single Phase systems, this is the actual voltage applied to the heater. For 3 Phase systems, this should be the phase-to-phase voltage. TraceCalc Pro then calculates the actual voltage applied to the heater and displays it in the **Heater Operating Voltage** field.

This voltage affects which heating cables may be selected, and their maximum circuit lengths.

Heater Operating Voltage

This is a read only field where TraceCalc Pro displays the calculated voltage that is assumed to be applied to the heating element. For Single phase systems and Three phase DELTA systems, this value will be the same as the entered **Voltage**. For Three phase WYE (Star) systems, this value will be calculated by dividing the **Voltage** by the square root of 3.

Maximum CB Size

The **Maximum CB Size** is the largest circuit breaker that you desire to use. TraceCalc Pro will only design heating cables that are compatible with the lower of (1) this breaker size or (2) factory defined circuit requirements.

The program uses this data to determine the maximum heating cable length that can be connected to the circuit breaker or fuse.

A CB load factor is applied to calculate the maximum permissible load for this device. Standard practice, in accordance with the U.S. National Electrical Code and

the Canadian Electrical Code, is to load a circuit breaker to no more than 80% of its nominal current rating (for example, a 30 amp circuit may be loaded to 24 amperes). In Europe, the maximum load is normally 100% of the nominal rating. For more information, refer to “[Design Tab](#)” on page 93.

In general, the larger the circuit breaker size, the longer the heat-tracing circuit, and in turn, the fewer the number of heat-tracing circuits required. You should refer to the product literature to confirm that the circuit breaker chosen for the design does not exceed the maximum size allowed for the heating cable selected.

Reference Tab

Use the Reference tab to enter data such as area, fluid, drawing number, and location details of the heat-tracing installation.

The screenshot shows a software interface with a tabbed menu at the top. The 'Reference' tab is selected. Below the tabs, there are two main sections: 'Reference' and 'Location'. The 'Reference' section contains dropdown menus for 'Area' (set to 'None') and 'Fluid' (set to 'WATER'), a text field for 'Drawing No' (containing 'HT-DWVG-001'), and a 'Project Settings...' button. The 'Location' section contains radio buttons for 'Indoor' and 'Outdoor' (with 'Outdoor' selected), a text field for 'Wind Speed' (8.9 m/s), a dropdown for 'Chemical Expos.' (None), a text field for 'Startup Temp.' (-25 °C), and a text field for 'HL Safety Factor' (10 %). At the bottom, there is a 'Comment:' label followed by a large empty text area.


Reference

The information included in the reference section is displayed in various reports. You should use this information to help organize your design, particularly as your designs become more complicated.

Area

In a large design project, there may be several areas where heat tracing is required. You can select the default Area name or create a list of Area names to suit your needs.

... Customize Areas

To add, modify, or delete an **Area** name, click the **ellipsis** button  adjacent to the **Area** field to open the Customize Areas dialog box.

The area names you enter or modify will be available for selection for any existing lines or new lines you add to this project. You can then print reports for specific


areas by applying Area name as the ‘filter’ condition. For more information, please see “[Filter Settings](#)” on page 87.

- **Add** – To add an **Area** name, click **Add**. Enter a name. For example, enter a meaningful or description, such as ‘Plant 9’ or ‘Loading area.’ Click **OK**, and then **Close**.
- **Modify** – To modify an **Area** name, highlight the name you wish to modify. Click **Modify**. Edit the name as necessary. Click **OK**, and then **Close**.
- **Delete** – To delete an **Area** name, highlight the name you wish to delete. Click **Delete**. You will be prompted to confirm that you really want to delete this item. Once deleted, it cannot be restored. Click **Yes** to confirm, and then **Close**.
- **Copy** (using right-click) – To copy an **Area** name, highlight the name you wish to copy and then right-click and select **Copy** from the pop-up menu. You can then **Paste** or **Paste Append** the copied data.
- **Paste** (using right-click) – You can copy and paste some or all of the properties of an **Area** name to an existing **Area** name. Highlight the **Area** name you wish to paste the data to and right-click and select **Paste**. The **Paste Area** window shows you the source and destination of the data and you are then able to select to paste the properties of the Area name the description. This will overwrite that data associated with the destination **Area** name. You can also select **All** to check all the groups of items or **None** to clear all the checked items.
- **Paste Append** (using right-click) – All of the properties of a copied **Area** name can be pasted to a new **Area** name. Highlight any **Area** name and right-click and select **Paste Append**. Enter a new **Area** name and click **OK**. You can then use **Modify** to edit the information for the new **Area** name.

Fluid

The **Fluid** field can be left blank. However, this field allows you to develop a list of fluid names for the project. You can select a previously entered **Fluid** name or enter a new one.

... Customize Fluids

To add, modify, or delete a **Fluid** name, click the ellipsis button  adjacent to the **Fluid** field. This opens the Customize Fluids dialog box.

The fluid name you enter or modify will be available for selection for any existing lines or new lines added to this project. You can print reports for lines grouped by Fluid name by applying this as a custom ‘filter’ condition. For more information, please see “[Using the Filter and Sort Settings Dialog Box](#)” on page 87.

Identifier/Description

- **Add** – To add a **Fluid** name, click **Add**. Enter a name. Click **OK**. The Fluid Properties dialog box opens. Enter specific properties of this fluid.
- **Modify** – To modify a **Fluid** name, highlight the name you wish to modify. Click **Modify**. The Fluid Properties dialog box opens. Edit the

specific properties of this fluid, as necessary. Click **OK**, and then **Close**.

- **Delete** – To delete a **Fluid** name, highlight the name you wish to delete. Click **Delete**. You will be prompted to confirm that you really want to delete this item. Once deleted, it cannot be restored. Click **Yes** to confirm, and then **Close**.
- **Copy** (using right-click) – To copy a **Fluid** name, highlight the name you wish to copy and then right-click and select **Copy** from the pop-up menu. You can then **Paste** or **Paste Append** the copied data.
- **Paste** (using right-click) – You can copy and paste some or all of the properties of a **Fluid** name to an existing a **Fluid** name. Highlight the **Fluid** name you wish to paste the data to and right-click and select **Paste**. The **Paste Fluid** window shows you the source and destination of the data and you are then able to select to paste the properties of the **Fluid** name. This will overwrite that data associated with the destination a Fluid name. You can also select **All** to check all the groups of items or **None** to clear all the checked items.
- **Paste Append** (using right-click) – All of the properties of a copied a **Fluid** name can be pasted to a new a **Fluid** name. Highlight any **Area Name** and right-click and select **Paste Append**. Enter a new a **Fluid** name and click **OK**. You can then use **Modify** to edit the information for the new a **Fluid** name.

Drawing No.

This is a reference field where you can enter data to better identify the lines in the reports, cross-referencing them to the pipe drawing. You can leave this field blank if you wish.

You can print reports for lines sorted by Drawing Number by applying this as a custom ‘filter’ condition. For more information, please see “[Using the Filter and Sort Settings Dialog Box](#)” on page 87.

Location

Indoor / Outdoor

Specify whether the heat-tracing installation will be **Indoor** or **Outdoor**. If it is **Indoor**, then no allowance is made for additional heat loss as a result of wind. If the heat tracing is in an indoor area, but still subjected to wind, such as a loading bay, it is advisable to specify the application as **Outdoor**.

Wind Speed

This entry is required for outdoor applications. You should enter a reasonable value to ensure the design is done for ‘worst case’ conditions. However, you should enter an average sustained wind speed (over a period of hours) rather than the maximum speed of a short gust.

Chemical Exposure

You can select ‘None’, ‘Organics’ or ‘Inorganics’. This will influence the outer jacket selection for some heating cables. However, for applications with particularly severe exposure conditions, you should confirm that the selected heating cable is

suitable for the anticipated exposure. Please also refer to the product literature to confirm the suitability of the selected material with your chemical exposure.

Startup Temperature

The **Startup Temperature** is the lowest pipe or equipment temperature expected when the heating cables are switched on. It might be the **Minimum Ambient** temperature, but realistically will often be higher. TraceCalc Pro uses the **Startup Temperature** to calculate the maximum current at the startup temperature. This is particularly important for self-regulating heating cables.

For self-regulating heating cables, which draw more current at lower temperatures, the startup temperature impacts the maximum circuit length allowed since longer circuit lengths will draw a higher current at lower temperatures. Entering a very low value, such as the **Minimum Ambient** temperature, will result in shorter maximum circuit lengths for a given size Circuit Breaker. If you anticipate that the heating cables will never need to be started 'cold' (i.e. when the pipe and contents have reached the Minimum Ambient temperature), then you should select a more realistic **Startup Temperature** to allow the use of longer circuit lengths.

HL Safety Factor

The HL Safety Factor (heat loss safety factor) is a user-specified increase to the calculated heat loss by a specified percentage to ensure that the heating cable provides extra power. It is one way to compensate for important design variables that cannot be controlled or quantified.

While 10% is a typical factor for designs at low or moderate temperatures, for higher temperatures, many material properties, installation variables, and heat transfer processes become more important. To compensate for these additional potential heat loss factors, which are difficult to predict or quantify accurately, we recommend higher safety factors as shown below:

- Below 150°C (300°F)-- 10%
- Up to 260°C (500°F)-- 25%
- Above 260°C (500°F)-- 50% or more depending on the application

Keep in mind that this is not the only safety factor incorporated in your design. There are other safety factors incorporated automatically in the design, such as a conservative Minimum Ambient temperature, the minimum power output of the heating cables, the conservative thermal conductivity of the insulation and other variables. A high value should not be relied upon to compensate for extreme changes from the initial design conditions, such as wet or improperly installed insulation.

Comment

Use the **Comment** field to enter comments about the line being designed. This information is for your convenience only and can be left blank.

TIP: You can enter an identifier code in this field so that a report can be printed for lines grouped by Comments by applying this as a custom 'filter' condition. For more information, please see "[Using the Filter and Sort Settings Dialog Box](#)" on page 87.

Area Class Tab

⚠ WARNING: Fire or Explosion Hazard. Designs for hazardous locations that are based on incorrect data can create a risk of fire or explosion. Be sure your data is reliable or consult an expert for assistance.

Use the Area Class tab to enter area class data associated with your heat-tracing installation.

TraceCalc Pro provides two systems for the classification of areas containing explosive gases:

- The Class-Division System, which is the primary system in use in North America. This system is described in API-RP-500, the NFPA National Electrical Code and the Canadian Electrical Code.
- The IEC Zone System, which is the primary system in use in Europe. This system is also described in API-RP-505 and referenced in the NFPA National Electrical Code and the Canadian Electrical Code.
- Equipment intended for installation in Zone classified locations must be designed by a registered P.E. – NEC 505.7 (A)”

Both systems have the same goal—preventing the explosion of volatile gases caused by heat or an electrical spark. Both systems use the auto-ignition temperature and the probability of occurrence of volatile gas, combustible dust or fibers as the basis for classification of the areas.

You must provide the auto-ignition temperature or pick a T-Rating matching your hazardous location. Remember that even a water line in an area where explosive gases can be present might need special attention to the selection of products, components and controls. The processes in the area determine the classification, not the fluid in the pipe. Pentair Thermal Management Technical Support can provide more information about relevant API, NEC and IEC documents concerning hazardous locations.

Basic | Reference | **Area Class** | Heater Options | Components | Controls

Standards Body: CANADA

Class

Non-hazardous
 I
 II
 III

Division / Zone

Div 1
 Div 2
 Zone 1
 Zone 2

Gas / Dust Groups

A
 B
 C
 D
 E
 F
 G

Design Parameters

Specify equipment T-rating
 Specify auto-ignition temperature

T-Rating: T1

Sheath temperature calculation options

Allow stabilized design
 Use control limited design
Control Limited Setpoint: _____ °F

Area Class Tab for US/Canada as Standards Body

Basic	Reference	Area Class	Heater Options	Components	Controls
Standards Body: CENELEC					
Area Classification					
<input type="checkbox"/> Non-hazardous <input type="checkbox"/> Zone 1 <input type="checkbox"/> Zone 21					
<input checked="" type="checkbox"/> Zone 2 <input type="checkbox"/> Zone 22					
Design Parameters			Sheath temperature calculation options		
<input checked="" type="radio"/> Specify equipment T-rating <input type="radio"/> Specify auto-ignition temperature			<input checked="" type="checkbox"/> Allow stabilized design <input type="checkbox"/> Use control limited design		
T-Rating: T1			Control Limited Setpoint: <input type="text"/> °C		

Area Class Tab for CENELEC as Standards Body

Standards Body

You must select the Standard Body from the list of choices available. Depending on your version, you can select from US, CANADA, and/or CENELEC. This enables the program to only select products with the appropriate certifications.

- US represents FM, UL, or other equivalent Nationally Recognized Testing Laboratories (NRTL).
- CANADA represents CSA.
- CENELEC represents European approval agencies such as BASEEFA, FIMCO, KEMA, LCIE, NEMKO, PTB, SEMKO, and so on.

Class/Area Classification

For North American standards, select the appropriate **Class**. You will notice that only Class I allows the further selection of Zone 1 or Zone 2. If you select CENELEC in the Standards Body field, your selections will be Non-hazardous, for gas atmosphere Zone 1 and Zone 2 and for dust atmosphere Zone 21 and Zone 22.

Division / Zone

Select the **Division** or **Zone** classification if the design is for a hazardous location.

Gas / Dust Groups

When the Class and Division / Zone have been entered, the appropriate choices of **Gas** or **Dust** groups are available for selection. Select the group that represents the most critical condition. If you select CENELEC in the Standards Body field, Gas/Dust groups are directly selectable as part of the area classification.

Design Parameters

If any hazardous location has been selected, it is necessary to enter either the maximum T-rating of the equipment intended to be used for the design or the auto-ignition temperature for the specific gases or dusts in this specific hazardous location.

T-Rating

Standards associations have established the T-rating, or temperature rating, as a means of classifying electrical equipment based on the maximum temperature an exposed surface may attain.

The T-rating is identified as the “Temperature Identification Number” in the National Electrical Code (U.S.), as the “Temperature Code” in the Canadian Electrical Code, and as the “Temperature Class Number” in IEC standards.

The purpose of the T-rating is to ensure that electrical equipment does not exceed the auto-ignition temperature of flammables that might be present in a hazardous location.

If you select **Specify equipment T-rating** and then select the appropriate **T-rating** from the list, the program simply selects a heating cable with a **T-rating** less than or equal to the one you selected. See the table below for T-rating designations and associated temperatures.

Table 5-1: Temperature ratings

Division T-Rating	Temperature (°C) / (°F)	Zone T-Rating
T1	450 / 842	T1
T2	300 / 572	T2
T2A	280 / 536	
T2B	260 / 500	
T2C	230 / 446	
T2D	215 / 419	
T3	200 / 392	T3
T3A	180 / 356	
T3B	165 / 329	
T3C	160 / 320	
T4	135 / 275	T4
T4A	120 / 248	
T5	100 / 212	T5

Division T-Rating	Temperature (°C) / (°F)	Zone T-Rating
T6	85 / 185	T6

Auto-Ignition Temperature

If you select **Specify Auto-Ignition Temperature**, enter the lowest **Auto-Ignition temperature** for the hazardous materials present. The program will select a heating cable with a temperature T-Rating or conditional sheath temperature less than or equal to the stated **Auto-Ignition Temperature**.

The program determines the heating cable sheath temperature by using two approaches: (1) A product classification approach in which the maximum self-generated sheath temperature of the heating device has been established by testing the device in an artificial environment simulating worst-case conditions in accordance with IEEE 515 – 1997 4.2.2, similar clauses in EN 50-014 and other similar standards. (2) A systems approach, in which Pentair Thermal Management has demonstrated the ability to predict sheath temperatures by conducting tests in accordance with IEEE 515 – 1997 4.2.1 and other similar standards. Additional criteria for the design are required (maximum Ambient temperature, no wind, etc.). Additional criteria that TraceCalc Pro uses to determine the maximum sheath temperature are summarized in Table 5-2 in “[Allow Stabilized Design](#)” on page 53.

Sheath Temperature Calculation Options

These options determine how sheath and contact temperatures of heating cables are calculated and should only be changed by users who are very familiar with heat-tracing design and control methods.

Allow Stabilized Design

If this option is not selected, the program will only search for heating cables that match the T-Rating (T-Class) under any condition (so called unconditional T-Rating) and would such exclude the use of any power-limiting or series heating cable, because their surface temperature must be calculated based on the application. By default, **Allow stabilized design** is checked to allow for a wide variety of heating cable technologies. If you check the **Allow stabilized design** box, the program typically calculates the maximum sheath temperature of the heating cable under worst-case conditions (over-voltage, max. heating cable tolerances, uncontrolled pipe or highest pipe Operating temperature, no wind at Maximum Ambient temperature). The calculated sheath temperature will then be compared with the **Auto-Ignition Temperature** or the upper limit of the T-rating you previously entered unless you select an additional control system. Depending on the Standards Body and your definition of the area, the worse case is defined by applying different parameters, which are shown in the following table.

Table 5-2: Sheath temperature calculation

For more information on the criteria applied for a hazardous location, see “[Appendix B: Hazardous Gases and Vapors](#)” on page 129.

Area Class	Area Division/ Zone	Area Group	Over voltage: NEC	Over voltage: CEC	Over voltage: CENELEC	Max. Sheath Temp: FM	Max Sheath Temp: CSA	Max. Sheath Temp: CENELEC
Non-haz.	-	-	100%	100%	100%	-	-	-
I	D1	A,B, C,D	120%	110%	-	≤80% AIT	100% AIT	-
I	D2	A,B, C,D	110%	110%	-	100% AIT	100% AIT	-
II	D1, D2	E,F	110%	110%	-	100% AIT	100% AIT	
II	D1, D2	G	110%	110%	-	The lower of 165°C or 100% AIT	The lower of 165°C or 100% AIT	-
III	D1, D2		110%	110%	-	100% AIT	100% AIT	
(I)	Z1	-	110%	110%	110%	≤80% AIT	100% AIT	AIT – 5K for AIT≤200°C AIT – 10K for AIT>200°C
(I)	Z2	-	110%	110%	110%	100% AIT	100% AIT	AIT – 5K for AIT≤200°C AIT – 10K for AIT>200°C

Use Control Limited Design

This option allows you to influence the way TraceCalc Pro determines the calculation of the maximum sheath temperature as well as the contact temperature between the heating cable and the pipe (if applicable, e.g. for plastic pipes).

Check the **Use control limited design** box if you wish to include a temperature controller to limit the sheath temperature of the heating cable. You must verify, independent of the TraceCalc Pro program, whether a single controller (with or without failure annunciation) is permissible, or whether there is a requirement for a separate high temperature limit controller (perhaps even with a manual reset requirement) to de-energize the heating cable. Check local codes and standards to verify requirements. TraceCalc Pro assumes the requirements summarized below when selecting controls.

Table 5-3: Control limited design requirements

Class	Division/ Zone	Group	Requirements for control limited design NEC/CEC	Requirements for control limited design CENELEC
Non-haz.	-	-	Sheath temperature calculation based on max. controlled temperature, no need for failure alarm	Sheath temperature calculation based on max. controlled temperature, no need for failure alarm
I	D1	A,B,C,D	Not allowed	n/a
I	D2	A,B,C,D	Line sensing with failure alarm or std. line sensing and additional lockout	n/a
II	D1, D2	E,F	Line sensing with failure alarm	n/a

Class	Division/ Zone	Group	Requirements for control limited design NEC/CEC	Requirements for control limited design CENELEC
			or std. line sensing and additional lockout	
II	D1, D2	G	Line sensing with failure alarm or std. line sensing and additional lockout	n/a
III	D1, D2		Line sensing with failure alarm or std. line sensing and additional lockout	n/a
(I)	Z1	-	Line sensing with failure alarm or std. line sensing and additional lockout	Line sensing with or without failure alarm and additional lockout
(I)	Z2	-	Line sensing with failure alarm or std. line sensing and additional lockout	Line sensing with failure alarm or std. line sensing and additional lockout

Control Limited Setpoint

You will need to specify the setpoint for the control limited design. It needs to be slightly above Maintain temperature, but can also be much higher, if you apply the control limited design using a high limit cut-out approach.

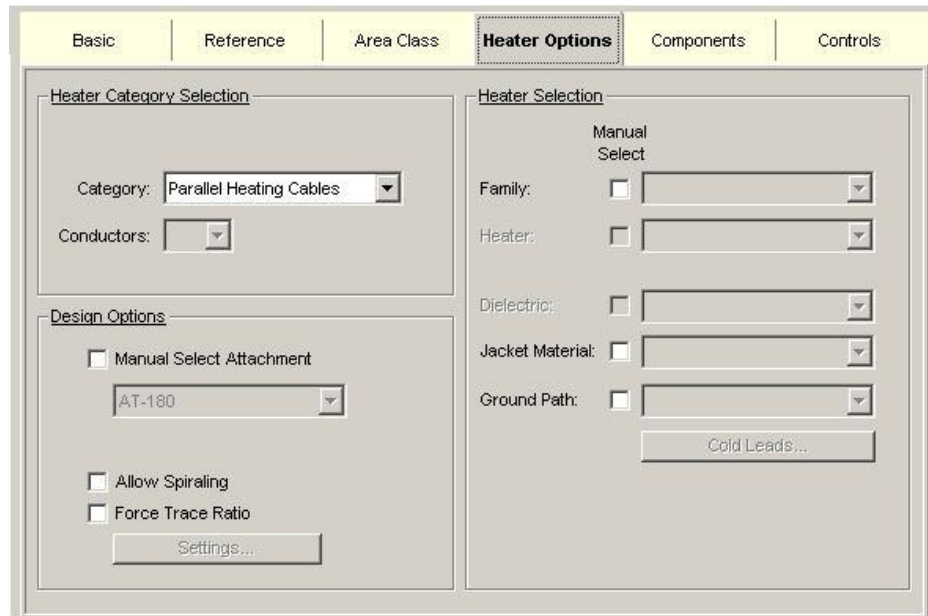
It is also important to place the temperature sensor used for control limited designs at the most representative location for the warmest section of the heat-tracing circuit. If your temperature controller allows, it is good design practice to use a separate temperature sensor for this function, otherwise it is recommended that you define the set point sufficiently above the Maintain temperature to allow for a safe operation.

Note: If you check the **Use control limited design** box, a default value slightly above the Maintain temperature is automatically entered in this field. You can override these default values.

For information regarding ignition temperatures of gases, vapors, dusts, fibers or flyings, see Classification of Gases, Vapors, and Dusts for Electrical Equipment in Hazardous (Classified) Locations, NFPA 497M-1991, and Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids, NFPA 325M-1991.

Heater Options Tab

Use the Heater Options tab to specify heater category and heater selection for your heat-tracing project.



Heater Category Selection

TraceCalc Pro allows you to choose various heater technologies. Each technology is a different heating cable construction and requires some differences in the design method.

Category

You can select from any of the technologies available in the selection list.

- **Parallel Cables** – Parallel heating cables can typically be cut to length in the field, simplifying installation.
- **Series Cables** – Includes cables such as Mineral Insulated (MI) heating cables and other series cables using a resistance wire as the heating element. The availability of this selection may depend on your user authorization. Contact Pentair Thermal Management if you require this option.

Conductors

The **Conductors** box is only applicable for **Series** heating cables. Series heating cables with various numbers of conductors may only be offered for certain geographic areas or approval settings.

Design Options

Manual Select Attachment

Check the **Manual Select Attachment** box to view the list of attachment methods available for selection.

If you leave the **Manual Select Attachment** box unchecked, the program will select an appropriate method by default.

The method used to attach a heating cable to a pipe or vessel can affect the heat output of the heating cable. This is particularly relevant when installing self-regulating heating cable.

- Glass tape is the typical attachment method for parallel heating cables.
- Adhesive-backed aluminum tape allows better dissipation of heat and is often used on plastic pipes. Self-regulating heating cables will generate more power when installed with aluminum tape than when installed with glass tape due to improved heat transfer.
- The Channel option is often used on pre-insulated piping. When a self-regulating heating cable is used in a channel, it will operate at reduced power and the program will make this adjustment.
- Banding or tie wires are typically used with metal sheathed heating cables and are not appropriate for cables with polymer insulation.

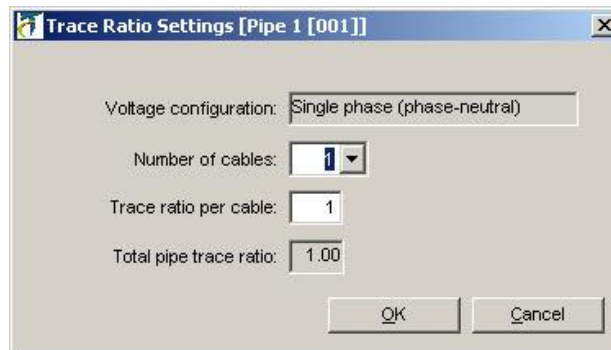
If an inappropriate method of attachment is selected, the program will override this selection without warning.

