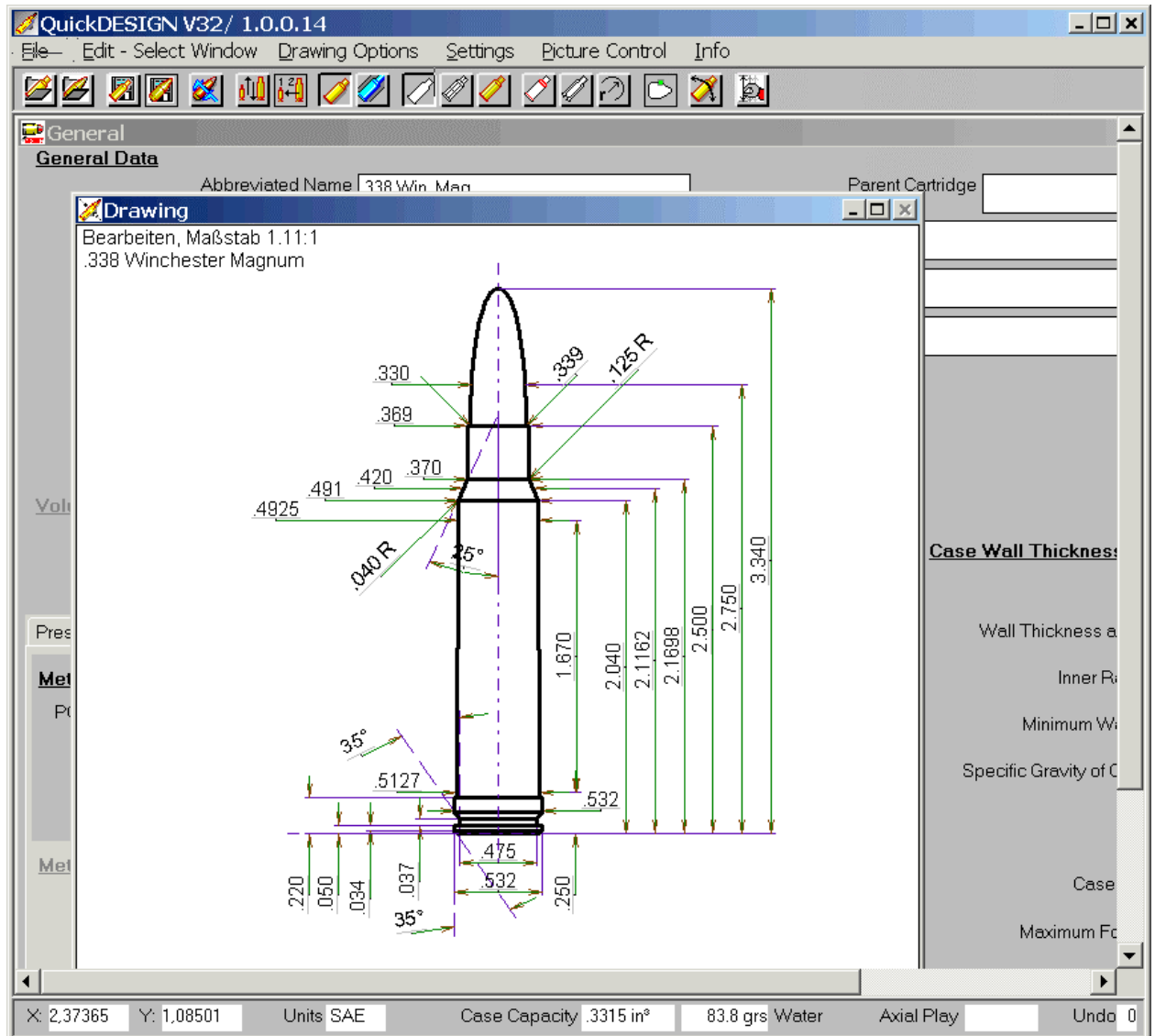


QuickDESIGN

USER'S GUIDE



Cartridge and Chamber Designer and Viewer Program

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Introduction

QuickDESIGN program allows the user to edit, check and view dimensions of cartridges and their chambers.

Standard-, non-standard- or wildcat cartridges and suitable chambers may be entered from scratch, edited or one may form a cartridge by using an already existing parent design.

Case capacity, case weight and collisions (interference of dimensions) between cartridge and chamber will be calculated and checked.

Restrictions: Not all possible designs of ammunition may be drawn properly. Elliptical shoulders, folded ammunition, caseless ammunition and special industrial designs are beyond scope of this program.

Cartridges can be viewed or printed in form of outline sketch, wireframe drawing or solid model. Included is a bullet shape edit function. The user may generate a bullet model approximating the actual shape of the bullet, weight and appearance. This virtual bullet can be seated in a case by varying the overall length of cartridge. Clearance from rifling and available case capacity is checked by the program as well as bullet properties like form factor, sectional density. Drag function and B.C. will also be estimated.

You may transfer necessary data of an actual cartridge design made by *QuickDESIGN* to *QuickLOAD* interior ballistics program.

Drawing metrics take pattern from CIP or ANSI / SAAMI standards. There are two civilian regulating bodies providing standards for cartridges and weapons.

In the United States of America, the SAAMI (**S**porting **A**rms and **A**mmunition **M**anufacturer's Institute, Inc., 555 Danbury Road, Wilton, Connecticut 06897) publishes and sponsors standards approved by ANSI (American National Standards Institute) as *voluntary* industry performance standards for the use by commercial manufacturers.

The C.I.P. (**C**ommission **I**nternationale **P**ermanente Pour l'Epreuve des Armes à Feu portatives, 45, Rue Fond-des-Taves, 4000 Liège, Belgium) sets the standards for civil ammunition and weapons for member countries. These standards are *mandatory* (like a law, or forced into local law) in countries having acknowledged the CIP Standard. Every member acknowledges products from other members as being safe according to their standards. Members are Austria, Belgium, Chili, Czech Republic, Finland, France, Germany, Hungary, Italy, Russian Federation, Spain, Slovakia and United Kingdom (naming may not be complete). Beside other documentations concerning techniques of ammunition- and gun production, the CIP publishes the TDCC: the tables of maximal dimensions of cartridges and minimal dimensions of chambers. Data of TDCC can be used with this program but are property of CIP. The same is true for SAAMI data.

Therefore, cartridge data contained in *QuickDESIGN* is derived from public sources like tables of cartridge and chamber dimensions in German Gun Law or other similar official sources, which contain necessary data. Some missing data have been calculated with this program. The drawback is that German Gun Law's Appendix does not keep track of actual decisions and revisions of CIP or SAAMI data. So data may not reflect the latest corrections and decisions in standards.

The declaration of dimensions and their symbols in *QuickDESIGN* follows CIP standard symbols. When the user will create a SAAMI-like drawing the program provides a numbering system for symbols. Each dimension got a unique number (description in Appendix) like in SAAMI drawings, but the numbering is not in accordance with actual SAAMI data sheets, because SAAMI changes the order of numbering from time to time.

Note: Military- and governmental standards for guns and ammunition can differ significantly from civilian standards, especially in pressures, bullet diameter, throat- and headspace dimensions. So firing military ammunition in civil weapons and vice-versa can result in an unsafe condition.

Installation of *QuickDESIGN*

The software will run and has been tested on IBM-PC compatible computers under the operating systems Microsoft® Windows® 98, ME, NT4.0®SP4, 2000 and XP, versions and releases dated before December 2002.

It is assumed the program will run also under newer releases and versions of Microsoft® Windows®, but it cannot be guaranteed.

Recommended screen resolution is 1024 x 768 and higher.

The installation program will automatically start after inserting the CD into the drive when the autostart feature for your CD-Rom drive is enabled.

To install the software manually run the 'SETUP.EXE' program from the root directory of the CD. In addition, follow the instructions on screen. This setup program will invoke the program installation for *QuickDESIGN*.

You will be asked for a destination directory where you want to install *QuickDESIGN*. If you have already installed Interior Ballistics Program *QuickLOAD* you will have the opportunity to tell the setup program where to find *QuickLOAD* ini- file. Setup program will then install necessary settings to *QuickLOAD* enabling you to retrieve data provided by *QuickDESIGN*.

You may uninstall the program by selecting *My Computer* icon, *Control Panel* icon, *Software* icon. Search there for *QuickDESIGN* entry to uninstall the program. Files you may have created meanwhile which are not known to the uninstaller program cannot be removed.

To read this manual you must have the Acrobat® Reader ready installed. The actual version of Adobe® Acrobat® Reader you will find on ***QuickDESIGN*** Setup-CD in folder Adobe\.
(Adobe, the Adobe logo, Acrobat and Reader are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States and/or other countries.)

Note:

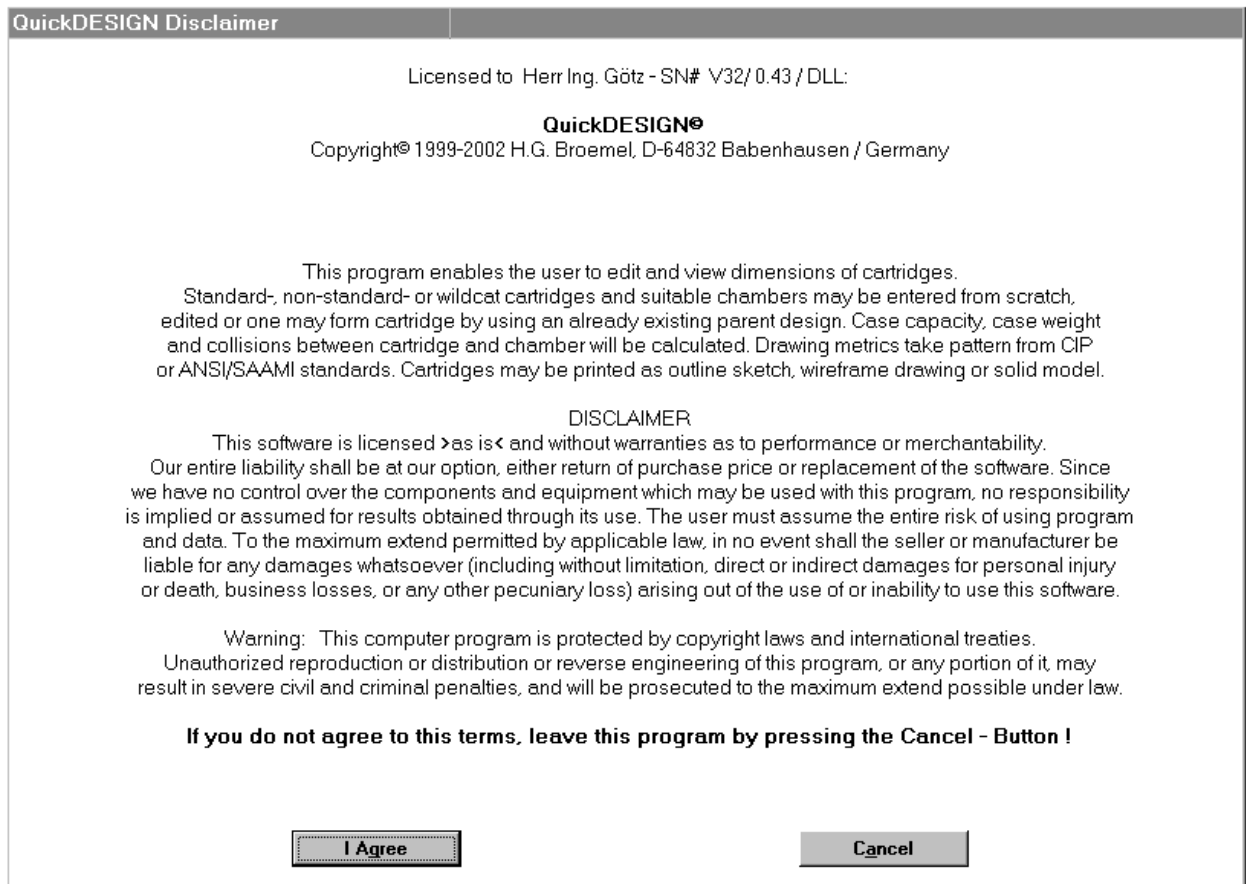
The program is registered to the computer on which it was first installed by saving a unique equipment ID. Changing the motherboard or CPU may cause a re-installation of the program.

Please save your cartridge designs from time to time to a separate backup medium.

Please do not copy the *QuickDESIGN* CD to prevent software piracy.

The **DEMO** version of *QuickDESIGN* cannot save any data, the graphic toolbox is disabled.

Disclaimer Window



Picture 1 : Disclaimer Window

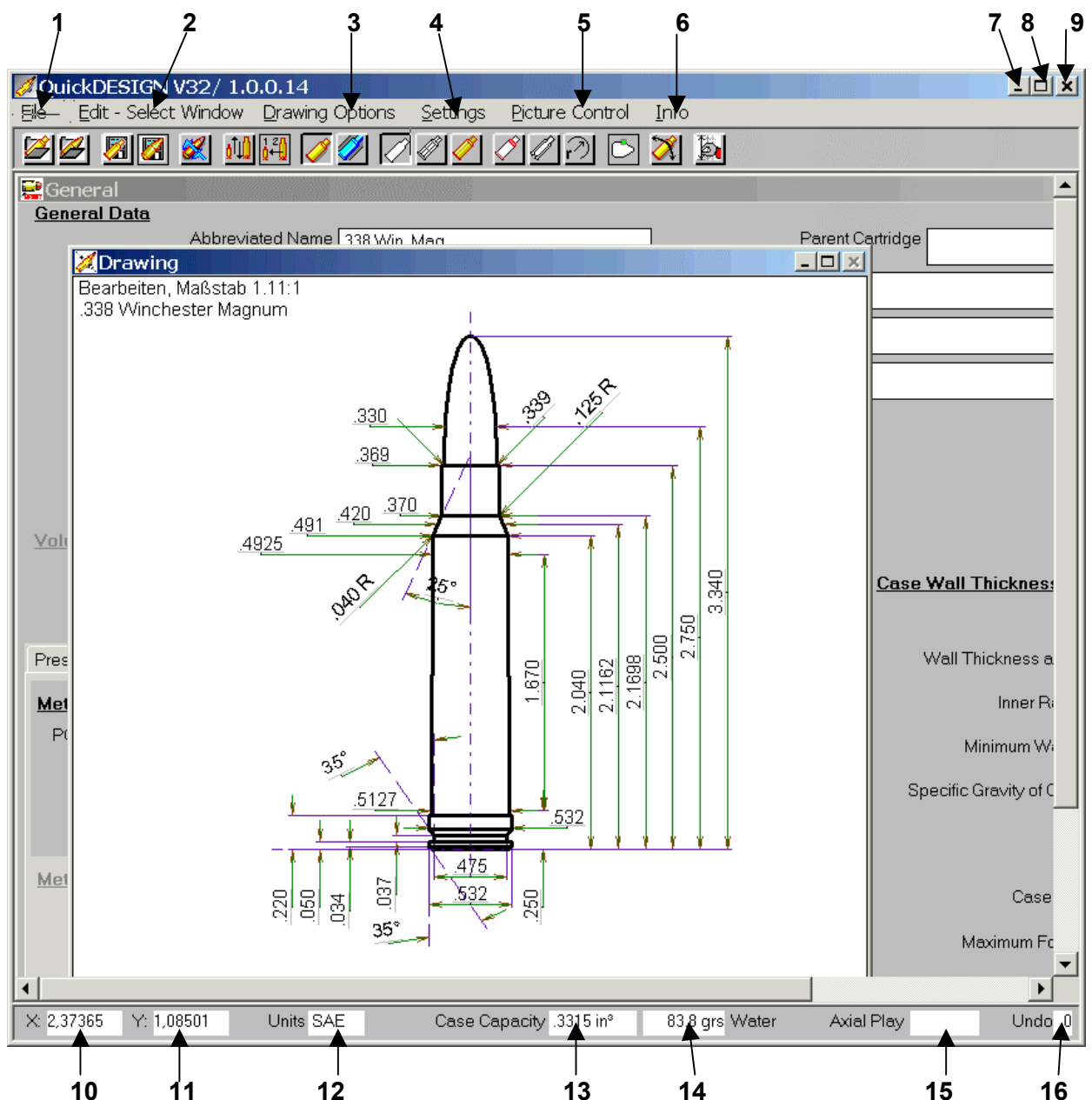
The first window comes up immediately after starting *QuickDESIGN*.

This window appears during loading of program and program's data.

The buttons "*I Agree*" and "*Cancel*" appear after all necessary loading of data has been completed.

Pressing the *Cancel* button terminates the program immediately, pressing the *I Agree* button you agree to the terms written in this window. Program's main window will open.

QuickDESIGN Main Menu



Picture 2 : Main Window Menu Items and Status Bar

The main window contains all forms belonging to the program. On top of the window, you will find the main menu bar containing all necessary menu items to work with the program. Directly below the menu bar there is an icon bar with icon buttons for most frequently used commands within the menu. On bottom of the main window, there is a status bar with information about the cartridge in use.

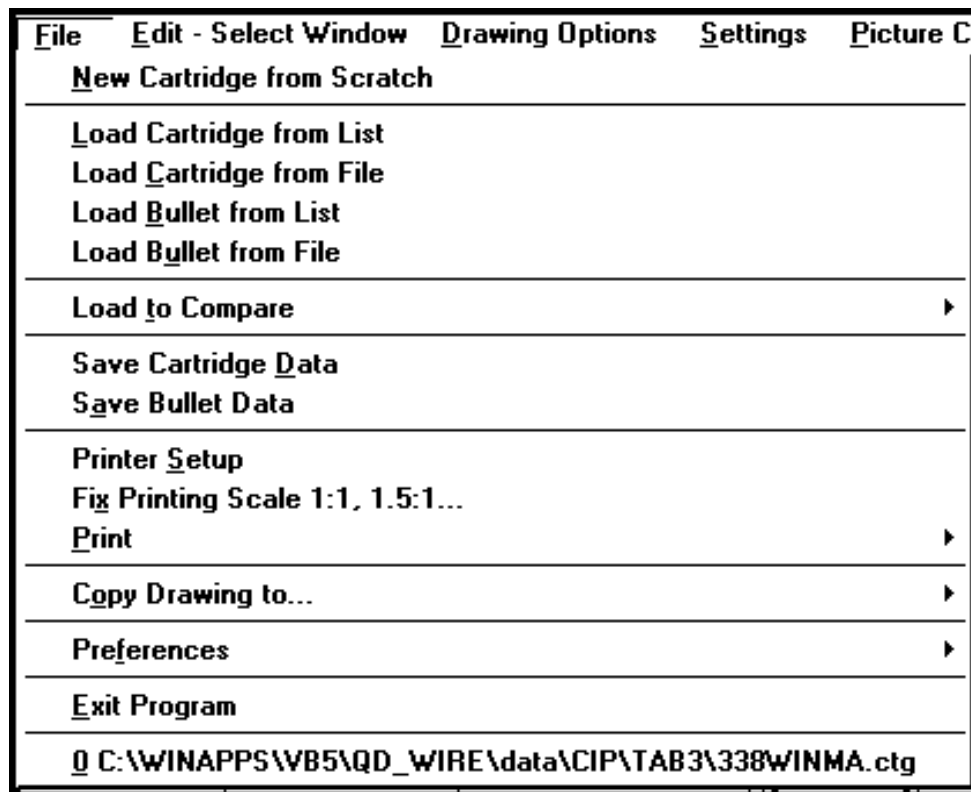
Within the main window you will find a form containing general data for the selected cartridge, a form containing cartridge dimensions, a form containing chamber dimensions and a graphic window displaying cartridge, chamber or both as selected by the user.

If the main window is smaller than the contained forms, slider bars appear at the right side and bottom of main window to pan forms inside main window. Main window should be enlarged to full screen size for editing data. Best view is obtained with screen resolution larger than 1024x768. The contained forms and the font size can be resized by menu command, so you can fit the appearance of forms to your monitor's screen size.

On the following pages the **numbered items** are described:





1. Menu File

The *File* menu contains a sub menu:

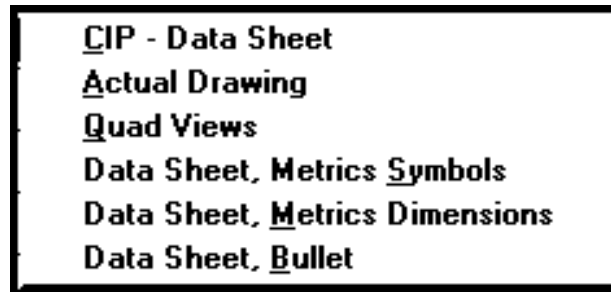


Picture 3 : File Menu

Meaning of the menu items:

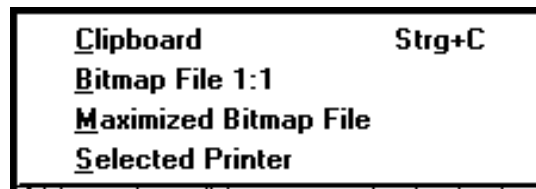
- ◆ **New Cartridge from Scratch:** all forms are cleared, numerical entries set to zero and text entries are emptied. User must fill in all forms completely.
- ◆ **Load Cartridge from List:** Open *cartridge select list* window to select one of the available cartridge designs by cartridge name, origin, date of revision or file name.
 Symbolbar Icon *Load Cartridge from List*
- ◆ **Load Cartridge from File:** Open file open window to select a cartridge data file located in positions on disk that differ from programs standard data directories.
- ◆ **Load Bullet from List:** Open bullet select list window to select one of the available bullet designs by bullet name and type.
 Symbolbar Icon *Load Bullet from List*
- ◆ **Load Bullet from File:** Open file open window to select a bullet data file located in positions on disk that differ from programs standard data directories.
- ◆ **Load to Compare:** Opens submenu to allow user to load separately a different chamber and a different cartridge case to compare visually differences between both dimensions. When cartridge is larger than chamber the program calculates collisions between both designs.
- ◆ **Save Cartridge Data:** Opens file save window allowing user to save cartridge design under unique name.
 Symbol Bar Icon *Save Cartridge Data*
- ◆ **Save Bullet Data:** Opens file save window allowing user to save bullet design under unique name.
 Symbol Bar Icon *Save Bullet Data*

- ◆ **Printer Setup:** Opens printer dialog window to select printer and setup printer properties.
- ◆ **Fix Printing Scale 1:1, 1:1,5...** Select this entry to force printer to print cartridge picture on data sheets using fixed scale. If window size on paper is smaller than cartridge use next best fitting scale factor like 1:1,5, 1:2, 1:2,5, 1:3 and so on.
- ◆ **Print:** Opens printing submenu. User may select from following options:



Picture 4 : Menu Print

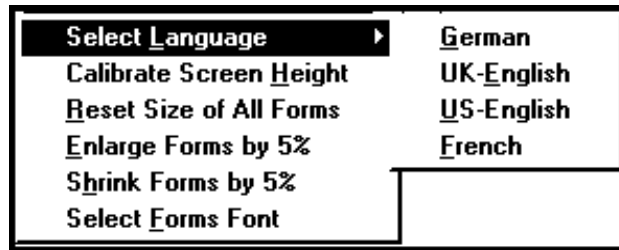
- **CIP- alike Data Sheet:** Print datasheet similar to CIP specs. When *Metrics Layout Scheme* is set to *SAAMI* this menu item is disabled.
- **Actual Drawing:** Print drawing as seen on screen.
- **Quad Views:** Print sheet with four pictures: Cartridge with dimensions, chamber with dimensions, chambered cartridge rendered in color, a chambered cartridge outline drawing showing possible collisions/interference between chamber and cartridge if improper designed.
- **Print Datasheet, Metrics Symbols:** Print a datasheet showing symbols of metrics rather than dimensions in metrics.
- **Print Datasheet, Metrics Dimensions:** Print a datasheet showing dimensions in metrics.
- ◆ **Copy Drawing to:** Opens submenu for miscellaneous printing or output options:



Picture 5 : Copy Drawing To

- **Clipboard:** Copies entire drawing to clipboard to use picture within other applications.
- **Bitmap File 1:1:** Opens file save window allowing user to save drawing in a Bitmap (.bmp) file. Saved picture has same size as on screen.
- **Maximized Bitmap File:** Opens file save window allowing user to save drawing in a Bitmap (.bmp) file. Saved picture has approximately a 10 times magnified size as seen on screen.
- **Printer:** Prints bitmap image of drawing on printer.

