



WARDFLEX Sizing Application for AutoCAD User Manual **Release 1.00**

Prepared by Synergis Technologies, Inc.
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Program Description:

This add-on utility for AutoCAD has been developed to aid in the sizing of WARDFLEX fuel gas piping systems using the summation method. It is assumed that the user is familiar with the summation method of sizing and with standard AutoCAD techniques.

Unlike black pipe, the flow characteristics of CSST vary significantly from manufacturer to manufacturer; therefore this utility will only give accurate results for the WARDFLEX brand of CSST.

The Sizing Utility will determine pressure drop for all currently available sizes of WARDFLEX: 10A, 15A, 20A, 25A, 32A, 38A and 50A. It will also determine pressure drop for black pipe or rigid pipe sizes 1/2" to 4". Underground PE Pipe can also be sized using the respective rigid pipe sizes; this technique is slightly conservative.

The Sizing Utility will handle designs with single or multiple meters, 2D or 3D layouts and un-regulated single pressure systems or regulated dual pressure systems.

Installation:

Software Requirements:

Operating System:

Same as AutoCAD® 2007

Required Software:

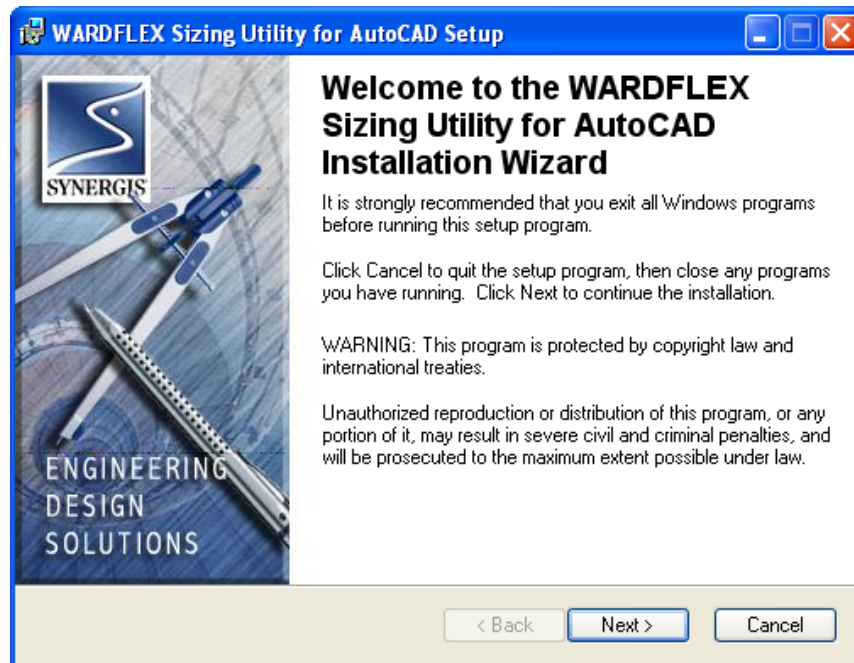
Autodesk AutoCAD® 2007

Hardware:

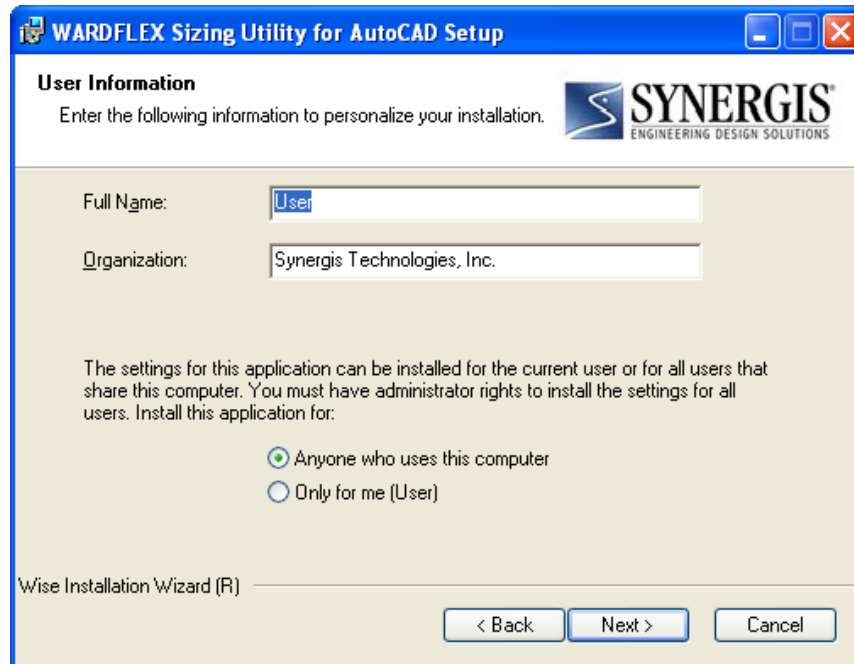
Same as AutoCAD® 2007 plus the following:
2.0 MB of hard disk space (minimum)

Installation Instructions:

- 1) From the Start menu, choose Run, and enter the path name and setup.exe. For example, enter C:\setup.exe.
- 2) When the welcome screen is displayed, choose Next.