Allow Spiraling (Piping Only)

The most efficient way of applying heating cable is to install it straight along the pipe, so we recommend you leave the **Allow Spiraling** box unchecked. However, by checking this box, you allow the program to more closely balance the heat provided to the heat required by specifying the degree to which the heating cable should be spiraled.

Force Trace Ratio (Piping Only)

Check the **Force Trace Ratio** box if you wish to make the program use a specific trace ratio. After doing so, click on the **Settings...** button to display the following window:



The following fields are available from this window:

- **Voltage configuration** – This is a read-only field and it is displayed as a reminder of voltage configuration for the current line. For more information, see “[Electrical](#)” on page 45.
- **Number of cables** – From the drop-down list, select how many separate runs of heater cable you would like to have on this line. This field is used in conjunction with the **Trace ratio per cable field** below in order to determine how many total passes of heater are applied to the current line. If you were using a 3-phase voltage configuration, this field would be labelled **Number of Cable Groups** and it would be

assumed that three separate cables are required to make up a single circuit.

- **Trace ratio per cable** – Enter the desired trace ratio per run of cable. If you have checked **Allow Spiral** on the previous Heater Options tab, then you can enter fractional trace ratios, such as 1.5. Otherwise, you will be limited to whole number values for this field.
- **Total pipe trace ratio** – This is a read-only field where TraceCalc Pro displays the total trace ratio for the current line. This value is derived from the preceding two fields.

Heater Design Options... (Vessels Only)

Click the **Heater Design Options...** button to bring up the Heater Design Options dialog box.

The screenshot shows the 'Heater Design Options' dialog box. It features a title bar with a close button. The main area contains several sections: 'Limit Heater Output' with a checkbox and a text box for 'W/ft'; 'Force Segment Length' with a checkbox and a text box for 'ft'; 'Cover All Available Area' with a checkbox and a 'Heater Spacing' text box for 'in'; and 'Available Area' with three text boxes for 'Body: 33 %', 'Top: 0 %', and 'Bottom: %'. At the bottom are 'OK' and 'Cancel' buttons.

- **Limit Heater Output** – Check this box if you want to limit the heater to some maximum value. When you check the box, the text box is enabled, allowing you to enter the maximum heater wattage per unit length.
- **Force Segment Length** – If you know that your design will require more than one power connection, you may choose to set the length of each cable set. Checking this box enables the text box. Enter the desired segment length in the text box.
- **Cover All Available Area** – If you select **Cover All Available Area**, and enter a desired **Heater Spacing**, TraceCalc Pro calculates a cable length using your available area and preferred heater spacing, and selects the most economical cable possible, giving the required power with the required length. By contrast, if you do not select this option, TraceCalc Pro may select a shorter length of higher wattage cable, since that may result in lower cable cost.

Heater Selection

We strongly recommend that you only use this option to force certain parameters of the heater selection if you are very familiar with TraceCalc Pro and its heating cable selections. Leaving all boxes unchecked will give TraceCalc Pro the flexibility to select the most appropriate products for your application.

Family

Check the **Manual Select** box adjacent to **Family** if you wish to force the program to use a heating cable from a specific family.

Heater

Check the **Manual Select** box adjacent to **Heater** if you wish to force the program to use a specific heating cable.

Dielectric

Check the **Manual Select** box adjacent to **Dielectric** if you wish to force the program to select cables constructed with a specific dielectric.

Jacket Material

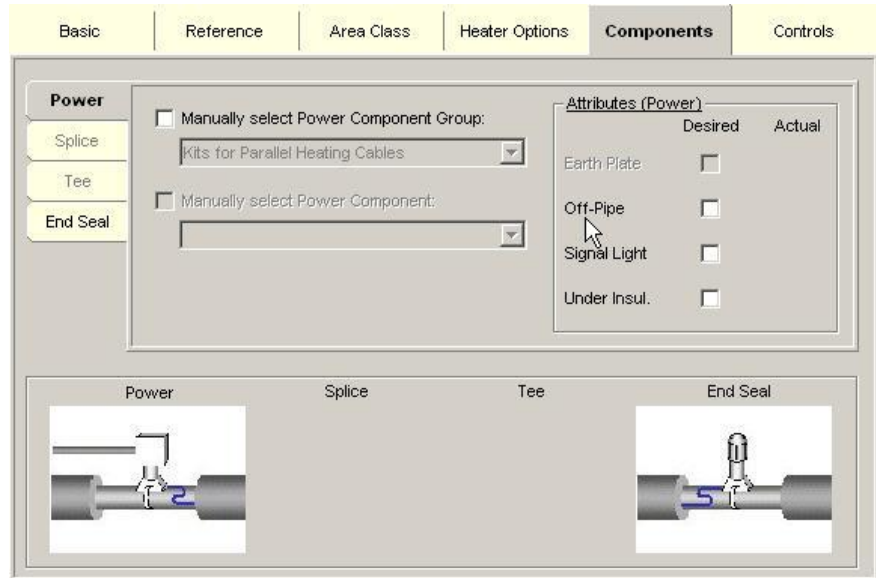
Check the **Manual Select** box adjacent to **Jacket Material** if you wish to force the program to use a specific jacket material.

Ground Path

Check the **Manual Select** box adjacent to **Ground Path** if you wish to force the program to select a heating cable with a specific type of ground path.

Components Tab

Use the Components tab to manually select the connection system you wish TraceCalc Pro to use for the Power Connection, Splices, Tees and End Seals. You can also select a specific product from a list of optional configurations for that connection system.



Components

A picture of the selected components will display in the selection area at the bottom of the screen. Each picture is simply a visual representation of a specific aspect of a component attribute. A picture only appears if you have automatically selected a component (by recalculation) or if you have forced a component.

To view or change your component options, you must click on the appropriate component type tab at the left side of the Components screen. For instance, in the picture above, the Power component options are visible. To view and edit your end seal options, you would click the End Seal tab.

TraceCalc Pro allows you to enter preferences only for needed components. The pictured component screen is for a stand-alone parent line. The Splice and Tee tabs are disabled, because a stand-alone line normally would require no splice or tee kits.

When you make a component selection, it only applies to the line segment that is currently selected in the Project Explorer Pane. As an example of how this works, suppose you have configured a line with two pipe segments; a parent and an end-segment splice. The line will need three component kits; power, splice and end seal. TraceCalc Pro associates each component with a particular pipe segment. The power kit is associated with the parent segment; the splice kit and end seal are associated with the child segment. When the parent is the selected pipe segment, only the power component tab is enabled. The splice kit and end seal kit are 'assigned' to the child line, so those tabs are enabled when the end-segment splice pipe segment is selected, not when the parent segment is selected.

The assignment is based on two things; connectivity, and function. In the case above, both the parent and child are connected to the splice kit; but you could say that the splice kit is only needed because of the presence of the end-segment splice child, so the kit is associated with the child.

There are two ways of selecting components; you may use the **Attributes** check boxes to indicate what attributes (for instance, Signal Light) you want on your component; or you may use the **Manually Select ... Group** and **Manually Select ... Component** check boxes and select a particular component group and component kit from the associated drop-down lists.

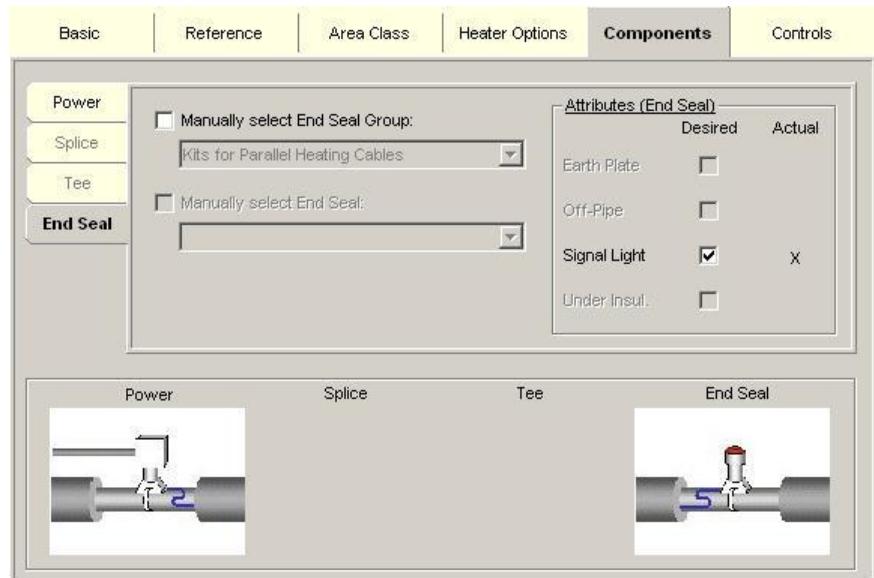
For all but advanced users, the preferred way of selecting components is by indicating desired component attributes. Selecting desired attributes easy and does not require studying the list of available components.

Attributes

To indicate your preferred attributes for a particular component kit, simply click the appropriate tab of the component type tab (End Seal in the picture below); then check the box adjacent to the attribute you wish to select. You may select more than one attribute, if available.

If an **Attribute** check box is disabled, that is because no available component kit has that attribute. In the case pictured below, after the user selected the **Signal Light** attribute, all other attribute check boxes became disabled, because no component kit with a signal light is installed off-pipe, under insulation, or with an earth plate.

In the picture below, the user simply checked the **Signal Light** Attribute check box. TraceCalc Pro attempts to find a component with a signal light in its default group of end seal components. It indicates that the actual end seal kit has a signal light with the X in the **Actual** Attribute column. In this case, the picture also indicates the presence of a signal light.



Manually Select ... Component Group

If you wish to restrict TraceCalc Pro to selecting from a particular set of component kits, then you would first check the **Manually Select ... Component Group** check box, then choose the desired group of components from the component group drop-down list. For instance, if you are not designing in a hazardous area, but wish to force TraceCalc Pro to assign a component rated for Hazardous Area use, you may check **Manually Select ... Component Group** and then select 'Kits for Class I Div. 1' from the drop-down list box.

If you have check this check box, then the **Manually Select ... Component** check box will become enabled, allowing you to select a particular component kit if you wish.

During calculation, if you have checked this check box and no appropriate component is found for your particular pipe application in the selected component group, then TraceCalc Pro de-selects the forced component group, and attempts to find an appropriate component from another group of components (the default one).

If you have not checked the check box, the component group drop-down list will be disabled; yet after calculation a component group will appear in the drop-down list box. The component group shown is the group of components where TraceCalc Pro found the selected component. It is the 'default' component group for the selected heater.

Manually Select ... Component

If you wish to select a particular component kit, you must first select a component group using the **Manually Select ... Component Group** check box. You may then check the **Manually Select ... Component** check box and select the desired component kit from the component kit pull-down list.

Controls Tab

Use the Controls tab to set the type of thermostatic control to be used, if any, and whether it is to be a centralized or local system. You can also select a specific product and assign which panel it is to control, if centralized.

The screenshot displays the 'Controls' tab of the TraceCalc Pro software interface. At the top, there are several tabs: 'Basic', 'Reference', 'Area Class', 'Heater Options', 'Components', and 'Controls'. The 'Controls' tab is active. The main area contains the following controls:

- Control Method:** A dropdown menu set to 'Line sensing, w/failure alarm'.
- Sensor is located on this line**
- Use centralized control equipment**
 - Panel Name:** A dropdown menu set to 'Panel LSENS/ALARM 1'.
 - Edit Panels...** button
 - Select Sensor:** A dropdown menu.
 - Force Qty:** A numeric input field set to 0.
- Use local control equipment**
 - Category:** A dropdown menu set to 'Electronic'.
 - Select Product:** A dropdown menu.
 - Select Sensor:** A dropdown menu.
 - Force Qty:** A numeric input field set to 0.
- Reference Information (optional)**
 - CB No:** A text input field set to 'CB-1'.
 - Circuit No:** A text input field set to 'HTP1-001'.

Control Method

You can specify whether the heating cable will be controlled by a temperature controller or be **Uncontrolled**. Select the **Control Method** type from the selection list. This will tell the program which control method to use for all calculations. If you want to add the temperature controllers to the Bill of Materials, select:

- **Use centralized control equipment** – Check this box if this temperature control system will be placed in a location, such as a panel or control room, removed from some or all of the circuits being controlled.

- **Use local control equipment** – Check this box if the control will be located in the immediate vicinity of the circuit being controlled, as is usually the case for line sensing thermostats.

Note: If you have already allocated several lines to the same panel and now specify different control methods for some of these lines, the program will use a panel named ‘Unassigned’ and move the changed lines to this panel. You will see this in the Project Explorer Pane when in **View By: Panel Groups** mode. You may want to reconsider whether the lines should use different control methods or whether they should be supplied from another existing panel. You can use the Drag-and-drop feature in the Project Explorer Pane to relocate the lines to another existing panel, which will make the lines use the control method for this panel.

Local Sensor Location

If you have selected a local control method (Line Sensing or Line Sensing With Failure Alarm) for a line group, then the **Local Sensor Location** checkbox should be used to indicate which line segment has the sensor. The line with the sensor will dictate the power being distributed to the whole group. After the lines are calculated, the duty cycle of the line with the sensor will be used to calculate the controlled temperatures of the other lines in the group. Any line whose controlled temperature is below the maintain temperature will have a **WARNING**.

You can only change the **Local Sensor Location** by selecting the line where you intend to locate the sensor and clicking the **Local Sensor Location** checkbox. You may not ‘de-select’ the checkbox if it is checked.

The **Local Sensor Location** checkbox will be disabled for all other control methods.

WARNING: On a line with child segments, the location of the temperature sensor must be selected with care as incorrect placement can cause over- or under-heating of some pipe sections and create a risk of fire or damage to the process material or piping.

Centralized Control Equipment

If you selected **Use centralized control equipment**, complete the following required fields.

Panel Name

The **Panel Name** field shows which panel the heat-tracing circuit is assigned to.

You can change that assignment by selecting a different **Panel Name** from the list of all the panels with the same **Control Method** as the one selected. This change will be immediately shown in the Project Explorer Pane if you are in **View By: Panel Groups** mode.

Conversely, if you move a heat-tracing circuit from one panel to another by using the drag-and-drop feature of the Project Explorer Pane, you will see that the new **Panel Name** is automatically entered in the **Panel Name** field.

Customize Panels

Click the **Edit Panels** button to add, modify, or delete a control panel name.

- **Add** – To add a new panel name, click **Add** and enter a unique **Identifier**. Click **OK**. In the Control Panel Properties dialog box, enter a panel name, and select from a list of possible Control Methods for the panel. Then select from a list of products that can be used to provide

that control method. Finally, specify the quantity of this control product in the **Product Qty.** field.

- **Modify** – To modify a panel name, highlight the panel you wish to modify. Click **Modify**. In the Control Panel dialog box, modify the panel name, specify the maximum allowable load for the panel (in kW) and select from a list of possible Control Methods for the panel. Then, select from a list of products that can be used to provide that control method. Finally, specify the quantity of this control product in the **Product Qty.** field.
- **Delete** – To delete a panel name, highlight the panel name you wish to delete. Click **Delete**.
- **Copy, Paste and Paste Append** – These menu items are available from the pop-up menu using right-click. However, as panels do not include lengthy data associated with them in this program, it is usually easier just to **Add** a new panel rather than copy the attributes of an existing one.

TIP: You can also access the Panel Name list and Edit Panels feature from the **Setup** menu by selecting the **Project Lists** menu item then selecting **Control Panels**.

Select Sensor

Check the **Select Sensor** box and then select from a list of available sensors. The default number of sensors for the selected panel will be added to the Bill of Materials unless you override that quantity using the **Force Central Sensor Qty.** check box.

Force Central Sensor Qty.

If you have selected a particular sensor to go with a control panel, you may dictate how many are included in the Bill of Materials by checking the **Sensor Qty.** check box and entering the quantity in the adjacent text box.

Local Control Equipment

If you selected **Use local control equipment**, complete the following fields.

Category

Select either **Electronic** (e.g. RTD) or **Mechanical** (e.g. Bulb and Capillary) as the temperature sensing method.

Select Product

Check the **Select Product** box only if you want to choose a specific product. You can then select from the list of available temperature controllers matching the control method and enter the quantity of temperature controllers to be included for this line. You can also leave this option unchecked and let TraceCalc Pro find a product that matches your specifications.

If you select a particular local control product, you may check the **Force Qty:** check box to force a particular number of control products.

Select Sensor

If you have chosen an Electronic temperature sensor and have chosen the product, you can now check the **Select Sensor** box and select from a list of available sensors. You can also leave this option unchecked and let TraceCalc Pro find a product that matches your specifications. Then check the Force Qty: check box if you want to enter the quantity of sensors to be included for this line. Otherwise, TraceCalc Pro will select the number of sensors to include according to the control product specifications.

Reference Information (optional)

CB No.

Enter the **CB No.** (i.e. a reference number for the circuit breaker) if you wish to have it for reference. This number will be useful if you anticipate exporting the results of this program to generate a listing of heat-tracing circuits sorted by CB Number. For more information about exporting data, see “[Export](#)” on page 14.

You can also print reports for lines grouped by CB Number by applying this as a **custom filter** condition. For more information, see “[Using the Filter and Sort Settings Dialog Box](#)” on page 87.

You can enter any text, up to 30 characters long, such as “Panel3”.

Circuit No.

Enter the **Circuit No.** if you wish to have it for reference. This number can be useful if you anticipate exporting the results of this program to generating a listing of heat-tracing circuits sorted by Circuit Number. For more information about exporting data, please see “[Export](#)” on page 14.

You can also print reports for lines grouped by Circuit Number by applying this as a **custom filter** condition. For more information, please see “[Using the Filter and Sort Settings Dialog Box](#)” on page 87.

Vessel Properties Dialog Box

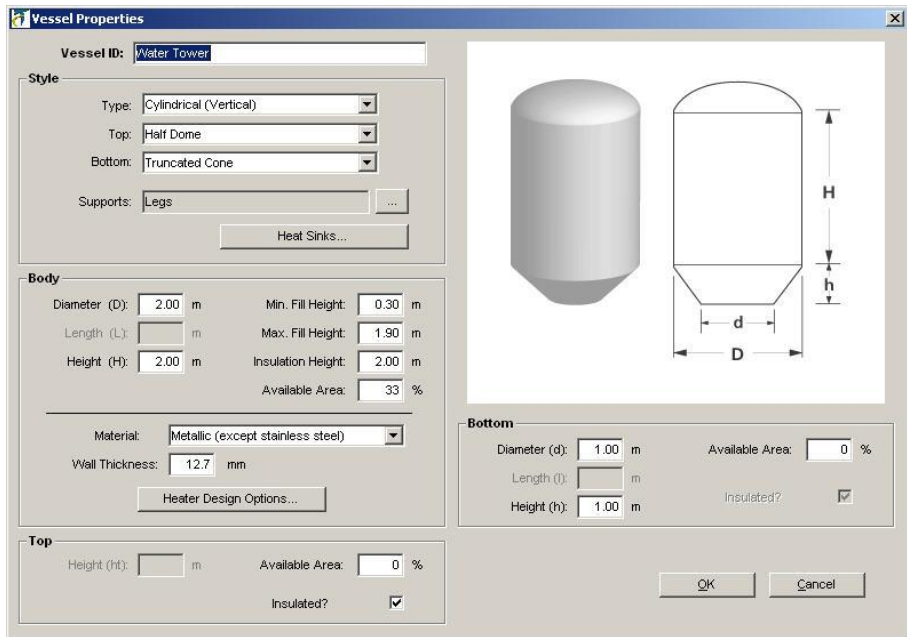
The availability of all vessel options may depend on your user authorization. Contact Pentair Thermal Management if you require this option.

The Vessel Properties dialog box is used to enter basic vessel data such as body style, dimensions and material, fill height, and insulation level. There are separate input forms for vessel support data and heat sink data such as ladders, manholes and miscellaneous. Please see “[Vessel Supports Dialog Box](#)” on page 69 and “[Vessel Heat Sinks Dialog Box](#)” on page 71.

For an existing vessel, the Vessel Properties dialog box is accessed by clicking the **Vessel Properties...** button on the Basic Tab, or by double-clicking on the **Vessel ID** in the Project Explorer window.

If you create a new vessel, the Vessel Properties dialog box appears automatically. There are three ways to create a new vessel; select **Edit > Add Vessel...** from the menu bar, click the **Add Vessel** button from the button bar, or right-click anywhere in the Project Explorer pane and select **Add Vessel...** from the pop-up menu.

TIP: If you click **Cancel** while first defining a vessel, no vessel will be created.



TIP: The form is conveniently designed to enter data from top to bottom, down the left side and then the right, to complete data entry.

Vessel ID

The **Vessel ID** serves the same purpose as the pipe segment **Line ID**. Since vessels do not have children, however, each **Vessel ID** must be unique. There is no **Section No.** to differentiate between vessels.

You may change the **Vessel ID** here on the Vessel Properties dialog, or on the Basic tab of the main project form.

Style

The **Style** section of the Vessel Properties dialog box allows you to specify the vessel body, top and bottom style; and to bring up the [Vessel Supports Dialog](#) and [Vessel Heat Sinks Dialog](#). The vessel graphic illustrates the selected style and required dimensions.

Use the **Type** pull-down list to select the body style from the four available choices: vertical cylinder, horizontal cylinder, rectangular, and spherical.

Use the **Top** pull-down list to select the top style from the available choices. Available top styles will be among conical, flat, floating, full dome, and half dome. The exact choices will depend on body style.

Use the **Bottom** pull-down list to select the bottom style from the available choices. Available bottom styles will be among flat, truncated cone, truncated pyramid, full dome, and half dome. The exact choices will depend on body style.

Use the **Supports** button, the one with the ellipsis (...) to the right of the Supports text box, to bring up the [Vessel Supports dialog box](#), described on page 69. The Vessel Supports dialog box allows you to fully specify the vessel supports.

Use the button labeled **Heat Sinks...** to bring up the [Vessel Heat Sinks dialog box](#), described on page 71. The Vessel Heat Sinks dialog box allows you to specify any ladders, manholes, handholes, nozzles, and miscellaneous heat sinks.

Body

Dimensions: Diameter, Width, Height, Length

Enter the body dimensions in the text boxes provided. The vessel graphic illustrates the required dimensions.

Minimum Fill; Maximum Fill

The **Minimum Fill Height** is the minimum fill level, in length, up the side of the vessel body (the base, if it has volume, is assumed to be full).

The **Maximum Fill Height** is the maximum expected fill level, again measured in units of length up the side of the vessel body.

The maximum allowable value for the minimum and maximum fill heights is the vessel height (in the case of horizontal cylinders and spheres, the maximum allowable value is the vessel diameter).

Insulation Height

Insulation Height indicates how far up the body of the vessel the insulation extends. The maximum value is the body height (or diameter, for horizontal cylinders and spherical vessels). The minimum value is the **Maximum Fill Height**.

Available Area (Body)

Enter the fraction of the vessel body that is available to be traced. For example, to indicate that you want to restrict heat tracing to the bottom third of the vessel, you would enter **33%** in the **Available Area** text box.

Since the traced area must be insulated, the available area may not exceed the area defined by your insulation height.

To trace all of the area you have specified with some specific spacing, you must in addition specify **Cover All Available Area**. For more information, please see [“Heater Design Options... \(Vessels Only\)”](#) on page 58.

Material (Body)

The Material pull-down list is used to indicate the vessel wall material. For metal-walled vessels, you must select either stainless steel or metal (other than stainless). For plastic-walled vessels, the options are HDPE, FRC, or PVC. Select the plastic type that has thermal properties closest to those of your vessel.

WARNING: If you are designing for plastic vessels, make sure that you have indicated the maximum allowable temperature on the Basic Tab of the TraceCalc Pro Design Pane to avoid possible damage to the vessel.

Material Thickness

Use this text box to enter the vessel body wall thickness.

Heater Design Options...

The **Heater Design Options...** button brings up the Heater Design Options dialog box, which allows you to set the parameters **Limit Heater Output**, **Force Segment**

Length, and Cover All Available Area. For more information, please see “[Heater Design Options... \(Vessels Only\)](#)” on page 58.

Top

Height (Top)

If the selected top style is conical, then you should enter its height.

Available Area (Top)

Enter the fraction of the vessel top that is available to be traced. The minimum value is 0; the maximum is 100%.

Since any traced area must be insulated, if your top is not insulated, the **Available Area** is set to zero and cannot be changed.

To trace all of the area you have specified with some specific spacing, you must in addition specify **Cover All Available Area**. For more information, please see “[Heater Design Options... \(Vessels Only\)](#)” on page 58.

Top Insulated

To indicate that the top of the vessel is insulated, check the **Top Insulated** check box.