- ◆ **Preferences:** Opens a submenu to setup language and appearance of main window.



Picture 6 : Preferences

- **Select Language:** Opens a submenu to select different language interfaces:
 - **German**
 - **UK-English**, CIP definitions differ somewhat in cartridge naming from US-English
 - **US-English**, consider US case neck to UK case collar
 - **French**
- **Calibrate Screen Height:** User should measure total screen height and enter this value. This is to display correct item dimensions. For example if user selects 1:1 picture scale, one can compare actual cartridge by holding it near the picture on screen. If user makes adjustments to screen size in graphics driver software or within monitor menu settings this calibration should be updated.
- **Reset Size of all Forms:** Setting dimension of all forms to standard values.
- **Enlarge Forms by 5%:** If forms are too small on screen enlarge them.
- **Shrink Forms by 5%:** If forms are too large, shrink them.
- **Select Forms Font:** Select a font for good readability of form's text. User may select name and size. Standard font is MS Sans Serif.
- ◆ **Exit Program:** Terminate program, close all windows.
- ◆ **0 to 9:** List of last recent files if available. Number may be altered in *qdesign.ini*, section *[files] recentfilemax=20*

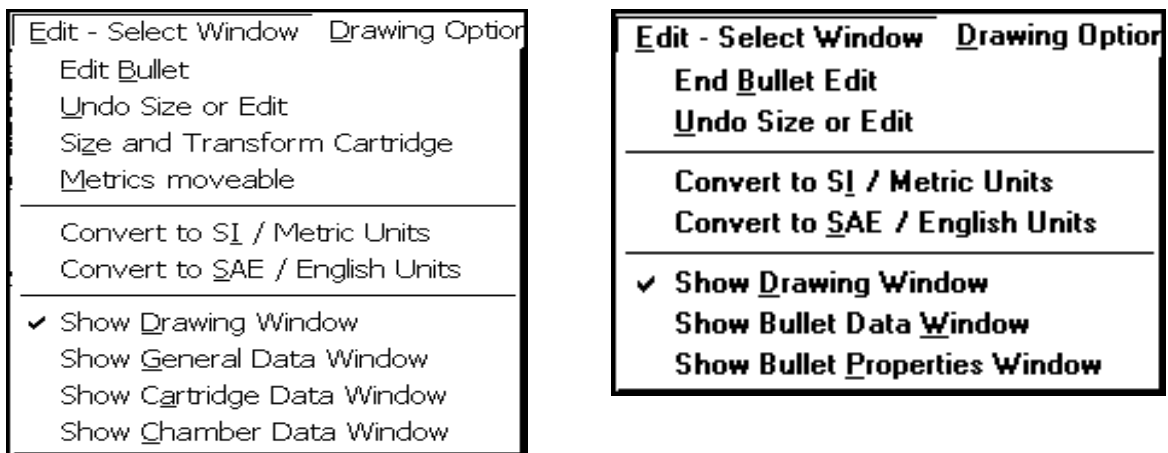
Fitting QuickDESIGN Forms and Fonts to Your Monitor

Upon initial entry into the main *QuickDESIGN* window, the form windows might not align and fit properly in the display area. To achieve a proper fit of the *QuickDESIGN* form windows (each is completely visible within parent window follow this procedure:

- ◆ Maximize Program's main window = select Icon 8 of main windows' control box.
 - When forms are too large to be fully seen inside main window:
 - Single-click to **Shrink Forms by 5%** in the menu *File...Preferences*.
 - When forms are too small to work properly with them:
 - Single-click to **Enlarge Forms by 5%** in menu *File...Preferences*.
- ◆ If the text on forms is too large or too small for good legibility:
 - Single-click to **Select Forms Font** in menu *File...Preferences*.
 - Use standard Windows procedures to select font, style and size.





For those with limited visual acuity, we recommend increasing usable screen area by invoking the *Taskbar Auto Hide* feature: Position mouse cursor over free area of taskbar and single-click right mouse button, select *Properties*, *Auto Hide*, *OK*. Taskbar hides until mouse is moved to screen edge.

2. Menu Edit-Select Window



Picture 7 : Edit-Select Window

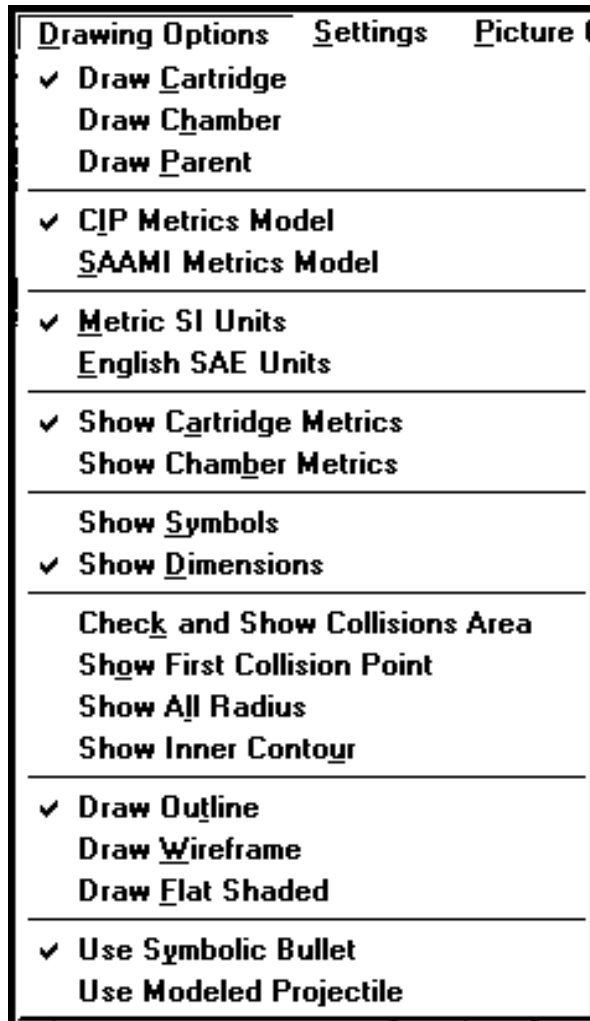
Meaning of the menu items:

- ♦ **Edit Bullet:** Switch to Bullet Edit mode. Forms for declaration of cartridge and chamber are closed. Entry form defining bullet data is opened. Menu switches from *Edit Bullet* to *End Bullet Edit*.
 Symbol Bar Icon *Edit Bullet*
- ♦ **Undo Size or Edit:** When the user has made changes to actual cartridge or bullet data he can “undo” the last nine changes done before. Undoing from step 1 to step 0 means to recover to the state of beginning regardless how many changes have been applied in this work session.

- ♦ **Size and Transform Cartridge:** Opens the *Size Cartridge* window. See Sizing Cartridges under Support of *QuickDESIGN*.
 Symbol Bar Icon *Size and Transform Cartridge*
- ♦ **Metrics moveable:** Enables/disables the option to manually replace dimensioning. See Manually Repositioning of Dimensionings.
 Symbol Bar Icon *Metrics moveable*
- ♦ **Convert to SI / Metric Units:** When the cartridge data have been originally entered in English or SAE units, the program calculates Metric units when activating this menu item. Then the user may switch between English or Metric metrics in the drawing or printing. Both units are kept in Cartridge data record simultaneously. Please check calculated units for proper value (according to standard) of least significant decimal.
- ♦ **Convert to SAE / English Units:** When the cartridge data have been originally entered in Metric units, the program calculates English or SAE units when activating this menu item. Then the user may switch between English or Metric metrics in the drawing or printing. Both units are kept in Cartridge data record simultaneously. Please check calculated units for proper value (according to standard) of least significant decimal.
- ♦ **Show Drawing Window:** Places the drawing window on top of all other windows.
- ♦ **Show General Data Window:** Places the general data form window on top of all other windows.
- ♦ **Show Cartridge Data Window:** Places the cartridge data form window on top of all other windows.
- ♦ **Show Chamber Data Window:** Places the chamber data form window on top of all other windows.

In case of bullet edit mode menu entries change to:

- ♦ **Show Bullet Data Window:** Places the bullet data form window on top of all other windows.
- ♦ **Show Bullet Properties Window:** Places the bullet properties window on top of all other windows.

3. Menu Drawing Options



Picture 8 : Drawing Options

Meaning of the menu items:

- ♦ **Draw Cartridge:** When checked, cartridge case will be displayed in drawing window.









Symbol Bar Icon *Draw Cartridge*

- ♦ **Draw Chamber:** When checked, chamber will be displayed in drawing window.

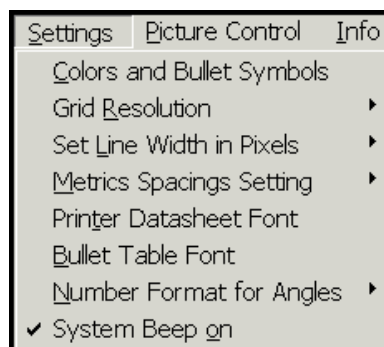


Symbol Bar Icon *Draw Chamber*

- ♦ **Draw Parent:** When checked, parent cartridge will be displayed in drawing window too.
- ♦ **CIP Metrics Model:** When checked, Metrics will be drawn according to CIP standard.
- ♦ **SAAMI Metrics Model:** When checked, Metrics will be drawn according to SAAMI standard.
- ♦ **Metric SI Units:** Units in drawing, forms and printer are metric or SI units (System International), Millimeters or Bars.
- ♦ **English SAE Units:** Units in drawing, forms and printer are English or SAE units, Inches or PSI.

- ♦ **Show Cartridge Metrics:** Regardless chamber or case drawing, cartridge metrics are displayed.
- ♦ **Show Chamber Metrics:** Regardless chamber or case drawing, chamber metrics are displayed.
- ♦ **Show Symbols:** Instead of dimensions, symbols are displayed in metrics on drawing.
- ♦ **Show Dimensions:** Instead of symbols, dimensions are displayed in metrics on drawing.
- ♦ **Check and Show Collisions Area:** When checked, cartridge and chamber is checked for possible collisions and interfering dimensions. Areas overlapping are marked with red (default) lines (color is user selectable).
 Symbol Bar Icon *Check and Show Collisions Area*
- ♦ **Show First Collision Point:** When checked, the first point of collision (improper dimensioned design only) of cartridge with chamber is marked by cross and circle.
- ♦ **Show all Radiuses:** When checked, existing shoulder radius is drawn by forming arcs consisting of small lines. In addition, a radius is formed at intersection of inner case wall with web. Remark: Shotgun shells, as well as blank cartridges or rimfire cartridges may show a rounded rim when option is enabled.
 Symbol Bar Icon *Show all Radiuses*
- ♦ **Show inner Contour:** When checked and drawing in *Outline* or *Wireframe* mode, the inner contour of the case is drawn. Option must be checked for calculating *case capacity*.
 Symbol Bar Icon *Show inner Contour*
- ♦ **Draw Outline:** When checked, drawing is done in outline mode. Only contour of cartridge, chamber or bullet appears.
 Symbol Bar Icon *Draw Outline*
- ♦ **Draw Wireframe:** When checked, drawing is done in wireframe mode. Drawing is represented by a mesh.
 Symbol Bar Icon *Draw Wireframe*
- ♦ **Draw Flat Shaded:** When checked, drawing is done in wireframe mode with the mesh filled with rendered colors.
 Symbol Bar Icon *Draw Flat Shaded*
- ♦ **Use Symbolic Bullet:** When checked, a symbolic bullet is placed on the cartridge case (user selectable shape).
- ♦ **Use Modeled Projectile:** When existent, a bullet modeled under *Bullet Edit* is displayed instead of symbolic bullet. Useable case capacity is displayed on drawing.

4. Menu Settings

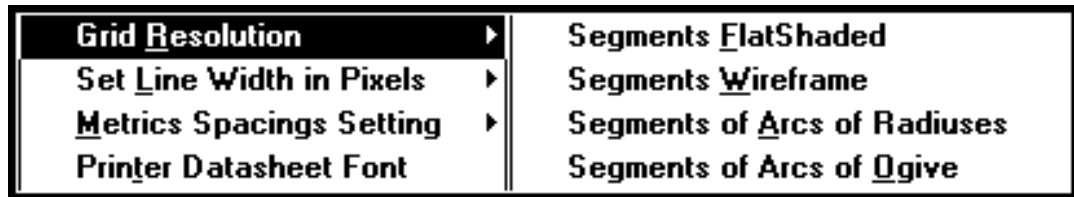


Picture 9 : Menu Settings

Meaning of the menu items:

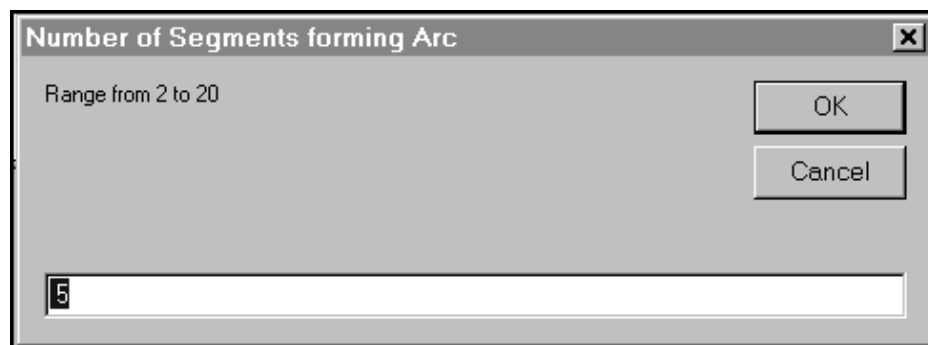
- ♦ **Colors and Bullet Symbols:** Opens window Colors and Bullet Shape. User may select different colors for outline, metrics, rendering and text. In addition, various bullet shapes are available (See Colors and Bullet Symbols Window).

- ◆ **Grid Resolution:** Opens submenu:



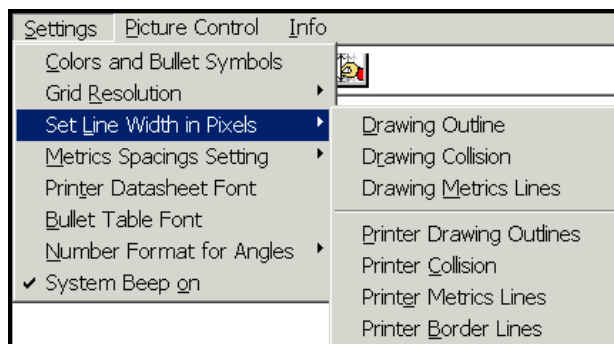
Picture 10 : Menu Grid Resolution

- **Segments Flat Shaded:** Opens entry box where user specifies the number of slices of cartridge body of flat shaded drawing on screen.
- **Segments Wireframe:** Opens entry box where user specifies number of slices of cartridge body for wireframe drawing.
- **Segments of Arcsof Radiuses:** Opens entry box. Arcs defined by radiuses have to be drawn as small line segments.
- **Segments of Arcs of Ogive:** Opens entry box. The ogive of a bullet has to be approximated by some line segments. Sample entry box:



Picture 11 : Entry Box for single Values

- ◆ **Set Line Width in Pixels:** Opens submenu to specify drawing of lines.



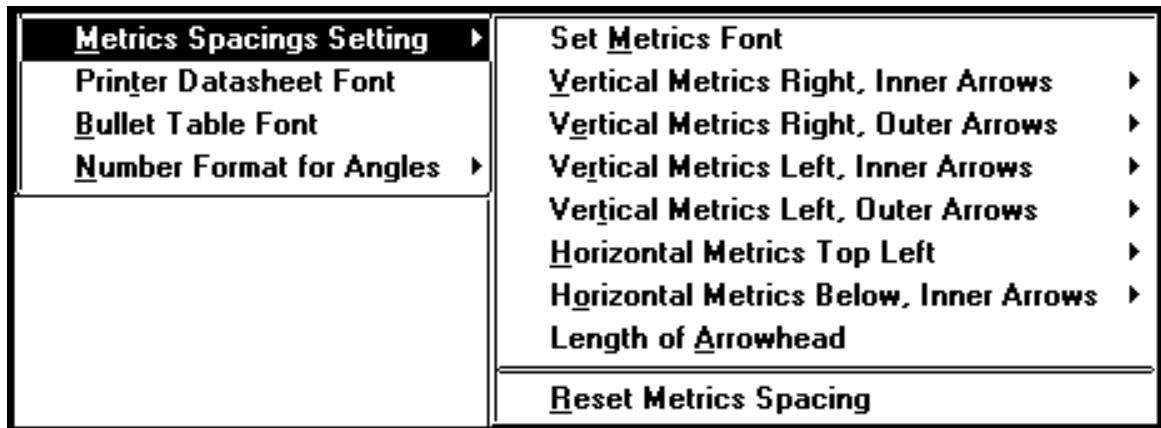
Picture 12 : Menu Set Line Width in Pixels

- **Drawing Outline:** Opens input box to specify width of outline in drawing of case or chamber.
- **Drawing Collision:** Opens input box to specify width of lines marking collision area in drawing.
- **Drawing Metrics Lines:** Opens input box to specify width of lines used by metrics.
- **Printer Outline:** Opens input box to specify width of outline in printing of case or chamber.
- **Printer Collision:** Opens input box to specify width of lines marking collision area on printer.

- **Printer Metrics Lines:** Opens input box to specify width of lines used by metrics.
- **Printer Border Lines:** Opens input box to specify width of lines used to separate areas of text on data sheet.

Note: Line width settings refer to pixels. Example: If printer resolution is set to 600dpi this means one pixel will be 1/600 inch in diameter. If you specify a line width of 5 pixels the resulting printed line width will be 0.00833 inch thick.

- ◆ **Metrics Spacings Settings:** Opens submenu to specify drawing of metrics.



Picture 13 : Metrics Spacings Settings

- **Metrics Font:** Opens font dialog box. User may select suitable font for metrics symbols or dimensions on screen and on printed datasheet.
- **Vertical Metrics Right, Inner Arrows:** Metrics arrows pointing from measurement point to measurement point at right side of cartridge (Example L3 or case length).
 - **Distance between Dimensions:** Factor of distance between two metrics side by side.
 - **Bias Distance from Body:** Distance of the first metrics position from case body.
- **Vertical Metrics Right, Outer Arrows:** Two metrics arrows pointing to each measurement point (Example e_{min} or length to first body diameter).
 - **Distance between Dimensions:** Factor of distance between two metrics side by side.
 - **Bias Distance from Body:** Distance of the first metrics position from case body.
- **Vertical Metrics Left, Inner Arrows:** Metrics arrow pointing from measurement point to measurement point at left side of cartridge (Example S).
 - **Distance between Dimensions:** Factor of distance between two metrics side by side.
 - **Bias Distance from Body:** Distance of the first metrics position from case body.
- **Vertical Metrics Left, Outer Arrows:** Two metrics arrows pointing to each measurement point (Example R or rim thickness).
 - **Distance between Dimensions:** Factor of distance between two metrics side by side.
 - **Bias Distance from Body:** Distance of the first metrics position from case body.
- **Horizontal Metrics Top Left:** Metrics arrows pointing to measurement point left of case neck (Example H2 or diameter at mouth).
 - **Distance between Dimensions:** Factor of distance between two metrics side by side.
 - **Bias Distance from Body:** Distance of the first metrics position from case body.

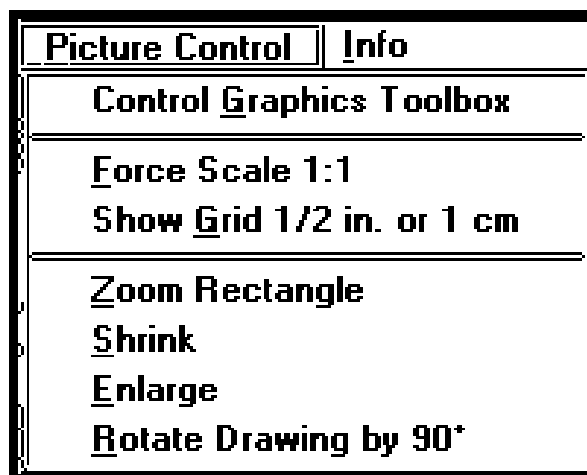
- **Horizontal Metrics Case Head, Inner Arrows:** Metrics arrow pointing from measurement point to measurement point at base of cartridge (Example R or head diameter).
 - **Distance between Dimensions:** Factor of distance between two metrics side by side.
 - **Bias Distance from Body:** Distance of the first metrics position from case body.
- **Length of Arrowhead:** Factor to size dimension of metrics arrows.
- **Reset Metrics Spacing:** Set all metrics to initial standard values.
- ◆ **Printer Datasheet Font:** Opens font dialog box. User may select suitable font for listed data on printer.
- ◆ **Bullet Properties Table Font:** Opens font dialog box. User may select suitable font for listing of bullet properties on bullet property form.
- ◆ **Number Format for Angles:** Opens submenu with two options: Select one of both.



Picture 14 : Number Format of Angles

- **Deg Min Sec:** Display and print angles in degrees, minutes and seconds format.
- **Decimal:** Display and print angles in decimal format.
- ◆ **System Beep on:** Switches warning beep on and of. Selection means on state condition.

5. Menu Picture Control



Picture 15 : Menu Picture Control

Meaning of the menu items:

- ◆ **Control Graphics Toolbox:** Opens window to manipulate drawing. User may rotate, translate, and scale the drawing. Set number of slices for wireframe or rendered drawing. Set number of segments for drawing an arc specified by radius. Reposition light source, intensity, reflective and specular light. Seating a primer cup into case and more (see Customize Drawing).
- ◆ **Force Scale 1:1:** When checked, draw cartridge in original size on screen.
- ◆ **Show Grid ½ in. or 1 cm:** When checked, the background of drawing contains gray grid lines.
- ◆ **Zoom Rectangle:** Mouse cursor changes to magnifier symbol. User may zoom a window frame by pointing with mouse to the upper left corner of rectangle and drag

rectangle to desired lower right corner holding left mouse button down. Move mouse button up and again down (click). Selected area will be zoomed in.

- ◆ **Shrink:** Drawing is zoomed out by factor of about 1.5.
- ◆ **Enlarge:** Drawing is zoomed in by factor of about 1.5.
- ◆ **Rotate Drawing by 90°:** Switch drawing from vertical standing cartridge to horizontal positioned cartridge pointing to the right and vice-versa.



Symbol Bar Icon *Rotate Cartridge Drawing*

Additional Picture Manipulating Commands not in Menu:

- ◆ **Pan Drawing:** Place mouse crosshair cursor over point of drawing you want to pan or drag. Press and hold [CTRL] key. Press left mouse button and release button and key. Mouse pointer changes from crosshair to standard arrow, showing a fixed rubber band fixed to selected point and mouse arrow. Move rubber band to new position and click left mouse button again. Drawing will be panned to new position.
- ◆ **Enlarge Drawing at selected Zoom Center Position:** Place mouse crosshair cursor over center to be zoomed. Hold [SHIFT] key and click with left mouse button. Drawing will be zoomed in around mouse cursor position.
- ◆ **Shrink Drawing at selected Zoom Center Position:** Place mouse crosshair cursor over center to be zoomed. Hold [ALT] key and click with left mouse button. Drawing will be zoomed out around mouse cursor position.