- 3) When the user information dialog appears, enter the user name for the computer and the organization name. Choose whether this application is accessible for all users on this computer or only the user who is installing the application. Choose Next to continue.



The dialog box is titled "WARDFLEX Sizing Utility for AutoCAD Setup" and features the SYNERGIS logo. It prompts the user to enter information to personalize the installation. The "Full Name" field contains "User" and the "Organization" field contains "Synergis Technologies, Inc.". Below these fields, a message states: "The settings for this application can be installed for the current user or for all users that share this computer. You must have administrator rights to install the settings for all users. Install this application for:". Two radio buttons are present: "Anyone who uses this computer" (selected) and "Only for me (User)". At the bottom, there are three buttons: "< Back", "Next >", and "Cancel".

WARDFLEX Sizing Utility for AutoCAD Setup

User Information
Enter the following information to personalize your installation.

Full Name:

Organization:

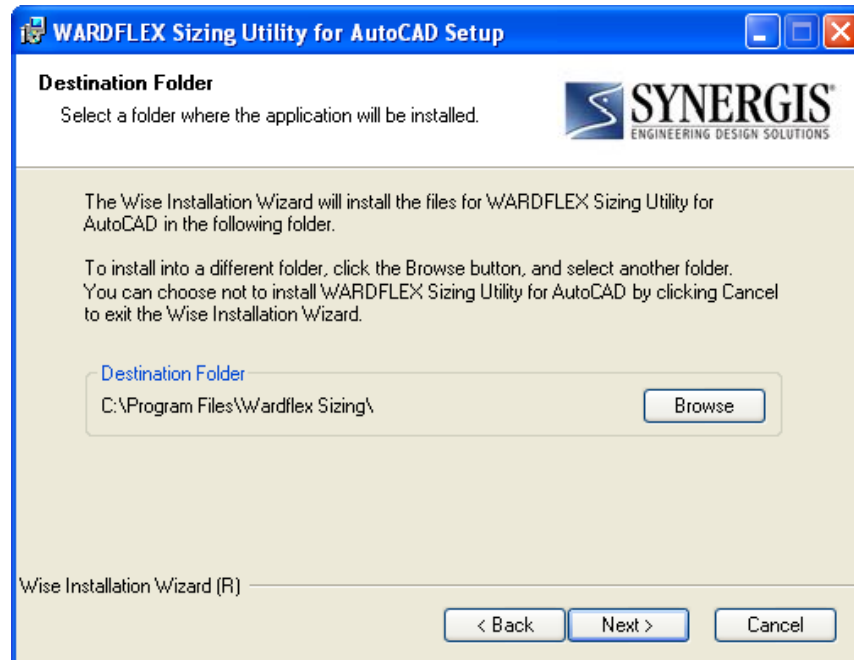
The settings for this application can be installed for the current user or for all users that share this computer. You must have administrator rights to install the settings for all users. Install this application for:

☒ Anyone who uses this computer
☐ Only for me (User)

Wise Installation Wizard (R)

< Back Next > Cancel

- 4) The destination drive and folder where the program will be installed is listed. You can accept the default or choose Browse to specify a different location. If you specify a folder that does not exist the setup program prompts you before creating it.



The dialog box is titled "WARDFLEX Sizing Utility for AutoCAD Setup" and features the SYNERGIS logo. It prompts the user to select a folder where the application will be installed. The text explains that the Wise Installation Wizard will install files for WARDFLEX Sizing Utility for AutoCAD in the following folder. It also provides instructions on how to change the folder using the "Browse" button or how to exit the wizard using the "Cancel" button. The "Destination Folder" field shows "C:\Program Files\Wardflex Sizing\" and a "Browse" button is next to it. At the bottom, there are three buttons: "< Back", "Next >", and "Cancel".

WARDFLEX Sizing Utility for AutoCAD Setup

Destination Folder
Select a folder where the application will be installed.