If the top is not insulated, then no heat tracing will be allowed there (the **Top Available Area** will be set to zero and may not be changed).

Bottom

Dimensions: Height, Width, Length, Diameter

If the selected bottom style is a truncated cone or truncated pyramid, then you will enter the dimensions. For a truncated cone, the needed dimensions are bottom height and bottom diameter. For a truncated pyramid, the needed dimensions are bottom height, bottom length, and bottom width.

The dimensions will be illustrated by the vessel graphic that appears on the Vessel Properties dialog box.

Bottom Insulated

To indicate that the bottom of the vessel is insulated, check the **Bottom Insulated** check box.

This option is only enabled in the case of the closed skirt. If the vessel has a closed skirt with an access port, you may indicate that the bottom is insulated by checking the **Bottom Insulated** check box. For all other support types, the option is disabled.

If the support type is legs, gussets, saddle, or open skirt, the check box is checked and cannot be changed. You must insulate the vessel bottom if you use leg, gusset, saddle or open skirt supports. If the support type is slab, the check box is cleared and cannot be changed. No insulation is assumed if the vessel is on a slab.

If the bottom is not insulated, then no heat tracing will be allowed there (the **Bottom Available Area** will be set to zero and may not be changed).

Available Area (Bottom)

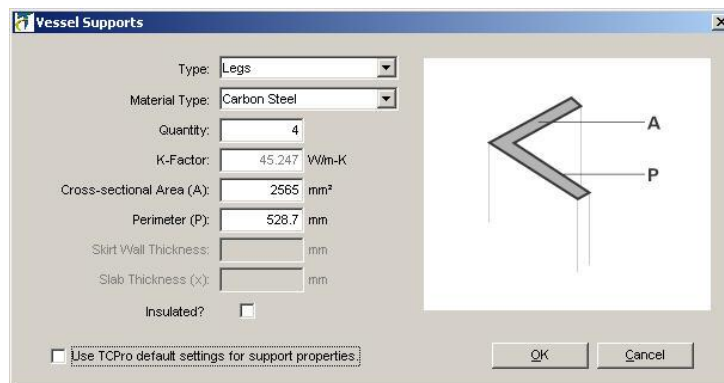
Enter the fraction of the vessel bottom that is available to be traced. The minimum value is 0; the maximum is 100%.

Since any traced area must be insulated, if the bottom is not insulated, the **Available Area** is set to zero and cannot be changed.

To trace all of the area you have specified with some specific spacing, you must in addition specify **Cover All Available Area**. For more information, please see [“Heater Design Options... \(Vessels Only\)”](#) on page 58.

Vessel Supports Dialog Box

Use the Vessel Supports dialog box to enter all support data for a vessel. The Vessel Supports dialog box is accessible from the Vessel Properties dialog box.



Type

Select from slab, gusset, leg, saddle, open skirt, and closed skirt.

The available choices will depend on the vessel body style and bottom style. Saddles are only available for horizontal cylinders. Slab is only available for vessels with flat bottoms.

Material

Available materials will be among stainless steel, carbon steel, aluminum, concrete, and other (depending on the support type chosen).

Other is always available. If you wish to adjust the material thermal conductivity (k-factor), then select Other to enable the **K-Factor** text box.

Quantity

The number of supports (**Quantity**) applies if the support type is saddle, leg or gusset. If you select **Use TCPro default settings for support properties**,

if you select **Use TCPro default settings for support properties**, you will not be able to set the **Quantity**. TCPro will automatically set and update it whenever you change the vessel or support definition. For more information, see [“Use TCPro default settings for support properties”](#) on page 70.

K-Factor

Standard values of thermal conductivity (**K-Factor**) are used for all materials. The **K-Factor** may not be changed unless you select **Other** as the support **Material**.

Cross-sectional Area and Perimeter

The **Cross-sectional Area** and **Perimeter** of a leg, saddle or gusset support is the area and perimeter of the surface of the support that is in contact with the vessel. The support graphic on the Vessel Supports dialog box illustrates the required dimensions.

If you select **Use TCPro default settings for support properties**, you will not be able to set these dimensions. TCPro will automatically set and update them whenever you change the vessel or support definition. For more information, see [“Use TCPro default settings for support properties”](#) on page 70.

Skirt Wall Thickness and Perimeter

For skirts, instead of entering the **Cross-sectional Area** and **Perimeter**, you will enter the **Skirt Wall Thickness** and the outer **Perimeter** where the skirt meets the vessel. When you select skirt as the support type, a graphic on the Vessel Supports dialog box illustrates the required dimensions.

If you select **Use TCPro default settings for support properties**, you will not be able to set these dimensions. TCPro will automatically set and update them whenever you change the vessel or support definition. For more information, see [“Use TCPro default settings for support properties”](#) on page 70.

Slab Thickness

For slabs, enter the **Slab thickness**.

If you select **Use TCPro default settings for support properties**, you will not be able to set **Slab Thickness**. TCPro will set and update it whenever you change the vessel or support definition. For more information, see [“Use TCPro default settings for support properties”](#) on page 70.

Insulated?

You can greatly reduce heat loss from vessel supports by insulating them. TraceCalc Pro will make allowance for insulated supports if you check the **Insulated?** check box.

IMPORTANT: If you use support insulation, in order to avoid underestimating your support heat loss, you must insulate the support as follows:

Leg, saddle and open skirt supports must be insulated along at least the first two feet from where they meet the vessel.

Closed skirts must be fully insulated.

Gussets must be insulated along the first four inches from where they meet the vessel if the vessel is very small. For vessels over 6 feet in diameter, the insulation must extend at least ten inches from where the gusset meets the vessel.

Use TCPro default settings for support properties

By default, the support properties quantity, cross-sectional area, perimeter, skirt wall thickness, and slab thickness will be automatically updated for you.

TraceCalc Pro will initialize all support properties when the support type changes. By default, TCPro will also automatically recalculate default values and update the support properties with the new defaults if you change vessel type, size or support material.

If you prefer NOT to have TCPro update these properties, then you must clear the check box marked **Use TCPro default settings for support properties**. It is checked by default. If you do clear the check box, you must update the support properties yourself.

Vessel Heat Sinks Dialog Box

Heat sinks are a significant source of heat loss and must not be neglected in vessel heat-tracing system designs.

Use the Vessel Heat Sinks dialog box to enter data for all heat sinks other than supports.

Ladders, manholes, handholes and nozzles all may be defined on the Vessel Heat Sinks dialog box.

For other heat sinks, you may choose to use the ‘Miscellaneous’ heat sink category.

Finally, for any heat sinks that you have not accounted for in any other way, you may specify an additional length of heater.

Accessories						
	Type	Quantity	Diameter	Height	Insulated?	Above Max Fill Level?
1:	Manhole	1	609.6 mm	152.4 mm	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2:			mm	mm	<input type="checkbox"/>	<input type="checkbox"/>
3:			mm	mm	<input type="checkbox"/>	<input type="checkbox"/>

Ladders

Material: Carbon Steel Contact Points With Vessel: 20

Quantity: 1 Cross-sectional Area: 645 mm²

K-Factor: 45.247 W/m-K Perimeter: 101.6 mm

Miscellaneous

Allow percentage of vessel body heat loss
 Allow lump sum watts

Quantity: 0 % Additional length of heater: 0 m

OK Cancel

Accessories

You may create up to three different accessory “definitions”. For each accessory you define, you specify how many (the **Quantity**), the **Diameter**, the **Height**, whether it is **Insulated**, and whether it is above the maximum fluid level.

Type

Select from manhole, hand hole, or nozzle. If you wish to remove an accessory definition, you may select the blank from the drop-down list, and the other fields will be cleared.

Quantity

Enter the number of accessories that match this definition. For instance, if you have two manholes that are essentially the same, you may create one accessory definition, and enter ‘2’ in the **Quantity** field.

If you enter zero **Quantity**, the accessory definition will be removed.

Diameter

Enter the accessory outer **Diameter**.

Height

Enter the **Height** that the accessory extends from the vessel. For a nozzle, you might think of this as the length.

Insulated?

If the sides and top of the accessory are insulated, then check this check box. If not, then clear the check box.

It is not possible to indicate that only the sides of an accessory are insulated or that only the end is insulated. If that is the case, then you should clear this check box.

Above Max Fill Level?

If the inner surface of the accessory will ever be wet, then you must clear this check box. Check this check box only if the accessory is entirely above the maximum fill level of the vessel.

TraceCalc Pro neglects the contribution of accessories that are entirely above the maximum fill level.

Ladders

Use this section to define any ladders that extend below the maximum fill level. You may neglect any ladders and handrails that are above the maximum fill level.

If you have more than one ladder, a single definition must be used for all of them.

Material

Select Carbon Steel or Other from the drop-down list. If you select Other, you will be allowed to change the thermal conductivity (**K-Factor**).

Quantity

Enter the number of ladders.

K-Factor

Enter the ladder thermal conductivity. If you have selected Other as your ladder **Material**, this field will be editable. Otherwise, it will be read-only.

Contact Points With Vessel

Enter the number of supports attaching each ladder to the vessel.

Cross-Sectional Area and Perimeter

These dimensions are measured from the cross-section of the ladder support where it meets the vessel. The ladder support cross-sectional area and perimeter are exactly analogous to the cross-sectional area and perimeter of a leg support.

Miscellaneous

If you know of other heat sinks that are not accounted for as accessories or ladders, you can include a single allowance for all of them together. This allowance can be based on a fraction of vessel body heat loss, or on total wattage as described below.

- **Allow percentage of vessel body heat loss.** This selection adds a user-defined percentage of the vessel body heat loss, resulting in extra cable that can be installed wherever needed. Check this button and enter a percentage value in the Quantity (%) field. This will cause the program to add an additional length of heating cable to provide the number of watts specified by the given percentage of the total body heat loss.
- **Allow Lump sum watts.** This selection adds a user-defined amount of watts to the calculated heat loss. Check this button and specify the total additional heat loss in the Quantity (W) field. This will cause the program to specify an additional length of heating cable to provide the specified number of watts at the Maintain temperature and Minimum Ambient conditions.

Additional length of heater

This selection adds a user-defined length of heater, resulting in extra cable that can be installed wherever needed. Check this button and specify the total additional length of cable in the Quantity field.

Viewing Calculated Results

Use the Calculated Results Pane to view a brief summary of the values calculated by the program as a result of the data you provided.

You can resize the window to show all the information without scrolling, or shrink it to a minimal height when you do not wish to view the results. Note: This pane might be hard to see if your screen resolution is smaller than 1024x768 or if you are using the “large fonts” setting for the appearance in Windows Display Properties.

Before viewing the results, you will need to select **Calculate** from the menu, which offers the following choices for generating calculated results:

- **Current Record** – This command calculates the results only for the line that is highlighted in the Project Explorer Pane.
- **All Records** – This command calculates, or recalculates all lines in the project. However, only the line that is highlighted in the Project Explorer Pane will have its results shown in the Calculated Results Pane. You will need to highlight each of the lines in the Project Explorer Pane to show their results in the Calculated Results Pane.
- **Changed Records Only check box** – When this box is checked, the program will only recalculate lines that have been changed since they were last calculated.

Status Messages

The first line of the window will show the status of the calculation. Several warning or error messages might apply at the same time. In this case, you will see a down arrow appear on the right end of the message text. Click on this arrow to see all the messages.

Status Messages

RECALC – Heat loss calculation required

RECALC – Heater selection required

OK

ERROR

WARNING

Explanations

Data has not been processed or has been changed since the last calculation. Select Calculate in the main menu, use the F9 key, or use the Recalculate icon to view the updated results.

The program has been able to complete its calculations with the data provided.

A description to indicate the possible reason the program could not complete its calculations.

The program has completed its calculations but has encountered a situation that you should review.

Pipe Data

If the selected item is a pipe segment, then the first column of the **Calculated Results** shows the values calculated for parameters related to the pipe segment. These include:

- **Heat Loss** per unit length of pipe. This is the calculated heat loss based on the data you entered.
- **Total Heater Length** – This is the total amount of heating cable required for the selected line/pipe segment. This is divided into the specific amounts for Pipes, Valves, Supports, Flanges and Misc., including contingencies for power connections, splices and any miscellaneous heat sink allowances.
- **for Piping** – The total amount of heater that has been allowed to trace the length of this pipe segment.
- **for Valves()** – The amount of heater that has been allowed to trace all the valves in this pipe segment. The number of valves that have been specified for this segment is shown in parenthesis.
- **for Supports()** – The amount of heater that has been allowed to trace all supports in this pipe segment. The number of supports that have been specified for this segment is shown in parenthesis.
- **for Flanges()** – The amount of heater that has been allowed to trace all flanges in this pipe segment. The number of flanges that have been specified for this segment is shown in parenthesis.
- **for Misc** – The amount of heater that has been allowed to trace miscellaneous heat sinks for this pipe segment. For more information, see “[Valves, Supports ...](#)” on page 39.
- **for Terminations** – The amount of heater that has been allowed for heater terminations. Note: this only applies to heaters that are field terminatable. Also, the length shown is assumed to be “wastage” and is not included when calculating Electrical Data.

Vessel Data

If the selected item is a vessel, then the first column of the **Calculated Results** shows the values calculated for parameters related to the vessel. These include:

- **Heat Loss.** This is the calculated heat loss based on the data you entered, including the safety factor.
- **Vessel Body** – The calculated heat loss of the wet and dry areas of the vessel.
- **Slab/Supports** – The calculated heat loss of the vessel supports. In the case of a slab, the calculated heat loss through the base of the vessel.
- **Other** – The calculated heat loss of all other heat sinks. This includes accessories, ladders, and miscellaneous heat sinks, all of which are entered on the Vessel Heat Sinks dialog box.
- **Safety Factor** – The calculated safety factor, in watts.
- **Vessel Area** – The total surface area of the vessel.
- **Heated Area** – The area of the vessel surface that will be covered with heater, using the specified heater length and spacing.
- **Ave. Heat Loss Rate** – The average rate of heat loss from the vessel body per unit area, in watts per unit area.
- **Total Heater Length** – This is the total amount of heating cable required for the selected vessel. This includes the amount needed to account for the total heat loss, plus any additional length of heater specified on the Vessel Heat Sinks dialog box, and amounts for terminations.
- **for Terminations** – The amount of heater that has been allowed for heater terminations. Note: this only applies to heaters that are field terminatable. Also, the length shown is assumed to be “wastage” and is not included when calculating Electrical Data.

Heater Data

The second column of the **Calculated Results** shows the calculated values that relate to the heating cable. These include:

- **Catalog No.** of the heating cable selected by the design calculation.
- **Power Output** per unit length of the selected heating cable when operating at the Maintain temperature.
- **Trace Ratio** of the heating cable (pipes only). 1.00 indicates a straight application of heating cable along the pipe. 1.50 indicates that 50% more tracing is to be applied, by spiraling, so that 15 m of heating cable would be applied to each 10 m of pipe. 2.00 indicates even more spiraling or more typically a double tracing of the heating cable on this pipe segment.
- **Heater Spacing** (vessels only). The heater spacing to be used on the vessel. The heater spacing will be either Default, Forced, or Calculated. If the user has not specified **Use All Available Area**, then the user’s specified default spacing will be used if the available area is sufficient. If the available area is not sufficient, the spacing will be reduced to meet the specified heat loss requirements. If the spacing

must be smaller than the user-specified spacing, then the Calculated mode will be used. If the user has specified **Use All Available Area**, then the spacing will be Forced, unless a smaller spacing than specified must be used. In that case, the spacing is Calculated.

- **Cable Set Qty** shows the number of cable sets that will be used for this line. This could be 2 if you design a pipe to be traced by two independent lengths of heating cable. (See Design Options where you can specify a forced trace ratio and elect to use Multiple Cable Sets.)
- **Sheath Temperature** of the heating cable in a worst-case situation, i.e. Maximum Ambient temperature, no wind, maximum heating cable power, over voltage, and so on, as required by the standards body and the requirements of the area class.
- **Max Cable Length** (Parallel Heating Cables) **or** **Max. Unjointed Length** (Series Heating Cables) – This is the maximum continuous length of cable allowed for the selected heating cable. For a parallel heating cable, also called max. circuit length, this value depends on various parameters such as CB size, startup temperature, and so on. Circuits using more cable than this value need to be broken into several circuits. For series cable, this value typically only refers to the maximum length that the supplier can deliver in one piece. Circuits using more cable than this value can be used, but not without splices, which need to be added when installing the system. The heating cable manufacturer specifies the value for the max. cable length.
- **Min. Controlled** – This is the calculated *minimum* estimated temperature at which the pipe will be maintained, taking the selected control method and nominal heater ratings into consideration.
- **Max. Controlled** – This is the calculated *maximum* estimated temperature at which pipe will be maintained, taking the selected control method and nominal heater ratings into consideration.
- **Uncontrolled** – This is the calculated worst-case pipe temperature that the pipe could reach. This calculation assumes the heater is operating with no control device and conditions (Ambient temperature, voltage, heater output, etc.) are at their worst-case expected values as defined by the selected Standards Body. For more information, refer to the table in the section “[Auto-Ignition Temperature](#)” on page 53. The only exception is if you specified “control limited design.” In this case, no uncontrolled temperature will be calculated and the setpoint for the control limiting temperature device will be shown. For more information, see “[Use Control Limited Design](#)” on page 54.
- **Contact Temp** – This is the calculated *maximum* estimated temperature of the cable where it contacts the pipe, taking the selected control method and nominal heater ratings into consideration. **Contact Temperature** is calculated only for plastic pipes and vessels.

Electrical Data

The third column of the **Calculated Results** shows the calculated values relating to the electrical load for heating cable system. These include:

- **Line Segment / Vessel Operating Load** – The nominal operating load at Maintain temperature for selected line segment or vessel (which

might consist of multiple circuits if they were broken down by the program).

- **Circuit Operating Load** – The nominal load at Maintain temperature for each circuit (the program might have broken the line segment or vessel tracing sub-system into several circuits).
- **Circuit Operating Current** – The nominal current at Maintain temperature for the each circuit (the program might have broken the line segment or vessel tracing sub-system into several circuits).
- **Circuit CB Current** – Maximum steady state current at startup temperature used for sizing the circuit breaker(s) for each circuit (the program might have broken the line segment or vessel tracing sub-system into several circuits).

Summary Data

The Summary Pane shows record counts, as well as some averages and totals. The summary may be for a selected set of lines, or for the project as a whole.

Summary for Piping

Record Counts	
OK:	5
WARNING:	1
ERROR:	0
RECALC:	0
Total:	6

Totals	
Total pipe length:	567.4 m
No. Traced Pipes:	6
Traced Pipe Length:	567.4 m
No. Traced Vessels:	
Vessel Heated Area:	m ²
Heater Length:	722.0 m
Total Operating Load:	22.12 kW

Averages	
Avg Pipe Heat Loss:	24.3 W/m
Avg Pipe Heater Output:	29.4 W/m
Avg Vessel Heat Loss:	kW
Avg Vessel Heater Output:	W/m

Viewing the Summary Pane

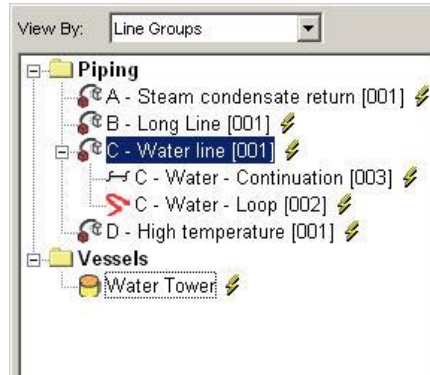
- Select **View > Summary** from the TraceCalc Pro menu. The summary will include all lines and vessels in the project.
- Click on a folder in the Project Explorer. The summary will include all lines and vessels in that folder. For example, if you were viewing by Line Groups, and click on the Piping folder, then the summary includes pipes only. If you are viewing by Panel Groups and click on a panel name in the Project Explorer, then the summary includes all lines and vessels assigned to that panel.

Filtering the Summary

You may set filter criteria for the summary at any time by clicking on the **Filter...** button. The filter criteria you set replace the current filter. For more information, please see “[Using the Filter and Sort Settings Dialog Box](#)” on page 87.

Managing Project Elements

The Project Explorer Pane is where you manage all the lines, vessels and panels for your project.



Use the Project Explorer Pane to do the following:

Select how you wish to view your project elements (by Line Groups or Panel Groups)

Move and Edit (add, modify, delete, copy, paste and paste append) the project elements.

View by Line Groups

When you select **View By: Line Groups**, all the lines you have entered for heat-tracing segments of piping are shown under the **Piping** folder. All the vessels you have entered for heat tracing are shown under the **Vessels** folder. If you have entered some lines or vessels, but cannot see them, the folder may be closed. You can open the folder by clicking on the + symbol to the left of the folder. You can also open the folder by clicking the **Expand Treeview** button on the toolbar, or by clicking **View > Expand Treeview** on the main menu.

This way of representing your project elements allows you to drag and drop to reconfigure child lines in a line group. It also lets you change a child into a parent or vice versa. For more information, see “[Organizing Your Project Lines](#)” on page 82.

View by Panel Groups

When you select **View By: Panel Groups**, all the lines you have entered will be shown under the **Panel** folders. There will be a folder for each default panel and for any other panels you have created. There will also be an **Unassigned** folder for lines that have not yet been assigned to a specific panel.

If you have entered some lines, but cannot see them, some of the panel folders may be closed. You can open the folder by clicking on the + symbol to the left of the folder.

This way of representing your project elements allows you to drag and drop the lines or groups of lines to assign them to different panels. For more information, see [“Organizing Your Project Lines”](#) on page 82.

TIP: You can add new panels in the Controls tab. For more information, see [“Customize Panels”](#) on page 63.

Find a Line or Vessel

It is easy to change the view in the Project Explorer or to find a particular line you are looking for by using **View** menu items. These items are also available on the button bar for your convenience.

Find

The Find form is a powerful, easy-to-use tool for finding a particular pipe segment or vessel, and for managing your project. The Find form has an alphabetized list of project lines and vessels, which you may filter in either of two ways:

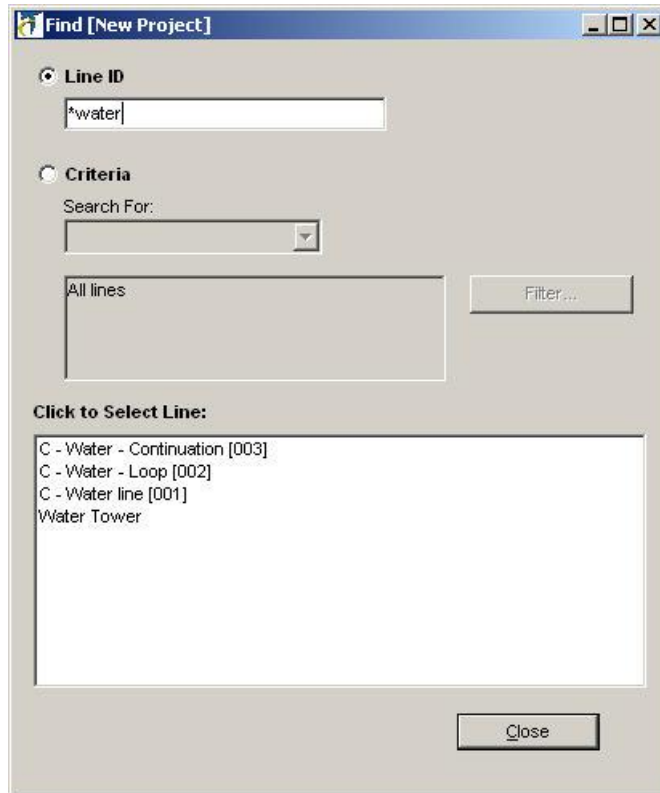
- You may type part of a **Line ID** or **Vessel ID**.
- You may enter Filter criteria using the Filter and Sort dialog box.

When you click on an item in the Find form item list, that item becomes the selected item in the TraceCalc Pro Project Explorer. If a scroll bar appears at the right side of the list, some items are hidden. Use the scroll bar to show the hidden items.

Since the Find form does not close automatically, you may view the Design Pane of the TraceCalc Pro main form, while you click on several items in the item list, to find the item you are looking for.

Find using text within a Line ID or Vessel ID

If you select the **Line ID** option, then you may filter the item list based on all or part of the **Line ID** or **Vessel ID**. You may even use this option to search for particular text within the **Line ID** or **Vessel ID**.