6. Menu Info



Picture 16 : Menu Info

- ◆ **Tooltip Help Enabled:** When checked, to most items and entry fields a “bubble-help” text window pops-up when mouse cursor resides over active area of item.
- ◆ **Symbolbar Visible:** Switch shortcut symbolbar **on** or **off**. Default setting is **ON**.

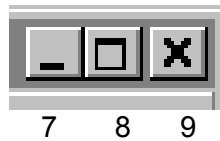
QuickDESIGN Bubble Help System

QuickDESIGN includes a user selectable and interactive Bubble-help system named the ToolTip help system. When this system is active, positioning the mouse cursor over any data box and pausing opens a sub-window containing useful information about the selected box or screen area.

This system is enabled and disabled by a toggle switch under the Info menu item **Tooltip Help Enabled**. The initial program startup value is **ON** and checkmark is set. We suggest leaving this system active until you are reasonably familiar with *QuickDESIGN*.

QuickDESIGN Main Window Control Box

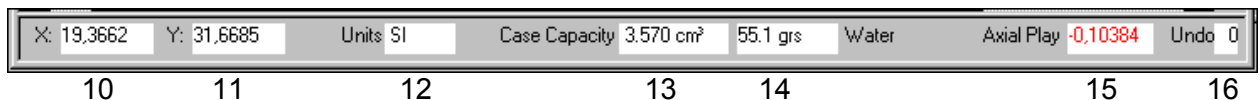
7, 8 and 9. Control Box



Picture 17 : Control Box

- ◆ **Icon 7:** Minimize Application to Icon on Taskbar
- ◆ **Icon 8:** Switch between windowed and Full Screen Mode
- ◆ **Icon 9:** Close Application, End Program

QuickDESIGN Status Bar



Picture 18 : Status Bar

The status bar is located at the bottom of main window.

10 and 11. Coordinate Display

In the left corner of the status bar there are two fields displaying the X- and Y- coordinates of the mouse cursor position while being over drawing area. The units of coordinates are millimeters or inches according to users unit settings.

12. Unit System in Use

This field contains **SI** when **metric units** are selected; it contains **SAE** when **English units** are selected. Responds to settings in menu *Drawing Options...Metric SI Units or English SAE Units*.

13 and 14. Case Capacity

Field 13 displays case capacity full to case mouth in cubic centimeters or cubic inches. Field 14 displays case capacity in grains of water overflow at case mouth. User must enforce *Show Inner Contour* in menu *Drawing Options*. Furthermore, he must specify the correct primer type, wall thickness at web region and web height. You must switch off *symbolic bullet* to obtain valid case capacity for cartridges where overall length is shorter than case length due to folded or crimped case mouth (for example: shotgun cartridges).

15. Axial Play

When the cartridge is inserted into chamber until it is stopped by touching the chamber walls in shoulder region or other part of body (or real bullet) and there is a gap between cartridge head and drawing origin (= breech face) this axial play (positive values show play) is here displayed, pointing to possibly designed headspace. Check for excess headspace in design data and for possibly non-zero values in window *Size Cartridge*, entry field *headspace*.

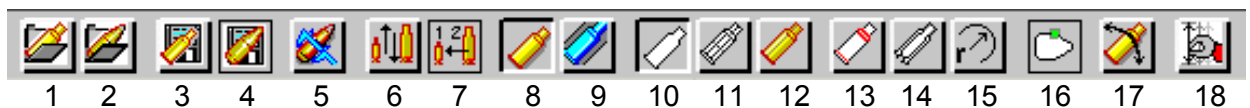
If cartridge is too long or chamber too short the case head will protrude over virtual breech face: a negative number in red color is displayed – you cannot chamber this cartridge in this chamber. To enable this display, in menu *Drawing Options* you must check item *Check and Show Collisions Area*.

16. Undo Count

If you make changes to cartridge, chamber or bullet data every change increments an undo counter up to nine counts.

You may undo to the last recent nine positions by using menu *Edit-Select Window... Undo Size or Edit* command or clicking with mouse pointer onto this field. Reaching zero means you have recovered the state of data when loading this cartridge first time. Example: The undo counter shows 9 and you have changed data 19 times you may step back from 9 to 1 (virtually from instance 19 to instance 11), but stepping after that to zero means you step really to zero at beginning of editing this cartridge.

QuickDESIGN Symbol Bar



Picture 19 : Symbol Bar

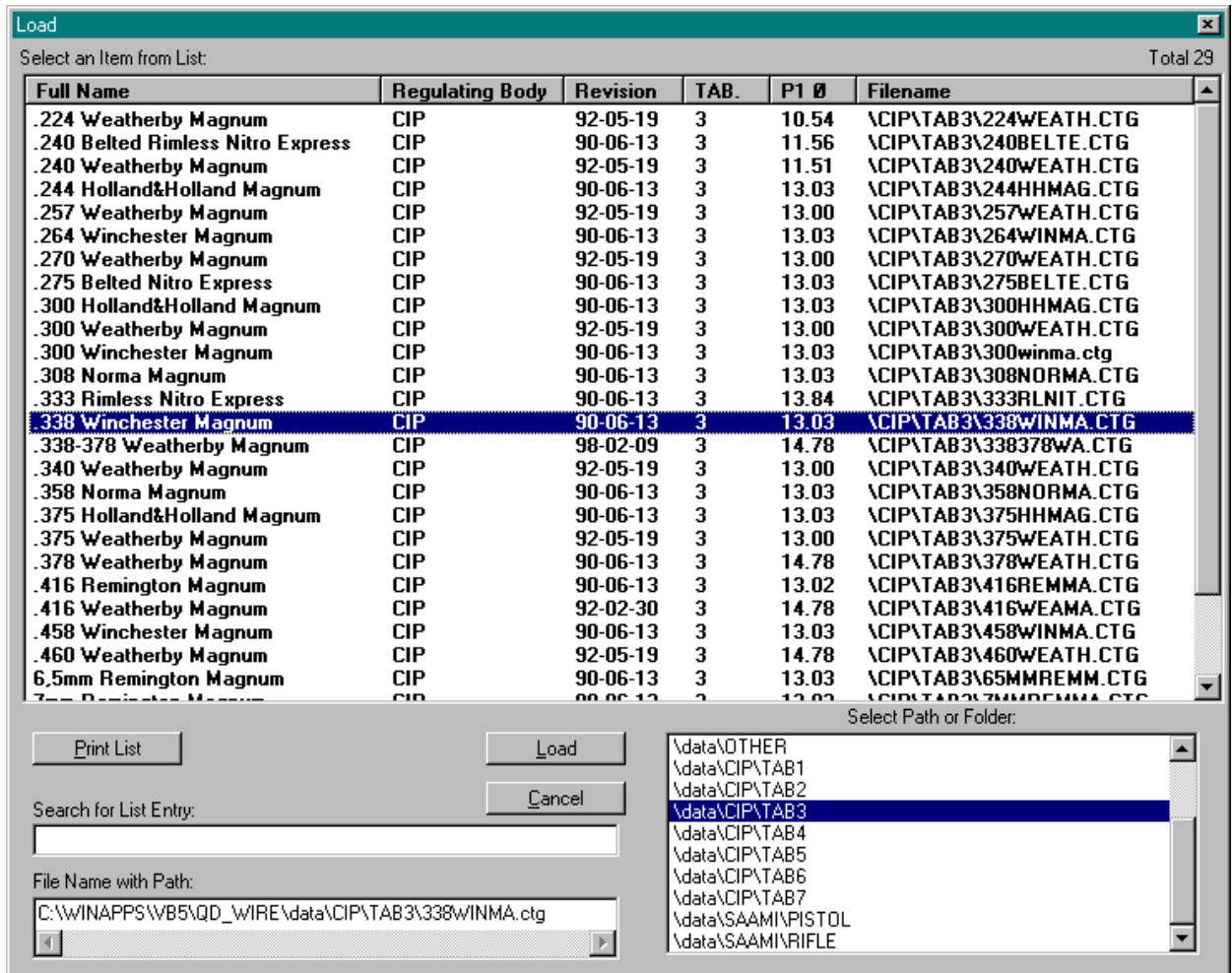
The symbol bar's icons are connected to corresponding menu options. Their meaning from left to right:

1. Load cartridge from cartridge list window
2. Load bullet from bullet list window
3. Save cartridge data...
4. Save bullet data...
5. Edit bullet
6. Size and transform cartridge
7. Undo last change
8. Draw case (cartridge)
9. Draw chamber
10. Show outline drawing
11. Show wireframe drawing
12. Show rendered, flat shaded drawing
13. Show collisions between case and chamber
14. Show inner contour
15. Show radiuses
16. Edit waypoint of contour of bullet
17. Rotate picture by 90 degrees from vertical to horizontal view and back
18. Enable / disable manual movement of dimensioning

This symbol bar can be switched on and off by menu *Info*.

Load a Design from List

Select menu *File, Load Cartridge from List*. The *Load* window appears.



Picture 20 : Load Window

The menu option *Load Cartridge from List* or *Load Bullet from List* invokes loading of this window. It lists all cartridges (or bullets) of *QuickDESIGN*. The user may select one cartridge (or bullet) and load it into the workspace of *QuickDESIGN*. This window is sizeable.

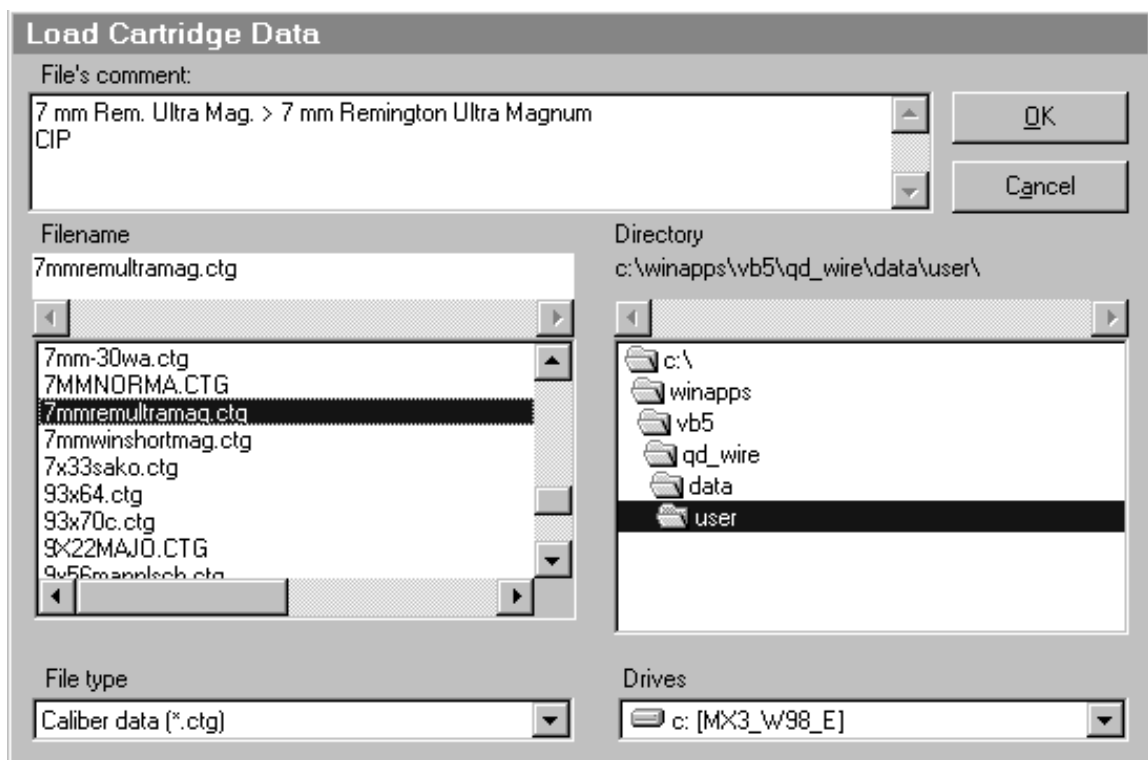
Data Fields and Buttons

- ◆ **Select item from List:** The list view window shows all cartridges contained in the selected path or folder. The first column contains the long name of the cartridge. The second column contains the regulating body. The third column contains the last revision date. The fourth column contains the number of the CIP table. The fifth column contains the diameter of case body before rim. The sixth column contains the location of the file on disk. User may select an entry by clicking with mouse pointer on it and load selected item by double-clicking on it or use *button load* (or up or down arrow key, enter key to select). Clicking on column header, all data will be sorted according to column contents. Direction of sorting toggles by consecutive clicking on column header. Column headers can be resized in width by moving the mouse pointer to the intersection between adjacent column headers, then pressing mouse button and drag header to the desired position.
- ◆ **Select Path or Folder:** All directories containing data files are displayed in this field. The *\data* directory is *QuickDESIGN*'s parent data directory containing all other subdirectories with data files. Double clicking on *\data* entry invokes browsing through all including subdirectories. Cartridges found are listed in *Select Item from List* list view

field. When the user wants to display the contents of only a single subdirectory, for example \SAAMI \RIFLE he must double-click to the \saami \rifle subdirectory entry.

- ◆ **Search for List Entry:** User may search for a long name by entering a partial string of characters of the name for which he searches. Selection bar in list view window marks the first cartridge found matching the string. Without making any other keystrokes or mouse-button clicks, begin typing designation of cartridge or bullet that you want to find. Program automatically searches for and displays first entry matching entered data in Select Item from List window. Each new keystroke narrows selection.
- ◆ **File Name with Path:** This field contains the full path and file name for the cartridge selected.
- ◆ **Button Print List:** User may print the whole contents of the list view window on the printer. Before printing, he may sort the list of cartridges by clicking on to the appropriate column header. In addition, the invisible entries of the list view windows are printed too.
- ◆ **Button Load:** Loads the selected item into workspace. Window is closed. Undo count is set to zero.
- ◆ **Button Cancel:** Window is closed without action.

Load a Design from File



Picture 21 : Load Data

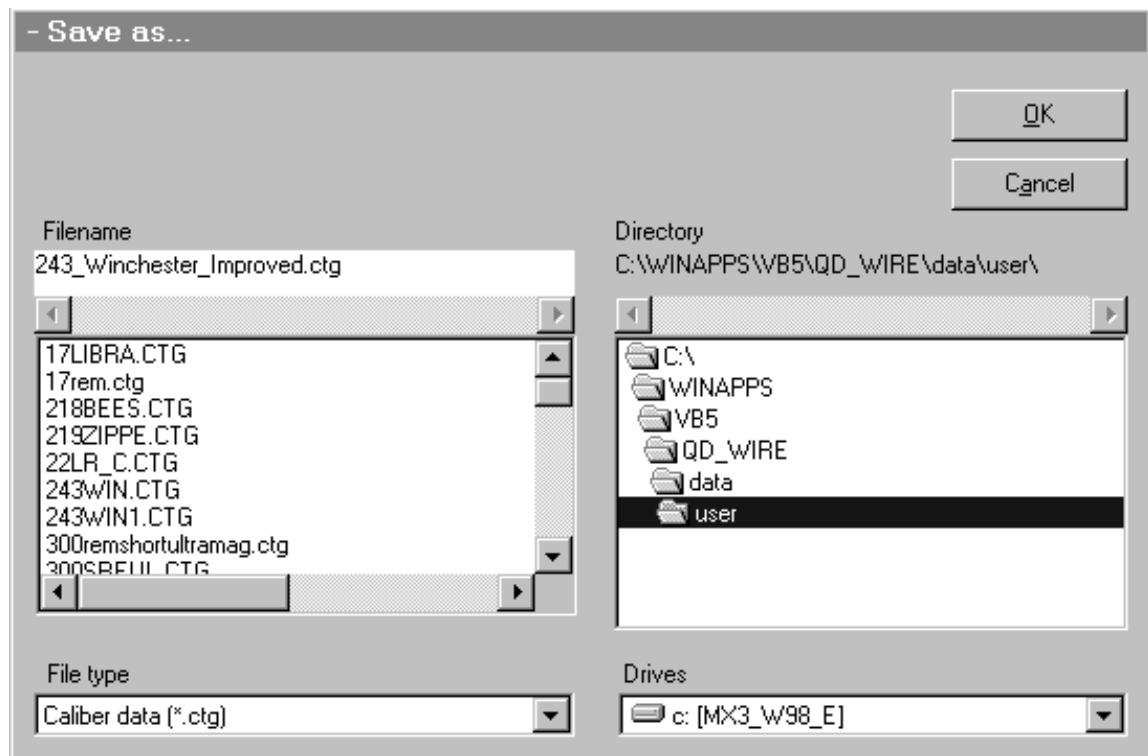
The menu option *Load Cartridge from File* or *Load Bullet from File* opens this window. While the list view window allows only access to data within *QuickDESIGN* data directory, user may select directly a cartridge- or bullet data file from any directory available on computer or a network connection.

Fields and Buttons:

- ◆ **File's Comment:** Displays the short and long name of the cartridge and the governing body, so far available.
- ◆ **Filename:** Name of the selected file. User may select a cartridge file from the file list box under it. The list box contains all files of the selected directory containing the file extension shown in file type field. Double clicking on file name selects entry and loads file. Window is closed. The file extension can be selected by field

- ◆ **File Type:** User can select from caliber or cartridge data file type **.ctg** or caliber data backup file **.ct\$** (bullet file **.bfl**, bullet backup **.bf\$**).
- ◆ **Directory:** Selected directory. List box under it allows the user to select from directories available on storage media.
- ◆ **Drives:** Selected drive. Select other drive if needed.
- ◆ **OK Button:** Loads selected file into workspace, closes window. Undo count is set to zero.
- ◆ **Cancel Button:** Closes window. Discards selection.

Saving a Cartridge Design



Picture 22 : Save Data ...

This window opens on menu command *Save Cartridge Data* or *Save Bullet Data*. Normally the user may not save data to the *data\cip* or *data\saami* directory to avoid overwriting of data coming with *QuickDESIGN*. This feature can be disabled by editing *qdesign.ini* - file and inserting the line *wriprivileg=1* under *STARTUP* section.

Fields and Buttons:

- ◆ **Filename:** Name of the file to be saved. User may enter a name describing the cartridge properly. The file name may not contain one of the following characters ? * ; : = ' ^ ° > < | \ % . The user may also use the actual filename and therefore overwrite existing data. Alternatively, select an existing file name from the listbox under it. Double clicking on file name in list box saves file. Window is closed. If an existing file is overwritten, the extension of old file is renamed to **.CT\$** (**.BF\$** in bullet save mode). In any case, user will be warned and asked when overwriting a file.
- ◆ **File Type:** User can select from caliber or cartridge data file type extension **.ctg** (bullet file **.bfl**).
- ◆ **Directory:** Selected directory. List box under it allows the user to select from directories available on storage media.
- ◆ **Drives:** Selected drive. Select other drive if needed.
- ◆ **OK Button:** Saves selected file to specified disk location, closes window.
- ◆ **Cancel Button:** Closes window. Discards entries.

The Cartridge Data Entry Forms and their Use

General Data Form

Picture 23 : General Data Form

This form holds all necessary data to specify the cartridge's global and common definitions. The windows title line shows the short name of the cartridge and the name of the regulating body. Enter dimensions and data according to unit settings either SAE or SI.

Meaning and Operation of Entry Fields, Selection Boxes and Buttons:

- ◆ **Abbreviated Name:** Abbreviated cartridge name as normally found on headstamp of cartridge.
- ◆ **Full Name:** Full name of cartridge without abbreviation.
- ◆ **Parent Cartridge:** Optional name of original design.
- ◆ **Synonyms:** Optional other names designating same cartridge.
- ◆ **Comment:** Optional comment to your design.
- ◆ **Regulating Body:** CIP, SAAMI or empty.
- ◆ **Country of Origin:** Select one country matching. Few cartridges are of double country origin, then enter appropriate characters divided by a slash character. Open drop down box and look for both countries' abbreviations. No space between characters allowed. Example: US/UK . Abbreviations listed are ISO standard names.
- ◆ **Date:** The date for the first release (birth) of cartridge.
- ◆ **Revision:** Date of the last revision of data.
- ◆ **CIP Appendix of proof barrels:** The number of the appendix of CIP decisions containing proof barrel dimensions for the actual cartridge. Is used to print as information on CIP datasheet.
- ◆ **Metrics Layout Scheme:** Select SAAMI or CIP. Metrics differ between both regulating bodies. Example: SAAMI defines most angles to centerline, CIP uses full angle.

- ◆ **TAB:** CIP sorts cartridges by design features into 10 (or more) tables. Example: Rimless centerfire rifle cartridges belong to table 1 (Roman I), Rimmed centerfire rifle cartridges to table 2 (Roman II) (see CIP Tables Classification). CIP uses Roman numbers to specify table number; here you enter number keys from keyboard (printer converts them to Roman). Cartridges of table 1 to 3 have proof pressures of 1,25 times of Maximum Average Pressure (MAP), all other cartridges use a proof pressure of 1,3 times of MAP. Altering TAB number changes factor in label in front of proof pressure box (**PE**) between 1,25 and 1,30.
- ◆ **Volumes:** Additional space (volume) between cartridge and driving piston for cartridges of CIP Table VI (activated by setting TAB to 6). Those cartridges are mainly used for riveting tools.
 - **Va 1:** = First additional volume to measure pressure and energy under Va1
 - **Va 2:** = Second additional volume to measure pressure and energy under Va2

Pressure Tr.: Frame tab containing transducer pressure data:

- **Method Transducer:** Pressure data obtained by electronic transducers.
 - **Pmax: Maximum Average Pressure:** Maximum average pressure: in units of psi (SAE) or bars according to CIP or SAAMI standards.
 - **PK: 1.15 Pmax :** Entry of Maximum statistical individual pressure. In units of psi (SAE) or bars (SI).
 - **PE: 1.30/1,25 Pmax, mean intended pressure:** Average proof pressure in units of psi (SAE) or bars (SI). See also **TAB** field.
- **Method Transducer 2:** Pressure data obtained by electronic transducers. Valid only for cartridges of Tab VI with second volume specified.
 - **Pmax: Maximum Average Pressure:** Maximum average pressure: in units of psi (SAE) or bars according to CIP or SAAMI standards.
 - **PK: 1.15 Pmax :** Entry of Maximum statistical individual pressure. In units of psi (SAE) or bars (SI).
 - **PE: 1.30/1,25 Pmax, mean intended pressure:** Average proof pressure in units of psi (SAE) or bars (SI). See also **TAB** field.

Pressure Cr.: Frame tab containing crusher pressure data. Values: SAAMI: psi-equivalents, CIP: bar-equivalents. Copper units are no longer standard. *Data entered and displayed only for historical and informative purpose*

- **Method Crusher:** Values: SAAMI: psi-equivalents, CIP: bar-equivalents. Copper units are no longer standard. *Data displayed only for historical and informative purpose.*
 - **Pmax: Maximum average pressure:** Maximum average pressure in units of Copper Units of Pressure.
 - **PK: 1.15 Pmax = maximum statistical individual pressure:** Maximum statistical individual pressure in units of Copper Units of Pressure.
 - **PE: 1.30 Pmax = mean intended pressure:** Average proof pressure in units of Copper Units of Pressure.
- **Method Crusher 2:** Valid only for cartridges of Tab VI with second volume specified.
 - **Pmax: Maximum average pressure:** Maximum average pressure in units of Copper Units of Pressure.
 - **PK: 1.15 Pmax = maximum statistical individual pressure:** Maximum statistical individual pressure in units of Copper Units of Pressure.
 - **PE: 1.30 Pmax = mean intended pressure:** Average proof pressure in units of Copper Units of Pressure.