The Wise Installation Wizard will install the files for WARDFLEX Sizing Utility for AutoCAD in the following folder.

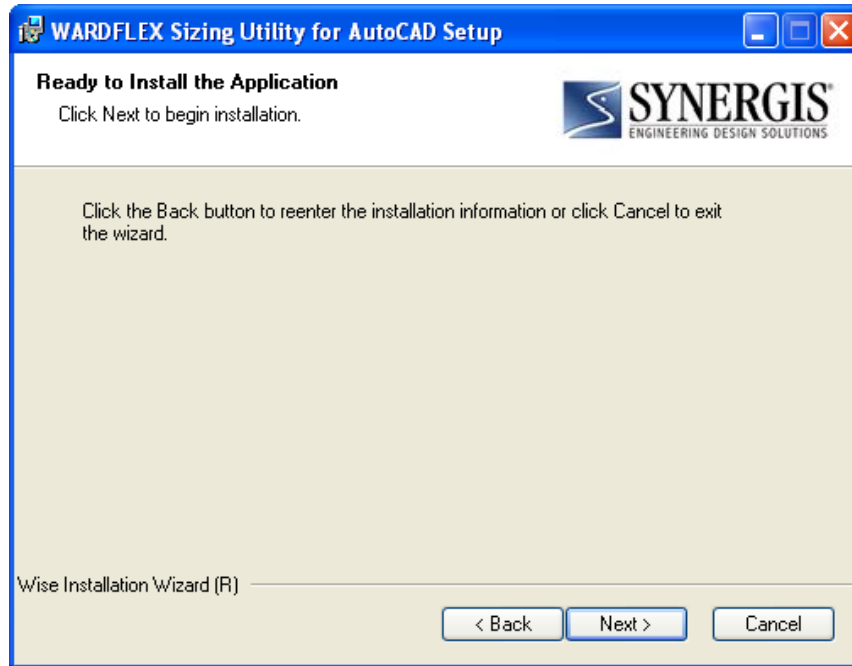
To install into a different folder, click the Browse button, and select another folder. You can choose not to install WARDFLEX Sizing Utility for AutoCAD by clicking Cancel to exit the Wise Installation Wizard.

Destination Folder

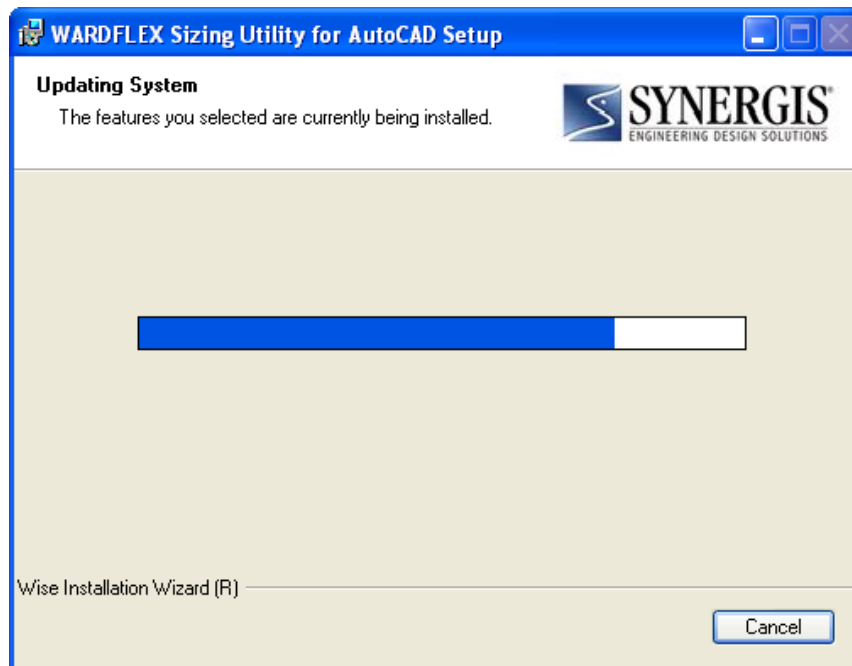
Wise Installation Wizard (R)