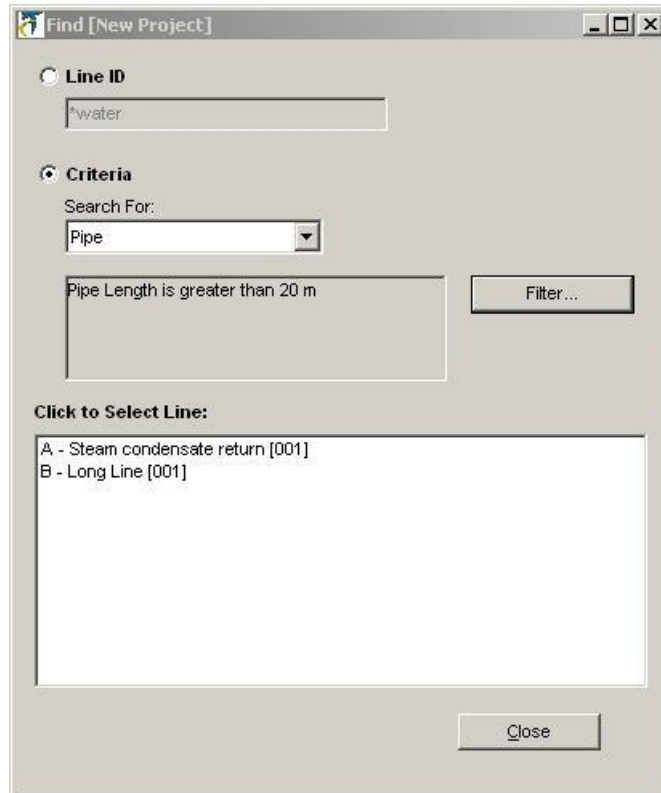
To search by **Line ID** or **Vessel ID**:

- Select the **Line ID** option.
- Begin typing the **Line ID** or **Vessel ID** in the text box provided.
- Click on the desired item in the list box. If a scroll bar appears at the right side of the list, some items are hidden. Use the scroll bar to show the hidden items.

TIP: If you begin by typing an asterisk, then the Find form searches within the **Line IDs** and **Vessel IDs** for the text that follows the asterisk, whether that text is at the beginning, in the middle, or at the end of the **Line ID** or **Vessel ID**. The graphic above illustrates this method. If you do not type the asterisk, then the list only shows **Line IDs** and **Vessel IDs** that begin with the text you entered.

Find using Criteria

If you select the Criteria option, then you may filter the item list based on line and vessel data to help find the line or vessel of interest.



To find an item using search criteria:

- Select the type of item you are searching for from the drop-down list: Pipe, Vessel, or Pipe/Vessel (if you wish your search to include both pipes and vessels).
- Click the **Filter...** button. The Filter and Sort Settings dialog box will appear. For information, please see “[Using the Filter and Sort Settings Dialog Box](#)” on page 87.
- Click on the desired item in the list box. If a scroll bar appears at the right side of the list, some items are hidden. You will need to use the scroll bar to show the hidden items.

Expand Treeview

To expand the Project Explorer list so that no lines or vessels are hidden, click on the **Expand Treeview** button on the button bar. You may also click **View > Expand Treeview** from the main menu.

Collapse Treeview

Use this option to collapse all parent lines in the Project Explorer.

In large projects, this option will ease scrolling to a particular parent line.

This option will not expand any folders. If a **Piping** or **Panel** folder is closed (collapsed), no change will be made to the view of that folder. For any open folders, the result is to collapse all parent lines.

Organizing Your Project Lines

A powerful capability of this program is that you can reorganize which lines to allocate to each panel and its associated control method. If you have created a project with more than one panel, you can select **View By: Panel Groups** and then click on any line and drag it to any other panel by holding down the left mouse button as you move it. If you move a line from a panel that has been defined, for example, as having a centralized ambient sensing control to a panel with no central control system (uncontrolled), you may need to review the settings under the Control tab for the line you moved and specify a local ambient sensing control.

You can also drag lines to different positions when you are viewing your project elements by **Line Groups**. It may not be that common to move segments of a parent line to another parent line. However, the facility can be useful in complex situations.

Working with Project Lines and Vessels

The following commands are accessible from the **Edit** main menu or by right-clicking on an item in the Project Explorer Pane.

Add New Line


To add a parent line, right-click on the folder for which you want to add a parent line. For example, to add a parent to a particular panel, change to Panel View and right-click on the desired panel's folder and select **Add New Line**. In the Line Configuration dialog box, enter a **Line ID** name that identifies your pipe. Then, enter a section number in the **Section No.** field. Then, click **OK**.

To add a child line, right-click on the line for which you want to create a child line. In the **Line Configuration** dialog box, pull down the **Line Type** list and select Child. Pull down the **Line Type** list again and select the desired line type. Enter a **Line ID** name that identifies your pipe segment. Then enter a section number in the **Section No.** field. Then click **OK**.

You may also add a new line by clicking on the **Add New Pipe** button  on the button bar, or by clicking **Edit > Add New Pipe...** on the main menu.

Add New Vessel

To add a vessel, right-click on a folder for which you want to add a vessel. For example, in Panel View, right-click on the panel that will be used to control the new vessel heat tracing system. Click on **Add New Vessel**. Enter your vessel data, then click **OK** in the Vessel Properties dialog box.

You may also add a vessel by clicking on the **Add New Vessel** button  on the button bar, or by clicking **Edit > Add New Vessel** on the main menu.

Delete Current Pipe / Vessel

To delete an item, right-click on the item you wish to delete and select **Delete Current Pipe / Vessel**. You will be prompted to confirm that you really want to delete this item. Once deleted, it cannot be restored. Click **Yes** to confirm.

NOTE: If the item has child lines, all child lines will also be deleted. If you do not wish to delete the child lines, you must move them before performing the deletion.

Copy Current Pipe / Vessel

To copy a parent or child line or vessel, right-click on the item you wish to copy and select **Copy Current (Pipe / Vessel)**. This copies the selected item to the “clipboard” where it can be used for a subsequent **Paste** or **Paste Append** operation.

Paste

Once you have copied an item, select the item to which you want to paste some or all of the attributes of the copied item. Right-click and select **Paste**. In the Paste dialog box, select **All** to paste all of the item’s attributes or **None** to clear all of the checked attributes and then check just the attributes you wish to paste. Then, click **OK**.

Paste Append

Once you have copied an item, right-click and select **Paste Append** to paste all the information into a new item.

If the copied item is a pipe segment, the Line Configuration dialog box will appear, and you will be prompted to enter a new **Line ID** and **Section No.** You may also change the line type to Child and select the desired Parent, if you wish to create the pipe segment as a child line. You can then edit the attributes of the new line using the tabs in the Design Pane.

If the copied item is a vessel, then the Vessel Properties dialog box appears. Set the vessel properties and click **OK**. If you click **Cancel** on the Vessel Properties dialog box, no new vessel will be created.

TIP: If you want to create a child item, right-click on the desired parent. When you select Child as the line type in the Line Configuration dialog, the line that was selected in the Project Explorer Pane is selected as the new Parent.

Set Current Pipe / Vessel As Default

The default pipe is the pipe that will be created when you use the **Add New Pipe...** option. The default vessel is the vessel that will be created when you use the **Add New Vessel...** option.

To set the default pipe, select a pipe segment whose properties you wish to designate as the default. Right-click and select **Set Current Pipe As Default**. Then choose either **For This Project** or **For Future Projects**.

If you select **For This Project**, any new pipe segments created in this project using the **Add New Pipe...** option will use these parameters. If you select **For Future Projects**, the default line for **any** new project will use the parameters of the selected line. However, lines added to other existing projects will not use this new default, but will use the default previously set for that project.

TIP: Since some project settings must be consistent with piping data for correct operation, if you select **For Future Projects** some project-level defaults for new projects will also be changed.

To set the default vessel, select a vessel whose properties you wish to designate as the default. Right-click and select **Set Current Vessel as Default**. Then choose either **For This Project** or **For Future Projects**.

If you select **For This Project**, any new vessel created in this project using the **Add New Vessel...** option will use these parameters. If you select **For Future Projects**, the default vessel for any new project will use the parameters of the selected line. However, vessels added to other existing projects will not use this new default, but will use the default previously set for that project.

TIP: Since some project settings must be consistent with vessel data for correct operation, if you select **For Future Projects** some project-level defaults for new projects will also be changed.

Recalculate

To recalculate a line or vessel, select the item, right-click, and select **Recalculate**. The program recalculates the results and displays the calculated data in the Calculated Results Pane.

If you select **Recalculate** from the main menu, the highlighted item will be recalculated.

Bill of Materials for Current Pipe / Vessel

Select an item for which you want to generate a single item **Bill of Materials**. Right-click and select **Bill of Materials for Current Pipe / Vessel**. You can now **Preview the Bill of Materials** for that line or **Export** the results to a comma separated file (.CSV format). You can also enter **Filter** criteria to view the Bill of Materials for another pipe or vessel, or change the view to enter other filter criteria. For more information, see “[Bill of Materials](#)” on page 106.

TIP: If you collapse a parent line that has child lines associated with it, so that the child lines are not displayed, there will be a + symbol adjacent to the parent line. You will need to expand these groups so you can view the Bill of Materials for each line.

Bill of Materials for Current Pipe Group

Select a pipe segment in a pipe group for which you want to generate a **Bill of Materials**. Select **Bill of Materials for Current Pipe Group** from the Edit menu, or click the appropriate button on the button bar. The Bill of Materials will include items for all pipe segments with the same root parent. The root parent line is indicated in the **Criteria** pull-down list of the Bill of Materials dialog. You can now **Preview the Bill of Materials** or **Export** the results to a comma separated file (.CSV format). You can also change the scope of the **Bill of Materials** using the **Display By:** or **Criteria** pull-down. For more information, see “[Bill of Materials](#)” on page 106.

Detail Report for Current Pipe / Vessel

Select an item for which you want to generate a single line **Detail Report** or **Vessel Detail Report**. Right-click and select **Detail Report for Current Pipe / Vessel**. You can review this multi-page report using the arrows at the top of the report to jump to the next or last page and the magnifying glass drop-down menu to zoom. You can also click the printer icon to open the Print dialog box to select a printer and print the report.

Detail Report for Current Pipe Group

Select a pipe segment in the pipe group for which you want to generate single line **Detail Reports**. Right-click and select **Detail Report for Current Pipe Group**. A Single Line **Detail Report** will be generated for every pipe segment in the currently selected group. You can review these multi-page reports using the arrows at the top of the reports to jump to the next or last page and the magnifying glass drop-down menu to zoom. You can also click the **Printer** icon to open the Print dialog box to select a printer and print the reports.

Global Edit

This command lets you make changes to one or more items that you have entered into your project. Since this command can make significant changes to your database, use it with caution. Consider saving your project before you apply the global edit command.

Not all variables can be changed using **Global Edit** because some variables relate to other variables that need to be changed at the same time. For example, changing all lines to hazardous area would require the user to enter more information, like class/zone, T-rating, and so on. To change this type of variable globally, use global paste.

- Select one of the following items from the **Select List:** pull-down list:
 - Pipe – To apply edits only to pipe segments, select Pipe. The list of available variables will be limited to those that apply to pipes.
 - Vessel – To apply edits only to vessels, select Vessel. The list of available variables will be limited to those that apply to vessels.
 - Common – To apply edits to pipes and vessels, select Common. Only those variables that apply to both pipes and vessels (for example, **Maintain Temperature**) will be available.
- The **Select Field:** list shows the available variables stored in conjunction with each designed item. To change the value for any of the fields, select the field and enter a replacement value. Some default values may be displayed in the replacement window, depending on the field chosen. If you select a field that has a Yes / No answer, such as **Allow Spiraling**, then the **Replacement Value** field will be a pull-down list box with the Yes / No choices. Likewise, if the field has standard entry choices associated with it, such as is the case with **Chemical Exposure**, then the **Replacement Value** field will show those standard choices.
- The **Replacement Value** function allows you to enter the new design parameters for all the lines in the project. For example, you may have entered various wind speeds but have now decided to design for a 20 MPH wind for all the lines. Entering that replacement value will overwrite the previous values for all the lines when you click **Apply**.

Global Edit → Filter

Use this command to change the design parameters for a selection of the items in your project. From the **Edit** menu select **Global Edit** then click on the **Filter** button. The Filter and Sort Settings dialog box appears. For more information, please see [“Using the Filter and Sort Settings Dialog Box”](#) on page 87.

Global Paste

This menu command lets you paste groups of data from one or more lines to all the other lines in the project. Like Global Edit, this command can make significant changes to your database, so use it with caution. Consider saving your project before you apply the global paste command.

- First, select the item (pipe segment or vessel) that contains the design parameters that you want to copy to the other items (pipe segments, vessels, or both). Click on this item in the Project Explorer Pane, and then right-click or select **Edit** from the menu, and then select **Copy**

Current Pipe / Vessel. All of the data associated with that item is now on the clipboard, available for pasting to all the other items in this project.

- From the **Edit** menu select **Global Paste** to access the Paste Pipe dialog box. This dialog box displays the **Line ID** or **Vessel ID** of the source data in the **Source** field. Verify that this is the intended source for the data you wish to paste before proceeding, as there is no Undo feature.
- In the **Destination:** section, select Pipe, Vessel or Pipe / Vessel to indicate the type of item you want to paste the copied data to. You may paste only to pipe segments, only to vessels, or to either type of item.
- Also in the **Destination:** section, if you wish to change the design parameters for a selection, but not all of the items of the type selected, then click the **Filter...** button to bring up the Filter and Sort Settings dialog box, which allows you to limit the items to be pasted to, based on filter criteria. For more information, please see “[Using the Filter and Sort Settings Dialog Box](#)” on page 87.
- You will see that there is a list of groups of design parameters under the heading **Paste Items**. This is different from **Global Edit**, where each design parameter is selectable. You can use the **None** button to clear all the selections and then just check the groups of design parameters which you wish to paste. When you click **OK**, the copied values for the selected groups of parameters will replace the previous values for all the items of the selected type in the project, or all those items that match the filter criteria that you have set. You will notice that if you select **Temperature Data**, the value in all the temperature fields in the Design Pane, under the Basic tab, will be updated and also the **Startup Temperature** value which is under the Reference tab.
- You must use **Calculate All Records (Shift+F9)** to update the results for all the changed lines.

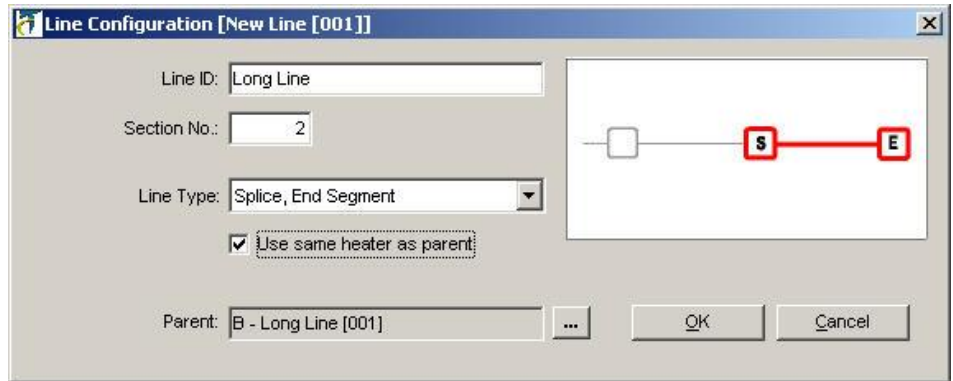
Line Configuration Dialog Box

The Line Configuration dialog box is used to change a line’s **Line ID, Section No., Line Type, Use Same Heater as Parent, and Parent** properties.

For further information on the definitions of these data, refer to “[Basic Tab](#)” on page 31.

There are two ways to call up the Line Configuration dialog box:

- Click the button next to the **Line Type:** text box on the Basic tab.
- Double-click the **Line ID** in the Project Explorer Pane.



Line Type

You may use this drop-down list to change any line's **Line Type**. You may select Parent to change a child line from child to parent; all of its children will move with it. You may change a Parent line to a child type; in that case, you would use the **Select Parent** button (the one with the ellipsis next to the Parent text box) to select a parent for the line.

Select Parent

Changing a child line's Parent may be accomplished by dragging the line from one place to another in the Project Explorer Pane. As an alternative, you may call up the Line Configuration dialog box and click the button next to the Parent: text box with the ellipsis. When you click the button, the Find form appears. Simply select the line you wish to make the Parent of the line you are configuring and click the **Close** button. The line you chose will now be shown in the **Parent** text box. To learn more about using the Find form, please see "[Find a Line or Vessel](#)" on page 79.

Depending on the parent configuration, the **Line Type** might need to change. Check the **Line Type** after you change the Parent for a child line, or select a Parent for a line that was previously a Parent.

Using the Filter and Sort Settings Dialog Box

The Filter and Sort Settings dialog box is used to allow you to select a subset of the lines or vessels for an operation. For example, by default all lines are included in a Piping Report. You control which lines are included on a Piping report by setting a filter, using the Filter and Sort Settings dialog box. From the Reports dialog box, you call up the Filter and Sort Settings dialog box by clicking on the **Filter...** button. The Filter and Sort Settings dialog box is also used on the Bill of Materials, Export, Global Edit, and Global Paste dialog boxes.

Filter Settings

To specify filter conditions for your criteria, do the following:

- Specify the **Units** that will apply to the **Comparison Values** by selecting either the **English Units** or **Metric Units** option. These units need not be the same as were used when you initially entered the design parameters. For example, you could select **English Units** so you can enter **Maintain Temperature** in °F even though the project is using metric units. If you are entering multiple filter conditions, all your

conditions must use the same system of units (English or Metric). Units will be shown in the **Units** column adjacent to each of the **Comparison Values**.

- Select a **Field Name** from the drop-down list; for example, select “**Maintain Temp.**”
- Choose the **Comparison Type** for each **Field Name**. This selection choice will vary, depending on whether the field name is a Yes/No field, a text field, or a numeric field.
- Enter the **Comparison Value**, or select from a list of available comparison values. For example, enter 100 for 100°C.
- Select either the **Match all conditions** or the **Match any conditions** option. If you specify only one filter condition, it does not matter which you select. However, if you specify multiple conditions, such as “Maintain Temp. is greater than 100°C” and “Outdoors equals Yes”, then you must select either **Match all conditions** or the **Match any conditions** to obtain the desired result.

Sort Settings

Sort order does not have any effect on Bills of Materials, or on Global Edit or Global Paste operations. However, it does have an effect on data exports and reports.

To specify a sort order for your lines, do the following:

- Select a **Field Name** for the sort conditions from the drop-down list in the Sort area of the window.
- Enter a secondary sort field, if necessary.
- Select **Ascending** or **Descending** from the drop-down list for each of the sort fields selected.

Saving your criteria as a Saved Query

At any time, you may save your current filter and sort criteria for future use. You may have as many saved queries as you wish. You must give each saved query a unique name.

To save a set of criteria as a **Saved Query**, do the following:

- Click **Save Query As...**
- Enter a meaningful name, such as ‘Maintain Temperature above 100’, in the text box that appears
- Click OK.

Recalling your criteria (Saved Queries)

If you wish to use a previously saved query, simply select the name of the saved query from the drop-down list of **Saved Queries**.

If you modify the query criteria, the saved query is not affected unless you click the **Save Query** button.

Saving changes to a Saved Query

If you make changes to a saved query and would like those changes to be reflected the next time you use the query, you must save the changes.

If you save the changes to a query, the previous criteria will be overwritten unless you save the criteria as a new query using **Save Query As...**

There are three ways to save changes to a saved query:

- Click the **Save Query** button.
- Click **OK** (see Using your criteria below) and click **Yes** when prompted to save your query.
- Click **Save Query As...** and enter a new name (in this case, the saved query is not overwritten, and your criteria are saved as a new saved query).

Using your criteria

When you are finished creating or modifying your selection and sort criteria, click **OK**. The Filter and Sort Settings dialog box closes, and you return to the operation for which you needed the filter.

If you have modified a saved query, you will be prompted to save it. If you click:

- **Yes:** the changes to your saved query are saved, using the same query name (previous query criteria are overwritten). The criteria you have just selected are used.
- **No:** your saved query is left as it was before your modifications. The criteria you have just selected are used.
- **Cancel:** no action is taken, and you are returned to the Filter and Sort Settings dialog box.

Canceling your criteria

If you wish to return to your operation without setting a filter, you must click **Cancel**.

If you return to the operation with a filter set, but decide you do not want to use a filter, bring up the Filter and Sort Settings dialog box again, and click **Cancel**.

6 Advanced Settings

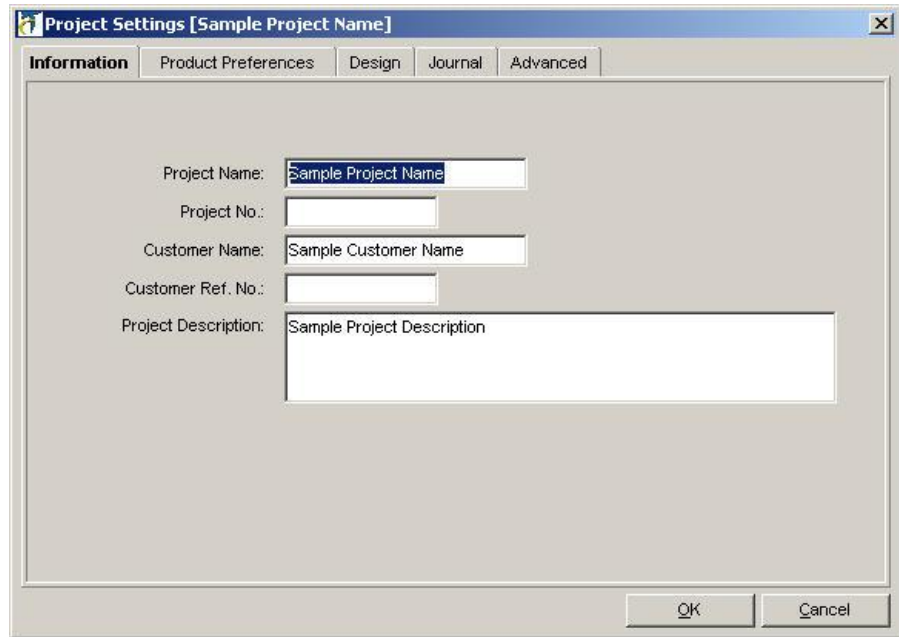
The TraceCalc Pro program includes basic default setting for many aspects of the program. However, you can configure the system with the Setup menu to accommodate the project and program settings that suit your needs. Attributes selected in the Setup menu will be saved when you close the Setup window.

Project Settings

TraceCalc Pro assigns some basic default project settings that are used for new projects that you create. However, you can modify these default settings as needed. To modify project settings, go to the Setup menu and click **Project Settings**. The Project Information screen appears.

This screen lets you customize settings for the current project. However, you can set your current project settings as the default for future projects. To set project settings as the default for future projects, select a pipe segment or vessel in the Project Explorer Pane, then from the **Edit** menu select **Set current pipe / vessel as default > For future projects**.

The Project Information screen contains five tabs for customizing your project settings.



Information Tab

Select this tab to enter the following project information:

Project Name – Enter a name for your heat-tracing design project. This field accepts 30 characters. The project name will appear on all reports generated by the program.

Project No. – Enter a number for your heat-tracing design project. This field accepts 30 characters. The project number will appear on reports generated by the program.

Customer Name – Enter the name of the customer who is the recipient of the heat-tracing design project. This field accepts 30 characters. The customer name will appear on all reports generated by the program.

Customer Reference No. – Enter the customer reference number that identifies the customer of the heat-tracing design project. This field accepts 15 characters. The customer reference number will appear on all reports generated by the program.

Project Description – Enter a project description for the heat-tracing design project. This field accepts 255 characters. This description will appear on some reports generated by the program.

Product Preferences Tab

Use of this tab is reserved for advanced users. If you have not been specifically instructed to use the Product Preferences tab, it is advised that you skip this section. Select this tab to choose product preferences, as follows:

Reference Data File – Select from the list of available product reference files, if more than one is available.

Data Version – Select from the list of available groups of products, if more than one is available.

Heaters - In the window below, click on the **Heaters** tab. Check the heating cable technologies, families, and/or specific heating cables that you wish the program to use in its selection process. When you check a folder, such as the heating cable

technology 'Parallel' folder, all the families and specific heating cables in that folder will be selected. You can select and deselect any combination of folders and products as you wish by expanding or collapsing the folder (click on the + symbol adjacent to the folder name) and checking or unchecking families or specific heating cables as needed.

Components - In the window, click on the **Components** tab. Check the different groups of components that you wish the program to use in its selection process. When you check a folder, such as the Power Kits folder, all the power components in every group of power components will be selected. You can select and deselect any combination of folders and individual component kits as you wish by expanding or collapsing the folder (click on the + symbol adjacent to the folder name) and checking or un-checking groups of component kits or individual component kits as needed.

Design Tab

Select this tab to enter the following design preferences:

Default Warning Label – Select from the list of Warning Label options.

Default Pipe Straps – Select the desired pipe strap type used for fixing components on the pipe.