Energy: Some very small cartridges do not allow reliable pressure testing. Then proof testing is performed by measuring muzzle velocity and calculating muzzle energy.

In future all other CIP cartridges will contain **pressure and energy** data. Then energy data will be mandatory for proof ammunition which must satisfy these energy figures. Proof energy has to be specified under position **EE** while **Emax** and **EK** is left empty. This decision has been made to avoid using of too fast powder for proof cartridges which gives appropriate peak pressures but not sufficient pressure integral.

- **Energy :**

- **Emax: Maximum average energy:** Bullet muzzle energy, commonly in units of Joules.
- **EK: 1.15 Emax = maximum statistical individual energy**
- **EE: 1.30 Emax = mean intended energy**

- **Energy 2 :** Valid only for cartridges of Tab VI with second volume specified.
 - **Emax: Maximum average energy:** Bullet muzzle energy, commonly in units of Joules.
 - **EK: 1.15 Emax = maximum statistical individual energy**
 - **EE: 1.30 Emax = mean intended energy**

- ◆ **Miscellaneous Dimensions**
 - **delta L: Headspace Extension:** Additional tolerance for maximum allowable headspace (CIP). Add this value to some cartridges, mostly military origin, which do not chamber a standardized maximum case in a standardized minimum chamber. Head protrudes over breech position. Cartridge designed for “guns with slam feed action” (example: .223 Win, .308 Win, .30-06 Springfield, 50 BMG - .270 Win inherits flaws from .30-06). In this case cartridge is squeezed into chamber.
 - **HS: Maximum Headspace:** Maximum allowed headspace at Maximum Material Conditions.
 - **M: Pressure Gauge Location:** Length from cartridge head to pressure transducer- or piston hole centerline.
 - **Lc: Proof Barrel Length:** Length of test barrel. Optional entry, not common with cartridge data. CIP reference standard pressure barrel length: rimless and semi-rimmed cartridges: $L_c = 600 \pm 10$ mm, rimmed cartridges: $L_c = 600 \pm 10$ mm, Magnum-headed cartridges: $L_c = 650 \pm 10$ mm, cartridges for pistols and revolvers: $L_c = 150 \pm 10$ mm.

- ◆ **Primer Pocket Dimensions:** Optional. Used in *QuickDESIGN* to calculate case capacity.
 - **Primer Pocket Diameter:** Diameter of primer pocket.
 - **Primer Pocket Height:** Distance from cartridge head to primer pocket bottom.
 - **Vent Hole Diameter:** Bore diameter of primer flash hole.
 - **Primer Type:** Select box to select various boxer primer types. New selection of primer fills automatically primer pocket dimension fields. Primer dimensions are read from file PRIMER.DAT that is a plain text file and can be edited with editor program like NOTEPAD (not WINWORD).

- ◆ **Case Wall Thickness:** Data used to calculate case capacity, case weight and force on case head. Missing values cause no calculation of these properties.
 - **Web Height:** Length from case head to bottom of powder chamber.
 - **Wall Thickness at Web Height:** Thickness of case wall at distance *Web Height* from case head.
 - **Minimum Wall Thickness:** Optional, but necessary for correct drawing of some rimfire and blank cartridges. Thickness of case wall in neck region for cases where inner neck diameter cannot be derived from bullet diameter (Example .22 LR). Normally thickness in neck region is calculated by outer neck diameter minus bullet diameter divided by 2.
 - **Specific Gravity of Case Material:** Optional: Enter value appropriate for case brass or other case material. Use to calculate case weight.

Output Fields:

- ◆ **Case Weight:** Approximate case weight in selected units. Dependent on *Specific Gravity of Case Material*. You must switch off *symbolic bullet* to obtain valid case weight for cartridges where overall length is shorter than case length due to folded or crimped case mouth (for example: shotgun cartridges and blank cartridges).
- ◆ **Case Taper Angle:** Full angle of case body taper.

- ◆ **Maximum Force on Head:** Calculated value for force on breech face valid at maximum average pressure and web dimensions specified. Friction between case walls and chamber is neglected.
- ◆ **Button Apply:** Transfer data from entry forms to data record. Save recent nine (9) instances of changes applied. Update UNDO count.

APPLY Button

The *APPLY* button resides in the lower right corner of all data forms.

Data in cartridge data record is not updated each time an entry is made into one single data field.

Otherwise, each entry will increment the UNDO counter and the UNDO function will become useless.

When all or some essential entries or changes to this form are complete press the APPLY button. Some data will be checked and others calculated. The drawing will be updated. The program begins to interpret the data of cartridge or chamber beginning from case mouth to breech or cartridge head.

It checks for presence of shoulder, shoulderless or straight design. Head region is checked for belt, extractor groove and/or rim. Checking differs somewhat according to settings of drawing scheme, either SAAMI or CIP. Do not change this setting while you are editing cartridge data. When you enter a new cartridge, first set drawing scheme and unit system you like to use. Not every design can be recognized properly by entered dimensions.

It is necessary for the program to set CIP table to number 7 to recognize a shotgun shell properly. For rimfire cartridges set table to 5 to allow program to apply a radius to the rim of cartridge, also select primer type of "Rimfire". It is a good practice to classify all cartridges including SAAMI designs by CIP table numbers. See CIP Tables Classification on page 73.

Always review drawing on monitor's screen for missing details or for error messages !

The user should use the convert to SAE or convert to SI units menu option in Edit menu after he has completed and verified all data to be OK.

After converting the design contains data in both units.

Do not forget to save cartridge design data in a file.

One may ask why conversion is not done automatically after entry of a value into the corresponding other unit's value and inserted into data record. That is because some values have to be slightly corrected after conversion to meet standards. If you check the converted data and apply carefully slight changes to it those changes would be destroyed by an automatic conversion.

Note

It is a good practice to use always CIP numbering scheme for cartridges of SAAMI origin. The program needs in some cases this number to recognize cartridge design properly. Please enter number 5 for rimfire cases firing bullets or shot, number 6 for industrial tool blanks, 7 for shotgun shells and 8 for handgun blanks.

Using number 6 for industrial cartridges changes some entry fields in all three entry tables. Because proof equipment for these calibers uses simulated tools with standardized pistons and up to two barrel plus chamber capacities, the *Pressure* frame exchanges energy fields against additional volume fields. For each volume, proof pressure is assigned.

Frame to enter Pressure and Energy figures

| Pressure Tr. | Pressure Cr. | Energy | Pressure Tr. | Pressure Cr. | Energy | Pressure Tr. | Pressure Cr. | Energy |
|---|--------------|--------|---|--------------|--------|---|--------------|--------|
| Method Transducer bars PT max: Maximum average pressure 3200 PK: 1.15 Pmax = Maximum statistical individual pressure 3680 PE: 1.30 Pmax = Mean intended pressure 4160 | | | Method Crusher bars PCr max: Maximum average pressure 2800 PK: 1.15 Pmax = Maximum statistical individual pressure 3220 PE: 1.30 Pmax = Mean intended pressure 3640 | | | Energy Joules Emax: Maximum average energy EK: 1.07 Emax = Maximum statistical individual energy EE: 1.10 Emax = Mean intended energy | | |
| Method Transducer 2 bars Pmax: Maximum average pressure PK: 1.15 Pmax = Maximum statistical individual pressure PE: 1.30 Pmax = Mean intended pressure | | | Method Crusher 2 bars Pmax: Maximum average pressure PK: 1.15 Pmax = Maximum statistical individual pressure PE: 1.30 Pmax = Mean intended pressure | | | Energy 2 Joules Emax: Maximum average energy EK: 1.07 Emax = Maximum statistical individual energy EE: 1.10 Emax = Mean intended energy | | |

Picture 24 : Pressure and Energy forms for normal and Industrial Cartridges (CIP Table 6)

Table-6 cartridges are mostly industrial cartridges for bolt- or rivet seating tools standardized by CIP. For normal cartridges only the upper portion of form has to be used, for Table 6 cartridges the lower greyed region has also to be used when a second additional volume is specified.

Pressure (Energies): Frame containing pressure and energy data:

- **Method Transducer [Va1]:** Pressure data obtained by electronic transducers valid with additional volume 1.
- **Method Transducer [Va2]:** Pressure data obtained by electronic transducers valid with additional volume 2.
- **Volumes:** Added space in front of cartridge between cartridge and driving piston.
 - **Va 1:** = Additional volume used to obtain pressure for Va 1
 - **Va 2:** = Additional volume used to obtain pressure for Va 2

See also (Cartridge Dimensions Form for Table 6 Cartridges, Chamber Dimensions Form for Table 6 Cartridges).

Interface to QuickLOAD

Every time the *APPLY* action is performed or new cartridge is loaded into workspace the file **QDESIGN.QMT**

located in **QuickDESIGN** directory is updated with essential data of cartridge and bullet for **QuickLOAD** program. Data from this file may be retrieved by **QuickLOAD** program to calculate Interior Ballistics of actual cartridge design.

Path to **QuickDESIGN** is set to **QuickLOAD** while installing **QuickDESIGN**. **QuickLOAD** searches the file **qloadfw.ini** in section **[startup]** for the following two entries:

```
qmtfil =[ your full path to quickdesign ] \qdesign
          (Example:  C:\PROGRAMS\QUICKDESIGN\QDESIGN)
qdesigner = -1
```

You may manually edit file **qloadfw.ini** either with plain-text editor or notepad.exe. Do not use Winword or similar applications because they may destroy the file. Before editing, make a backup of **qloadfw.ini** in a safe location.

Cartridge Dimensions Form

| Section | Dimension Label | Value | Unit |
|-----------------------------|---|-------------------|------|
| Cartridge Lengths | L1/13: Length to Shoulder | 39.62 | |
| | L2/19: Length to Shoulder-Neck Intersection | 43.48 | |
| | L3/23: Overall Case Length | 51.18 | 1) |
| | L4/29: Length to Bullet Diameter G2 | | |
| | L5/31: Length to Bullet Diameter F | | |
| | L6/26: Overall Cartridge Length | 71.12 | |
| | /9B: Length to first Body Diameter | | |
| | /11B: Length betw. 1st and 2nd Body Diameter | | |
| | /10: First Body Diameter | | |
| | /12: Second Body Diameter | | |
| Cartridge Head | R/2: Rim Thickness | 1.37 | |
| | /3: Length of Cylindrical Rim Section | | |
| | R1/1: Head Diameter | 12.01 | |
| | R3/1A: Belt Diameter | | |
| | E/8: Head Height | 3.85 | |
| Cartridge Body | rR/33: Underhead Radius | | |
| | P1/22: Underhead Diameter | 11.96 | |
| | P2/14: Shoulder Diameter | 11.53 | * |
| | Alpha/15: Shoulder Angle | 40.0000 (40.002)* | |
| | S: Length to Origin of Shoulder Angle | 55.46 (55.4584)* | |
| | r1 min/17: Shoulder Radius | 0.76 | |
| | r2/25: Neck Radius | 3.18 | |
| Cartridge Neck | H1/20: Diameter at Shoulder-Neck Intersection | 8.72 | * |
| | H2/24: Diameter at Mouth | 8.72 | 1) |
| Bullet | G1/27: Bullet Diameter | 7.85 | 1) |
| | G2/28: Bullet Diameter at L4/29 | | |
| | F/30: Bullet Diameter at L5 | | |
| | L1/L3+G: Length to Bore Diameter | 58.16 | 1) |
| ANSI/SAAMI Datum Dimensions | /17: Length to Datum Diameter | | |
| | /18B: Datum Diameter | | |
| | | | |

Picture 25 : Cartridge Dimensions Form

This form holds all necessary data to specify the cartridge's dimensions. Data represents the maximum cartridge dimensions for CIP designs or dimensions at Maximum Material Conditions (MMC) for SAAMI designs.

The windows title line shows the short name of the cartridge and the name of the regulating body.

The labels left of each entry data field begin with symbol or number. Most CIP symbols start with an Ascii character or Greek symbol; for SAAMI metrics a numbering scheme instead of symbols is used. Scheme: CIP Symbol / SAAMI Number : Descriptive Text. See page 65.

Entry Fields:

Cartridge Length Dimensions

- ◆ **L1/13: Length to Shoulder:** Length from cartridge head to shoulder-body intersection. Reference dimension.
- ◆ **L2/19: Length to Shoulder-Neck Intersection:** Length from cartridge head to shoulder-neck intersection. Reference dimension.
- ◆ **L3/23: Overall Case Length:** Length from cartridge head to case mouth.
- ◆ **L4/29: Length to Bullet Diameter G2:** Length to specified bullet diameter (CIP G2).
- ◆ **L5/31: Length to Bullet Diameter F:** Length from cartridge head to bore diameter. CIP only.
- ◆ **L6/26: Overall Cartridge Length:** Length from cartridge head to bullet tip.

SAAMI Dimensions defining Case Taper

- ◆ **/9B: Length to first Body Diameter:** Short distance from case head to first body diameter. SAAMI basic dimension.
- ◆ **/11B: Length between first and second Body Diameter:** SAAMI basic dimension.
- ◆ **/10: First Body Diameter:** Diameter close to head.
- ◆ **/12: Second Body Diameter:** Diameter close to shoulder or mouth.

Cartridge Head Dimensions

- ◆ **R/2: Rim Thickness:** Distance from head face to end of case rim.
- ◆ **/3: Length of Cylindrical Rim Section:** Thickness of rim without chamfered section (SAAMI only).
- ◆ **R1/1: Head Diameter:** Diameter of case rim.
- ◆ **R3/1A: Belt Diameter:** Diameter of "Magnum" belt.
- ◆ **E/8: Head Height:** Head to belt-end distance for belted cartridges (SAAMI). Head length or thickness for rimless or belted cartridges (CIP).
- ◆ **E1/5: Extractor Groove Diameter:** Diameter of extractor groove.
- ◆ **e min/6: Extractor Groove Width:** Height (width) of extractor groove.
- ◆ **Delta/7: Extractor Groove Angle:** (Half-) Angle of chamfer from body or belt to extractor groove diameter. Dimensioned to centerline.
- ◆ **f: Width of Rim Chamfer:** Height of case rim chamfer. (CIP only).
- ◆ **Beta/4: Rim Chamfer Angle:** Head angle or case rim chamfer angle. SAAMI dimensioned to centerline, CIP dimensioned to case head tangent line.
- ◆ **alfa_S/32: Underhead Angle:** Underhead angle from rim to extractor groove. For shotgun cartridge only (Headspace dimension - SAAMI basic angle).
- ◆ **rR/33: Underhead Radius:** Radius at intersection of extractor groove with rim or underhead angle (shotgun cartridges or rimfire cartridges).

Cartridge Body Diameters

- ◆ **P1/22: Underhead Diameter:** Underhead diameter at the end of case rim or before extractor groove or at distance E of case body. (SAAMI : rimmed cartridges only.)
- ◆ **P2/14: Shoulder Diameter:** Case diameter at distance L1 (shoulder diameter at virtual intersection). (SAAMI: may be calculated from 9B, 11B, 10, 12 and L1).

Cartridge Shoulder Dimensions

- ◆ **Alpha/15: Shoulder Angle:** Shoulder angle (SAAMI basic dimension. SAAMI dimensioned to centerline, CIP symmetrical to centerline).
- ◆ **S: Length to Origin of Shoulder Angle:** Distance to virtual peak of shoulder cone. CIP only.
- ◆ **r1 min/17: Shoulder Radius:** Radius at intersection of body with shoulder.
- ◆ **r2/25: Neck Radius :** Radius at intersection of shoulder with neck (Maximum dimension).

Cartridge Neck Diameters

- ◆ **H1/20: Diameter at Shoulder-Neck Intersection:** Diameter at distance L2.
- ◆ **H2/24: Diameter at Mouth:** Diameter at case mouth at distance L3.

Bullet Dimensions

- ◆ **G1/27: Bullet Diameter:** Diameter of projectile at case mouth.
- ◆ **G2/28: Bullet Diameter at L4/29:** Diameter of projectile at distance L4.
- ◆ **F/30: Bullet Diameter at L5:** Diameter of projectile at distance L5.
- ◆ **L1\L3+G: Length to Bore Diameter:** Length to bore (CIP only). Cartridge case length plus *chamber distance from mouth to bore diameter*. Normally L3+G is used, but for 6mm and 9mm Flobert shot cartridges L1+G is used.

SAAMI Basic Dimensions

- ◆ **/17: Length to Datum Diameter:** Basic distance from head to datum diameter (approximately midpoint of shoulder cone).
- ◆ **/18B: Datum Diameter:** Basic diameter on shoulder cone, located between body-shoulder and neck-shoulder intersection.

Buttons Apply and Tolerances

- ◆ **Button Apply:** Data in cartridge data record is not updated each time an entry is made in one field. Otherwise, each entry will increment the UNDO counter and the UNDO function will become useless. When all or some essential entries or changes to this form are complete press the APPLY button. Some data will be checked and other dependencies will be calculated. The drawing is updated. UNDO-count is incremented. Look at drawing for missing details or errors.
- ◆ **Button Show Tolerances:** Button to toggle between dimensions and tolerances. Forces form to show tolerances for each dimension and allows user to make entries and changes to tolerances. Button text changes to **Show Dimensions**. When you switch from dimensions to tolerances and vice versa all entry fields will be erased and rewritten with existing tolerances.

Notes to Angles and Dependent Diameters and Distances

There are dependencies between angles and adjacent diameters and distances. SAAMI fixes shoulder angle and calculates the corresponding diameters and distances, CIP fixes the diameters and distances and calculates the angle. Following applies to chamber and case so far appropriate.

When pressing APPLY button, the program checks

- ◆ **Shoulder angle** by calculating exact angle from neck diameter (H1), shoulder diameter (P2) and distance between both diameters (L2-L1). (CIP control value)
- ◆ The matching **shoulder diameter (P2)** and **body length (L2)** will be calculated for given shoulder angle. (SAAMI control value)
- ◆ **Length L1 and L2** calculated by fixed shoulder angle, P1 and H1.
- ◆ **Case mouth chamfer angle Alfa1** is checked using entries of neck diameter at mouth (H2), bullet diameter (G1) and height of mouth chamfer (h).
- ◆ Also **height of mouth chamfer (h)** is checked by dimensions G1, H2 and angle Alfa1.
- ◆ **Throat angle (i)** is checked against defining diameters and distance.
- ◆ The **distance (S)** for shoulder angle's center of circle is checked against entries of P2, H1, L1 and L2.
- ◆ **Head Height (E)** is checked by diameters P1, R, emin, E1 and angle Delta.
- ◆ The **bore area (Q)** is calculated using bore (F) and groove (Z) diameters, groove width (b) and number of grooves (n).
- ◆ **L3+G** will be calculated from both values.
- ◆ **P1** diameter and **E** length not available for most SAAMI designs will be calculated, displayed in parentheses for easier SAAMI to CIP conversion.

You will find in angle fields almost two different values: the first one in red color and a second one behind in red color and within parentheses. The first one is the entered (desired) value and the value in parentheses is the value calculated dependent on geometry of diameters and distance defining the angle.

Example:

The shoulder angle Alpha interacts with shoulder diameter P2, neck diameter H1 and length of shoulder L2-L1. All three fields may contain red values with correction values in parentheses. The user may decide what he wants to correct: dimensions or angle or leave entries untouched.

Please note that a red correction value appears when dimensions are very close to fit even in the third decimal. This is due to finding not a perfect match in the smallest decimal. The user has then to decide that the value will be exact enough to be appropriate for its purpose.

Entry of Angles in Dec, Min, Sec – Format

Standard angle entry fields contain values in decimal format. To enter a Dec, Min, Sec format user must click double into angle field. A small entry window for Dec, Min, Sec entry appears.

| | | | | | |
|---------------------------------------|---------------------|----|---|----|---|
| Alpha/15: Shoulder Angle | 40.0000 (40.0021) * | | | | |
| S: Length to Origin of Shoulder Angle | 55.46 (55.4584) | 40 | ° | 00 | ' |
| r1 min/17: Shoulder Radius | 0.76 | | | 00 | " |
| r2/25: Neck Radius | 3.18 | | | | |

Picture 26 : Dec, Min, Sec Entry Window

To invoke, the cursor must appear in the angle's field and the user may press [CTRL-W] on keyboard to open this window. Make entries or changes as you like. The [Enter] key or double click into Deg- or Min- or Sec field closes window and calculates new decimal value. The [ESC] key closes this window discarding any changes to it.

Entry of CIP Notes

CIP adds notes to some dimensions to declare a special meaning of this dimension. The user may open the CIP remarks symbol menu by clicking with **right mouse button** into corresponding entry field, or pressing [CTRL-R] key on keyboard when cursor is in the used field. Formerly up to 5 notes have been specified, now there are only 3 to select from.

| | | |
|--|------|----|
| * Basic dimension to calculate other dims. | 8.89 | 1) |
| ✓ 1) Check for safety reasons | | |
| 2) Tolerances for proof barrels | | |
| 3); | | |
| 4) | | |

Picture 27 : CIP Notes Menu

In this example, the CIP Notes Menu was invoked over R1 field. R1 should be checked for safety reasons. This field contained already the note **1)** which shows a checked mark in popup menu. User may now set or clear check marks as necessary. These marks and notes are used to print a correctly formatted CIP data sheet.

Window is closed by [ESC] key or by clicking into one of the entry fields. Notes are updated on screen **after pressing the Apply** button.

Cartridge Dimensions Form for Table 6 Cartridges

| | | |
|---|--------------------|----|
| | r2/25: Neck Radius | |
| Cartridge Neck | | |
| H1/20: Diameter at Shoulder-Neck Intersection | | |
| H2/24: Diameter at Mouth | 6.32 | 1) |
| Volumes | | |
| VC: Case Volume | 0.3300 | |

Picture 28 : Changes to Cartridge Dimensions Form Table 6 Devices

Instead of displaying entry fields to define bullet data, user has to enter case volume of cartridge. This is a special case for industrial cartridges for bolt- or rivet seating tools standardized by CIP.

Volumes (instead of "Bullet" section in form)

- ♦ **VC: Case Volume:** Total volume of maximum cartridge. This is not case capacity. This means the volume displaced by the folded or crimped case closed tightly. Exactly case capacity plus case material.

Chamber Dimensions Form

| Chamber Dimensions: .320 Court Blanc - CIP | | | |
|--|-------|------------|-------|
| Chamber Lengths | | Dimensions | |
| L1/57: Length to Shoulder | | | |
| L2/64: Length to Shoulder-Neck Intersection | | | |
| L3/66: Length to Neck Chamfer | 16.00 | 1)2) | |
| /52B: Length to first Body Diameter | | | |
| /54B: Length from first to second Body Diameter | | | |
| /53: First Body Diameter | | | |
| /55: Second Body Diameter | | | |
| Chamber Head | | | |
| R/51: Counterbore Depth | 1.35 | | |
| R1/50: Counterbore Diameter | 9.60 | | |
| R2: Partial Counterbore Depth | | | |
| R3: Belt Counterbore Diameter | | | |
| r/59: Radius Body Diam.-Counterbore | | | |
| alfaS/76: Angle at Counterbore of Rim of a Shotgun | | | |
| Powder Chamber | | | |
| E: Length to Underhead Diameter | | | |
| P1/56: Body Diameter at Counterbore Intersection | 8.10 | 1)2) | |
| P2/58: Shoulder Diameter | | | |
| Chamber Shoulder | | | |
| Alpha/60B: Shoulder Angle | | | |
| S: Length to Origin of Shoulder Angle | | | |
| r1 max/61: Shoulder Radius | | | |
| r2/68: Neck Radius | | | |
| | | | |
| Chamber Neck | | Dimensions | |
| H1/65: Diameter at Shoulder-Neck Intersection | | | |
| H2/67: Diameter at Neck Chamfer | | 8.10 | 1)2) |
| Throat Dimensions | | | |
| G1/71: Throat/Freebore Start Diameter | | 7.00 | 2)4)* |
| G: Length from Neck Chamfer to Bore Diameter | | 16.50 | 4)* |
| Alpha1/69B: Neck Chamfer Angle | | 90.0000 | |
| h: Neck Chamfer Height | | 0.55 | |
| s: Length of Freebore + Neck Chamfer | | 13.00 | * |
| i/72B: Throat Angle | | 45.0000 | * |
| w/73: Cylinder Gap Width | | 1.50 | 2) |
| /75: Diameter at Freeb.-Throat Intersection | | 7.00 | |
| /70: Length to Throat Diameter | | 16.55 | |
| /74: Length to Freebore-Throat Intersection | | 29.00 | |
| /81: Length to Bore Diameter | | 32.50 | |
| Barrel Dimensions | | | |
| F/82: Bore Diameter | | 3.00 | 2)4)* |
| Z/83: Groove Diameter | | 3.00 | 2) |
| Rifling | | | |
| b/87: Groove Width | | | |
| N/86: Number of Grooves | | | |
| u/85: Twist of Rifling and Direction | | | |
| Q/84: Minimum bore and groove area | | 7.07 | 4) |
| SAAMI Datum Dimensions | | | |
| /62: Length to Datum Diameter | | | |
| /63B: Datum Diameter | | | |
| Show Tolerances | | Apply | |

Picture 29 : Chamber Dimensions Form

This form holds all necessary data to specify the dimensions of the chamber. Data represents the minimum chamber dimensions for CIP designs or dimensions at Maximum Material Conditions (MMC) for SAAMI designs.