< Back Next > Cancel

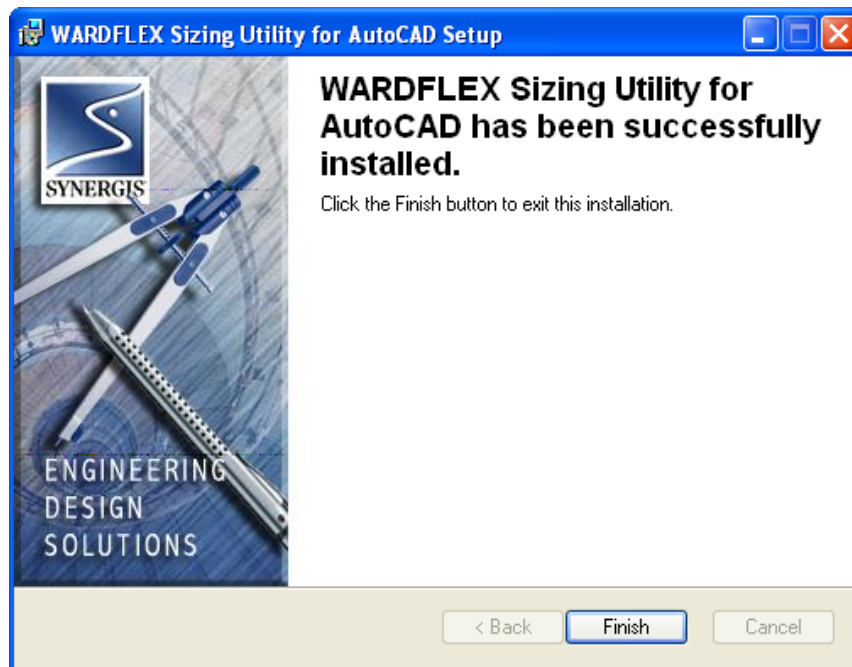
- 5) Everything is ready to install the software, click the next button.



- 6) During the installation, the following progress screen is displayed.

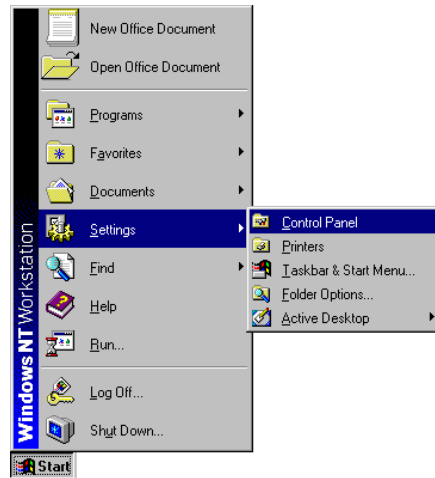


7) When the installation is complete select Finish.



Uninstalling Instructions:

- 1) From the Start menu, choose Settings, then choose Control Panel.



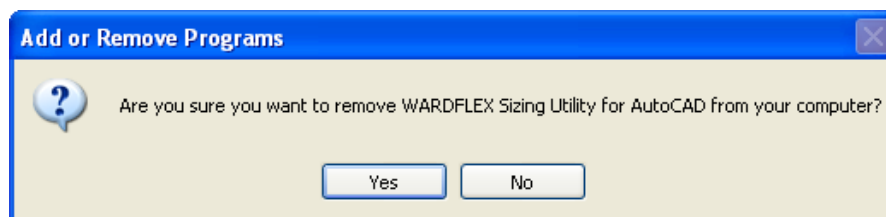
- 2) In the Control Panel, choose Add/Remove Programs.



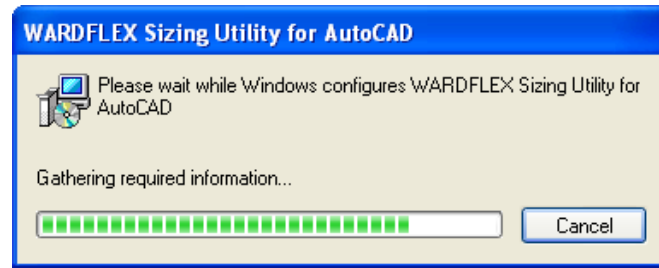
- 3) On the Install/Uninstall tab in the Add/Remove Program Properties dialog box, choose WARDFLEX Sizing Utility for AutoCAD, and click Remove



- 4) Confirm you want to uninstall the application by clicking Yes.



5) During the uninstall, the following progress screens are displayed.



Drawing Requirements:

General

- All entities representing **gas pipe**, **regulators**, **meters** or **appliances** must be on the *WARDFLEX* layer.
- Drawing units are in feet by default.
Drawings with inch units may be used see Mechanical Equipment - **meter**.
- The fuel gas is assumed to be Natural Gas of 0.60 Specific Gravity.

Gas Pipe

- **Gas pipe** must be represented by polylines (Lightweight or 3D) on the *WARDFLEX* layer.
- Endpoints of the **gas pipe** must be coincident with other **gas pipe** endpoints and/or insertion points of blocks representing **appliances**, **regulators** and **meters**.
- Multiple **gas pipes** can “branch” from a single point, thus allowing the representation of tees and manifolds.