Warning Label Interval – Enter a value to indicate the installation distance between warning labels. Labels should be installed at intervals sufficient to ensure personnel are alerted to the presence of electrical equipment.

Max Spiral Ratio – Enter a value to indicate the maximum spiral ratio you wish the program to consider. Above this value, the program will only allow straight runs of heating cable. We typically don't recommend any value higher than 1.5.

Minimum Heater Spacing – Enter a value to indicate the minimum distance you will allow between installed lengths of cable.

Default Heater Spacing – Enter a value to indicate the distance you normally want to allow between adjacent wraps of installed cable on a vessel.

Default Heater Max. Output – This value only applies to vessel designs. It specifies a project wide maximum heater wattage that you would like TCPro to try when selecting a heater for a vessel application. This just represents a starting point for heater selection calculations; in many cases, a much lower wattage will be required because of operational limitations. This limit can be over-ridden on a line by line basis by using the Heater Design Options dialog box. For more information, please see "[Heater Design Options... \(Vessels Only\)](#)" on page 58.

Preferred Cold Lead Glands – Check boxes corresponding to those glands you want to be considered for your design.

CB Load Factor – The CB Load Factor specifies the maximum allowed current loading (in percent) of the **Max. CB Size**. The National Electrical Code and the Canadian Electrical Code require the operating current of a heating device to not exceed 80% of the nominal CB rating. In Europe there is no such requirement and the typical setting is 100%.

If the allowed CB current (Max. CB Size * CB Load Factor) is exceeded during the heater selection process, depending on the **Line Type**, TraceCalc Pro will do one of the following:

- If the segment is a Parent line, with no Child line associated with it, a parallel heating cable length will be broken into multiple “circuits” with all necessary components allowed for each circuit.
- If the segment is a Parent line with Child line or is a Child line or is a series cables, warning **W1001** will be issued (the heating cable length will not be automatically split into circuits). You can then re-adjust the CB rating or change other parameters.

Termination Allowance – The TraceCalc Pro program adds this allowance for each end of a heating cable set to allow for termination with a component. This does not apply to factory terminated cable sets. The additional length appears in the Calculated Results Pane under Pipe Data/for Terminations, as well as in the Bill of Materials. However, it is not included in the electrical design of the circuit as it is assumed to have been cut off during installation.

Drain/Vent Length – Enter a value to indicate the length of drains and vents. TraceCalc Pro assumes that this drain/vent length will be traced as a simple loop, and as such will add double the drain/vent length to the BOM for each drain/vent.

Pipe Emissivity – Enter a value for TraceCalc Pro to use in calculating heat loss. It must be a value between zero and one.

Cladding Emissivity – Enter a value for TraceCalc Pro to use in calculating heat loss. It must be a value between zero and one.

Journal Tab

Select this tab to enter journal entries for your project. You can use the journal to conveniently track changes to, and history of, the project or simply to keep project notes. The information is only visible when you view the journal and is not used by the program for any design purposes.

- **Add** – Click **Add** to enter a new line into your journal. Place your cursor on a new line and begin your entry. There is a 255-character limit to your journal entry. To choose a date for your journal entry click on the left side of the line to select any date on the calendar.
- **Delete** – Highlight the line you wish to delete, and then click **Delete**.

Advanced Tab (Project Settings)

This tab contains settings that should only be modified by “advanced” users. Note: the Advanced tab is only visible if you selected this option under **Setup > Program Settings > Advanced**.

Bill of Materials

The following options are available for customizing your Bill of Materials.

- **Allow Priced Bill of Materials** – Check this box if you wish to show pricing information on your Bill of Materials. To disable pricing information of your Bill of Materials, deselect the box.
- **Price List File** – Select the price list file you wish to use for your Bill of Materials.
- **Currency Format** – Select the currency you wish to display on your Bill of Materials. TraceCalc Pro does not do currency conversion.

- **Clear Saved Prices** – Deletes prices that might have been saved for the particular project—although prices in the price list file are not affected.

Heat Sink Options

Heat sinks are an important consideration for electrical heat-tracing. The data you enter here will be used for selection in the Heat sinks dialog box, located under **Basic tab > Valves, Supports** For more information on how to select valve, support and flange data, see “[Valves, Supports ...](#)” on page 39.

Unless you define a specific value for the film coefficient, TraceCalc Pro will use the film coefficient calculated for the cladding of the thermal insulation. To use a fixed value, check the box “Use fixed film coefficient” and enter the value you desire.

Heat Sink Definitions

Click the **Heat Sink Definitions...** button to add, modify, or delete heat sink definitions.

The program includes data for several standard valves, pipe supports and flanges and this predefined data is marked as **Read Only – Yes** so it cannot be changed. However, you can copy and modify the data.

TIP: You can also **Copy, Paste** and **Paste Append** the heat sink definitions by highlighting a heat sink in the Customize Heat sinks dialog box, then right-clicking to a pop up menu. Select **Copy**, then **Paste Append** to add a duplicate of that item with a different **Identifier**, and then use **Modify** to make specific changes.

- **Add** – To add a heat sink definition, click **Add** and enter a unique **Identifying Code**. Click **OK**. Then, in the Heat Sink dialog box, click the **Edit** button next to the **Description** field and select from a list of existing descriptions or enter a new description. Click **OK**. Then select a **Category** for the heat sink from the drop-down list.

Check the boxes to specify the calculation methods that will be allowed for this heat sink. It is advisable to check one at a time when entering new data, so that you will see which fields of data are required for each calculation method. You can check any or all of the four calculation methods detailed below, making them all available for selection. The choice is made when you specify the type and quantity of heat sinks for each line under the Basic tab – Valves, supports ... button.

- **Specify total heater length** – This calculation method allocates a fixed amount of cable to each heat sink. You will need to enter the **Absolute Heater Length** to be allocated to each valve, support or flange, depending on the **Pipe Diameter**. You might also wish to enter a practical **Max. Recommended Length**, which will always override the calculated length if it is greater. You can also enter a **Default Spacing for heat sinks**. This option pertains primarily to supports and flanges, where you might want to specify a frequency of one support every 5 m of pipe for example (ignore this for valves). These assigned values can always be overwritten when you call up the heat sinks under the Basic tab. For more information, see “[Valves, Supports ...](#)” on page 39.
- **Specify total wattage** – This calculation method allocates a fixed amount of heat (watts) to each heat sink. You will need to specify the **Absolute Total Watts** to be supplied by the selected heating cable for each valve, support or flange, depending on the **Pipe**

Diameter. As above, you can enter a practical **Max. Recommended Length** and a **Default Spacing** of the heat sink item. The total wattage is a fixed value and will not change if you change for example, your Maintain temperature.

- **Specify equivalent pipe length** – This calculation method allocates an amount of heating cable that is obtained by treating the heat sink as if it were a defined length of pipe. You will need to specify the **Equivalent Pipe Length** to allow the program to calculate the correct length of heating cable. This “equivalent length” is the length of heating cable that would be required for a defined length of pipe of the same nominal size as the heat sink. If you specify, for instance, that each valve should use an amount of heating cable equal to the amount that would be needed for 0.8 m of pipe of the same size, and the program calculated that each meter of pipe needed 1 m of heating cables, then 0.8 m of cable would be specified for each valve. You need to enter this **Equivalent Pipe Length** for all relevant **Pipe Diameters**. As above, you can enter a practical **Max. Recommended Length** and a **Default Spacing** of the heat sink item.
- **Calculate heat loss** – This method calculates the heat lost from the heat sink based on its physical attributes. You will need to specify the following for all relevant **Pipe Diameters**: The **Body Heat Loss** factor (enter 0.3 m if you consider that the insulated body of the heat sink will loose the same amount of heat as 0.3 m of insulated pipe of this nominal diameter), the **Fin X-Sectional Area**, the **Fin X-Sectional Perimeter** and the **Fin Thermal Conductivity**. This allows the program to calculate the heat transfer of the heat sink by using a fin-equation. As above, you can enter a practical **Max. Recommended Length**. Note: The default spacing field is ignored for valves.

Having entered all the applicable data, click **OK**.

- **Modify** – To modify a heat sink definition that is not marked as **Read Only – Yes**, highlight a definition and click **Modify**. Then in the Heat Sink dialog box, modify the data as described in **Add** above, and click **OK**.
- **Delete** – To delete a heat sink definition that is not marked as **Read Only – Yes**, highlight a definition and click **Delete**.
- **Copy** – (using right-click to access this choice) – To make a copy of the selected heat sink data for pasting, highlight the heat sink, right-click and select **Copy**.
- **Paste** – (using right-click to access this choice) – To add part or all of the data from a copied heat sink to another user-defined heat sink, highlight the user-defined heat sink, right-click and select **Paste**. You are given the choice of pasting just the **Heat sink Category**, the **Heat sink General** information, all the **Heat sink Details** or any combination of these three.
- **Paste Append** – (using right-click to access this choice) – To make a duplicate of the copied heat sink data to a new heat sink with a different **Identifier**, highlight any heat sink, right-click and select **Paste Append**. The new heat sink can then be modified as described above.

Miscellaneous

To use maximum exposure temperature rather than maximum operating temperature for sheath temperature calculations, check the check box.

MI Cable Sheath Temperature Calculation

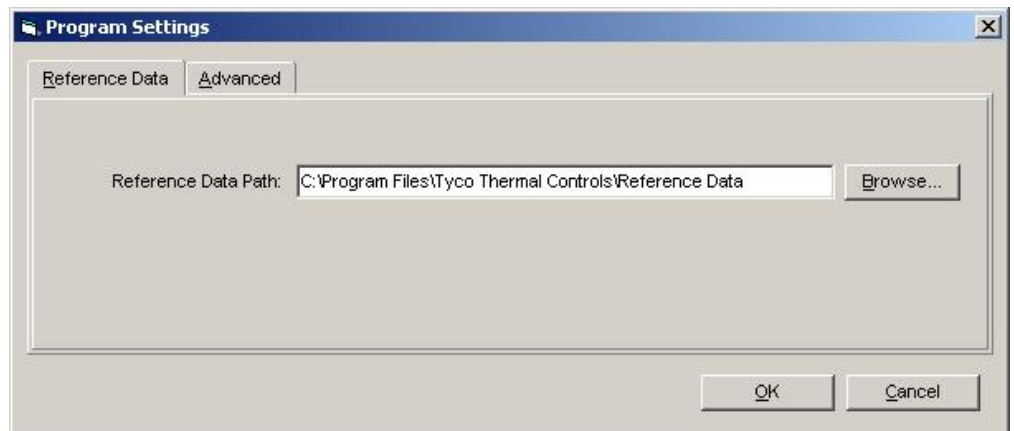
Leave the setting as 'Use data based on global codes and standards.' The second option, 'Use historic Pyro Designer data,' is included only for comparison of results with legacy applications. It should not be used to create new designs. This option will be available only if you chose to install North American data during program installation.

Project Lists

This sub-menu, accessed from the Setup Menu, provides access to the **Control Panels** and **Area Names** menu items. Each of these items allows you to access the respective list of definitions that are stored with the current project. These lists are actually stored with the project file and are available even if the project file is moved to or accessed from another workstation. They are not, however, accessible to other projects. Panels and Area Names must be defined in each project where they are used.

Program Settings

The TraceCalc Pro program has default program settings that are used for new projects that you create. However, you can modify these settings to suit your needs. To modify program settings, go to the **Setup** menu and click **Project Settings**. The Project Settings screen appears. This screen contains two tabs for customizing your program settings.



Reference Data Tab

Select the Reference Data tab to see where the Reference data is stored. To edit the path click Browse and select the folder where you want the Reference Data to reside.

Advanced Tab

Select the Advanced tab to enter the following options:

Open Projects in Multi-user (Shared) Mode

If this box is checked, project databases will be opened in such a way as to allow other TraceCalc Pro users on your LAN to open and work on the same projects simultaneously. Unless you need to have multiple users work on the same project at the same time, it is recommended that you leave this box unchecked.

Note: When projects are opened in Multi-user mode, any changes to a pipe segment are automatically saved to the database file as you move from line to line. Unlike single-user mode, you cannot make multiple changes and then at the end of your session, choose to cancel the saving of all changes.

Show Project Settings Advanced Options

Select the **Show Project Settings Advanced Options** check box in order to display the advanced project settings option tab. If left unselected the advanced project settings will be hidden from the user.

New Project Default Settings

By default, each new project contains one pipe segment. Use this option to create new projects with a vessel instead, or with both a pipe and a vessel.

User Defined Product List

From the Setup menu, select **Global Lists -> User Defined Product List** to review and modify the items in this list. Please note that this is a “global” list. This means that all data contained in the list is available to all projects on the computer workstation. The data is not stored in the project file, which means that if the project file is moved to or accessed from another workstation, this data will not be available.

Product List Editor

The Product List Editor allows you to define product lists, which can include pricing information, for the following Categories: Heaters, Components, Controls, Accessories, and Services. Simply select the desired category from the list then right-click for the pop-up editing menu. You can then edit, add, and remove products from the list. You can also copy an item and then paste its attributes to an existing item or use paste append to create a new item based on the copied item. Products entered in this list will override eventual duplicates in the standard price lists.

Units

From the **Setup** menu select **Units** to select English for English units, or Metric for metric units. With the exception of pipe schedules, all values displayed on screen and in reports will reflect the units system you selected.

Changing the system of units may require the lines in your project to be recalculated.

Language

From the Setup Menu, select a language from the language list. All text displayed on screen and in reports will be in the chosen language.

7 Heat-Tracing Technologies

There are two basic types of electrical heat-tracing technologies: Parallel and Series Circuit. The following are descriptions of cables based on these two technologies:

- Parallel Circuit
- Series Circuit

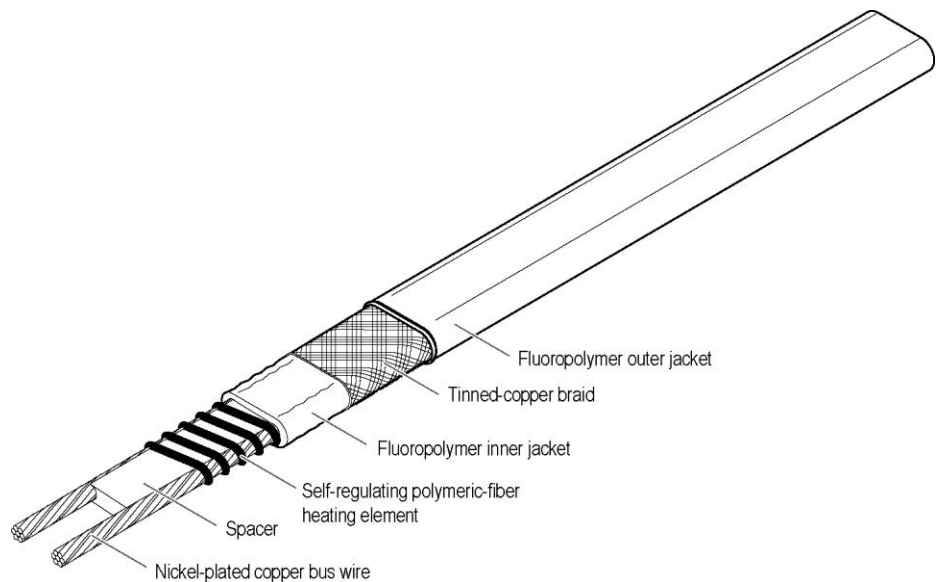
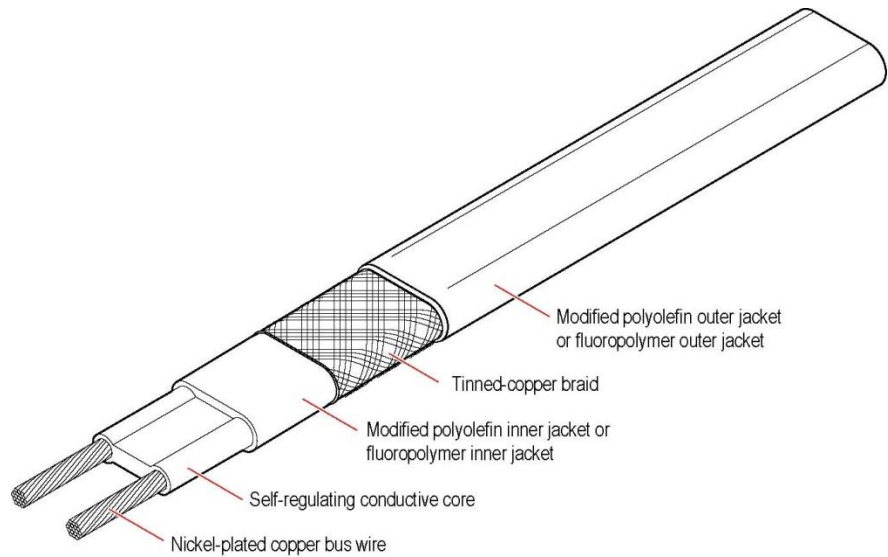
Parallel Circuit

Self-Regulating Heating Cables: Self-regulating heating cables are the preferred choice for most complex pipe-tracing applications. This is due to their parallel construction, which allows them to be cut to length and spliced in the field.

Self-regulating heating cables are based on conductive-polymer technology in both monolithic (solid core) and fiber-wrap heating cable designs. The heating element is made of polymers mixed with conductive carbon black. This special blend of materials creates electrical paths for conducting current between the parallel bus wires along the entire cable length.

In the heating cable core the number of electrical paths between the bus wires changes in response to temperature fluctuations. As the ambient temperature surrounding the heating cable decreases, the conductive core or fiber contracts microscopically. This contraction decreases electrical resistance and creates numerous electrical paths between the bus wires. Current flows across these paths to warm the core or fiber.

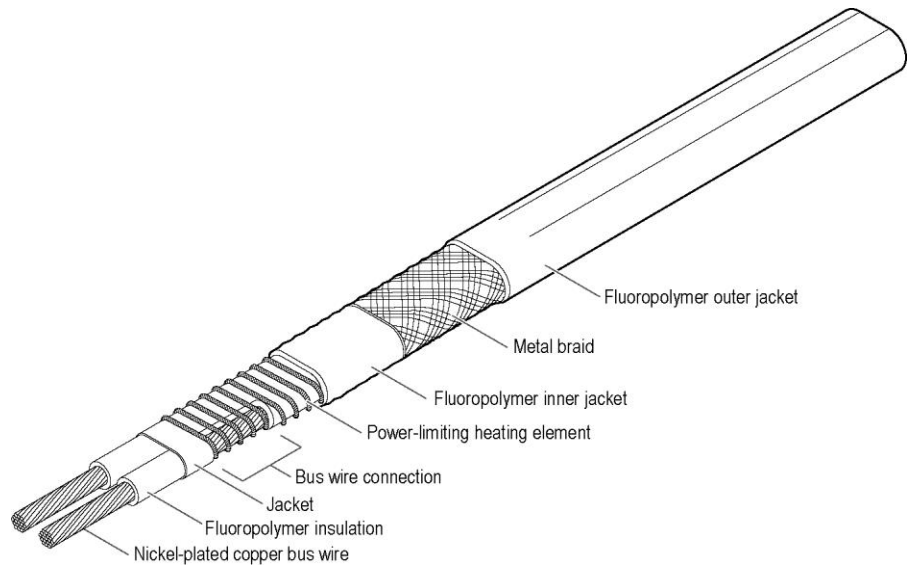
As the temperature rises, the core or fiber expands microscopically. This expansion increases electrical resistance, and the number of electrical paths decreases. As a result, the heating cable automatically reduces its power output.



Power-Limiting Heating Cables: Power-limiting heating cables are the preferred technology for applications requiring high power output at elevated temperatures. These cables can be used for high maintain temperatures ranging up to 455°F (235°C) depending on cable selection and exposure temperatures to 482°F (250°C).

This technology can provide a cost-effective alternative to self-regulating heating cables when more than a single run of cable is required (trace ratio > 1).

Power-limiting cables are parallel heating cables formed by a coiled resistor alloy heating element wrapped around two parallel bus wires. At a fixed distance, the insulation is removed alternatively, first from one of the bus wires and then from the other. This distance between contact points forms the heating zone length.



The positive temperature coefficient (PTC) of the heating element reduces power output as ambient temperature increases. This effect allows the power-limiting cable to be crossed over itself since the temperature of the heating element is reduced at the cross over points.

Series Circuit

Mineral Insulated (MI) Heating Cables: Mineral Insulated heating cables offer a wide variety of solutions for industrial pipe and equipment heat-tracing applications. MI heating cables are series-type heating cables and suitable for maintain temperatures up to 1022°F (550°C) and/or exposure temperatures for the heating cable to 1238°F (670°C). MI is the ideal choice when an application's temperature and power output requirements exceed the capabilities of self-regulating and powerlimiting heating cables.

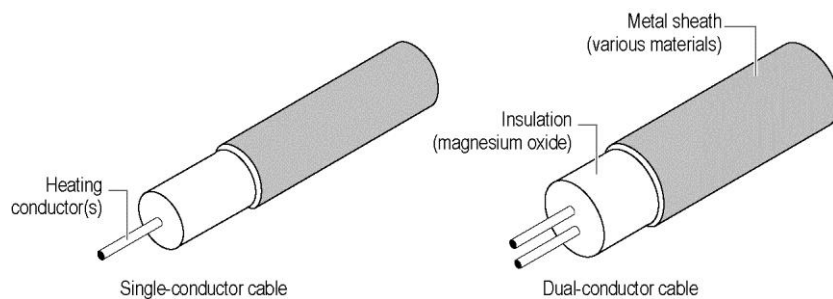
MI heating cables can be used for applications with the following requirements:

- Maintain temperature up to 1022°F (550°C)
- Maximum heating cable exposure temperature to 1238°F (670°C)*
- Power output to 82 W/ft (269 W/m)

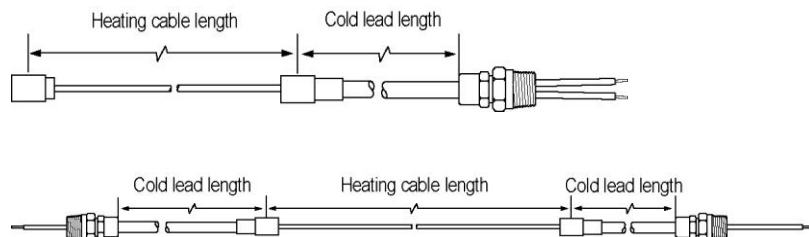
* Higher temperatures are available upon manufacturer's approval

MI heating cables consist of one or two conductors embedded in a highly dielectric magnesium oxide insulation surrounded by a metal sheath.

MI heating cables provide superior strength in dynamic cut-through, crush, and corrosion tests. Special annealing processes maximize flexibility for ease of on-site handling.



MI heating cable sets are supplied factory terminated and ready to install. They include a heating section and a cold lead (nonheating) section.

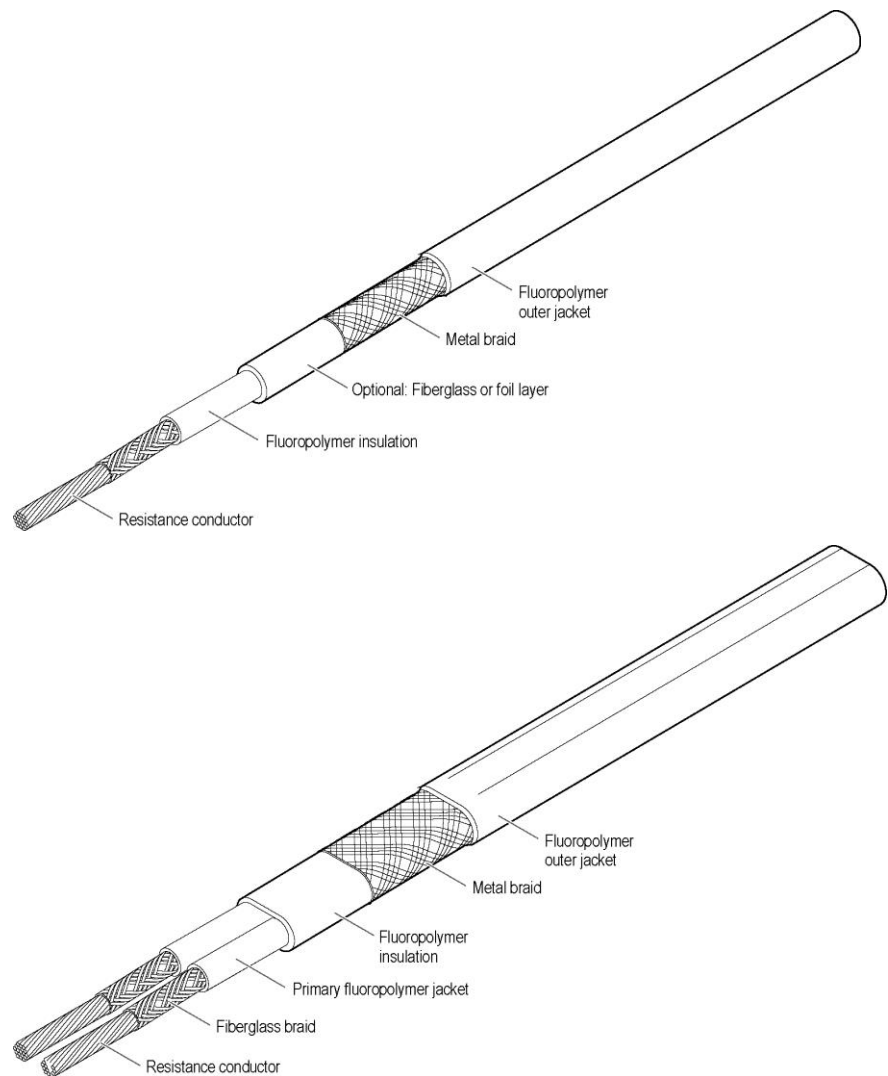


Various constructions are available in different market places. For detailed information, please refer to local product literature.