The windows title line shows the short name of the cartridge name and the abbreviation of the regulating body.

The labels left of each entry data field begin with symbol or number. Most CIP symbols start with an ASCII-character or Greek symbol; for SAAMI metrics a numbering scheme instead of symbols is used. Scheme: CIP Symbol / SAAMI Number : Descriptive Text (See 2. Chamber Symbols, page 69 for detailed description).

Entry Fields:

Chamber Length Dimensions

- ♦ **L1/57: Length to Shoulder:** Length of chamber at diameter P2. SAAMI reference dimension.
- ♦ **L2/64: Length to Shoulder-Neck Intersection:** Length of chamber at diameter H1. SAAMI Reference dimension.
- ♦ **L3/66: Length to Neck Chamfer:** Length of chamber at diameter H2.

SAAMI Dimensions defining Case Taper

- ♦ **/52B: Length to first Body Diameter:** Distance from breeching surface to first body diameter 53 to specify body taper. Basic dimension, SAAMI only.
- ♦ **/54B: Length from first to second Body Diameter:** Basic distance from first body diameter (53) to second body diameter (55) specifying chamber body taper. SAAMI only.

- ◆ **/53: First Body Diameter:** Basic diameter near counterbore or chamber point (52B): first body diameter specifying body taper. SAAMI only.
- ◆ **/55: Second Body Diameter:** Basic diameter near shoulder (54B): second body diameter specifying body taper. SAAMI only.

Chamber Head or Breech Area Dimensions

- ◆ **R/51: Distance between breech face and the backward edge of barrel:** Counterbore depth for rimmed or belted cartridges. Normally headspace dimension for rimmed designs.
- ◆ **R1/50: Breech (Counterbore) diameter:** Diameter of counterbore. Applies to both chamber and bolt head (SAAMI: may be taken from calculated P1).
- ◆ **R2: Breech depth (Counterbore Depth):** Counterbore depth for reception of part of the rim. CIP only.
- ◆ **R3: Diameter in front of the breech for belted Magnum cartridges:** Counterbore diameter for reception of cartridge belt. CIP only.
- ◆ **r/59: Radius of junction at chamber mouth:** Small radius at edge of counterbore to chamber intersection.
- ◆ **alfaS/76: Head angle:** Counterbore chamfer angle at rim of a shotgun chamber. SAAMI basic angle.

Powder Chamber Data

- ◆ **E: Distance between breech face and chamber mouth or Length to Underhead Diameter:** Distance from breech surface to underhead diameter. Location of body diameter P1. CIP only.
- ◆ **P1/56: Diameter at chamber mouth or at distance E. Diameter at Counterbore-Body Intersection:** Body diameter at counterbore-body intersection (SAAMI: may be calculated from 52B, 54B, 53 and 55).
- ◆ **P2/58: Shoulder Diameter or Diameter at the beginning of junction cone at distance L1:** Diameter at virtual body-shoulder intersection. SAAMI reference dimension. (SAAMI: may be calculated from 52B, 54B, 53, 55 and L1).

Chamber Shoulder or Junction Cone Dimensions

- ◆ **Alpha/60B: Angle of junction cone. Shoulder Angle:** SAAMI Basic angle dimensioned to centerline (half angle), CIP dimensioned symmetric to centerline.
- ◆ **S: Length of the peak of junction cone. Length to Origin of Shoulder Angle:** Distance to center of circle forming segment of shoulder angle. CIP only.
- ◆ **r1 max/61: Radius of junction at the extremities of diameter P2. Shoulder Radius:** Maximum dimension, at intersection between body and shoulder.
- ◆ **r2/68: Radius of junction at collar. Neck Radius:** At intersection between shoulder and neck.

Chamber Neck or Collar Dimensions

- ◆ **H1/65: Diameter at beginning of collar at distance L2. Diameter at Shoulder-Neck Intersection.** Virtual dimension.
- ◆ **H2/67: Diameter at distance L3. Diameter in front of Neck Chamfer.** Diameter at chamber mouth.

Chamber Throat or Commencement of Rifling Dimensions

- ◆ **G1/71: Diameter at commencement of rifling. Throat/Freebore Start Diameter:** Diameter of throat or freebore at intersection neck chamfer to throat. SAAMI reference dimension.
- ◆ **G: Distance between H2 and F. Length from Neck Chamfer to Bore Diameter:** Distance from neck to neck chamfer intersection to bore. CIP only.
- ◆ **Alpha1/69B: Angle of junction between H2 and G1. Neck Chamfer Angle:** Transition from neck to throat. Dimensioned from centerline by SAAMI (Basic angle, half angle), CIP uses full angle symmetric to centerline.

- ♦ ***h: Distance between H2 and G1 (at angle alfa1). Neck Chamfer Height:*** Height of neck chamfer. CIP only.
- ♦ ***s: Distance between H2 and commencement of rifling at diameter G1. Length of Freebore plus Neck Chamfer height:*** Length of neck chamfer plus cylindrical part of throat. CIP only.
- ♦ ***i/72B: Half angle of the inclination of commencement of rifling. Throat Angle:*** Angle of throat taper. Dimensioned to centerline.
- ♦ ***w/73: Cylinder Gap Width:*** In case of "Revolver" designs the distance from cylinder face to barrel end. Located in drawing at transition from cylindrical lead to conical throat.

SAAMI Dimensions

- ♦ ***/75: Diameter at Freebore to Throat Intersection:*** Diameter of throat at intersection freebore/lead to throat utilizing conical lead. Rarely used dimension, see .303 British SAAMI for example.
- ♦ ***/70: Length to Throat Diameter:*** Length from breech surface to neck chamfer-throat intersection. SAAMI only, reference dimension.
- ♦ ***/74: Length to Freebore-Throat Intersection:*** Length from breech surface to cylindrical freebore-throat taper intersection. SAAMI only.
- ♦ ***/81: Length to Bore Diameter:*** Length from breech surface to bore diameter/throat end.

Barrel Dimensions

- ♦ ***F/82: Land diameter of bore of barrel. Bore Diameter.*** With even number of rifling distance between opposite lands.
- ♦ ***Z/83: Diameter groove-to-groove of barrel. Groove Diameter:*** With even number of rifling distance between opposite grooves.

Rifling Dimensions or Grooves

- ♦ ***b/87: Width of grooves. Groove Width:*** Minimum value, reference dimension.
- ♦ ***N/86: Number of grooves:*** Reference value.
- ♦ ***u/85: Pitch of rifling of grooves. :*** Twist length. Distance for one full turn. Optional specify RH for right hand twist and LH for left hand twist.
- ♦ ***Q/84: Bore section of barrel. Minimum bore and groove area:*** Cross sectional area of barrel bore.

SAAMI Datum Dimensions

- ♦ ***/62: Length to Datum Diameter:*** Basic distance from head/breech to datum diameter (approximately midpoint of shoulder cone). SAAMI Headspace reference for all rimless cartridges including .220 Swift and .225 Win.
- ♦ ***/63B: Datum Diameter:*** Basic diameter on shoulder cone, located between body-shoulder and neck-shoulder intersection.

Buttons Apply and Tolerances

- ♦ ***Button Apply:*** Data in cartridge data record is not updated each time an entry is made in one field. Otherwise, each entry will increment the UNDO counter and the UNDO function will become useless. When all or some essential entries or changes to this form are complete press the **APPLY** button. Some data will be checked and other dependencies will be calculated. The drawing is updated. UNDO-count is incremented. Look at drawing for missing details or errors.
- ♦ ***Button Show Tolerances:*** Button to toggle between dimensions and tolerances. Forces form to show tolerances for each dimension and allows user to make entries and changes to tolerances. Button text changes to **Show Dimensions**. When you switch from dimensions to tolerances all entry fields will be erased and rewritten with existing tolerances.

Chamber Dimensions Form for Table 6 Cartridges

| Barrel Dimensions | |
|-----------------------|------|
| F/82: Bore Diameter | 6.00 |
| Z/83: Groove Diameter | 6.00 |

| Volumes | |
|--------------------------|-----|
| V(ET): Volume of chamber | .56 |
| V(T): Volume of chamber | .50 |

| SAAMI Datum Dimensions | |
|-------------------------------|--|
| /62: Length to Datum Diameter | |

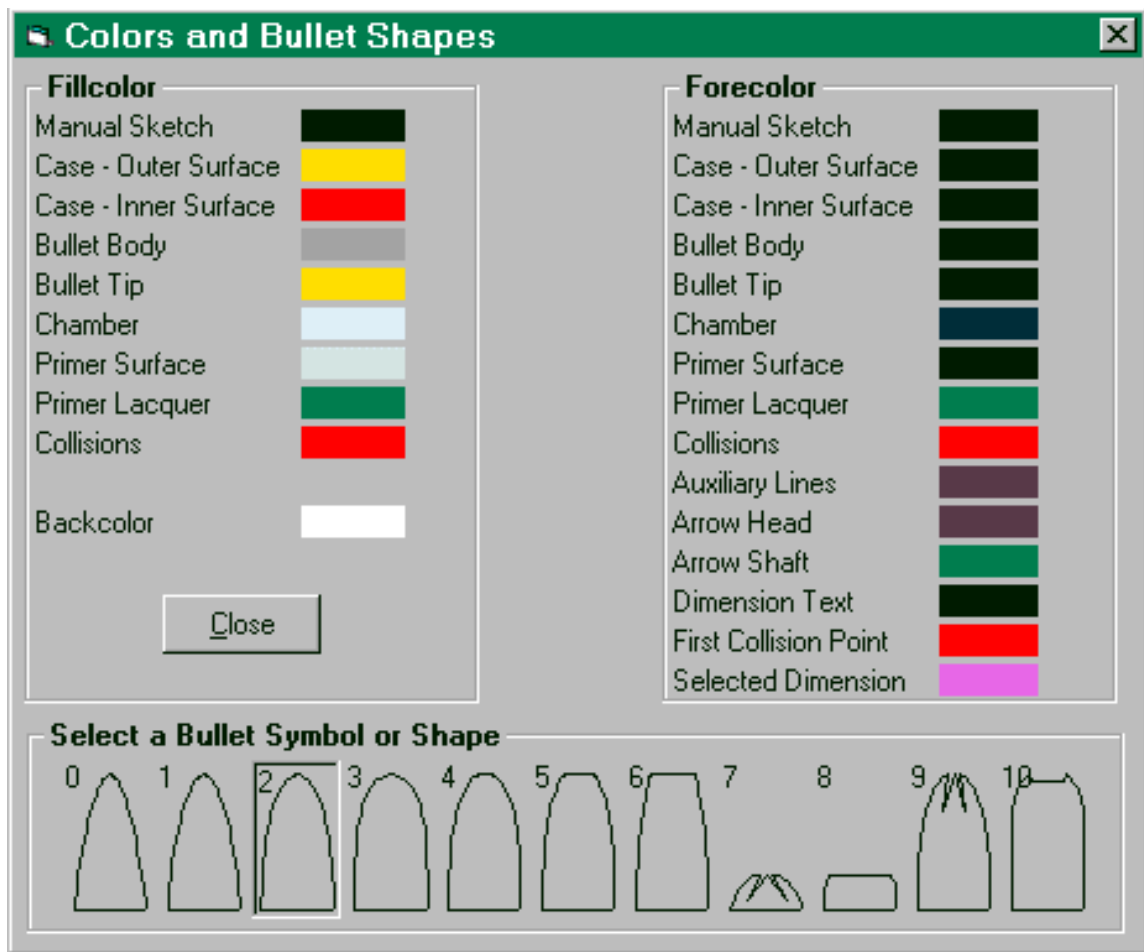
Picture 30 : Changes to Chamber Dimensions Form Table 6 Devices

Instead of displaying entry fields to define rifling data, user has to enter chamber volumes of cartridge. This is a special case for industrial cartridges for bolt- or rivet seating tools standardized by CIP.

Volumes (instead of "Rifling")

- ♦ **V(ET): Volume of Chamber:** Total volume of minimum chamber. (Chamber with throat)
- ♦ **V(T): Volume of total CombustionChamber:** Total combustion volume. Volume of chamber (V(ET)) minus volume of case material plus additional volume (Va1 or Va2)

Colors and Bullet Symbols Window



Picture 31 : Color and Bullet Shape Selection

The user may select a symbolic bullet for the cartridge he designs. Furthermore colors for lines, areas and drawing background. Colors apply to screen and printing. CIP datasheets are forced to print black on white.

A bullet symbol is only a shape and will be placed to the case mouth to draw a look-alike cartridge. The length of the shape depends on your overall cartridge length settings. Symbols 0 to 6 represent lead or jacketed bullets. All bullets contain body and tip. The length of tip is fixed and cannot be changed by the user. Different fill and outline colors may be assigned to bullet and tip. The bullet shapes numbers 7 to 10 are for crimped or folded blank cartridges. Shape 9 and shape 10 are for blank cartridges where the case is forming the bullet and **over all cartridge length L6 is longer than specified case length L3** (almost rifle blanks). Shape 7 and shape 8 is for crimps where **overall length L6 is shorter than specified case length L3** due to crimping, may also be used with SAAMI shotgun shells to show them in folded state (almost pistol blanks or industrial cartridges).

Simply click on desired shape to change bullet symbol. New shape will be immediately transferred into cartridge data in workspace and in file on disk. Drawing will be refreshed. No *APPLY* action is necessary.

Color selection applies to items listed left of color fields. To select a new color place cursor into color field and click with left mouse button or press [Enter] key. Windows color dialog window opens. You can easily navigate with mouse cursor and select desired color or use [Tab] key to jump between functions, move within colors with Arrow keys, [Space] key to select color and [Enter] key to apply color.

Fill colors for case, bullet jacket and bullet tip will be transferred immediately to cartridge data in workspace and on disk. Drawing will be refreshed.

Sizing Cartridges under Support of QuickDESIGN

The simplest way to resize cartridges is to enter new data into cartridge or chamber forms, but the user may change cartridge data without changing values in the entry form's fields. To generate a new design from an existing one you can interactively or automatically apply changes to cartridge and chamber data without switching between both forms. In main menu under *Edit –Select Window... Size and Transform Cartridge* you may open the

Size Cartridge by Pre-selected Options

The 'Size Cartridge' dialog box is shown with the following elements:

- Title Bar:** Size Cartridge
- Section Header:** Size or Move ...
- Radio Button Options:**
 - ☒ Body length, keep Case Length
 - ☐ Body length, affect Case Length
 - ☐ Shoulder Angle, keep Case Length
 - ☐ Shoulder Angle, affect Case Length
 - ☐ Body Taper of Bottleneck Design
 - ☐ Underhead Diameter, keep Rim
 - ☐ Underhead Diameter, affect Rim
 - ☐ Shoulder Diameter, keep Angle
 - ☐ Neck Length, affect overall Length
 - ☐ Bullet and Rifling Caliber
- Section Header:** Select a Standard Caliber
- Caliber Selection:** A dropdown menu showing '.173 - 4.27'.
- Radio Button Options:**
 - ☒ Size Cartridge and Chamber
 - ☐ Size Cartridge only
 - ☐ Size Chamber only
- Checkbox:** ☐ Resize Picture after Operation
- Step Increment:** A text box containing '1.00' next to the label 'Step Increment'.
- Buttons:** 'Step Up' and 'Step Down'.
- Headspace in Drawing:** A text box containing '.0000' next to the label 'Headspace in Drawing'.
- Case:** A text box containing '0°29'46"' next to the label 'Case'.
- Body Taper:** A text box containing '0°30'24"' next to the label 'Body Taper'.
- Chamber:** A text box containing '0°30'24"' next to the label 'Chamber'.
- Buttons:** 'Close', 'Undo', and a button with the number '1'.

Picture 32 : Size Cartridge Window

In the frame *Size or Move* you find the option buttons :

- ◆ **Size Cartridge and Chamber:** Sizing operation applies to both cartridge and chamber.
- ◆ **Size Cartridge only:** Operation applies only to cartridge.
- ◆ **Size Chamber only:** Operation applies only to chamber.

You may change dimensions separately or simultaneously in both cartridge and chamber. All operations listed in the frame *Size or Move* apply to the selection you make here. You can select one of 10 different operations. The first nine options allow stepwise operation. The amount of changing dimensions you will find in step increment entry window left of step increment text field. Depending on units settings, initial value will be 1 mm length angle for metric (SI) units or 0.04 inch length for English (SAE) units, for shoulder angle 2 degrees and body taper angle 0,1 degree. After selecting one of the first nine options, you can grow or shrink selected dimensions by pressing *Step Up* or *Step Down Button*. Some operations resize the cartridge's overall length. In such a case, the Check Box **Resize Picture after Operation** is enabled to allow the user to use always the full drawing area to view the cartridge. When check box is left unchecked, the cartridge may exceed the borders of drawing area or will be so small that you cannot watch any changes you apply. Any step updates the Case Capacity output fields in Status Bar.

All sizing functions performed in this window or under control of this window are applied directly to the design's data without using any of the *APPLY* buttons in entry forms.

When **Size Cartridge and Chamber** is selected, dimensions are changed to both by equal amount of step width in length, diameter or angle. Sizing underhead diameter region excessively may not lead to sufficient correspondence between chamber and case. In such a case, manual correction will be necessary.

Predefined Operations:

- ◆ **Body length, keep Case Length:** Move the shoulder back and forth. Case mouth stays at its position. Neck shortens or lengthens. **Resize Picture** check box is disabled.
- ◆ **Body length, affect Case Length:** Shoulder with neck is moved back and forth. Case lengthens or shortens. **Resize Picture** check box is enabled.
- ◆ **Shoulder Angle, keep Case Length:** Make shoulder angle larger or smaller. **Resize Picture** check box is disabled.
- ◆ **Shoulder Angle, affect Case Length:** With smaller angle neck is moved forward and vice-versa. **Resize Picture** check box is enabled.
- ◆ **Body Taper of Bottleneck Design:** Make more or less taper. Taper is indicated in output fields separately for case and chamber: **Resize Picture** check box is disabled.
- ◆ **Underhead Diameter, keep Rim:** Make case body at case underhead thicker or thinner. Rim diameter is not affected. **Resize Picture** check box is enabled.
- ◆ **Underhead Diameter, affect Rim:** Make case body in head region thicker or thinner including rim diameter. **Resize Picture** check box is enabled.
- ◆ **Shoulder Diameter, keep Angle:** Resize shoulder diameter, do not affect shoulder angle. **Resize Picture** check box is disabled.
- ◆ **Neck Length, affect overall Length:** Stretch or shorten neck length. **Resize Picture** check box is enabled.

Note: You may change step increment any time before using *step up* or *step down* buttons. When you want to reach a position within a single step, it may be useful to change the necessary step width. Example: Shoulder angle is at 21,55 degrees, you want to reach 30 degrees: set step increment to 8,45 and step up.

- ◆ **Bullet and Rifling Caliber:** Enables the select box below to select standard calibers.
- ◆ **Select a Standard Caliber:** Select one of several standard calibers and apply them to the given cartridge. The caliber list shown in selection box is loaded from file CALIBER.DAT (plain ASCII text) containing all necessary dimensions and tolerances of bore and throat. Only standardized calibers containing fully specified data and tolerances would be found in this list.

- ◆ **Headspace in Drawing:** Entry field. Normally the baseline for both chamber and case is at drawing origin at zero (0) of X and Y coordinates. If you change headspace value to positive numbers the chamber will hold it's zero position, but the case will protrude out of chamber exactly by the amount of entered headspace value towards negative Y- axis. Normally you will see then the gap in the shoulder between case and chamber with bottlenecked designs (assuming you set drawing to show both). Assigning a negative value for headspace places the cartridge deeper into chamber.
- ◆ **Undo Button:** Step back and erase up to recent nine operations. Stepping back to zero switches totally to instance at beginning of work.
- ◆ **Close Button:** Close Window.

Sizing Single- or Multiple Dimensions of Cartridge Manually

While **Size Cartridge window is visible**, additional operations to change dimensions are possible:

- ◆ Drawing must be set to show metrics, preferably to show dimensions and not symbols.
- ◆ Move mouse cursor over a dimension (or symbol) in drawing.
- ◆ Any dimension field contains a hot spot where cursor changes from crosshair to up arrow.
- ◆ Being in up-arrow mode click with left mouse button.
- ◆ Dimension color changes (to magenta, default color) to sign it as marked. Color may be set in *Colors and Bullet Symbols Window...Selected Dimension*.
- ◆ Use same procedure to unmark (toggle mark) dimension.
- ◆ You may mark several dimensions at one time.
- ◆ Use *UP-ARROW* or *DOWN-ARROW* keys to increment or decrement marked dimension(s).
- ◆ Step width is taken from Step Increment field on **Size Cartridge** Window.
 - Holding SHIFT key down while pressing ARROW key increases step increment ten times the displayed value.
 - Holding CTRL key down while pressing ARROW key decreases step increment to one tenth of displayed value.
 - Holding ALT key down while pressing ARROW key decreases step increment to one hundredth of displayed value.
 - Holding CTRL-ALT key down while pressing ARROW key decreases step increment to one thousandth of displayed value.

Note: Changes are made to cartridge **or** chamber but not to both, because you can enable either case metrics or chamber metrics. This is independent of settings of option buttons in *Size or Move...* frame.

Manually Repositioning of Dimensionings



By pressing of button **Metrics moveable** automatic placement of metrics can be manually moved.

By pressing of button or in **Menu Edit –Select Window** Menu point **Metrics moveable** is selected you may do following movements of arrows. Description below does not apply to dimensioning of angles and head radius of bullets:

- ◆ Move mousepointer above dimension (or symbol) in drawing.
 - ◆ Every dimension contains a hot spot where Mousepointer changes from crosshair to an arrow showing the direction of possible movement.
 - ◆ When arrow is shown, click to this point using left mouse button. (or right button if you changed mouse settings).
 - ◆ The color of dimension changes to magenta (default, selectable in color window) to show marked and selected dimension.
 - ◆ Additional marking of the same dimension resets selection.
 - ◆ **You may select only one dimension at one time. Multiple selection is disabled.**
 - ◆ Use arrow keys up, down left or right to move selected dimension. Not all arrow keys work with all dimensions in all directions.
-
- ◆ Step width is taken from Step Increment field on **Size Cartridge** Window.
 - Holding SHIFT key down while pressing ARROW key increases step increment ten times the displayed value.
 - Holding CTRL key down while pressing ARROW key decreases step increment to one tenth of displayed value.
 - Holding ALT key down while pressing ARROW key decreases step increment to one hundredth of displayed value.
 - Holding CTRL-ALT key down while pressing ARROW key decreases step increment to one thousandth of displayed value.