Mechanical Equipment

- All mechanical equipment (**appliances**, **regulators**, and **meters**) will be represented by blocks on the *WARDFLEX* layer. Many pre-defined blocks meeting the requirements listed below are included with the utility. (See Appendix A)
- An **appliance** is represented by a block whose insertion point is coincident with a **gas pipe**. This block must have an attribute whose tag is GAS_INPUT_CFH, the value of which is defined by the appliance’s required gas input in cubic feet per hour. This block may also have an attribute whose tag is MIN_INPUT_INWC, the value of which is defined by the appliance’s required minimum input pressure in inches of water column.
- A **meter** is represented by a block whose insertion point is coincident with a **gas pipe**. This block must have an attribute whose tag is GAS_METER_OUTLET_INWC, the value of which is defined by the meter’s gas outlet pressure in inches of water column. This block may also have an attribute whose tag is DWG_UNIT, the value of which is defined by the units of the drawing as either feet or inch; with feet being the default. In multiple meter systems, all meters must have the same value in this attribute. This block may also have an attribute whose tag is MAX_ALLOW_PRESS_DROP, the value of which is defines the maximum allowable pressure drop, in inches of water column, for any one pipe segment. This block may also have an attribute whose tag is GAS_TYPE, the value of which defines the type of gas for the system; Natural Gas or Propane.
- A **regulator** is represented by a block whose insertion point is coincident with a **gas pipe**. This block must have an attribute whose tag is GAS_REG_OUTLET_INWC, the value of which is defined by the regulator’s gas outlet pressure in inches of water column. This block may also have an attribute whose tag is GAS_REG_CAPACITY_CFH, the value of which defines the capacity of the regulator in cubic feet per hour.

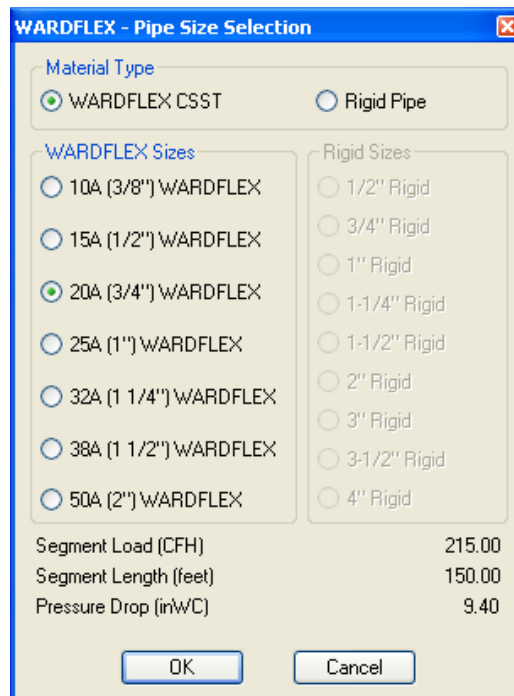
Sizing Utility Operation

General

The full extents of the objects to be analyzed must be visible on the display prior to running the Sizing Utility, i.e. zoom to extents. Leaders will be placed using the currently selected dimension style.

Pre-Selecting Gas Pipe Sizes (WARDFLEX-Mark)

To mark a section of **gas pipe** with a pipe size prior to running the sizing utility, enter *WARDFLEX-Mark* at the AutoCAD command prompt, select the command from the menu or pick it from the toolbar. The sizing utility prompts you to select the pipe to be marked and then provides a dialog of available pipe sizes for your selection.



The dialog box titled "WARDFLEX - Pipe Size Selection" contains the following elements:

- Material Type:** Two radio buttons, "WARDFLEX CSST" (selected) and "Rigid Pipe".
- WARDFLEX Sizes:** A list of radio buttons for various pipe sizes: 10A (3/8") WARDFLEX, 15A (1/2") WARDFLEX, 20A (3/4") WARDFLEX (selected), 25A (1") WARDFLEX, 32A (1 1/4") WARDFLEX, 38A (1 1/2") WARDFLEX, and 50A (2") WARDFLEX.
- Rigid Sizes:** A list of radio buttons for rigid pipe sizes: 1/2" Rigid, 3/4" Rigid, 1" Rigid, 1-1/4" Rigid, 1-1/2" Rigid, 2" Rigid, 3" Rigid, 3-1/2" Rigid, and 4" Rigid.
- Segment Load (CFH):** 215.00
- Segment Length (feet):** 150.00
- Pressure Drop (inW/C):** 9.40
- Buttons:** "OK" and "Cancel".