Polymer Insulated Heating Cables: Series constant-wattage, polymer-insulated heating cables can be used when the circuit length required exceeds that permitted by parallel-circuit heating cables. The polymer-insulated cables are suitable for exposure temperatures up to 400°F (204°C) for SC cables and 482°F (250°C) for SC-H cables. They incorporate a fluoropolymer outer jacket that makes them ideal for chemically aggressive applications.

Polymer-insulated heating cables can be used for applications with the following requirements:

- Maximum heating cable exposure temperature to 482°F (250°C)
- Maximum power output to 9 W/ft (30 W/m)



Various constructions are available in different market places. For detailed information, please refer to local product literature.

8 Reports

You can preview and print several reports to show the input parameters and the calculated results for all lines of your project or for a selection of lines.

Piping Reports and Vessel Reports

From the **Reports** menu, select Piping Reports or Vessel Reports to access the Reports dialog box. In this dialog box select from a list of available reports and then click the **Preview** button. If you wish to print the report, click the printer icon to open the Print dialog box, select a printer and print the report.

The **Electrical Line List** and the **Summary Line List** both display one line of data for each line in your project.

The **Single Line Details** report and **Vessel Details** report will typically generate two pages for each line in your project and display all of the input parameters and calculated results.

TIP: You can also view the **Single Line Details** or **Vessel Details** report by right-clicking on the line or vessel in the Project Explorer Pane and selecting **Detailed Report for Current Line / Vessel**.

TIP: You can use the **File > Export** command from the main menu to generate a comma-delimited file (.csv format) for some or all of the project items to include all or a selection of the data fields and the calculated results. For more information, see [“Export”](#) on page 14.

If you want to generate a report for only a selection of the items, such as all those for a specific electrical panel, and sort them, perhaps by circuit number, use the **Modify** button to enter **Filter and Sort Settings**. For more information, please see [“Using the Filter and Sort Settings Dialog Box”](#) on page 87.

Subtotals for Piping Reports

Check the box next to **Show Subtotals** to generate a report that is subtotaled by the field you specified as the primary Sort field. If you had not set any sort conditions, click the **Modify** button to go to the Filter and Sort Settings dialog box and set a **Sort** condition.

Report Preview

Click **Preview** to view this report. Use the left and right arrow buttons to move to another page of the report. Use the scroll bar to move up or down on the current page.

The Report Preview is modal, so you must close the report, by clicking on **Close** or the close window icon, to return to the Reports dialog box.

You can click the printer icon to open the Print dialog box to select a printer and print the report.

You can click on Save As... to save the report in a file, in PDF or HTML format.

TIP: If you have a mouse-wheel, the Control + Mouse-Wheel lets you zoom in and out. Shift + Mouse-Wheel lets you jump to next or previous page.

Bill of Materials

From the **Reports** menu, select **Bill of Materials** to access the Bill of Materials dialog box. From this dialog box you can select from a list of available groupings for this report. You can also add items to the Bill of Materials Report and run or export the report.

Display by: Total, Area, Line, Line Group, Custom Filter

Select one of the Display by: options: **Total**, **Area**, **Line**, **Line Group**, or **Custom Filter**.

If you select **Total**, no further choice is available in the **Criteria** selection box and you can click **Preview** to generate a print preview of the consolidated **Bill of Materials** for all the lines in your project.

If you select **Area**, **Line**, **Line Group**, or **Custom Filter** you can select **Criteria** options.

Criteria options

If you choose to display the Bill of Materials Report, grouped by **Area**, the **Criteria** list will show all the available **Area** names that you have assigned to the lines in your project.

If you choose to display the Bill of Materials Report, grouped by **Line** or **Line Group**, the **Criteria** list will show all the available **Line IDs** in your project.

If you choose to display the Bill of Materials Report using a **Custom Filter**, the **ellipses** button adjacent to the **Criteria** box will provide access to the **Filter and Sort Settings** dialog to let you select the specific lines you wish to include in the Bill of Materials Report. For more information, please see [“Using the Filter and Sort Settings Dialog Box”](#) on page 87.

Note: Sort options are not applicable to the Bill of Materials Report.

Having selected the filter settings and returned to the Bill of Materials dialog box, you will see an indication of the number of lines found that meet the criteria you have selected. This is shown at the bottom of the dialog box as **Lines Used:** x of y,

where x is the number of the lines found that meet the condition (and have been calculated/recalculated) and y is the number of lines that meet the condition (that may or may not have been calculated/recalculated).

The Bill of Materials window will list the parts needed to fabricate the design you created in TraceCalc Pro.

TIP: If you do not see any items selected, you may have run the report before calculating the line. You will need to close the Bill of Materials window and select **Calculate All Records**. (The shortcut key is Shift + F9.)

Add Item

Click the **Add Item** button to add an item to the Bill of Materials. You can select from a list of **Standard** items or from previously entered **User Defined** items. When you add an item, you must also add a quantity for that item. For more information, see “[User Defined Product List](#)” on page 98.

If you desire, you can add a contingency allowance for items such as additional End Seal Kits, which will be indicated on the Bill of Materials as “Quantity Override.”

TIP: You can only add items when you are viewing the Bill of Materials for a specific line or area—not if you look at a total Bill of Materials.

Delete Item

You can delete any item that you previously added. To do so, click on the “Quantity Override” checkmark in the displayed **Bill of Materials** and then click the **Delete** button. The system will prompt you to confirm that you want to delete the item. Click **Yes**.

Preview (Run Report)

Click the **Preview** button to view the Bill of Materials Report. You can then click the printer icon to open the Print dialog box to select a printer and print the report. In some cases, the **Preview** button will show the words **Run Report...** The **Preview** is shown in a separate window so you can click on close, or use the close window icon, to return to the previous Bill of Materials Calculated Results Pane.

TIP: If you have a mouse-wheel, the Control + Mouse-Wheel lets you zoom in and out. Shift + Mouse-Wheel lets you jump to next or previous page.

Export Data

Click **Export** to export the Bill of Materials in comma delimited (.CSV) format that can be read by programs like Microsoft Excel. For more information, see “[Export](#)” on page 14.

Bill of Materials Line Item Detail

Each line in the Bill of Materials is a summary for the catalog number shown; each catalog number will appear only once in a Bill of Materials, and the Quantity shown is the sum for all items (pipe segments, vessels) included in the Bill of Materials.

If you click on a Catalog Number in the Bill of Materials dialog box, the Bill of Materials Line Item Detail dialog box appears, showing in detail how that item came to be in the current Bill of Materials.

You may cancel a user-defined quantity or delete a user-added item using the Line Item Detail dialog box. Simply select the line and click the **Delete** button. To confirm the deletion, you must click OK when you close the Line Item Detail dialog box. To cancel the changes, click **Cancel**.

Appendix A: Troubleshooting

The TraceCalc Pro program will alert you with a warning or an error message under certain circumstances. These are typically either because the program cannot find an acceptable answer based on your input or because the user may need to take some additional action to ensure the design requirements are completely met.

For questions, please contact Technical Support at PTM-info@pentair.com.

Errors

The following error messages give descriptions that indicate the possible reason the program could not complete its calculations.

E17 “Unable to select heater, Thermal Insulation thickness is zero.”

Suggested Action: TraceCalc Pro requires pipes to be insulated. Review the value in the **Insulation Thickness** field under the Basic tab. This value must be greater than zero for Pipe Heat-tracing. Modify the value, if appropriate. Select **Recalculation** and review results.

E25 “The specified Insulation type could not be found in the Reference Database.”

Suggested Action: The line data refer to an insulation not found in your reference database. This may happen if you have received the project from someone else who has created a custom insulation type. Select another insulation type, or create an insulation definition, if necessary to describe the insulation.

E26 “The specified Pipe type could not be found in the Reference Database.”

Suggested Action: The line data refer to a pipe type not found in your reference data. This will happen if you receive the project from someone else that has created and used a custom pipe type. Select another pipe type. Create a pipe type, if necessary to describe the pipe.

E30 “A heater has been forced but it cannot be found in the Reference Database.”

Suggested Action: Deselect heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results. You may need to reinstall TraceCalc Pro if the Reference Database has become corrupted.

E31 “A heater has been forced but it cannot be found in the Allowed Heaters list.”

Suggested Action: Deselect heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results. Also check whether the heater has been deselected in **Setup > Project Settings > Product Preferences**.

E32 “A heater has been forced but its Power Output is too low.”

Suggested Action: Deselect heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results. Consider forcing the Trace Ratio under the Heater Options tab – **Design Options** or selecting a higher power output heater. You might also want to review the safety factor.

E33 “A family has been forced but it cannot be found in the Reference Database.”

Suggested Action: Deselect heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results. You may need to reinstall TraceCalc Pro if the Reference Database has become corrupted.

E34 “A family has been forced but it cannot be found in the Allowed Heaters.”

Suggested Action: Deselect heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results. Also check whether the heater has been deselected in **Setup > Project Settings > Product Preferences**.

E35 “No heaters found. The Voltage or Maintain Temp. is out of range.”

Suggested Action: Review the **Voltage** field and **Maintain** temperature under the Basic tab. Ensure you have chosen an appropriate Heater Technology (Series or Parallel) under Heater Options tab. Consider deselecting heater **Manual Select** under Heater Options tab – **Heater Selection** (if selected). Ensure all suitable products are available for selection. (Products might have been made unavailable in the Advanced Section under the menu item **Setup – Project Settings – Product Preferences**.) Select **Recalculation** and review results.

E36 “No heaters found; the Voltage is too low.”

Suggested Action: Review the **Voltage** field under the Basic tab. Modify the value, if appropriate. Consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection** (if selected). Select **Recalculation** and review results. Ensure you have chosen an appropriate Heater Technology (Series or Parallel) under Heater Options tab.

E37 “No heaters found; the Maintain temperature is too high.”

Suggested Action: Review the **Maintain** temperature field under the Basic tab. Modify the value, if appropriate. Consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection** (if selected). Select **Recalculation** and review results. Ensure you have chosen an appropriate Heater Technology (Series or Parallel) under Heater Options tab.

E38 “No heaters found; the Operating temperature is too high.”

Suggested Action: Review the **Operating** temperature field under the Basic tab. Modify the value, if appropriate. Consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection** (if selected). Select **Recalculation** and review results. Ensure you have chosen an appropriate Heater Technology (Series or Parallel) under Heater Options tab.

E39 “No heaters found; the Exposure Temperature is too high.”

Suggested Action: Review the **Exposure Temperature** field under the Basic tab. Modify the value, if appropriate. Consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection** (if selected). Select **Recalculation** and review results. Ensure you have chosen an appropriate Heater Technology (Series or Parallel) under Heater Options tab.

E40 “No heaters found; the Startup temperature is too low.”

Suggested Action: Review the **Startup** temperature field under the Reference tab. Modify the value, if appropriate. Consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection** (if selected). Select **Recalculation** and review results.

E41 “No heaters found that are suitable for Pipe Heating.”

Suggested Action: Deselect heater **Manual Select** under the Heater Options tab – **Heater Selection** (if selected). Review **Maintain** temperature and other temperatures. Select **Recalculation** and review results.

E42 “No heaters found that are suitable for the Chemical Exposure.”

Suggested Action: Review the **Chemical Exposure** field under the Reference tab. Deselect heater **Manual Select** under the Heater Options tab – **Heater Selection** (if selected). Select **Recalculation** and review results.

E43 “No heaters found that match the forced heater Construction Options.”

Suggested Action: Review the selections made under **Dielectric**, **Jacket Material** or **Ground Path** under the Heater Options tab – **Heater Selection**. Modify the values, if appropriate. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

E44 “No heaters found that are suitable for use on Plastic surfaces.”

Suggested Action: Review the selection made for **Pipe Type** under the Basic tab. Modify the value, if appropriate. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results. Ensure you have chosen an appropriate Heater Technology (Series or Parallel) under Heater Options tab.

E45 “No heaters could be found that are suitable for use in the specified Area Classification.”

Suggested Action: Review the **Standards Body** and **Class** selections made under the Area Class tab. Modify the value, if appropriate. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. This can also be the result of specifying a Hazardous Location heater (such as 5HBTV2-CT) in an unclassified area. Select **Recalculation** and review results.

E47 “No heaters could be found which support the requested Sheath Temperature Calculation mode.”

Suggested Action: Review selections made for **Sheath Temperature** calculations options under the Area Class tab. Enable “Allow stabilized design”, if appropriate. Consider specifying **Use control limited design**, to require the use of thermostatic control to limit the sheath temperature. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection** to see if the program can find a suitable heater when a free selection is allowed. Select **Recalculation** and review results.

E48 “No heaters found which have a suitable T Classification.”

Suggested Action: Review the **T-rating** value entered in **Design Parameters – Specify equipment T-rating** under the Area Class tab. Enable “Allow stabilized design”, if appropriate. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection** to see if the program can find a suitable heater when a free selection is allowed. Select **Recalculation** and review results.

E49 “No heaters found; the Sheath Temperature is too high.”

Suggested Action: Review the selections made for **Sheath Temperature** calculations options under the Area Class tab. Modify the value, if appropriate. Consider specifying **Use control limited design**, to require the use of thermostatic control to limit the sheath temperature. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection** to see if the program can find a suitable heater when a free selection is allowed. Select **Recalculation** and review results.

E50 “No heaters found; the required cable Resistance is too low.”

Suggested Action: The pipe might be too long. Break it up into several circuits, or review the **Voltage** entered under the Basic tab. Modify the voltage value lower, if appropriate. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

E51 “No heaters found; the required cable Resistance is too high.”

Suggested Action: Review the **Voltage** entered under the Basic tab. Modify the voltage value higher, if appropriate. Also consider deselecting any manual Heater Select under Heater Options tab - **Heater Selection**. Select **Recalculation** and review results.

E52 “No heaters found; the cable Conductor Temperature is too high.”

Suggested Action: Review the **Heater Operating Voltage** entered under the Basic tab. Modify the voltage value lower, if appropriate. Consider specifying **Use control limited design**, to require the use of thermostatic control to limit the conductor temperature. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

E53 “No heaters found; the Heat Loss or Trace Ratio is too high.”

Suggested Action: Review the values entered for the **Insulation Thickness and Maintain** temperature under the Basic tab. Modify the insulation thickness value higher, if appropriate. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

E54 “There is an error on another segment in this group.”

Suggested Action: Open each of the lines in the group of lines that belong to the same parent by clicking on them in the Project Explorer Pane. Find which line(s) have error messages and resolve those errors.

E55 “No Cold Leads found with required current rating.”

Suggested Action: Review the **Voltage** entered under the Basic tab. This can be the result of asking for a series cable to operate at low voltage, resulting in high current. Modify the voltage value higher, if appropriate. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results

E56 “Unable to locate a Cold Lead with the proper configuration.”

Suggested Action: Review and possibly remove any manually selected **Cold Lead Options** on the Heater Options tab.

E57 “No heaters found with specified Number of Conductors.”

Suggested Action: Change the number of conductors. Also, under Project Settings – Product Preferences, ensure that you haven’t excluded heaters with the proper number of conductors.

E58 “No heaters found that are suitable for the specified Voltage Configuration.”

Suggested Action: This indicates that TraceCalc Pro was unable for find any heaters that are rated for use with your specified Voltage Configuration. Change your

voltage configuration or review/remove any manually selected Heater Design settings.

E100 “No heaters found; the Power Output is too high.”

Suggested Action: The required heater power output might be too high because the heat loss is very high. Under the Basic tab, review the value in the **Insulation Thickness** field. This value may be unreasonably small. Modify the insulation thickness value higher, if appropriate. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

E101 “No heaters found the Power Output is zero.”

Suggested Action: This message indicates that the required Power Output is zero. This will be because the heat loss is zero. There could be no heat loss if the Maintain temperature is the same or less than the Minimum Ambient temperature. However, the program should not allow this condition. If you enter a Minimum Ambient temperature that is greater than or equal to the Maintain temperature, the program resets the Maintain temperature to be 1 degree greater than the Minimum Ambient temperature.)

E102 “The maximum allowed output is too low.”

Suggested Action: This error means that TCPro does not have enough vessel surface area to fit all of the required heater. It can occur for one or more of the following reasons:

- You have specified a **Maximum Heater Output** that is too low.
- You have specified a **Maximum Heater Output**, but no heaters could be found that satisfy this setting.
- You have specified a **Min. Heater Spacing** that is too high.
- You have specified an **Available Area** setting that is too low.
- The **Default Heater Max. Output** setting is too low.

Please review each of these settings adjust as required.

E103 “An Attachment has been forced but it can not be found in the Reference Database.”

Suggested Action: This indicates that an **Attachment Method** has been manually selected, but it can not be found in the current Product Database. This can occur if you are trying to use a project file that was created on a different workstation which had access to a different set of product data. From the **Heater Options** tab, clear the forced setting and allow TraceCalc Pro to select the default Attachment Method for the selected heater.

E110 “Unable to converge during equilibrium temperature calculation.”

Suggested Action: Contact Technical Support. This is an abnormal error condition.

E111 ““The specified Standards Body could not be found in the Reference Database.”

Suggested Action: This indicates that selected **Standards Body** can not be found in the current Product Database. This can occur if you are trying to use a project file that was created on a different workstation which had access to a different set of product data. From the **Area Class** tab, select an new Standards Body.

E150 “No heaters found, the user-defined heater output maximum is too low or the user-defined heater spacing is too large.”

Suggested Action: This indicates that the user-specified area and heater spacing does not allow enough heater length to supply the necessary power to offset the vessel heat loss. You may need to decrease the heater spacing, increase the available area, or select a higher-power cable.

E151 “No heaters found, the user-defined heater spacing is too large.”

Suggested Action: This indicates that the user-specified area and heater spacing does not allow enough heater length to supply the necessary power to offset the vessel heat loss. You may need to decrease the heater spacing, increase the available area, or select a higher-power cable.

“An unspecified error occurred during recalculation.”

Suggested Action: Contact Technical Support. This is an abnormal error condition.

Warnings

The following warning messages give descriptions that indicate that the program completed its calculations but has encountered a situation that you should review.

W1001 “Circuit current exceeds the Max. Allowed value for the specified CB size.”

Suggested Action: Review the Calculated Results Pane. Consider changing the **Max. CB Size** or **Heater Operating Voltage** the entered under the Basic tab. Modify the value, if appropriate. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

W1002 “Circuit current exceeds maximum allowed for the selected heater.”

Suggested Action: Review the Calculated Results Pane. Consider changing this section of piping into two separate sections using separate heat-tracing circuits. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

W1003 “Max. circuit or unjointed cable length exceeded.”

Suggested Action: Review the Calculated Results Pane, which will give you either the **Max. Circuit Length** (Parallel heating cables) or the **Max. Unjointed Length** (Series heating cables). Please refer to the manufacturers product literature. For Parallel heating cables, consider increasing the Max. CB Size or break the line into multiple circuits. For Series heating cables, split the line into multiple sublimes each connected with a splice, so that the max. length that can be supplied in one piece is not longer exceeded. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

W1004 “Max. controlled temperature exceeds Max. Allowable temperature.”

Suggested Action: Review the Calculated Results Pane. Consider changing the **Control Method** under the Controls tab to be **Line Sensing** or **Ambient Sensing**. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

W1005 “Contact Temp exceeds Max. Allowable temperature.”

Suggested Action: Review the Calculated Results Pane. Consider changing the **Control Method** under the Controls tab to be **Line Sensing** or **Ambient Sensing**. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

W1006 “Heater Sheath Temp exceeds Max. Allowable temperature.”

Suggested Action: Review the Calculated Results Pane. Consider changing the **Control Method** under the Controls tab to be Line Sensing or Ambient Sensing. Review **Maximum Allowable** temperature under the Basic tab. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

W1007 “Max. Controlled temperature exceeds heater limits. Line Sensing control is required.”

Suggested Action: Change the **Control Method** to “Line Sensing, no failure alarm,” or “Line sensing, w/failure alarm.” If applicable, you may also consider removing any **Manual Select** constraints from the Heater Options tab.

W1009 “Forced Power Components not suitable, default used.”

Suggested Action: Review the resultant component selection by right-clicking on the line name in the Project Explorer Pane and selecting Detail Report for Current Line. Go to bottom of page 2 to see the Components. If these are not appropriate, determine why the forced selection was not available. Consider changing the **Manual Select** component choice on the Components tab. Also consider deselecting heater **Manual Select** on the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

W1010 “Forced End Seal Components not suitable, default used.”

Suggested Action: Review the resultant component selection by right-clicking on the line name in the Project Explorer Pane and selecting Detail Report for Current Line. Go to bottom of page 2 to see the Components. If these are not appropriate, determine why the forced selection was not available. Consider changing the **Manual Select** component choice on the Components tab. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

W1011 “Forced Tee Components not suitable, default used.”

Suggested Action: Review the resultant component selection by right-clicking on the line name in the Project Explorer Pane and selecting Detail Report for Current Line. Go to bottom of page 2 to see the Components. If these are not appropriate, determine why the forced selection was not available. Consider changing the **Manual Select** component choice under the Components tab. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

W1012 “Forced splice components not suitable, default used.”

Suggested Action: Review the resultant component selection by right-clicking on the line name in the Project Explorer Pane and selecting Detail Report for Current Line. Go to bottom of page 2 to see the Components. If these are not appropriate, determine why the forced selection was not available. Consider changing the **Manual Select** component choice under the Components tab. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

W1020 “Forced Control not suitable, default used.”

Suggested Action: Go to middle of page 1 to see the Control selection. (Alternatively, view the Bill of Materials for Current Line.) If this is not appropriate, determine why the forced selection is not available. Consider changing to **Electronic – Local Control Equipment** under the Controls tab. Also consider deselecting heater **Manual Select** under the Heater Options tab – **Heater Selection**. Select **Recalculation** and review results.

W1021 “Forced Sensor not suitable, default used.”

Suggested Action: Review the choices of sensors available in the selection lists in **Centralized Control Equipment** or **Local Control Equipment** under the Controls tab and consider selecting a specific Sensor. Determine why a sensor could not be found. Check that the temperatures entered under the Basic tab are correct and that sensors are available for these temperatures. Consider changing the **Control Method** under the Control tab to see how this would affect the results.

W1022 “No suitable Controls found.”

Suggested Action: Review the choices of controls available in the selection lists in **Centralized Control Equipment** or **Local Control Equipment** under the Controls tab and consider selecting a specific Control. Determine why a control could not be found. Check that there is a suitable control for the **Area** selected under the Area

Class tab. Consider changing the **Control Method** under the Control tab to see how this would affect the results.

W1023 “No suitable Sensors found.”

Suggested Action: Review the choices of sensors available in the selection lists in **Centralized Control Equipment** or **Local Control Equipment** under the Controls tab and consider selecting a specific Sensor. Determine why a sensor could not be found. Check that the **Temperatures** entered under the Basic tab are correct and that sensors are available for these temperatures. Consider changing the **Control Method** under the Control tab to see how this would affect the results.

W1024 “The default Pipe Strap specified in Project Settings can not be found.”

Suggested Action: This indicates that selected **Pipe Strap** that is specified on the **Design** tab of the **Project Settings** window can not be found in the current Product Database. This can occur if you are trying to use a project file that was created on a different workstation which had access to a different set of product data. Go to Project Settings and re-select a Pipe Strap that is available in the current product data.

W1030 “Multiple circuits created.”

Suggested Action: Review the Calculated Results Pane. Note that **Cable Set Quantity** is greater than 1. This can be an acceptable design, but if you do wish to redesign with a single cable set, consider changing the **Insulation Thickness** or possibly the **Maximum CB Size** under the Basic tab. Also consider deselecting any manual Heater Select under Heater Options tab – **Heater Selection**. Do **Recalculation** and review results.

W1031 “Forced segment length exceeds heater max. circuit length.”