By double clicking onto the drawing area selection will be cleared.

Changed dimensioning positions will be saved with all data to data record by saving cartridge data.

Using the UNDO function will remove actual saved positions.

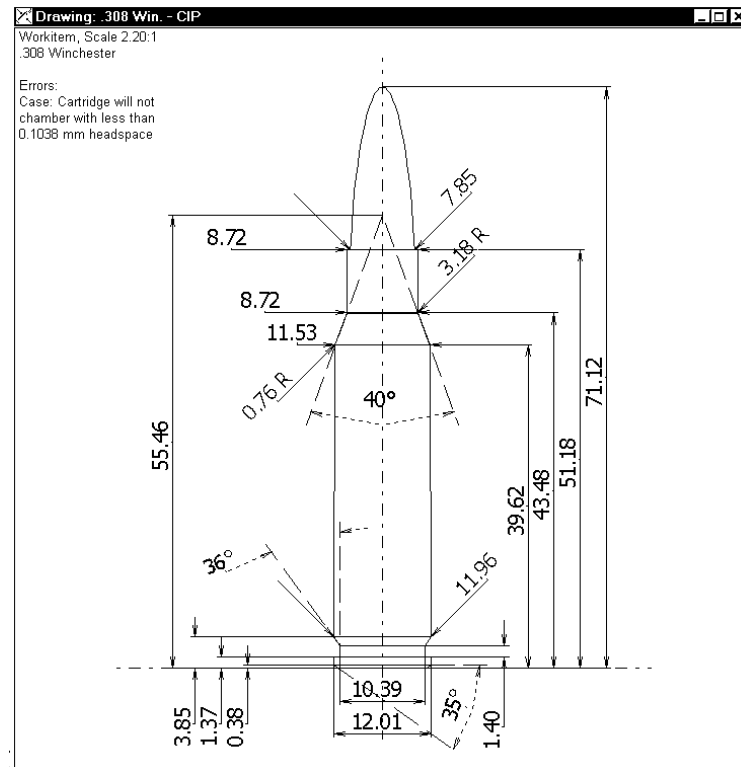
Moved positions of actual cartridge are hold fixed and are no more automatically positioned. If you want to clear all fixed positions press **Ctrl-Alt-D** key.

Important: Stepwidth setting in Size Cartridge window has to be done before moving dimensioning, because calling this window resets *metrics moveable* function. Furthermore the drawing must show the cartridge and/or chamber in vertical position.

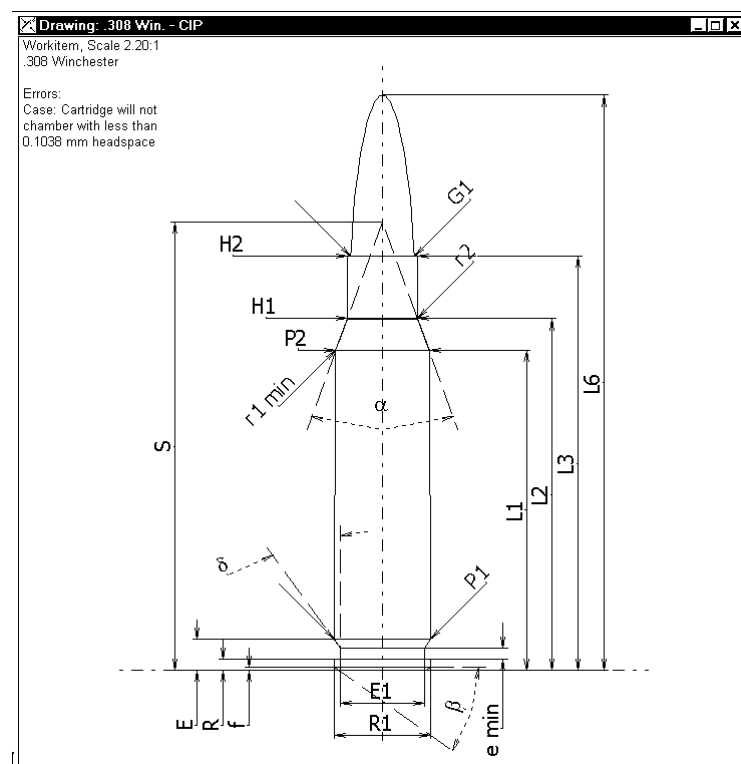
Changes made apply only to cartridge or chamber bot not both with one action, you have to rework cartridge and chamber separately. **This all applies to dimensioning of bullet drawing in the same manner.**

Drawing Appearance and Settings

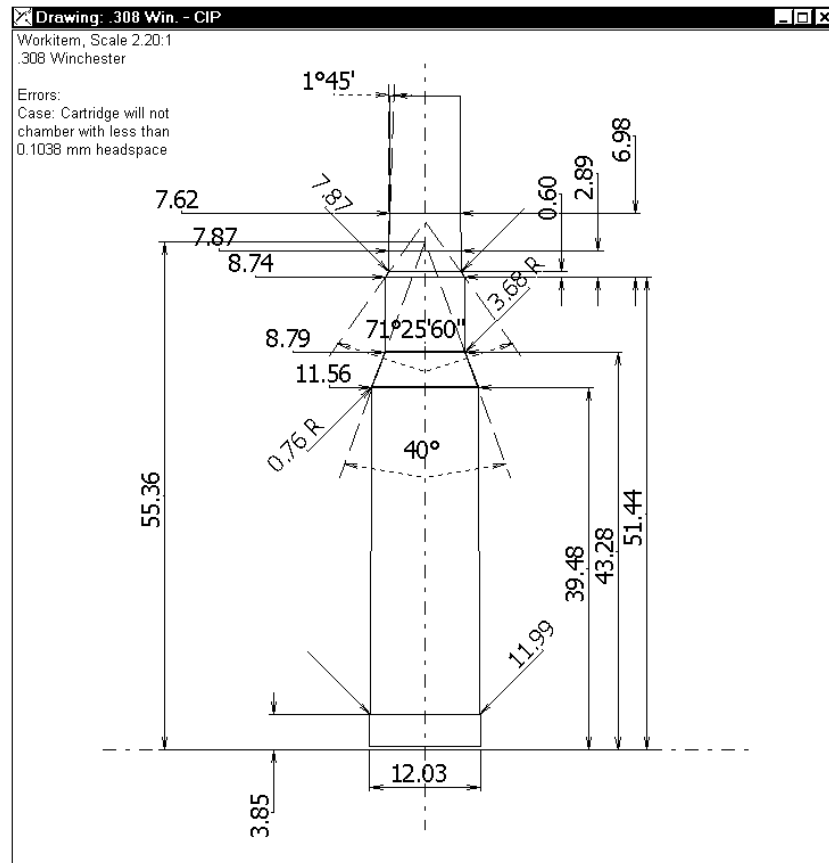
Drawing can be displayed as outline drawing, wireframe or solid flat shaded form. All drawings may contain cartridge or chamber separately or both together. All drawings may show metrics with dimensions or symbols, but either cartridge or chamber metrics, not both together. All drawings may show inner case contours.



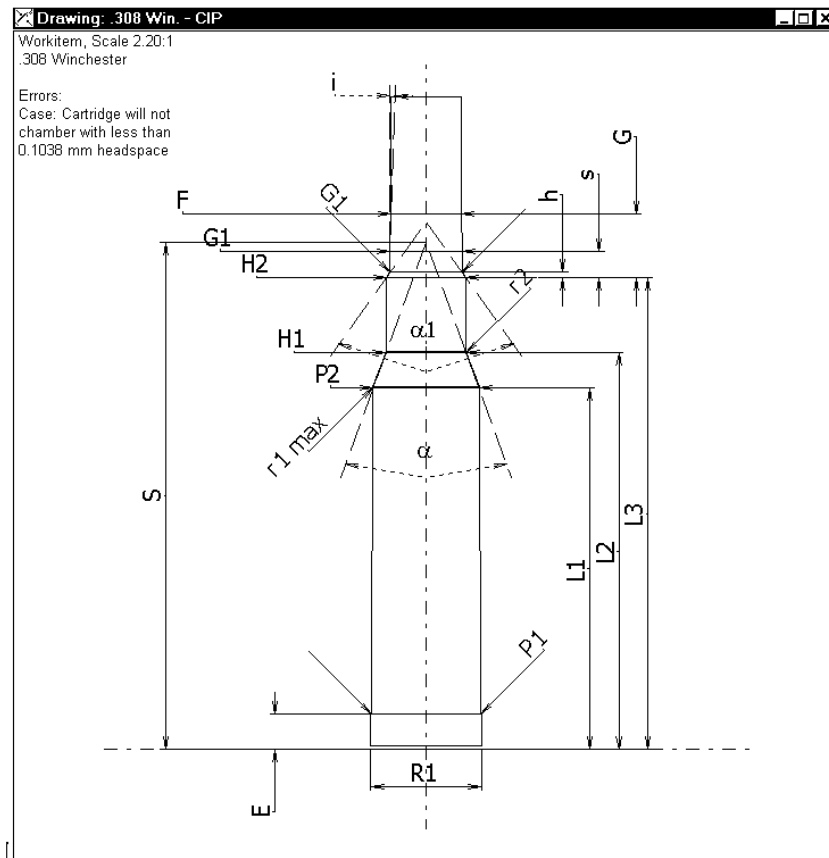
Picture 33 : Cartridge Outline Drawing with Metrics and Dimensions



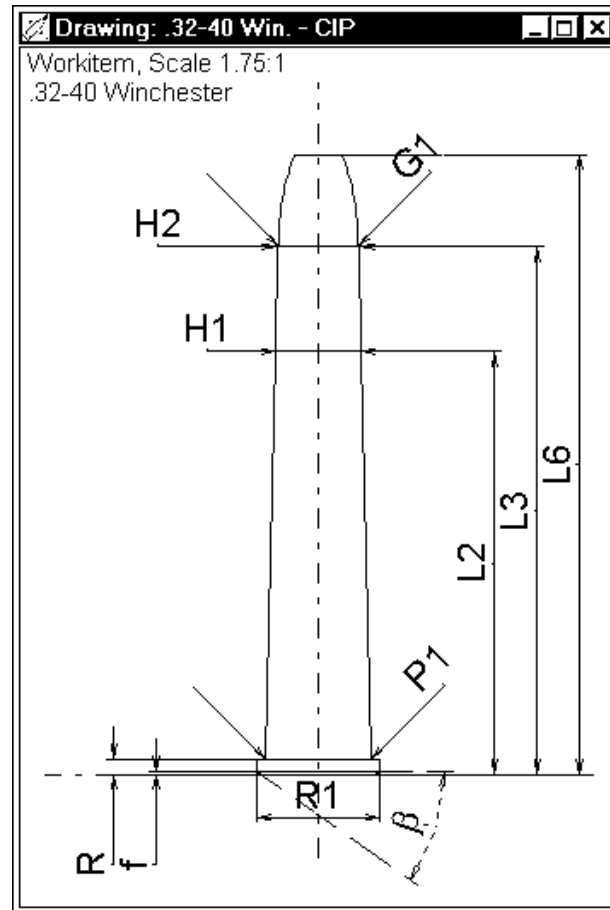
Picture 34 : Cartridge Outline Drawing with Metrics and CIP Symbols



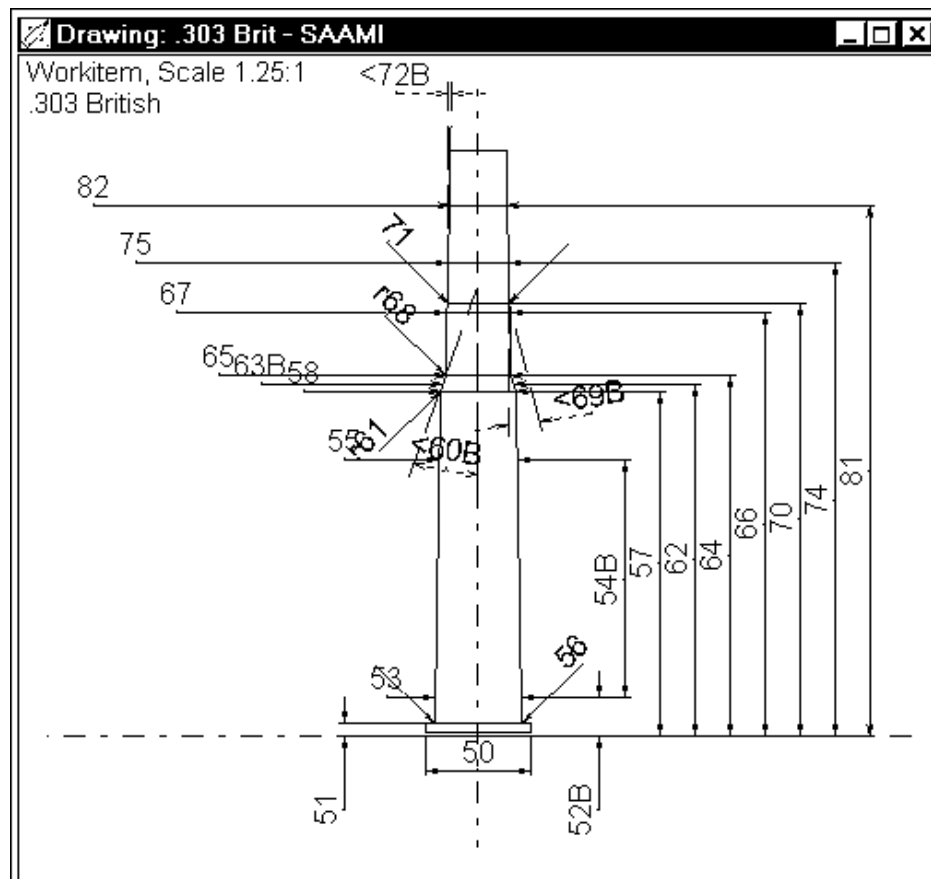
Picture 35 : Chamber Outline Drawing with Metrics and Dimensions



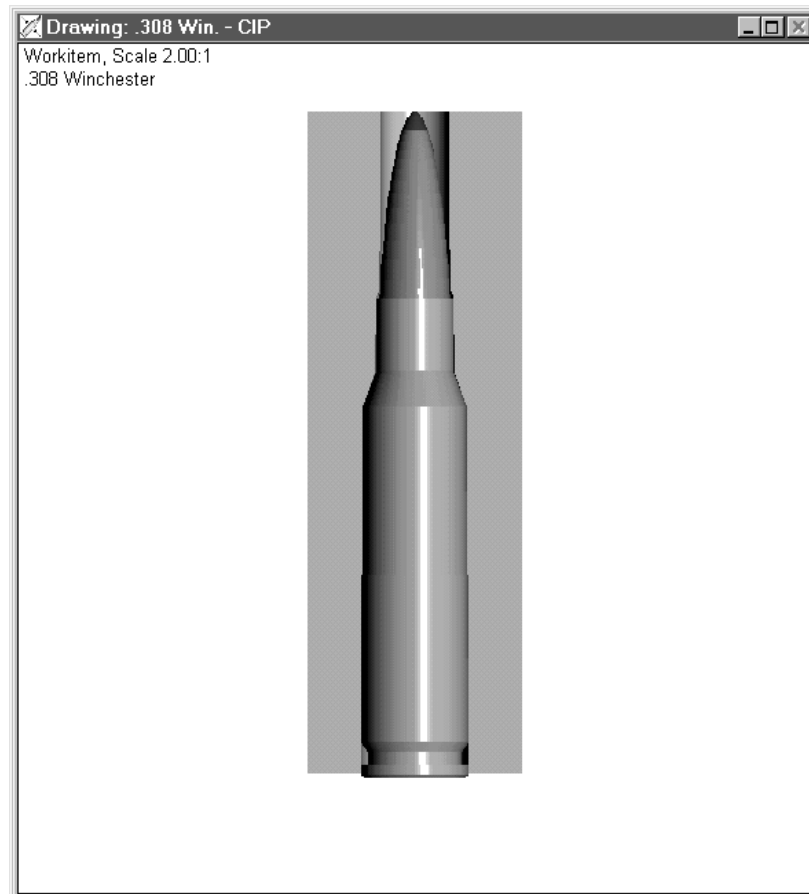
Picture 36 : Chamber Outline Drawing with Metrics and CIP Symbols



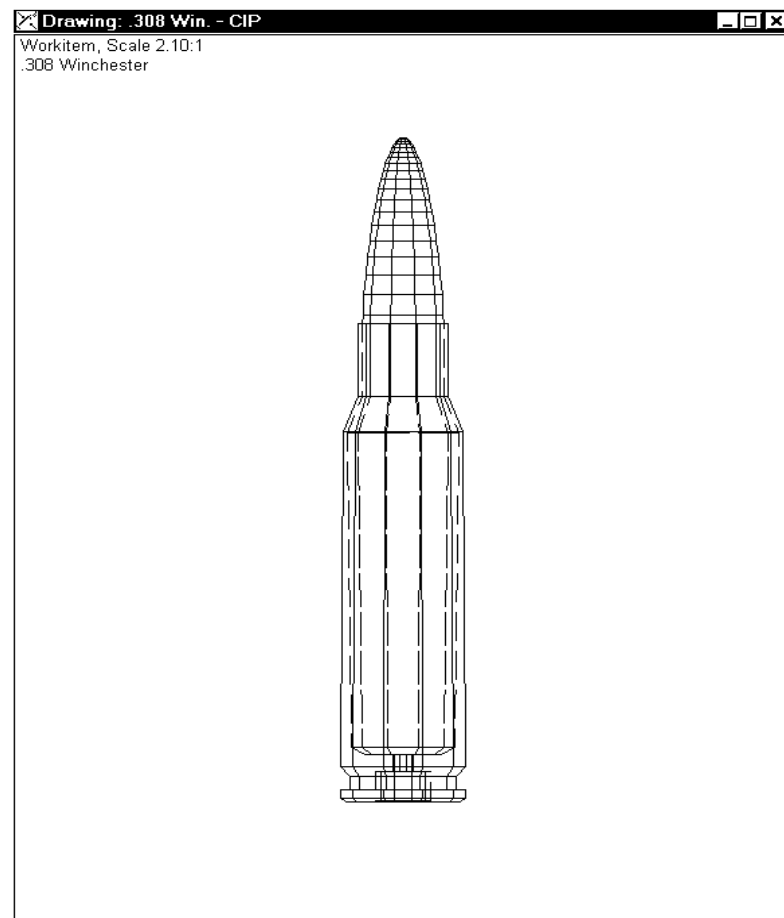
Picture 37 : Rimmed Cartridge without Shoulder CIP



Picture 38 : Rimmed Chamber SAAMI



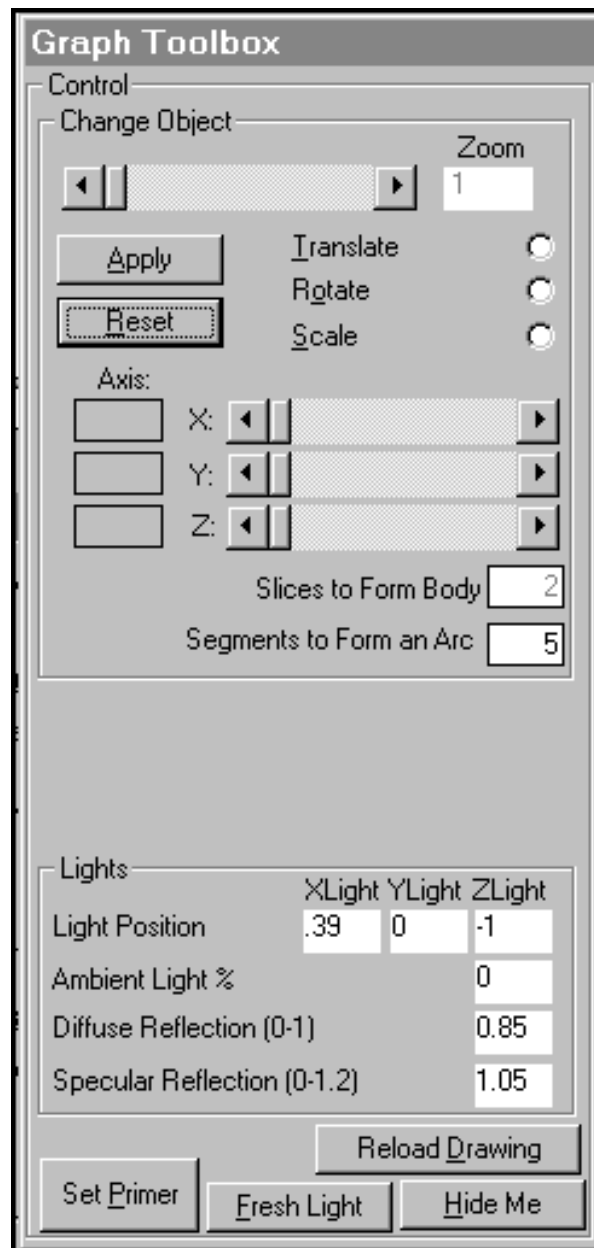
Picture 39 : Chambered Cartridge Flat Shaded



Picture 40 : Wireframe of Cartridge with Inner Contours

Customize Drawing

Under menu *Picture Control*, the window *Control Graphics Toolbox* can be loaded.



Picture 41 : Graph Toolbox

This window serves to rotate, translate and scale the drawing. A light source may be moved around and parts of ambient light, reflective light and specular reflection may be changed. A primer cup without anvil may be seated into the case.

Buttons:

- ◆ **Set Primer:** A primer cup corresponding to general form's setting is drawn into the primer pocket of case. Primer **must** be seated **before** making other operations to the drawing.
- ◆ **Refresh Light:** After changing light properties this button applies changes to the drawing without affecting drawing geometry.
- ◆ **Reload Drawing:** Reset drawing to initial state. Same as double clicking onto drawing. Primer will be erased.
- ◆ **Hide Me:** Hides Graph Toolbox window.

Options in *Change Object Frame*

- ◆ **Option Button Translate:** When set, move drawing along three axis using X, Y and Z sliders.
- ◆ **Option Button Rotate:** When set, rotate drawing around three axis using X, Y and Z slider.
- ◆ **Option Button Scale:** When set, scale drawing on all three axis using X, Y and Z slider.

After selecting an option and performing one of the above actions using the axis' sliders, the user should press the **Apply** button before selecting another option. Otherwise, operations like translation, rotation or scaling done before are destroyed.

- ◆ **The horizontal sliders have following properties:**
 - **LargeChange:** When the user clicks the area between the scroll box and scroll arrow. Value is set to 45 degrees for rotation, to 10 for translation and scale.
 - **SmallChange:** When the user clicks a scroll arrow. Value is set to 3 degrees for rotation, to 1 for translation and scale.
- ◆ **Slider X:** Apply selected option on X -axis. X-axis points from left to right.
- ◆ **Slider Y:** Apply selected option on Y-axis. Y-axis points from bottom to top.
- ◆ **Slider Z:** Apply selected option on Z-axis. Z-axis points from viewer into the drawing plane.
- ◆ **Button Apply:** Apply changes performed to draw data.
- ◆ **Button Reset:** Reset draw data back to state of last operation.
- ◆ **Slider Zoom:** Zoom picture in or out. Zoom factor is shown right near the slide. Zoom is independent of axis dependent operations.
- ◆ **Slices to form Body:** Set number of slices for wireframe (default =10) or flat shade (default=20) drawing. The higher the number, the smoother the drawing surface is in flat shade mode. Consider computation time is proportional to number.
- ◆ **Segments to form Radius:** This number represents the amount of line segments forming a radius in drawing. Default value should be 5 segments.