This is the dialog of available pipe sizes that is displayed during the process of pre-selecting the pipe size. Each time the size of the pipe is changed the pressure drop value is updated. This allows you immediate feedback as to the sizing of the pipe. Selecting, the cancel button closes the dialog and does not pre-select the pipe size for the selected pipe segment. Clicking, the ok button pre-selects the **gas pipe** size and marks it with a leader showing gas pipe length and the selected pipe size. These leaders are placed on layer *WARDFLEX-Sizing*, which is automatically created if it does not already exist.

Gas Pipe Sizing (WARDFLEX-Size)

To determine pressure drops for the gas pipe design, enter *WARDFLEX-Size* at the AutoCAD command prompt. The full extents of the objects to be analyzed must be visible on the display prior to running the utility, i.e. zoom to extents. This utility highlights a section of unmarked **gas pipe** and provides a dialog of available pipe sizes for the user's selection. This dialog is identical to the dialog displayed for the pre-selecting a gas pipe size command, *WARDFLEX-Mark*. This is repeated for each unmarked **gas pipe** on layer *WARDFLEX*. When every section of **gas pipe** has been assigned a size, leaders are placed in the drawing to detail the gas pipe system performance.

- Each **gas pipe** section is marked with a leader detailing the run length in feet, pipe size, total CFH of gas through the section and the resultant pressure drop across that section in inches of water column. These leaders are placed on layer *WARDFLEX-Sizing*, which is automatically created if it does not already exist.
- Each **appliance** is marked with a leader detailing the required appliance gas load in CFH and the final gas pressure at the appliance. These leaders are placed on layer *WARDFLEX-Appliance*, which is automatically created if it does not exist.
- Each **meter** is marked with a leader detailing the outlet gas pressure in inches of water column. These leaders are placed on layer *WARDFLEX-Reg-Meter*, which is automatically created if it does not exist.
- Each **regulator** is marked with a leader detailing the outlet gas pressure in inches of water column, the inlet gas pressure in inches of water column, and the capacity in cubic feet per hour. These leaders will be placed on layer *WARDFLEX-Reg-Meter*, which will be automatically created if it does not exist.

Gas Pipe Sizing with Minimal Leaders (WARDFLEX-Size-M)

To address the issue of cluttered layouts with complex piping designs, an additional sizing utility is available. *WARDFLEX-Size-M* operates the same as *WARDFLEX-Size* except that the resultant leader text contains less information to reduce screen/print clutter. It is recommended that the system be sized to the user's requirements using *WARDFLEX-Size* followed by a single application of *WARDFLEX-Size-M* to supply a clean layout.

- Each **gas pipe** section is marked with a leader detailing the run length in feet and pipe size.
- Each **appliance** is marked with a leader detailing the required appliance gas load in CFH.
- Each **meter** is marked with a leader detailing the outlet gas pressure in inches of water column.
- Each **regulator** is marked with a leader detailing the outlet gas pressure in inches of water column.

Gas Pipe Design Feedback

Certain design constraints that are common to Natural Gas piping systems have been selected and are used to provide feedback to the user. This feedback does not alter the sizing results in any way nor does it guarantee that the system is not undersized; it is provided merely as a visual aid to the user.

Appliance blocks may specify a minimum input pressure. When the sizing utility determines that the input gas pressure at an appliance is below this level the appliance is displayed in the color red.

Regulator blocks may specify a capacity. When the sizing utility sizes the system, if the capacity of a regulator is exceeded, the regulator is displayed in the color red. To correct this issue, change the regulator or its capacity, or re-design the system. The next time the system is sized, the regulator's capacity is checked and its color returned to normal if the capacity is not exceeded.

Meter blocks may specify a maximum allowable pressure drop. If the **gas pipe's** pressure drop is greater than the maximum allowable pressure drop defined by the meter, then the gas pipe is displayed in the color red. To correct this issue, resize the gas pipe with a larger size.

Changing Gas Pipe Sizes

Two methods are available to change the assigned size of a **gas pipe** section after sizing.

1. You can delete the labels associated with the pipe to be changed and re-run the *WARDFLEX-Size* utility. Using this method you are prompted to select gas pipe sizes using the dialog.
2. You can also use the *WARDFLEX-Mark* command and select the pipe to be changed.

Sizing LPG Systems

The sizing utility can be used to size LPG systems, using one of the two methods described below. Also, you should be aware that summation sizing of LPG appliances require 10.5"WC gas pressure at the appliance, as opposed to the 5"WC for Natural Gas Appliances.