Suggested Action: Review the advanced heater options settings. The forced segment length exceeds the circuit length for the selected heater. Use the Advanced Heater Options dialog to adjust the forced segment length. If you do not wish to reduce the segment length, you may choose to force a different family of heaters.

W1040 “Calculated sheath temp. exceeds Heater Max. Exposure Temp.”

Suggested Action: Review the calculated **Sheath Temperature** under the Heater Data in the Calculated Results Pane. Compare this with the temperature values entered under the Basic tab. Consider specifying **Use control limited design**, to require the use of thermostatic control to limit the **Sheath Temperature**. Also consider deselecting any manual Heater Select under Heater Options tab – **Heater Selection** to see if the program can find a suitable heater when a free selection is allowed. Do **Recalculation** and review results.

W1041 “Max. Operating temperature exceeds heater limits. Line Sensing control is required.”

Suggested Action: Change the **Control Method** to “Line Sensing, no failure alarm,” or “Line Sensing, w/failure alarm.” Depending on the heating cable type selected, you may want to consider forcing a higher temperature rated cable.

W1042 “Heater wattage too high at Max. Controlled temperature. Line Sensing control is required.”

Suggested Action: Change the Control Method to Line Sensing. Depending of the heater type selected, you may want to consider forcing a higher temperature rated cable. You could also try forcing the Trace Ratio to a higher value. This would allow TraceCalc Pro to look for lower wattage cables to meet the total heat loss requirement.

W1043 “Sheath temperature calculation is invalid. Spacing does not exceed cable minimum spacing.”

Suggested Action: Lower the trace ratio. If you have not forced the trace ratio, and have forced the heater, you should deselect the heater and allow TraceCalc Pro to select a heater, or select a higher-power heater.

W1044: Min. controlled temperature below maintain temperature. Check temperature sensor location.

Suggested Action: This warning indicates that you are using line sensing control to control multiple line segments based on the temperature of another segment. Move location of your temperature sensor to another line segment and recalculate. You may need to break the line grouping into additional, independently controlled circuits. You can also try to equalize the duty cycle amongst the segments.

W1045: Max. controlled temperature exceeds control limited setpoint. Check temperature sensor location.

Suggested Action: This warning indicates that you are using line sensing control to control multiple line segments based on the temperature of another segment. In this case, the temperature of some line segments may exceed the control limited setpoint value used for sheath temperature calculations. This is potentially a very serious condition and MAY INVALIDATE THE CALCULATED SHEATH TEMPERATURE. You should carefully review the design and possibly break the line grouping into additional, independently controlled circuits.

W1050 “Valve1 max. recommended heater length exceeded.”

Suggested Action: This warning message is an important caution to bring to your attention that the program needed to provide a greater length of heating cable to balance the heat loss from this valve than was entered as the **Maximum Recommended Length** (maximum practicable heating cable length) in the heat sink data tables. Consider using a heating cable with higher power output or specifying more insulation for the valves. Note: To view the **Maximum Recommended Length**, being the maximum practicable heating cable length, for all heat sinks, select **Setup** on the main menu, then **Project Settings > Advanced tab > Heat sink Definitions** button > **Modify**. You cannot modify standard default data marked **Read Only = Yes**, but you can right-click on an item and select Copy then Paste Append to define a new item with modified data. For more information, see “[Advanced Tab](#)” on page 94.

W1051 “Valve2 max. recommended heater length exceeded.”

Suggested Action: This warning message is an important caution to bring to your attention that the program needed to provide a greater length of heating cable to

balance the heat loss from this valve than was entered as the **Maximum Recommended Length** (maximum practicable heating cable length) in the heat sink data tables. Consider using a heating cable with higher power output or specifying more insulation for the valves. Note: To view the **Maximum Recommended Length**, being the maximum practicable heating cable length, for all heat sinks, select **Setup** on the main menu, then **Project Settings > Advanced tab > Heat sink Definitions** button > **Modify**. You cannot modify standard default data marked **Read Only = Yes**, but you can right-click on an item and select Copy then Paste Append to define a new item with modified data. For more information, see “[Advanced Tab](#)” on page 94.

W1052 “Valve3 max. recommended heater length exceeded.”

Suggested Action: This warning message is an important caution to bring to your attention that the program needed to provide a greater length of heating cable to balance the heat loss from this valve than was entered as the **Maximum Recommended Length** (maximum practicable heating cable length) in the heat sink data tables. Consider using a heating cable with higher power output or specifying more insulation for the valves. Note: To view the **Maximum Recommended Length**, being the maximum practicable heating cable length, for all heat sinks, select **Setup** on the main menu, then **Project Settings > Advanced tab > Heat sink Definitions** button > **Modify**. You cannot modify standard default data marked **Read Only = Yes**, but you can right-click on an item and select Copy then Paste Append to define a new item with modified data. For more information, see “[Advanced Tab](#)” on page 94.

W1053 “Support1 max. recommended heater length exceeded.”

Suggested Action: This warning message is an important caution to bring to your attention that the program needed to provide a greater length of heating cable to balance the heat loss from this support than was entered as the **Maximum Recommended Length** (maximum practicable heating cable length) in the heat sink data tables. Consider using a heating cable with higher power output or specifying more insulation for the supports. Note: To view the **Maximum Recommended Length**, being the maximum practicable heater length, for all heat sinks, select **Setup** on the main menu, then **Project Settings > Advanced tab > Heat sink Definitions** button > **Modify**. You cannot modify standard default data marked **Read Only = Yes**, but you can right-click on an item and select Copy then Paste Append to define a new item with modified data. For more information, see “[Advanced Tab](#)” on page 94.

W1054 “Support2 max. recommended heater length exceeded.”

Suggested Action: This warning message is an important caution to bring to your attention that the program needed to provide a greater length of heating cable to balance the heat loss from this support than was entered as the **Maximum Recommended Length** (maximum practicable heating cable length) in the heat sink data tables. Consider using a heating cable with higher power output or specifying more insulation for the supports. Note: To view the **Maximum Recommended Length**, being the maximum practicable heater length, for all heat sinks, select **Setup** on the main menu, then **Project Settings > Advanced tab > Heat sink Definitions** button > **Modify**. You cannot modify standard default data marked **Read Only = Yes**, but you can right-click on an item and select Copy then Paste Append to define a new item with modified data. For more information, see “[Advanced Tab](#)” on page 94.

W1055 “Support3 max. recommended heater length exceeded.”

Suggested Action: This warning message is an important caution to bring to your attention that the program needed to provide a greater length of heating cable to balance the heat loss from this support than was entered as the **Maximum Recommended Length** (maximum practicable heating cable length) in the heat sink data tables. Consider using a heating cable with higher power output or specifying more insulation for the supports. Note: To view the **Maximum Recommended Length**, being the maximum practicable heater length, for all heat sinks, select **Setup** on the main menu, then **Project Settings > Advanced tab > Heat sink Definitions** button > **Modify**. You cannot modify standard default data marked **Read Only = Yes**, but you can right-click on an item and select Copy then Paste Append to define a new item with modified data. For more information, see [“Advanced Tab”](#) on page 94.

W1056 “Flange max. recommended heater length exceeded.”

Suggested Action: The program will not call up a greater length of heating cable than can practicably be installation on the selected type, and size of flange. This warning message is an important caution to bring to your attention that the program needed to provide a greater length of heating cable to balance the heat loss from this flange than was entered as the **Maximum Recommended Length** (maximum practicable heating cable length) in the heat sink data tables. Consider using a heating cable with higher power output or specifying more insulation for the flanges. Note: To view the **Maximum Recommended Length**, being the maximum practicable heater length, for all heat sinks, select **Setup** on the main menu, then **Project Settings > Advanced tab > Heat sink Definitions** button > **Modify**. You cannot modify standard default data marked **Read Only = Yes**, but you can right-click on an item and select Copy then Paste Append to define a new item with modified data. For more information, see [“Advanced Tab”](#) on page 94.

W1057 “Circuit breaker size exceeds the maximum allowed for the selected heater.”

Suggested Action: The manufacturer’s ratings and approvals for each heater specify the maximum size of circuit breaker that may be used to power the heater. In order to clear this warning, you will need break the line down into additional Parent lines.

W1058 “Preferred gland size not available for selected cold lead. Default used.”

Suggested Action: This indicates that the **Cold Lead** that was selected by TraceCalc Pro is not offered with one of the **Preferred Cold Lead Gland Sizes** that have been specified on the **Design** tab of the **Project Settings** window.

W1059 “Heater sheath temp. may exceed the Insulation Max. Temp.”

Suggested Action: Use a lower-power heating cable, for instance by raising the trace ratio or increasing the insulation thickness; or consider using a high-temperature insulation, either by itself or as part of a two-layer insulation system.

W1060 “Forced cold lead or cold lead group not suitable. Default used.”

Suggested Action: Review the product data sheet to learn why the forced cold lead was not acceptable. You may choose to accept the cold lead selected by TraceCalc Pro, or you may select a different cold lead and recalculate.

W1061 “Standard cold lead not suitable, generic used. Contact TTC for alternatives.”

Suggested Action: This indicates that no standard cold lead in the TraceCalc Pro database is suitable for your application. An experienced Pentair Thermal Management representative can recommend a custom cold lead suitable for your application.

W1074 “No [??] were found that are compatible with the selected heater.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1075 “No [??] were found that are suitable for the application.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1076 “No [??] found, the voltage is too high.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1077 “No [??] found, the voltage is too low.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1078 “No [??] found, the Exposure temperature is too high.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1080 “No [??] found, the Operating Current is too high.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1081 “No [??] found, the Operating Current is too low.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1082 “No [??] found, the Pipe OD is too large.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1083 “No [??] found, the Pipe OD is too small.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1084 “No [??] were found that are suitable for plastic surfaces.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection.

Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1085 “No [??] were found that are suitable for the specified Area Classification.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1086 “No [??] were found, the Max. Surface Temp. exceeds the auto-ignition or T-class temp.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1087 “No [??] found with correct number of heater entries.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the input data specified in the message and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1088 “No [??] found that are suitable for the specified Voltage Configuration.”

Suggested Action: The [??] will be replaced with the specific component category (Power Kits, Splice Kits, Tee Kits or End Seals). If you are forcing a particular selection from the Components tab, consider removing the forced selection. Otherwise, you will be required to adjust the **Voltage Configuration** and try recalculating. Please note that to maintain the approvals and/or ratings of a heating cable, you must use the components that have been approved by the manufacturer for that particular heating cable.

W1100 “No controls were found that are suitable for the application.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1201 “No controls found, the voltage is too high.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1202 “No controls found, the voltage is too low.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1203 “No controls found, the Exposure Temperature is too high.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1204 “No controls found, the Maintain temperature or Control Limited Setpoint exceeds the setpoint range.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1205 “No controls found, the Operating Current is too high.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1206 “No controls found, the Operating Current is too low.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1207 “No controls found, the Pipe OD is too large.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1208 “No controls found, the Pipe OD is too small.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the

Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1209 “No controls found that are suitable for use on plastic surfaces.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1210 “No controls found that are suitable for the Area Classification.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1211 “No controls found, the controller Max. Surface Temperature exceeds the auto-ignition temperature.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1212 “No controls found that are suitable for the specified Voltage Configuration.”

Suggested Action: This indicates that TraceCalc Pro was unable to find any Temperature Controls that are rated for use with your specified Voltage Configuration. Change your voltage configuration or review/remove any manually selected settings on the **Controls** tab.

W1213 “No controls found with the correct number of switch poles.”

Suggested Action: This indicates that TraceCalc Pro was unable to find any Temperature Controls that have the correct number of poles. This is driven by the **Voltage Configuration**. Single phase (phase-phase) will require 2 poles and Three Phase configurations will require 3 poles. You may need to change your Voltage Configuration or modify settings on the **Controls** tab.

W1214 “No controls found suitable for Temperature Limited design.”

Suggested Action: If you have forced a controller, de-select the controller and allow TraceCalc Pro to select one.

W1215 “Temperature limited design in Zone 1 (Zone 21) requires the use of an approved temperature limiter.”

Suggested Action: This is just a reminder that you must use a controller/limiter that is approved to be used as a temperature limiter for a Zone 1 area.

W1220 “No sensors were found that are suitable for the application.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1223 “No sensors were found, the Exposure Temperature is too high.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1229 “No sensors were found that are suitable for use on plastic surfaces.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1230 “No sensors were found that are suitable for the Area Classification.”

Suggested Action: TraceCalc Pro was unable to locate a temperature control or sensor that meets the specified data value. You can try changing selections on the Controls tab or alternatively, changing the input data to generate a different heating cable circuit design.

W1231 “No sensors found, the sensor Max. Surface Temperature exceeds the auto-ignition temperature.”

Suggested Action: This indicates that TraceCalc Pro was unable to find any Temperature Sensors that have a maximum sheath temperature or T-rating that is compatible with your current Area Class settings. Review your settings on both the Area Class and Controls tabs.

Appendix B: Hazardous Gases and Vapors

The following pages contain excerpts from the National Fire Protection Association publication NFPA 497M “Classification of Gases, Vapors, and Dusts for Electrical Equipment in Hazardous (Classified) Locations 1994 Edition.” The list includes the ignition temperatures and group classifications for Class I gases. Class II dusts and Class III fibers and filings are not listed.

Note that considerable skill and judgment must be applied when deciding to what degree an area contains hazardous concentrations of vapors, combustible dusts, or easily ignitable fibers and filings. Many factors—such as temperature, barometric pressure, quantity of release, humidity, ventilation, and distance from the vapor source—must be considered. When information on every factor concerned is properly evaluated, a consistent classification of the selection and location of electrical equipment can be developed.

For the most current list of properties of flammable liquids, gases, and solids, see the latest edition of NFPA 497M, “Classification of Gases, Vapors, and Dusts for Electrical Equipment in Hazardous (Classified) Locations.”

Group Classification and AIT Table

Table B-1: Group Classification and Auto-ignition Temperature (AIT) of Selected Flammable Gases and Vapors

Material	Group	°F	°C
Acetaldehyde	C*	347	175
Acetic acid	D*	867	464
Acetic anhydride	D	600	316
Acetone	D*	869	465
Acetone cyanohydrin	D	1270	688
Acetonitrile	D	975	524
Actylene	A*	581	305
Acrolein (inhibited)	B*	455	235
Acrylic acid	D	820	438

Material	Group	°F	°C
Acrylonitrile	D*	898	481
Allyl alcohol	C*	713	378
Allyl chloride	D	905	485
Ammonia	D*	928	498
n-Amyl acetate	D	680	360
Aniline	D	1139	615
Benzene	D*	928	498
Benzyl chloride	D	1085	585
1,3-Butadiene	B*	788	420
Butane	D*	550	288
1-Butanol	D*	650	343
2-Butanol	D*	761	405
n-Butyl acetate	D*	790	421
iso-Butyl acetate	D*	790	421
n-Butyl acrylate (inhibited)	D	559	293
Butylamine	D	594	312
Butylene	D	725	385
n-Butyraldehyde	C*	425	218
n-Butyric acid	D	830	443
Carbon monoxide	C*	1128	609
Chlorobenzene	D	1099	593
Cresol	D	1038–1110	559–599
Crotonaldehyde	C*	450	232
Cumene	D	795	424
Cyclohexane	D	473	245
Cyclohexene	D	471	244
Cyclohexanol	D	572	300
Cyclohexanone	D	473	245
Cyclopropane	D*	938	503
p-Cymene	D	817	436
n-Decanol	D	550	288
Decene	D	455	235
Diacetone alcohol	D	1118	603
o-Dichlorobenzene	D	1198	647
1,1-Dichloroethane	D	820	438
1,2-Dichloroethylene	D	860	460
Dicyclopentadiene	C	937	503
Diethyl benzene	D	743–842	395–450
Diethylene glycol monobutyl ether	C	442	228
Diethylene glycol monomethyl ether	C	465	241
Diethylamine	C*	594	312
Diethyl ether	C*	320	160
N-N-Dimethyl aniline	C	700	371

Material	Group	°F	°C
Di-isobutylene	D*	736	391
Di-isobutyl ketone	D	745	396
Di-isopropylamine	C	600	316
Dimethylamine	C	752	400
Dimethyl formamide	D	833	455
Dimethyl sulfate	D	370	188
1.4-Dioxane	C	356	180
Dipentene	D	458	237
Di-N-propylamine	C	570	299
Dodecene	D	491	255
Epichlorohydrin	C*	772	411
Ethane	D*	882	472
Ethanol	D*	685	363
Ethyl acetate	D*	800	427
Ethyl acrylate (inhibited)	D*	702	372
Ethylamine	D*	725	385
Ethyl benzene	D	810	432
Ethyl chloride	D	966	519
Ethylene	C*	842	450
Ethylene chlorohydrin	D	797	425
Ethylene glycol monobutyl ether	C	460	238
Ethylene glycol monobutyl ether acetate	C	645	340
Ethylenediamine	D*	725	385
Ethylene dichloride	D*	775	413
Ethylene glycol monoethyl ether	C	455	235
Ethylene glycol monoethyl ether acetate	C	715	379
Ethylene glycol monomethyl ether	D	545	285
Ethylenimine	C*	608	320
Ethylene oxide	B*	804	429
Ethyl formate	D	851	455
2-Ethylhexaldehyde	C	375	191
2-Ethyl hexanol	D	448	231
2-Ethyl hexyl acrylate	D	485	252
Ethyl mercaptan	C*	572	300
Formaldehyde (gas)	B	795	429
Formic acid (90%)	D	813	434
Fuel oils	D	410–765	210–407
Furfural	C	600	316
Furfuryl alcohol	C	915	490
Gasoline	D*	536–880	280–471
Heptane	D*	399	204
Heptene	D	500	260
Hexane	D*	437	225

Material	Group	°F	°C
2-Hexanone	D	795	424
Hexene	D	473	245
Hydrazine	C	74–518	23–270
Hydrogen	B*	968	520
Hydrogen cyanide	C*	1000	538
Hydrogen sulfide	C*	500	260
Isoamyl acetate	D	680	260
Isobutyl acrylate	D	800	427
Isobutyraldehyde	C	385	196
Isophorone	D	860	260
Isoprene	D*	428	220
Isopropyl acetate	D	860	460
Isoamyl alcohol	D	662	350
Isopropylamine	D	756	402
Isopropyl ether	D*	830	443
Iso-octyl aldehyde	C	387	197
Kerosene	D	410	210
Liquefied petroleum gas	D	761–842	405–450
Mesityl oxide	D*	652	344
Methane	D*	999	630
Methanol	D*	725	385
Methyl acetate	D	850	454
Methyl acrylate	D	875	468
Methylamine	D	806	430
Methyl n-amyl ketone	D	740	393
Methylcyclohexane	D	482	250
Methylcyclohexanol	D	565	296
Methyl ether	C*	662	350
Methyl ethyl ketone	D*	759	404
Methyl formal	C*	460	238
Methyl formate	D	840	449
Methyl isobutyl ketone	D*	840	449
Methyl isocyanate	D	994	534
Methyl methacrylate	D	792	422
2-Methyl-1-propanol	D*	780	416
2-Methyl-2-propanol	D*	892	478
alpha-Methyl styrene	D	1066	574
Monoethanolamine	D	770	410
Monoisopropanolamine	D	705	374
Monomethyl aniline	C	900	482
Monomethyl hydrazine	C	382	194
Morpholine	C*	590	310
Naphtha (coal tar)	D	531	277

Material	Group	°F	°C
Nitrobenzene	D	900	482
Nitroethane	C	778	414
Nitromethane	C	785	418
1-Nitropropane	C	789	421
2-Nitropropane	C*	802	428
Nonane	D	401	205
Octane	D*	403	206
Octene	D	446	230
Pentane	D*	470	243
1-Pentanol	D*	572	300
2-Pentanone	D	846	452
1-Pentene	D	527	275
Propane	D*	842	450
1-Propanol	D*	775	413
2-Propanol	D*	750	399
Propionaldehyde	C	405	207
Propionic acid	D	870	466
Propionic anhydride	D	545	285
n-Propyl acetate	D	842	450
Propylene	D*	851	455
Propylene dichloride	D*	1035	557
Propylene oxide	B*	840	449
n-Propyl ether	C	419	215
Propyl nitrate	B*	347	175
Pyridine	D*	900	482
Styrene	D*	914	490
Tetrahydrofuran	C*	610	321
Tetrahydronaphthalene	D	725	385
Toluene	D*	896	480
Turpentine	D	488	253
Unsymmetrical dimethyl hydrazine (UDMH)	C*	480	249
Valeraldehyde	C	432	222
Vinyl acetate	D*	756	402
Vinyl chloride	D*	882	472
Vinylidene chloride	D	1058	570
Vinyl toluene	ti	921	494
Xylenes	D*	867–984	464–529

*Material has been classified by test.

Appendix C: Field Name Locator

The following table gives you a list of TraceCalc Pro's field and the location (tab, sub-window, dialog box) where each field is located in the program.

Field Name Locator Table

Table C-1: Field name locator

Field Name	Location (tab or menu item)
Above Max Fill (Vessel Accessories)	Basic / Vessel Properties / Heat Sinks
Additional Length of Heater	Basic / Vessel Properties / Heat Sinks
Additional Length of Heater	Basic / Vessel Properties / Heat Sinks
Advanced	Setup / Project Settings
Allow Lump Sum Watts	Basic / Valves, Supports
Allow Percentage Of Pipe Length	Basic / Valves, Supports
Allow Priced Bill of Materials	Project Settings / Advanced
Allow Spiraling	Heater Options
Allow Stabilized Design	Area Class
Area	Reference
Area Classification	Area Class
Auto-ignition Temperature	Area Class
Auto-ignition Type	Area Class
Available Area	Basic / Vessel Properties
Body Diameter	Basic / Vessel Properties
Body Height	Basic / Vessel Properties
Body Length	Basic / Vessel Properties
Body Width	Basic / Vessel Properties
Bottom Diameter	Basic / Vessel Properties
Bottom Height	Basic / Vessel Properties
Bottom Insulated	Basic / Vessel Properties
Bottom Length	Basic / Vessel Properties
Bottom Style (Vessel)	Basic / Vessel Properties
Bottom Width	Basic / Vessel Properties

Field Name	Location (tab or menu item)
Category	Controls
CB Number	Controls
Central Sensor Name	Controls
Central Sensor Quantity	Controls
Chemical Exposure	Reference
Circuit Breaker Load Factor	Project Settings / Design
Circuit Breaker Number	Controls
Circuit Number	Controls
Cladding Emissivity	Project Settings / Design
Class	Area Class
Comment	Reference
Conductors	Heater Options
Contact Points (Ladder)	Basic / Vessel Properties / Heat Sinks
Control Method	Controls
Cold Leads	Heater Options
Cross-Sectional Area (Ladder)	Basic / Vessel Properties / Heat Sinks
Cross-Sectional Area (Vessel Support)	Basic / Vessel Properties / Supports
Currency	Setup / Project Settings / Advanced
Customer Name	Setup / Project Settings / Information
Customer Reference Number	Setup / Project Settings / Information
Data Version	Setup / Project Settings / Product Preferences
Default Pipe Straps	Setup / Project Settings / Design
Default Warning Label	Setup / Project Settings / Design
Design	Setup / Project Settings
Diameter (Vessel Accessories)	Basic / Vessel Properties / Heat Sinks
Dielectric	Heater Options
Division / Zone	Area Class
Drain / Vent Heater Length	Basic / Valves, Supports
Drain / Vent Quantity	Basic / Valves, Supports
Drain / Vent Length	Setup / Project Settings/ Design
Drawing Number	Reference
End Seal	Components
Exposure Temperature	Basic
Film Coefficient	Project Settings / Advanced
Flange Mode	Basic / Valves, Supports
Flange Quantity	Basic / Valves, Supports
Flange Spacing	Basic / Valves, Supports
Flange Specify Spacing	Basic / Valves, Supports
Flange Type	Basic / Valves, Supports
Fluid	Reference
Force Attachment	Heater Options
Force Dielectric	Heater Options
Force Family	Heater Options