Entries in *Lights Frame*

- ◆ **Light Position X, Y and Z values:** A single light source is positioned.
 - Default X value = +0,39, slightly to the right.
 - Default Y value = Zero, at the baseline
 - Default Z value = -1, between viewer and drawing plane. User may change positions carefully and press *Fresh Light* button to watch changes.
- ◆ **Ambient Light %:** Part of Light surrounding drawing object from all directions.
- ◆ **Diffuse Reflection:** Part of Light reflected from a matte surface.
- ◆ **Specular Reflection:** Part of Light reflected from a mirror-like surface.

Drawing can be printed under *Main Menu...Print...Actual Drawing* or using *Copy To...* menu function. Settings do not influence printing of datasheets. Settings for Slices to form Body are reset to default values after selecting between, contour, wireframe or flat mode. Segments to form Radius (2 to 20) are saved until new entry is made.

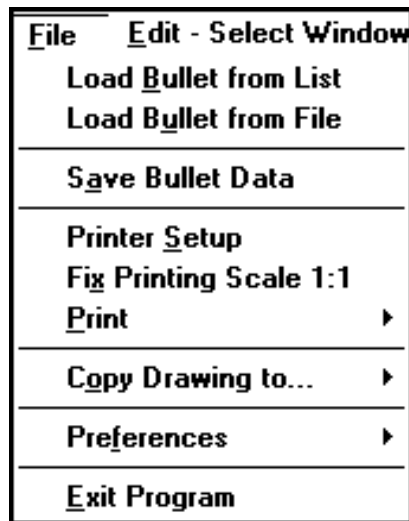
Designing Bullets

To use real existing bullets *QuickDESIGN* provides an optional bullet edit capability. The user may enter bullet data to form a bullet. This bullet can be seated into the selected cartridge and bullet ogive shape will be verified against throat dimensions. Influence of seated bullet on remaining case capacity is calculated. An estimate of drag function, B.C. and gyroscopic stability will be performed. Assuming an overall equal mass distribution calculations for center of gravity is performed but not for inertia moments. Necessary data can be transmitted to *QuickLOAD* program.

Bullet Edit mode is invoked by Main Menu *Edit- Select Window...Edit Bullet*, it opens *Bullet Main Dimensions* form.

Being in Bullet Edit Mode the main menu changes the *FILE* submenu, the *EDIT – SELECT WINDOW* submenu and the *DRAWING OPTIONS* submenu.

File Menu in Bullet Mode



Picture 42 : File Menu in Bullet Mode

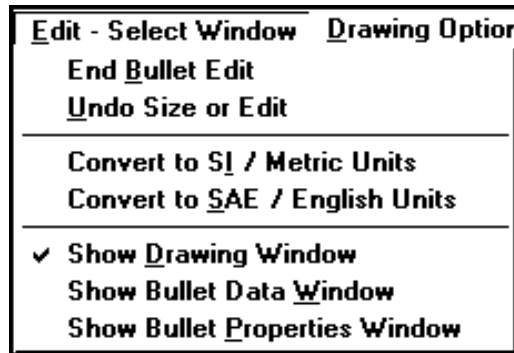
This menu is analogous to menu *File* on page 11. It is abbreviated and contains only bullet related menu points. All functions invoke same program behavior and same windows as in *File* menu with the exception of *PRINT* menu option. Refer to details in *File* menu.

Meaning of the menu items:

- ♦ **Print:** Allows user to print a bullet's data sheet. Data sheet contains all information about bullet.

All other menus or submenus are described under 1. Menu File on page 11.

Edit-Select Window Menu in Bullet Mode

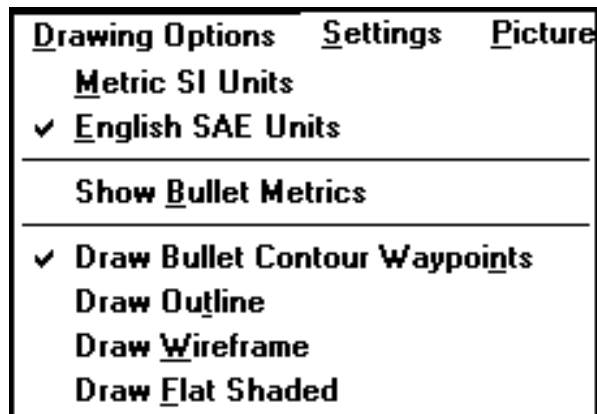


Picture 43 : Edit - Select Window in Bullet Mode

Meaning of the menu items:


- ◆ **End Bullet Edit:** Closes bullet windows. Restarts cartridge mode, opens cartridge windows. Changes menus to cartridge mode.
- ◆ **Undo Size or Edit:** Undo last changes made to bullet data.
- ◆ **Convert to SI / Metric Units:** While working with SAE units, convert SAE to SI units and place them into actual bullet data instance. Undo is incremented.
- ◆ **Convert to SAE / English Units:** While working with SI units, convert SI to SAE units and place them into actual bullet data instance. Undo is incremented.
- ◆ **Show Drawing Window:** Place drawing window into foreground.
- ◆ **Show Bullet Data Window:** Place bullet data window into foreground.
- ◆ **Show Bullet Properties Window:** Place bullet properties window into foreground.

Drawing Options Menu in Bullet Mode



Picture 44 : Drawing Options in Bullet Mode

Meaning of the menu items:

- ◆ **Metric SI Units:** Bullet entry forms and output devices use Metric / SI units.
- ◆ **English SAE Units:** Bullet entry forms and output devices use English / SAE units.
- ◆ **Show Bullet Metrics:** Apply metrics to bullet drawing.
- ◆ **Draw Bullet Contour Waypoints:** While it is not possible to draw a good-looking bullet from characteristic data, user may apply, place and move waypoints on bullet contour to enhance drawing.
 Symbol Bar Icon Draw Bullet Contour Waypoints
- ◆ **Draw Outline, Draw Wireframe and Draw Flat Shaded:** Same action as under cartridge mode.

Bullet Main Dimensions Form

Bullet Main Dimensions: Sierra - 5.689 - HP Boattail Matchking

Bullet Data

| | | | |
|------------------------------------|--------------------------|--|-------|
| Designation / Type | HP Boattail Matchking | | |
| Manufacturer | Sierra | | |
| Nominal Caliber, Weight | .224, 69, | Code / ID-Number | 1380 |
| Comment | | | |
| Bullet Weight | 4.47 | Diameter at Intersection Head-Tip (Meplat) | 1.60 |
| Bullet Diameter | 5.689 | Length of Boattail | 3.17 |
| Bullet Overall Length | 22.43 | Large Diameter of Boattail | 5.69 |
| Length to Shank/Ogive Intersection | 10.50 | Small Diameter of Boattail | 4.342 |
| Diameter of Shank at Base | 5.69 | Angle of Boattail to Centerline | 12.00 |
| Diameter of Shank at Ogive | 5.69 | Length to Hollow Base Bottom | |
| Length to Head/Meplat Intersection | 22.43 | Large Diameter of Hollow Base | |
| Headradius | 39.83 | Small Diameter of Hollow Base | |
| Headradius Center Offset | 0.686 | Length to Hollowpoint Bottom | |
| Length of Tip | | Diameter of Hollowpoint | |
| Rounded Tip | <input type="checkbox"/> | Rifling Twist Length | 170.6 |
| Length Head plus Tip | 11.93 | Gyroscopic Stability Factor | 1.5 |
| Sectional Density | 0.196 | | |
| Length to Center of Gravity | 9.480 | | |
| Headshape of Bullet | Secant Ogive | | |

Apply Changed Data Only

Apply Build Outline New

Picture 45 : Bullet Main Dimensions Form

Entries to this form must be in accordance to selected unit system, either SAE or SI. The title line contains manufacturer, caliber and type of the bullet as described in form.

Bullet Data Fields

- ◆ **Designation/Type:** Type as specified by manufacturer.
- ◆ **Manufacturer:** Name or brand of manufacturer.
- ◆ **Nominal Caliber, Weight:** Text string containing information about bullet.
- ◆ **Code / ID-Number:** Manufacturer's code or catalogue number.
- ◆ **Comment:** Description of special specifications.
- ◆ **Bullet Weight:** Weight of bullet.
- ◆ **Bullet Diameter:** Nominal diameter of bullet.
- ◆ **Bullet Overall Length:** Length from base to tip.
- ◆ **Length to Shank / Ogive Intersection:** Length from base to shank or bearing part to point where shank body intersects ogive of head.
- ◆ **Diameter of Shank at Base:** Diameter at base for flat- or hollow-base designs or at intersection of base with shank for boattail designs.
- ◆ **Diameter of Shank at Ogive:** Diameter at shank – ogive intersection.
- ◆ **Length to Head / Meplat Intersection:** Distance from base to meplat or base of tip. Color settings in Colors and Bullet Symbols Window, page 40, assume this part of bullet as body, from meplat to tip as tip.
- ◆ **Headradius:** Radius of tangent ogive or secant ogive of head.
- ◆ **Headradius Center Offset:** For tangent ogive head the center of ogive circle is at length to shank/ogive intersection, the offset is zero. For secant ogive head the center of ogive circle lies by some extent backward to base.
- ◆ **Length of Tip:** Length from tip to position of virtual meplat/head intersection. If meplat forms a flat nose, Length of Tip is zero. If tip is spitzer or conical enter length.

- ◆ **CheckBox Rounded Tip:** If tip on meplat is spherical, then set marking into box.
- ◆ **Diameter at Intersection Head / Tip or Meplat:** Diameter of meplat or virtual meplat.
- ◆ **Length of Boattail:** Distance from base to boattail/shank intersection.
- ◆ **Large Diameter of Boattail:** Diameter of boattail/shank intersection or for recessed boattails diameter before the step to shank.
- ◆ **Small Diameter of Boattail:** Diameter of boattail at base.
- ◆ **Angle of Boattail to Centerline:** Half angle of boattail cone.
- ◆ **Length to Hollowbase Bottom:** Distance from base to bottom of hollowbase.
- ◆ **Large Diameter of Hollowbase:** Diameter of cavity at base.
- ◆ **Small Diameter of Hollowbase:** Diameter at bottom of cavity.
- ◆ **Length to Hollowpoint Bottom:** When bullet contains hollowpoint, distance from meplat to bottom of hollowpoint.
- ◆ **Diameter of Hollowpoint:** Diameter of hollowpoint bore. Only simple hollowpoint cavities can be entered here.
- ◆ **Rifling Twist Length:** Desired length of twist for one full turn of bullet.
- ◆ **Gyroscopic Stability Factor:** Desired factor of stability >1.

Output Control Fields

- ◆ **Length of Head plus Tip:** Sum of both values. To compare with existing bullet.
- ◆ **Sectional Density:** Sectional density value, regardless of unit settings.
- ◆ **Length to Center of Gravity:** Distance from base to center of gravity.
- ◆ **Headshape of Bullet:** Description one of four: Tangent Ogive, Secant Ogive, Conical Head or Cylinder Head.

Buttons

- ◆ **Apply Changed Data only:** Data changed or entered are applied to bullet design data. No further action is performed.
- ◆ **Apply Build Outline New:** Data are applied to bullet design. Older drawing and shape will be destroyed. A new bullet shape will be calculated and drawn. Non-fitting dimensions will be corrected by querying user.

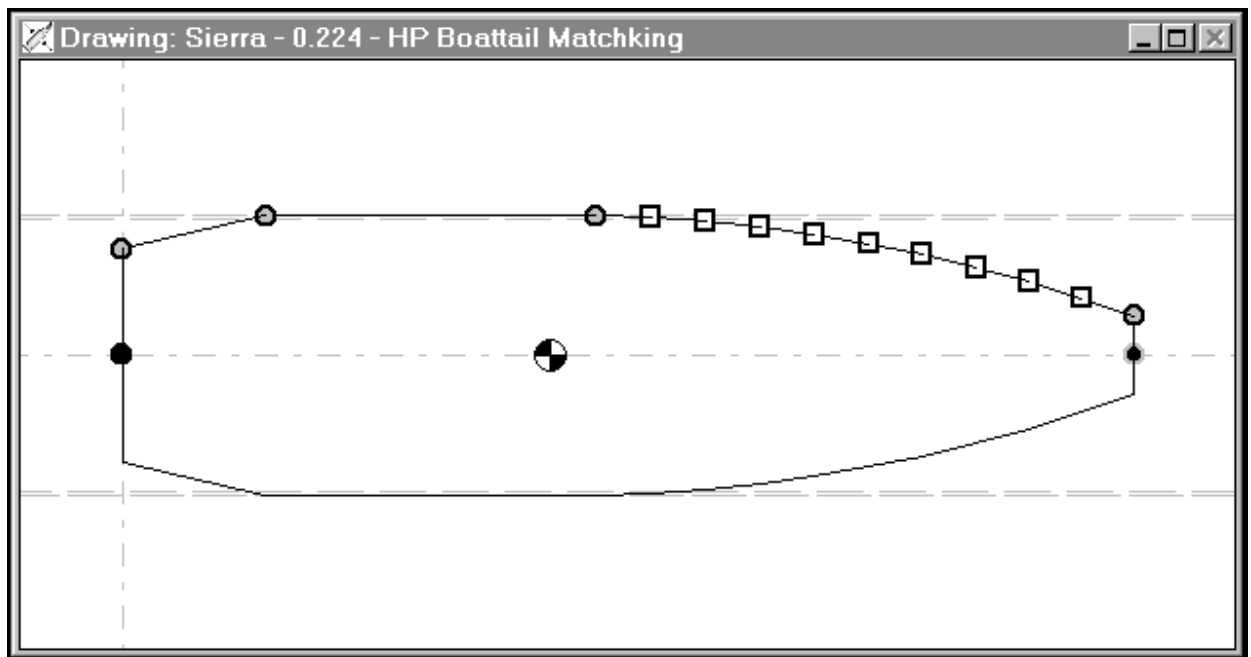
The bullet's calculated initial outline contains the basic waypoints to form the initial shape of the bullet.

When bullet has specified an ogive by headradius value, the ogive will be formed by waypoints along contour of ogive.

Bullet shape can be manually refined by moving, inserting and deleting waypoints forming the shape. Therefore, shape can match that of real bullet. Seating such a bullet in a designed cartridge and chamber allows you to examine precisely the clearance of ogive from rifling.

Following a typical drawing from initial calculation:

Redesigning Bullet Shape



Picture 46 : Bullet Waypoint Drawing

This initial drawing was generated by using the data in the above shown bullet entry form. This example shows a .224 Cal. simplified Sierra MK bullet. The hollowpoint was omitted.

- ◆ The **dash-dot lines** are the centerline and the base line for the drawing.
- ◆ The **dashed lines** along shank of the bullet are lines representing bore- and groove diameter of the cartridge's chamber loaded in program.
- ◆ The **sign** within center of projectile represents position of center of gravity of bullet.
- ◆ **Bullet Contour Waypoints**, beginning at base, valid for this example (appearance may vary by design of bullet):
 - **Base point** defining base of bullet. Filled with black color. This point cannot be moved interactively., only by changing data in bullet form.
 - **Boattail point** at base line's edge to boattail. Point has black outline color and gray fill color. This point symbol appears at all positions defined in bullet data window. Point is an interactive point. That means user may move mouse cursor over this point. When cursor meets point, point's color changes to highlighted green, indicating an interactive point. Click on green point to mark it permanently. Click again to this point to unmark it. Marked round points can be moved with some exceptions: Points on baseline cannot be moved to left or right, only up and down. They cannot be deleted. With marked boattail base point, user can move point up and down, but not below zero and not larger as shank diameter. Movement is done by use of one of four keyboard [ARROW] keys (Amount of one step described below). Changed position values are updated into bullet data form.
 - **Point at intersection boattail to shank**. Appearance same as before. This point can be marked and then moved to all directions.
 - **Point at intersection of shank with ogive**. Appearance same as before. This point can be marked and then moved to all directions.
 - **Points on ogive**. 9 points of rectangular shape, indicating points are generated by program. These points can be marked and then moved to all directions. Points may be deleted when marked by pressing [DEL] key.
 - **Point at meplat edge**. This point can be marked and then moved up, down and left. Upward movement is limited by position of neighbored point.
 - **Point at center of tip**. Filled with black color and gray outline. Point cannot be moved.

Two points in vicinity may be marked to insert an additional point between both marked points by pressing Insert [INS] key. New point is inserted at midpoint of virtual line between both marked points.

A single marked point inserted or at ogive may be deleted by Delete [DEL] key.

All changes applied by moving points to new position can be erased by using UNDO function like in cartridge mode.

The amount of moving with ARROW keys depends on set unit system. Standard movement step width is

- ◆ **1 millimeter for SI or Metric units and**
- ◆ **0,01 inch for SAE or English units.**

- Holding [SHIFT] key down while pressing ARROW key increases step increment ten times.
- Holding [CTRL] key down while pressing ARROW key decreases step increment to one tenth.
- Holding [ALT] key down while pressing ARROW key decreases step increment to one hundredth.
- Holding [CTRL-ALT] key down while pressing ARROW key decreases step increment to one thousandth.

Single mark on point can be moved back and forth to next points by pressing [TAB] or [SHIFT-TAB] keys.

When waypoint color changes to highlight green while cursor moves over point's area, the coordinate display changes to highlighted green too and displays the center's coordinates of highlighted point as long point stays green.

All changes applied in waypoint window are stored in bullet data when saving data to disk.

Pressing *Apply-Build Outline New* button in bullet data window destroys and resets all changes made here.

Bullet Aerodynamic Properties Window

| Bullet Aerodynamic Properties: Sierra - 5.689 - HP Boattail Matchking | | | | | | | | | | |
|---|------|------|--|-------|-------|---|------|---|-----|-----|
| Estimated Drag, BC and Gyroscopic Stability at Standard ICAO Sea Level Conditions | | | | | | | | | | |
| Sierra HP Boattail Matchking Cal. 5.689 mm, 4.47 g | | | | | | | | | | |
| Ballistic Coefficient Calculated for Drag Function G1 | | | | | | | | | | |
| Velocity | | | Drag Coefficient Factor of Form and B.C. | | | RPM and Stability at a Twistlength of 30,0 Cal. | | maximum Twist- length for s = 1.5 | | |
| Mach | m/s | fps | Cw | i | B.C. | RPM | s | Cal. | in. | mm |
| 0,441 | 150 | 492 | 0,102 | 0,499 | 0,393 | 52755 | 2,02 | 34,8 | 7,8 | 198 |
| 0,514 | 175 | 574 | 0,101 | 0,505 | 0,389 | 61547 | 1,99 | 34,5 | 7,7 | 196 |
| 0,588 | 200 | 656 | 0,101 | 0,503 | 0,390 | 70340 | 1,94 | 34,1 | 7,6 | 194 |
| 0,661 | 225 | 738 | 0,101 | 0,489 | 0,402 | 79132 | 1,87 | 33,5 | 7,5 | 191 |
| 0,735 | 250 | 820 | 0,102 | 0,455 | 0,432 | 87925 | 1,79 | 32,7 | 7,3 | 186 |
| 0,808 | 275 | 902 | 0,103 | 0,401 | 0,490 | 96717 | 1,66 | 31,6 | 7,1 | 180 |
| 0,882 | 300 | 984 | 0,111 | 0,348 | 0,564 | 105510 | 1,47 | 29,7 | 6,6 | 169 |
| 0,955 | 325 | 1066 | 0,195 | 0,474 | 0,414 | 114302 | 1,10 | 25,7 | 5,7 | 146 |
| 1,000 | 340 | 1116 | 0,419 | 0,886 | 0,222 | 119681 | 1,49 | 29,9 | 6,7 | 170 |
| 1,102 | 375 | 1230 | 0,216 | 0,372 | 0,529 | 131887 | 1,53 | 30,3 | 6,8 | 173 |
| 1,175 | 400 | 1312 | 0,384 | 0,619 | 0,318 | 140680 | 1,67 | 31,7 | 7,1 | 180 |
| 1,763 | 600 | 1969 | 0,388 | 0,628 | 0,313 | 211020 | 2,26 | 36,8 | 8,2 | 209 |
| 2,351 | 800 | 2625 | 0,337 | 0,618 | 0,318 | 281360 | 2,48 | 38,6 | 8,6 | 220 |
| 2,939 | 1000 | 3281 | 0,299 | 0,589 | 0,333 | 351700 | 2,60 | 39,5 | 8,8 | 225 |
| 3,526 | 1200 | 3937 | 0,271 | 0,546 | 0,360 | 422040 | 2,67 | 40,0 | 9,0 | 228 |
| 4,114 | 1400 | 4593 | 0,249 | 0,506 | 0,388 | 492380 | 2,73 | 40,4 | 9,1 | 230 |
| 4,702 | 1600 | 5249 | 0,233 | 0,473 | 0,415 | 562720 | 2,77 | 40,8 | 9,1 | 232 |
| 5,290 | 1800 | 5906 | 0,220 | 0,446 | 0,440 | 633060 | 2,81 | 41,0 | 9,2 | 233 |

Picture 47 : Bullet Aerodynamic Properties

This window shows a listing of bullet's aerodynamic properties in steps of Mach number and corresponding velocity at Standard ICAO atmosphere, Sea Level conditions. Stepping of velocity is performed in practical steps dependent on Unit System selected. Calculation uses an approximation of selected empirical functions described in technical papers listed in Bibliography [1-12].

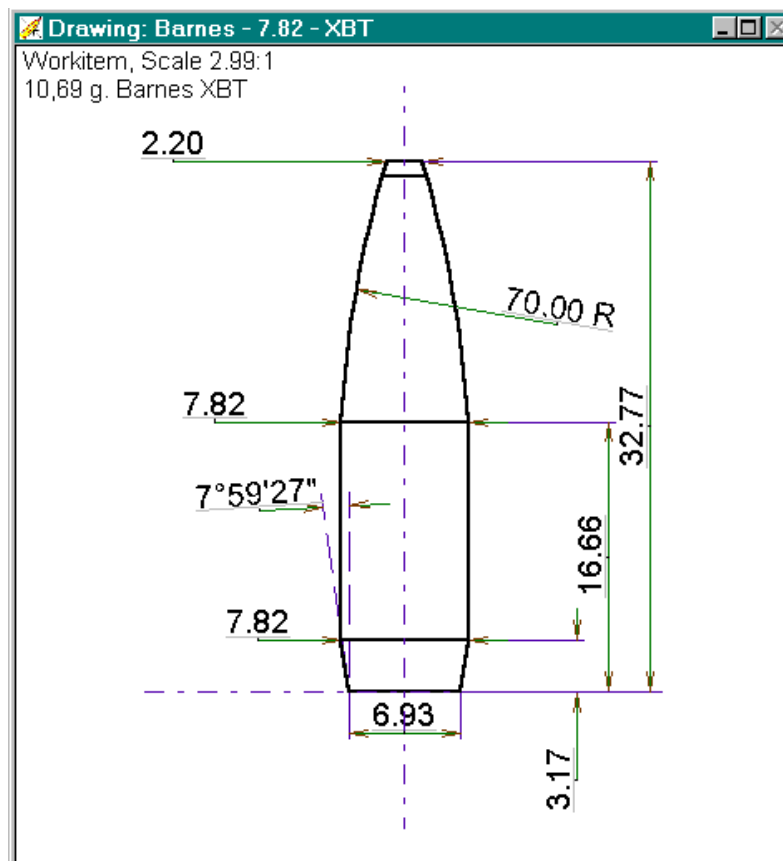
These calculations use the data from bullet main dimensions form and **not** from different bullet shape defined by editing waypoints.