1. The appliance gas input ratings must be converted from BTU (LPG) to CFH (NG) using the equation below. This converted gas input rating is entered in the block for its respective appliance.

$$CFH_{NG} = \frac{BTU_{LPG}}{1535}$$

(For LPG with a 1.52 Specific Gravity & 2516 BTU per CFH)

2. Meter blocks may specify a gas type. Change the gas type in the meter to 'Propane'. Enter all appliance gas input ratings in BTU (LPG); the utility automatically calculates the pressure drop using the above conversion formula.

Appendix A

AutoCAD Menu

Menu Filename: WARDFLEX.CUI
Menu group: WARDFLEX
Menu Hierarchy:

Wardflex

Set Block Scale Factor

Insert Domestic Meter

Insert Industrial Meter

Appliances

Cook top

Dryer

Fireplace

Furnace

Generator

Generic

Grill

Hot Water Heater

Hot Water Heater – Domestic

IR Tube Heater – 20

IR Tube Heater – 30

IR Tube Heater – 40

IR Tube Heater – 50

IR Tube Heater – 60

IR Tube Heater – 70

Roof top unit – Large

Roof top unit – Small

Unit Heater

Regulators

Regulator

Regulator 3253 – 250 CFH

Regulator 3255 – 500 CFH

Regulator 3257 – 1,000 CFH

Mark Pipe Segment

Size Drawing

Size Drawing - Minimal

About Wardflex sizing for AutoCAD

The 'Set Block Scale Factor' menu pick allows you to specify the scale factor used when a Wardflex block is inserted into the drawing. The default scale factor is 1.0.

The 'Insert Domestic Meter' and 'Insert Industrial Meter' menu picks allow you to insert the predefined meter blocks. These blocks are inserted using the scale factor assigned using the 'Set Block Scale Factor' command.

All the items under the 'Appliances' sub-menu allow you to insert various types of predefined appliance blocks. These blocks are inserted using the scale factor assigned using the 'Set Block Scale Factor' command.

All the items under the 'Regulators' sub-menu allow you to insert various types of predefined appliance blocks. These blocks are inserted using the scale factor assigned using the 'Set Block Scale Factor' command.

The 'Mark Pipe Segment' menu pick allows you to pre-select a gas pipe size for a polyline.

The 'Size Drawing' menu pick allows you to size the entire drawing.

The 'Size Drawing – Minimal' menu pick allows you to size the entire drawing; however it only labels items with minimal information.

The 'About Wardflex sizing for AutoCAD' menu pick displays the about dialog for the sizing utility.

AutoCAD Toolbar



Button – Left to Right
Mark Pipe Segment
Size Drawing
Size Drawing - Minimal

AutoCAD Commands

Command	Action
WARDFLEX-Mark	Marks a polyline with a gas pipe size
WARDFLEX-Size	Sizes the drawing and labels all gas pipe entities
WARDFLEX-Size-M	Sizes the drawing and labels all gas pipe entities with minimal information within the labels

Drawing Layers

Name	Color	Linetype	Lineweight	Description
Wardflex	Yellow	Continuous	Default	Used for piping and blocks
Wardflex-Appliance	Blue	Continuous	Default	Used for appliance labels
Wardflex-Reg-Meter	Cyan	Continuous	Default	Used for regulator and meter labels
Wardflex-Sizing	Green	Continuous	Default	Used for piping labels

Appendix B

Disclaimer

ATTENTION

1. The installation of WARDFLEX Flexible Gas piping must be performed by a qualified installer who has successfully completed the WARDFLEX training program. The installer must also meet all qualifications required by the state and/or local administrative authority administering the provisions of the code where the gas piping is installed.
2. WARDFLEX must be installed only by qualified installers who have passed WARD MANUFACTURING'S training program. WARDFLEX training may augment but does not supersede any state or local regulations regarding installer certifications.
3. All piping systems using WARDFLEX shall be designed and installed according to the requirements Ward Manufacturing's Design and Installation Guide.
4. Only WARDFLEX components may be used in the system. Components from other systems are not interchangeable. Only components supplied or specified by WARD shall be used.
5. Installation shall be in accordance with local codes, or in their absence, in accordance with the National Fuel Gas Code ANSI Z223.1 in the USA, and CAN/CGA - B149.1 & B149.2 in Canada. In cases where the requirements of this guide are in conflict with the local code, the local code must take precedence, unless the local authority having jurisdiction approves a variance, or change.