Field Name	Location (tab or menu item)
Force Ground Path	Heater Options
Force Heater	Heater Options
Force Jacket Material	Heater Options
Force Multiple Runs	Heater Options
Force Trace Ratio	Heater Options
Gas / Dust Groups	Area Class
Ground Path	Heater Options
Heat Loss Safety Factor	Reference
Heater Attachment	Heater Options
Heater End Seal Group	Components
Heater Family	Heater Options
Heater Maximum OCD Size	Basic
Heater Operating Voltage	Basic
Heater Power Group	Components
Heater Splice Group	Components
Heater Tee Group	Components
Heater Type	Heater Options
Heat sink Definitions	Project Settings / Advanced
Height (Vessel Accessories)	Basic / Vessel Properties / Heat Sinks
Hi-limit Temperature	Area Class
Indoor	Reference
Insulated (Vessel Accessories)	Basic / Vessel Properties / Heat Sinks
Insulated (Vessel Support)	Basic / Vessel Properties / Supports
Information	Project Settings
Insulation Diameter	Basic / Advanced
Insulation Height	Basic / Vessel Properties
Insulation OverSize	Basic / Advanced
Insulation Thickness	Basic
Insulation Thickness (Inner)	Basic / Advanced
Insulation Thickness (Outer)	Basic / Advanced
Insulation Two Layer	Basic / Advanced
Insulation Type	Basic
Insulation Type (Inner)	Basic / Advanced
Insulation Type (Outer)	Basic / Advanced
Jacket Material	Heater Options
Journal	Project Settings
K-factor (Ladder)	Basic / Vessel Properties / Heat Sinks
K-Factor (Vessel Support)	Basic / Vessel Properties / Supports
Line ID	Basic
Line Type	Basic
Local Control Category	Controls
Local Controller Name	Controls
Local Controller Quantity	Controls

Field Name	Location (tab or menu item)
Local Sensor Name	Controls
Local Sensor Quantity	Controls
Maintain Temperature	Basic
Manual Select Attachment	Heater Options
Material (Ladder)	Basic / Vessel Properties / Heat Sinks
Material (Vessel)	Basic / Vessel Properties
Material (Vessel Support)	Basic / Vessel Properties / Supports
Maximum Allowable Temperature	Basic
Maximum Ambient Temperature	Basic
Maximum CB Size	Basic
Maximum Fill	Basic / Vessel Properties
Maximum Heater Exposure Temperature	Basic
Maximum Operating Temperature	Basic
Maximum Spiral Ratio	Project Settings / Design
Minimum Ambient Temperature	Basic
Minimum Fill	Basic / Vessel Properties
Minimum Heater Spacing	Project Settings / Design
Miscellaneous Sink Quantity	Basic / Valves, Supports
Miscellaneous Sink Qty (Vessel)	Basic / Vessel Properties / Heat Sinks
Miscellaneous Drain/Vent Quantity	Basic / Valves, Supports
Number of Conductors	Heater Options
Outdoors	Reference
Over size Diameter	Basic / Valves, Supports
Panel Name	Controls
Perimeter (Ladder)	Basic / Vessel Properties / Heat Sinks
Perimeter (Vessel Support)	Basic / Vessel Properties / Supports
Pipe Diameter	Basic
Pipe Length	Basic
Pipe Type	Basic
Pipe Emissivity	Setup / Project Settings / Design
Power	Components
Price List File	Setup / Project Settings / Advanced
Product Preferences	Setup / Project Settings
Product Quantity	Controls
Project Description	Setup / Project Settings / Information
Project Name	Setup / Project Settings / Information
Project Number	Setup / Project Settings / Information
Quantity	Basic / Valves, Supports
Quantity (Ladder)	Basic / Vessel Properties / Heat Sinks
Quantity (Vessel Accessories)	Basic / Vessel Properties / Heat Sinks
Quantity (Vessel Support)	Basic / Vessel Properties / Supports
Reference Data File	Setup / Project Settings / Product Preferences
Reference Data Path	Setup / Program Settings / Reference

Field Name	Location (tab or menu item)
	Data
Reset Price Table	Setup / Project Settings / Advanced
Safety Factor	Reference
Section	Basic
Select Product	Controls
Select Sensor	Components
Sensor Quantity	Controls
Sheath Temperature Calculation Type	Area Class
Show Components Tab	Project Settings / Advanced
Show Project Settings Advanced Options	Program Settings / Advanced
Skirt Wall Thickness	Basic / Vessel Properties / Supports
Slab Thickness	Basic / Vessel Properties / Supports
Specify Auto-ignition Temperature	Area Class
Specify T-Rating	Area Class
Splice	Components
Standards Body	Area Class
Startup Temperature	Reference
Support 1 Mode	Basic / Valves, Supports
Support 1 Quantity	Basic / Valves, Supports
Support 1 Spacing	Basic / Valves, Supports
Support 1 Specify Spacing	Basic / Valves, Supports
Support 1 Type	Basic / Valves, Supports
Technology	Heater Options
Tee	Components
Termination Allowance	Project Settings / Design
T-rating	Area Class
Top Height	Basic / Vessel Properties
Top Insulated	Basic / Vessel Properties
Top Style (Vessel)	Basic / Vessel Properties
Two Layer Insulation System	Basic / Advanced
Type (Vessel)	Basic / Vessel Properties
Type (Vessel Accessories)	Basic / Vessel Properties / Heat Sinks
Type (Vessel Support)	Basic / Vessel Properties / Supports
Use Artificial Hotspot Design	Area Class
Use Centralized Control Equipment	Controls
Use Control Limited Design	Area Class
Use Local Control Equipment	Controls
Use Multiple Cable Sets	Heater Options
Use Over size Insulation	Basic / Valves, Supports
Valve 1 Mode	Basic / Valves, Supports
Valve 1 Quantity	Basic / Valves, Supports
Valve 1 Spacing	Basic / Valves, Supports
Valve 1 Specify Spacing	Basic / Valves, Supports
Valve 1 Type	Basic / Valves, Supports

Field Name

Wall Thickness (Vessel)
Warning Label Interval
Wind Speed
Zone

Location (tab or menu item)

Basic / Vessel Properties
Project Settings / Design
Reference
Area Class

Glossary of Terms

ambient sensing

A control method where the heating cable system power is controlled by input from a temperature sensor measuring the ambient temperature.

ambient temperature

The temperature in the area where the pipe is located, outside of the thermal insulation.

artificial hotspot

A method of installing a high-temperature limit sensor that measures the heating cable sheath temperature under “worst case” conditions. The heating cable in the immediate vicinity of the sensor is intentionally installed such that it is not in contact with the surface to be heated and will, therefore, be representative of the highest temperature attained for the entire pipe.

auto-ignition temperature

The AIT is the minimum temperature required to cause self-sustained combustion, independent of a flame or a heated element. This is different from the flash point of a liquid, which is the lowest temperature at which the liquid gives off sufficient vapor to form an ignitable mixture with air near the surface of the liquid or within the vessel used. The flash point of gasoline is -50°F (-45°C) and the AIT is 536°F (280°C).

available area

The percentage of the total surface area that could be used to apply heater. It is considered as a maximum; TraceCalc Pro will calculate a heater length and spacing that will never require more than the available area. If you prefer for all of the available area be used, then you must select the ‘Use All Available Area’ option, which is located on the Heater Options dialog box.

bill of materials

List of parts needed to fabricate a design created with TraceCalc Pro.

cable set

A heating cable length between components. A pipe line traced with three cables, each with end seals, is considered to have three cable sets. The same line traced three times with a single cable run is considered to have only one cable set.

calculated results pane

The TraceCalc Pro pane that users use to preview online calculated results for a project. This window lists specific information related to heating cable length, type, performance, and electrical operating characteristics.

CB load factor

The factor that is applied to calculate the maximum permissible load for a circuit breaker. Standard practice, in accordance with the U.S. National Electric Code and Canadian Electrical Code CEC, is to load a circuit breaker to no more than 80% of its nominal current rating (for example, a 30 amp circuit may be loaded to 24 amperes). In Europe, the maximum load is normally 100% of the nominal rating.

CENELEC

European Committee for Electrotechnical Standardization. An approval organization that sets industrial safety standards.

chemical exposure

Identifies whether significant exposure to chemicals is anticipated and limits heating cables selected to those having the appropriate outer jacket.

child

Also can be thought of as a *subline*. A user-defined identification of a pipe segment for the purposes of organizing or simplifying the heat-tracing design. A segment of a pipe system that is connected to, and is typically downstream of, a parent segment for either electrical or flow purposes. It takes on the design-related characteristics of the parent unless overridden by the user. For instance, a bypass loop on a fire water line could be a “child” of the water line.

circuit breaker

A device that opens and closes a circuit by non-automatic means; it also opens the circuit automatically on a predetermined overcurrent condition without damage to itself.

circuit breaker size

This is the nominal rating or size of the circuit breaker typically specified in amperes. It is the highest continuous current the breaker will pass.

circuit load

Either power or current supplied through one circuit breaker (or a group of circuit breakers) and associated distribution wiring at the maintain temperature.

cladding

An outer jacket, usually metallic, encasing the thermal insulation to provide mechanical and environmental protection.

Class I

North American classification for Hazardous Areas where the explosive danger consists of flammable gases or vapors.

Class II

North American classification for Hazardous Areas where the explosive danger consists of combustible dusts.

Class III

North American classification for Hazardous Areas where the explosive danger consists of combustible fibers or fillings.

classified location

See *hazardous location*.

cold lead

Electrically insulated conductors that connect a heating cable conductor to the branch-circuit; it does not produce any appreciable heat. Series type heating cables, such as mineral insulated cables, require the use of cold leads.

component

The device that provides mechanical, electrical and environmental protection to the exposed ends of a heating cable segment and a means for making necessary electrical connections. Typical components include power connections, splices, tees and end seals.

conduction

One of the three methods of heat transfer (the others: radiation and convection). The transfer of heat by molecular motion without the bulk movement of material. Conduction is the only way that heat can be transferred within a solid.

conductor

A long thin piece of metal used to carry current. An insulated conductor is a wire.

continuous load

An electrical load in which the maximum current is expected to continue for more than three hours.

controller

A device that regulates the heat-tracing system by comparing the signal from a sensor to a predetermined value and adjusts its output accordingly. Controllers that regulate temperature are referred to as temperature controllers or thermostats. Temperature sensors can be mechanical (bulb and capillary, bimetallic) or electronic (thermocouple, RTD, thermistor).

control limited design

A control method option requiring, for sheath temperature prediction purposes, the use of a temperature control device to limit the maximum temperature. The need for failure annunciation and a separate high-temperature limit controller varies. Be sure to check local codes and standards for your specific requirements.

control method

The particular user-selected method of temperature control used for a heat-tracing systems. See *ambient sensing*, *line sensing*, and *uncontrolled*.

cross-sectional area

The amount of vessel surface that is in direct contact with the vessel support.

CSA

Canadian Standards Association. An approval organization that sets industrial safety standards.

design pane

The TraceCalc Pro pane that users use to enter line parameter and design data. This window contains six tabs: Basic, Reference, Area Class, Heater Options, Components, and Controls. Each tab represents a screen where the user enters specific design data for a project.

Division 1

Terminology used for classification of an industrial area in which flammable gases or combustible dusts can be present under normal conditions, or from frequent breakdowns, or where failure of equipment could release materials and create simultaneous failure of electrical equipment. Refer to the NEC for a detailed definition.

Division 2

Terminology used for classification of an industrial area in which flammable gases or combustible dust will only be present under abnormal conditions. Refer to the NEC for a detailed definition.

earth plate

A means for making a conducting connection in a component between a heating cable ground and a conducting path to earth.

electric heat-tracing system

A system of electric heating cables, components, and a power distribution system that may include cables, panelboards, and transformers whose purpose is to maintain a piping system at or above a given temperature. The system may also include a control system with sensors, alarms, and controllers. Electric heat-tracing systems are sometimes referred to as electric pipe heating or trace-heating systems.

end seal

A component used to seal the unpowered end of a heating cable circuit. See *component*.

filter

Algorithm with user-supplied criteria for sorting results to prepare desired reports or export data.

flange

A projecting rim on a pipe end used to connect to another pipe, valve or other piping component.

fluid

A substance, such as water or air, that flows readily and assumes the shape of the container.

FM

Factory Mutual Research Corporation. An approval organization that sets industrial safety standards.

FM Approved

Meets a specific set of criteria established and confirmed by Factory Mutual Research Corporation.

force trace ratio

Instructs the program to use the trace ratio defined by the user. See *trace ratio*.

grounded

Electrically connected to earth or to some conducting body that serves in place of the earth.

ground fault

The passage of current from a circuit to earth-ground.

ground-fault circuit breaker

A device that protects equipment and property from damage from electrical faults or fire; it turns off a circuit (within an established period of time) when the current to

ground exceeds some predetermined value (typically 30 mA) which is less than that required to operate the overcurrent protective device of the supply circuit. Its use is required by codes and standards for most heat-tracing applications. Consult Pentair Thermal Management or local codes and standards, as applicable, for details.

hand hole

Small entry port into a vessel.

hazardous location

Also referred to as *hazardous (classified) location*. An area where fire or explosive situations may exist due to the presence of flammable gases or vapors, flammable liquids, combustible dusts, or ignitable fibers or filings. For a detailed description, refer to the relevant sections of national codes and standards such as the National Electrical Code, Articles 500 through 503, the Canadian Electrical Code, Part 1, Section 18 and Cenelec EN 50014.

hazardous location divisions

See *Division 1* and *Division 2*.

hazardous location groups

Groups A, B, C, D, E, F, and G in the National Electrical Code Article 500 classification system, and Groups IIA, IIB and IIC in the National Electrical Code Article 505 method of classification. For purposes of testing, approval, and area classification, various air mixtures (not oxygen-enriched) are grouped together because they have similar explosion characteristics.

heat loss

The rate of thermal energy lost from a pipe, vessel, or equipment to the surrounding environment due to the difference in temperature between the pipe and the surrounding environment. The heat loss needs to be calculated for heat-tracing designs because the heat-tracing must maintain the desired temperature by replacing the heat lost.

heat loss safety factor

User-specified increase in the calculated heat loss to ensure that the heating cable provides extra heat. It is one way to compensate for important design variables that cannot be controlled or quantified. See *safety factor*.

heated area

Portion of vessel surface covered by heater.

heater operating voltage

The nominal voltage applied at the power supply point for a specific heating cable.

heater technology

For the purposes of TraceCalc Pro, heating cables are divided into two technology groups, series and parallel, based on the type of electrical circuitry employed in their construction. Typical series cables, such as MI cable, use an electrical resistance wire to generate heat and their power output is determined, in part, by their length.

Parallel cables, such as self-regulating and zone cables, use conductive polymers or resistance wires between bus wires to generate heat and can typically be cut to length during installation without affecting their power output per unit length.

heating cable circuit

In TraceCalc Pro, all the heating cable segments that are powered through a single circuit breaker. More commonly, a discrete length of heating cable that is directly wired to a single power connection component at one end and terminated with an end seal component. Intermediate branch heating cables connected to the heating cable with a tee connection are considered part of the heating cable circuit. Note that multiple-entry power connection components will accommodate multiple heating cable circuits.

heatsink

A part that conducts and dissipates heat away from the pipe or equipment. Typical examples are pipe supports and valve operators.

indoor location

The installation is sheltered and not subject to wind conditions. For TraceCalc Pro purposes, it does not describe whether the location is indoors or not, but rather whether there is any wind. If the shelter is heated, the minimum ambient temperature will differ from the outdoor minimum ambient temperature.

inner insulation

The thermal insulation installed closest to the heated surface in two layer insulation installations. See *two layer insulation*.

insulation height

The vertical extent to which the side walls of the vessel are insulated. It is the distance between the lower edge of the side wall and the upper edge of the insulation. If the side walls are fully insulated, then the Insulation Height is the same as the vessel height (or diameter, if it is a horizontal cylinder).

insulation thickness

Dimension from the inner diameter to the outer diameter of the thermal insulation on a pipe or the linear thickness of thermal insulation on the surface of a tank or other flat surface. See *inner insulation* and *outer insulation*.

jacket

A thermoplastic or thermosetting plastic covering, sometimes fabric-reinforced, applied over the insulation, core, metallic sheath, or armor of a cable.

K-factor

Characteristic of thermal insulation that specifies the thermal conductivity of the thermal insulation.

line sensing

A control method where the heating cable system power is controlled by input from one or more temperature sensor(s) measuring the temperature of the pipe or equipment under the thermal insulation at specific representative locations .

local control equipment

Control or monitoring equipment mounted in the vicinity of the pipes or power connections.

maintain temperature

Specified temperature of the surface that the heat tracing is designed to hold at equilibrium under specified design conditions. The desired pipe equipment temperature at the minimum ambient temperature.

manhole

Vessel entry port, large enough for a person.

maximum allowable temperature

The maximum temperature permitted by the user for the process/fluid or piping. This temperature is used by the program to determine whether temperature controls are required. It is typically the lowest value of the fluid degradation temperature, the piping expansion temperature, or the piping material withstand temperature (especially in the case of plastic piping).

maximum ambient temperature

The highest ambient temperature expected to occur at the location of the pipe or equipment using heat tracing.

maximum CB (circuit breaker) size

The largest circuit breaker the user is willing to use. The TraceCalc Pro program will only design heating cables circuits that are compatible with the lower of (1) this breaker size or (2) factory defined circuit requirements.

maximum equilibrium temperature

The highest predicted equilibrium pipe temperature that occurs when the heating cable is continuously energized at the maximum ambient temperature (defined as runaway pipe temperature by IEEE 515).

maximum fill height

The height of the wet surface when the vessel is at its maximum fill level. It is the distance between the lower edge of the side wall and the wet/dry surface interface.

Since the wet surface must be insulated, the Insulation Height must always be greater than or equal to the Maximum Fill Height.

maximum heater exposure temperature

The highest temperature to which the heating cable may be exposed intermittently. Defined as high-temperature excursions of not more than 48 hours in duration, with total cumulative exposure of less than 1000 hours. This temperature is ignored for the purpose of predicting maximum heating cable sheath temperatures.

maximum intermittent exposure temperature (power on or off)

See *maximum heater exposure temperature*.

maximum operating temperature

The highest temperature of the heat-traced fluid during normal process operating conditions. Excursions of less than 1000 hours may be ignored.

maximum spiral ratio

Upper limit to the spiral ratio the program can consider for a particular heating cable. See *spiral ratio*.

minimum ambient temperature

The lowest expected ambient temperature at the location of the pipe or equipment using heat tracing.

minimum heating cable spacing

Minimum center-to-center distance of heating cables on a pipe.

minimum fill height

The height of the wet surface when the vessel is at its minimum fill level. It is the distance between the lower edge of the side wall and the wet/dry surface interface. The minimum wet surface area is calculated using the minimum fill height to establish whether any part of the heated surface will ever be dry.

non-hazardous

An area where explosive or flammable materials are not present. Generally synonymous with *ordinary area* and *unclassified location*. See *classified location*.

nozzle

A section of pipe attached to the side or bottom of a vessel.

off-pipe

A component installation method where the component is not in contact with the pipe.

operating voltage

The actual voltage applied to the heating cable when in service.

ordinary area

An area where explosive or flammable materials are not present. Generally synonymous with *non-hazardous* and *unclassified location*. See *classified location*.

outdoor location

The installation is subjected to environmental extremes, including exposure to a wind .

outer insulation

The thermal insulation installed farthest from the heated surface in two layer insulation installations. See *two layer insulation*.

oversize insulation

A term applied to thermal insulation when the thermal insulation inner diameter must be larger than the nominal outer diameter of a particular pipe in order to accommodate the heating cable.

panelboard

A single panel or group of panel units assembled in a single panel; it includes buses, automatic overcurrent devices. A panelboard may or may not have switches for the control of light, heat, or power circuits. Designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front.

parallel heating cable

A heating cable with heating elements that are electrically connected in parallel, either continuously or in zones, such that watt density per unit length is approximately equal along the length of the heating cable (allowing for the drop in voltage down the length of the heating cable).

parent

A single heating cable with a power connection. Also referred to as a main-line. A user defined identification of a pipe segment for the purposes of organizing or simplifying the heat-tracing design. A segment of a pipe system that is isolated, or is connected to, and upstream of, a child segment for either electrical or flow purposes. For instance, a main fire water line would be the parent in a water line system containing main line and a branch.

perimeter

The distance around the cross-sectional area of the vessel support.

pipe size

The nominal diameter of the pipe. For tubing, the size and outside diameter are the same.

pipe support

A device for supporting a section of pipe.

pipe type

Material construction of a pipe.

power connection

The means for making an electrical connection between a heating cable and the power distribution system. See *component*.

power output

The heat produced by a heating cable, typically expressed in watts.

power-limiting heating cable

A type of heating cable that shows PTC behavior based on the properties of a metallic heating element. The PTC behavior exhibited is much less (a smaller change in resistance in response to a change in temperature) than that shown by self-regulating heating cables.

project

A TraceCalc Pro database file that contains the design parameters, specifications and components for a heat-traced application that the user designs. From this file, the user can generate useful reports for building/implementing the heat-traced application.

project explorer pane

The TraceCalc Pro pane that users use to manage all the pipe lines and the electrical panels for a project.

safety factor

Degree of engineering conservatism. The additional confidence that the thermal design will meet or exceed the practical needs of the designer. See *heat loss safety factor*.

segment

Section of piping system.

self-regulating

The inherent capability of polymer-core heating cables to inversely vary their power output in response to an increase or decrease in the actual temperature in the immediate vicinity of the heating cable.

sensor, sensing element

The first system element that responds quantitatively and performs the initial measurement. In electrical heat-tracing systems, sensors respond to the temperature of the system and may be directly connected to controllers. Sensors can be mechanical (bulk and bellows, bimetallic) or electrical (thermocouple, RTD, thermistor).

series heating cable

Heating elements that are electrically connected in series with a single current path and have a specific resistance at a given temperature for a given length. See *heater technology*.

setpoint

Control variable used to determine required pipe system temperature.

sheath

The outermost continuous covering for the cable.

sheath temperature

The temperature of the outermost heating cable jacket covering that may be exposed to the surrounding atmosphere.

signal light

Light connected to heating cable circuit to give visual confirmation of available voltage.

skirt wall thickness

The thickness of a vessel skirt support.

slab thickness

The thickness (depth) of a vessel slab support.

spiraling

method of installing heating cable such that more than one, and typically less than two, lengths of heating cable are used for every unit length of pipe. See *trace ratio*.

splice

Electrical connection joining two heating cable segments. See *component*.

stabilized design

A design option for predicting the maximum sheath temperature of the heating cable without thermostatic control in a worst-case condition - no wind, highest pipe operating temperature, and the higher of highest ambient temperature or 104°F (40°C).

start-up temperature

The lowest anticipated pipe equipment temperature at which the heating cable circuit will be energized.

style

The vessel body style is one of: horizontal cylinder, vertical cylinder, rectangle or sphere. Top and bottom styles include flat, floating, half dome, full dome, cone, truncated cone and truncated pyramid.

summary pane

The TraceCalc Pro pane that users use to see summary results for a project or set of lines or vessels within a project. This window lists specific information such as number of records needing recalculation, total pipe length and total heater length.

support attachment

Physical attachment used to anchor pipes and other pipe components to support structures.

tee connection

Electrical connection joining three heating cable segments. See *component*.

thermal insulation

Material that is designed to have a low thermal conductivity. Thermal insulation is placed on the outside of pipes and vessels to reduce the rate of heat loss.

thermostat

An electromechanical switch device that senses its surrounding temperature and activates a relay to control the flow of current to a downstream device.

T-Rating

Standards associations have established the T-rating, or temperature rating, as a means of classifying electrical equipment based on the maximum temperature an exposed surface may attain. The T-rating is identified as the “Temperature Identification Number” in the National Electrical Code (U.S.), as the “Temperature Code” in the Canadian Electrical Code, and as the “Temperature Class Number” in IEC standards. The purpose of the T-rating is to ensure that electrical equipment does not exceed the auto-ignition temperature of flammables that might be present in a hazardous location.

trace ratio

A design variable that describes the amount of heating cable used in a design per unit length of pipe. Fractional trace ratios will typically be installed by spiraling, while whole number trace ratios will typically be installed by running multiple lengths along the pipe. See *spiraling*.

two layer insulation

An insulation system where two insulation types are used, rather than one, to take advantage of the benefits (lower cost, higher temperature resistance, higher k-value, etc.) of each.

UL

Underwriters Laboratory. An approval organization that sets industrial safety standards.

unclassified location

An area where explosive or flammable materials are not present. Generally synonymous with *ordinary area* and *non-hazardous* location. See *classified location*.

uncontrolled

A control method where the heating cable system power is not controlled by input from any temperature sensor.

uncontrolled temperature

Maximum temperature a pipe or piping system will attain at maximum ambient temperature with nominal voltage applied and no electrical control of the circuit.

under insulation

Physical location under the thermal insulation and touching the pipe.

units

Dimension system used for design, either Metric or English.

valve

Piping device used to control flow.

voltage

The voltage available to power a heating cable.

wind speed

Scalar value of velocity of airflow over piping system.

Zone 1

Terminology used for classification of an industrial area in which an explosive atmosphere is likely to exist under normal operation. (Refer to the NEC, Article 505, and IEC 79-10 (1995) [B12] for a detailed definition.)

Zone 2

Terminology used for classification of an industrial area in which an explosive atmosphere is not likely to occur in normal operation, and if they do, they will exist only for a short period. (Refer to the NEC, Article 505, and IEC 79-10 (1995) [B12] for a detailed definition.)

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