USER WARNINGS (see section 1.8 of ANSI LC 1-CSA 6.26-2005)

The use of fuel gas can be dangerous. Special attention must be given to the proper design, installation, testing and application of the gas piping system. Sound engineering practices and principles must be exercised, as well as diligent adherence to the proper installation procedures to insure the safe operation of the piping system. **All installed systems must pass customary installation inspections by the local building official having authority prior to being placed into service.**

This document is intended to provide the user with general guidance when designing and installing a WARDFLEX corrugated stainless steel tubing (WARDFLEX) gas system. Its use with any other gas tubing system is inappropriate and may result in serious bodily injury and property damage. Where local gas or building codes impose greater requirements than this document, you should adhere to the local code requirements.

Performance of accessory devices, such as pressure regulators and shut off valves, should be reconfirmed by contacting the accessory device manufacturer and receiving the latest technical data on sizing, installation and performance.

Improper installation methods or procedures could lead to accidents such as explosions, fires, gas poisoning, asphyxiation, etc. **This system shall be installed with strict adherence to this guide as well as local building codes.** All installed systems must pass installation inspections by the authorized local building official prior to being placed in service. Ward Manufacturing, Inc. shall have no responsibility for any misinterpretation of the information contained in this guide or any improper installation or repair work or other deviation from procedures recommended in this manual, whether pursuant to local building codes or engineering specifications or otherwise.

Only those components designed and made for or specified for use in this system shall be used in its installation.

WARDFLEX components and tubing shall not be used with other corrugated stainless steel tubing system components from other manufacturers.

WARDFLEX shall be used only in gas piping systems where the operating gas pressure does not exceed 25 PSI. Accessories for systems shall be rated for the operating gas pressure used. Thus, for example, accessories for 25 PSI systems shall be rated for 25 PSI service. Performance of accessory devices, such as pressure regulators and shut-off valves should be reconfirmed by contacting the accessory device manufacturer and receiving the latest technical data on sizing, installation and performance.

Certain chemicals are corrosive to WARDFLEX. See Section 4.1 of the current manual for more specific information on this topic.

A gas delivery system consisting of WARDFLEX offers significant advantages over other gas delivery systems because of its wall dimensions and corrugated design. In contrast to rigid steel pipe, WARDFLEX does not require intermediate joints in

most installations because the tubing is capable of being installed in one continuous run, reducing not only the total number of joints, but also the potential for leaks at joints. WARDFLEX's flexibility also affords more installation options because an installer can avoid existing obstacles, and it eliminates the repetitive measuring, cutting, threading and joint assembly that are common with installation of rigid steel piping systems. WARDFLEX's flexibility offers even further safety advantages in geographic areas that are prone to seismic activity because the tubing provides greater flexibility to withstand certain movement of the ground or structural shifts.

Although WARDFLEX provides significant advantages over more rigid gas delivery systems, its wall dimensions may make it more likely than steel pipe to be punctured by a nail or other sharp objects, or damaged by other extraordinary forces such as a lightning strike, depending on the circumstances. It is well known that lightning is a highly destructive force. Therefore, the user must ensure that the system is properly bonded and grounded. In order to maximize protection of the entire structure from lightning damage, the user should consider installation of a lightning protection system per NFPA 780 and other standards, particularly in areas prone to lightning. Note that lightning protection systems as set forth in NFPA 780 and/or other standards go beyond the scope of this manual.

Users of WARDFLEX should consider all of the limitations and benefits of WARDFLEX for their particular situation. Installers shall provide building owners and electricians with the required WARDFLEX Information Card discussing these limitations and benefits.

This document is intended to aid the user in the design, installation and testing of WARDFLEX Corrugated Stainless Steel Tubing (WARDFLEX) to distribute fuel gas in residential housing units and commercial structures. It would be impossible for this guideline to anticipate and cover every possible variation in housing configurations and construction styles, appliance loads and local restrictions. Therefore, there may be applications which are not covered in this guide. For applications beyond the scope of this guide, contact Ward Manufacturing's Engineering Department. The techniques included within this guide are recommended practice for generic applications. These practices must be reviewed for compliance with all applicable local fuel gas and building codes. Accordingly, where local gas or building codes impose greater requirements than this manual, you should adhere to the local code requirements. This system and related components should be used only as fuel gas piping where the operating gas pressure does not exceed 25 PSI.

In CANADA the installation of CSA-CGA certified WARDFLEX flexible gas tubing for natural and propane gas piping systems must be in accordance with the applicable sections of the current CAN/CGA-B 149.1 or .2 installation codes, and the requirements or codes of the local utility or other authority having jurisdiction. All gas components used in conjunction with the gas tubing must be certified for use in Canada.