Columns of table contain:

- Mach:** Mach number
- m / s:** Bullet velocity in meters per second
- fps:** Bullet velocity in feet per second
- Cw:** Values of drag function of bullet
- i:** Factor of form of bullet
- B.C.:** Ballistic coefficient approximated to G1 drag function
- RPM:** Bullet rotation in revolutions per minute for entered twist length
- s:** Gyroscopic stability factor for entered twist length
- Cal.** Maximum affordable twist length in calibers to obtain the entered stability factor
- in.:** Maximum affordable twist length in inches to obtain the entered stability factor
- mm:** Maximum affordable twist length in millimeters to obtain the entered stability factor



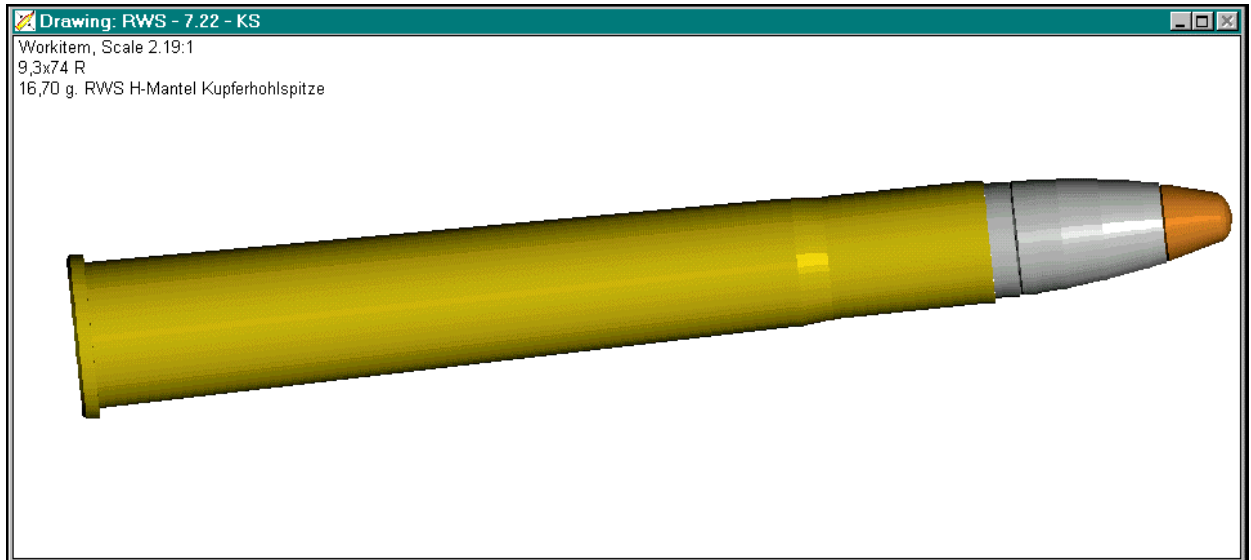
Picture 48 : Flat Shaded Bullet: RWS 9,3mm H-Jacket Copper Hollowpoint



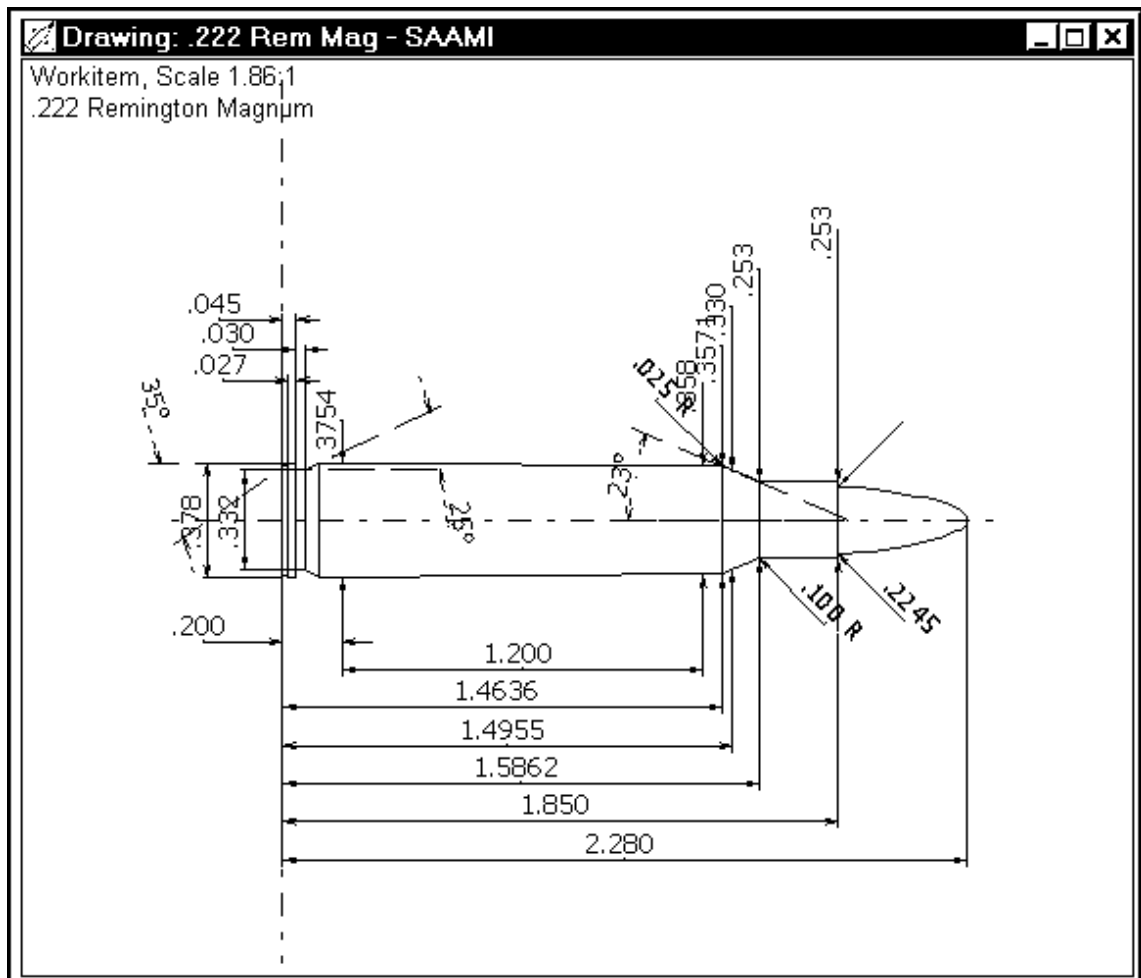
Picture 49 : Outline of a Bullet with Metrics

Appendix

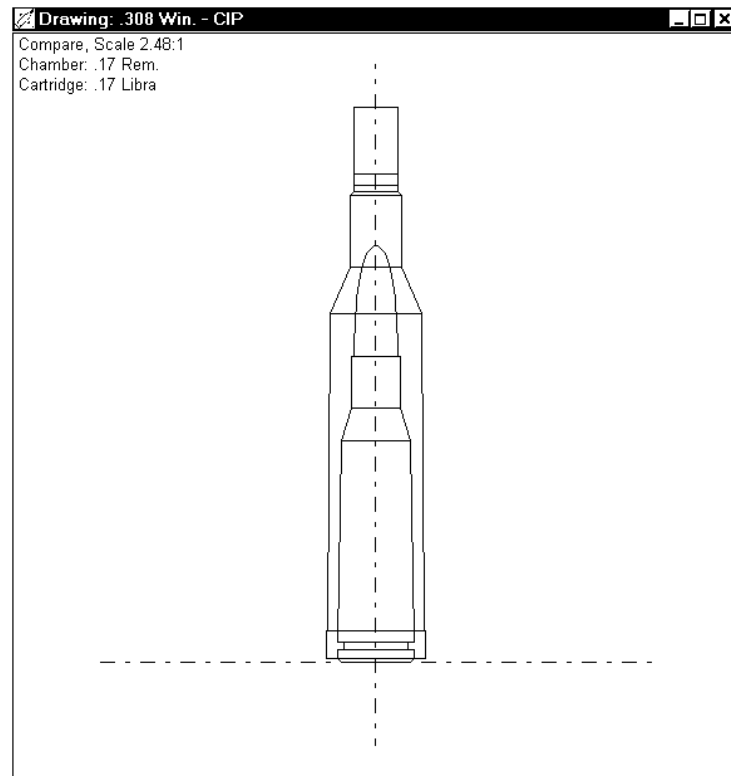
Miscellaneous Drawings and Prints



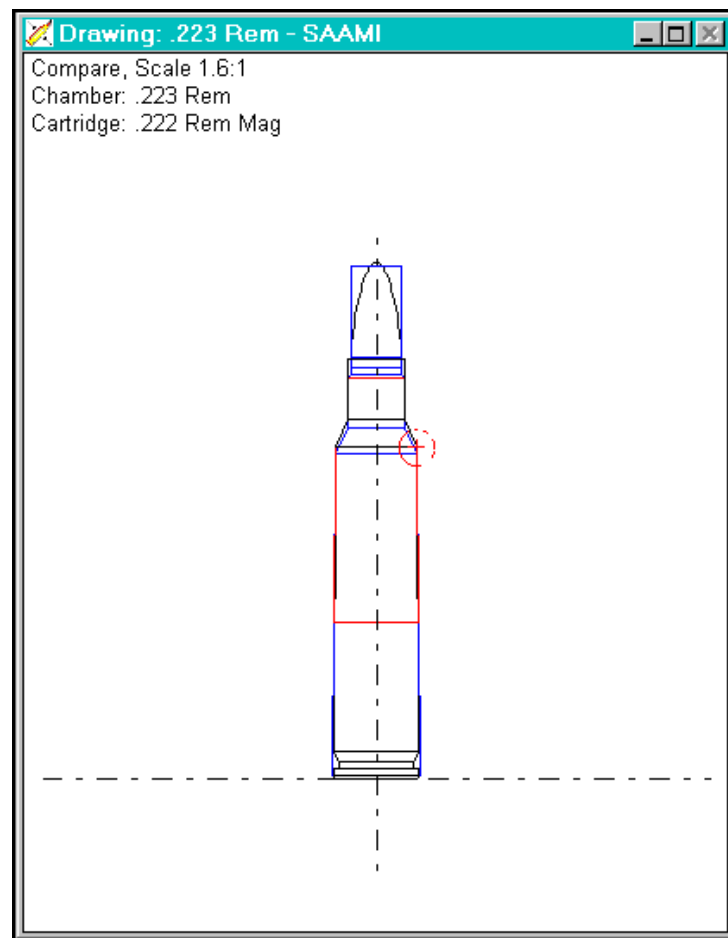
Picture 50 : Cartridge 9,3 x 74 R with Bullet Seated



Picture 51 : Cartridge with Metrics Rotated by 90 degrees

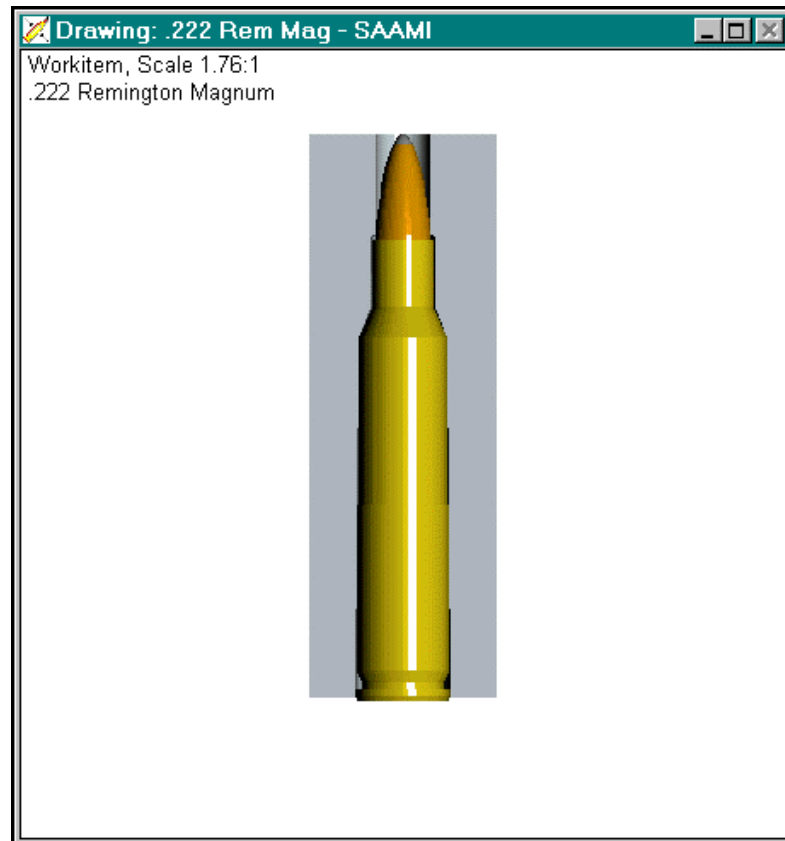


Picture 52 : Comparing Chamber and Cartridge, Chamber larger than Cartridge

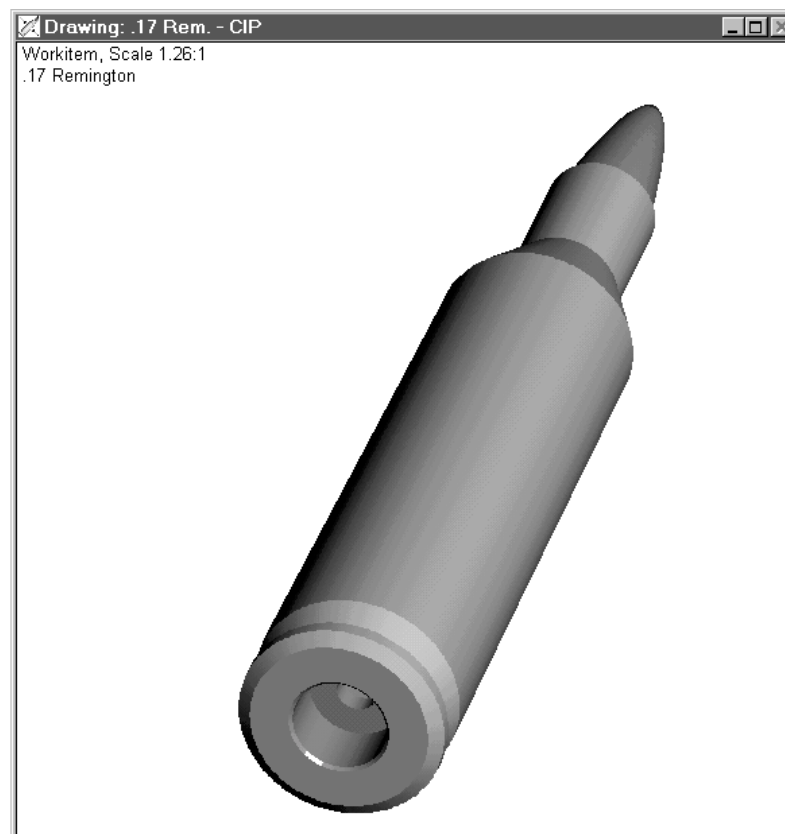


Picture 53 : Comparing Chamber and Cartridge, Chamber smaller than Cartridge

Collisions are detected. Drawing can be examined to decide whether chamber may be reamed to other caliber without seating back barrel.

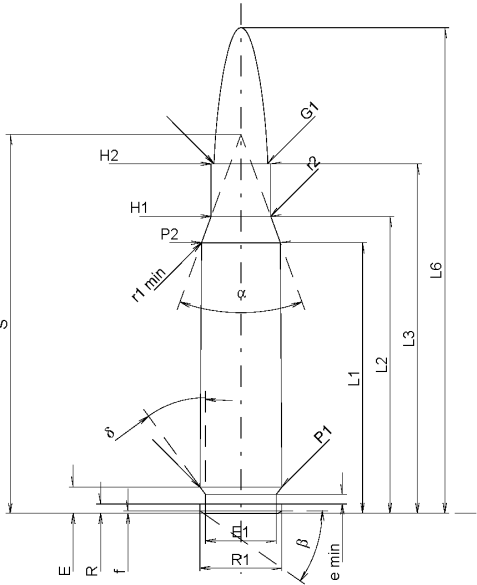
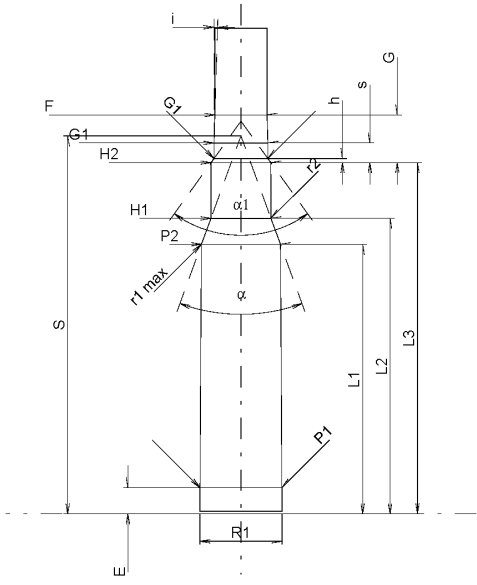


Picture 54 : Chambered Cartridge Flat Shaded



Picture 55 : Cartridge Flat Shaded without Primer

Printing Samples

| | | |
|---|--|---|
| QuickDESIGN Datasheet | .308 Win. Country of Origin: US | TAB. I Date 84-06-14 Revision 90-06-13 |
|  | Maximum Cartridge Cartridge Lengths L1 = 1.5598 -.0047 L2 = 1.7118 L3 1) = 2.015 L4 = L5 = L6 = 2.800 Cartridge Head R = .0539 -.0118 R1 = .4728 R3 = E = .1516 E1 = .4091 e min = .0551 delta = 36° f = .015 -.0059 beta = 35° Cartridge Body P1 = .4709 -.0173 P2 * = .4539 Cartridge Shoulder alpha * = 40°11'01" S * = 2.1835 r1 min = .0299 r2 = .1252 Cartridge Neck H1 * = .3433 H2 1) = .3433 Bullet G1 1) = .3091 G2 = F = L3+G 1) = 2.2898 Pressures (Energies) Method Transducer Pmax = 60191 psi PK = 69183 psi PE = 78248 psi M = .9843 Miscellaneous Dimensions HS = .0039 delta L = .0039 | Minimum Chamber Chamber Lengths L1 = 1.5543 L2 = 1.7039 L3 1)2) = 2.0252 +.0039 Chamber Head R = R1 = .4736 R2 = R3 = r = Powder Chamber E = .1516 P1 1)2) = .472 +.002 P2 2)* = .4551 +.002 Chamber Shoulder alpha 1)* = 40° S * = 2.1795 r1 max = .0299 r2 = .1449 Chamber Neck H1 * = .3461 H2 1)2) = .3441 +.002 Throat Dimensions G1 1)2)* = .3098 +.0012 G 1) = .2748 alpha 1 = 71°25'60" h = .0236 s * = .1138 i 1)* = 1°45' Barrel Dimensions F 1)2)* = .300 +.0008 Z 1)2) = .3079 +.0012 Rifling b = .176 N = 4 u = 12.0079 Q 3) = .0736 in² SAE Units |
|  | Scale 1.04:1 | Notes: 1) Check for safety reasons 2) With tolerances for pressure barrels 3) For production weapons * Basic dimension to calculate other dims. |

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Picture 56 : Printed Datasheet similar to CIP Standard

Note: Original CIP Datasheets normally contain **Metric Units Only**
 (Dimensions shown do not represent standard's data)

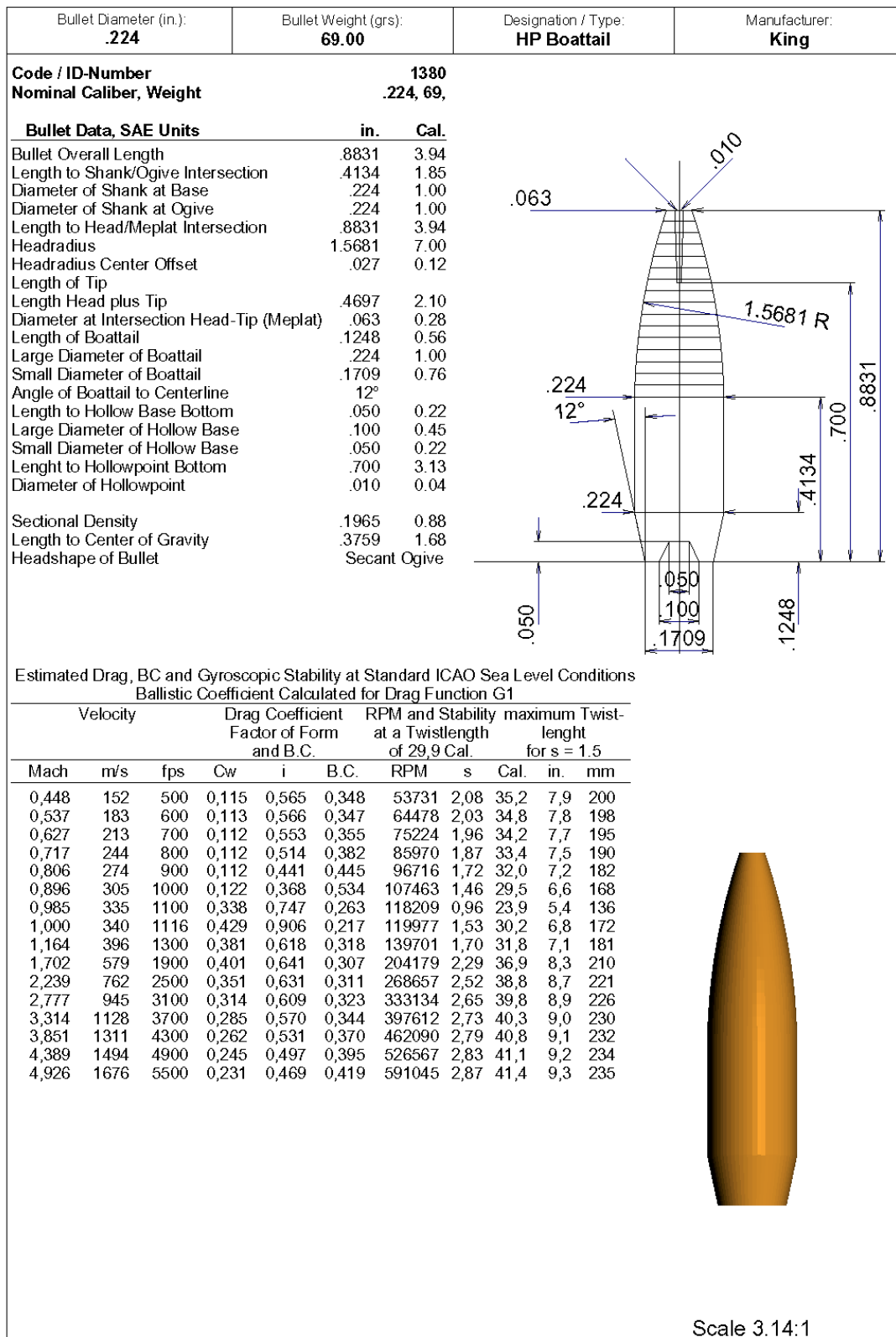
| | | | | | | | |
|------------------------------------|---|----------------------|--|-------------|--|-----------------------|--|
| Date: | | Regulating Body: | | SAAMI | | .338 Win. Mag. | |
| Revision: | | | | | | Country of Origin: US | |
| Maximum Cartridge, SAE Units (in.) | | | | | | | |
| L1/13 | Length to Shoulder | 2.040 | | | | | |
| L2/19 | Length to Shoulder-Neck Intersection | 2.1698 | | | | | |
| L3/23 | Overall Case Length | 2.500 | | - .020 | | | |
| L4/29 | Length to Bullet Diameter G2 | 2.750 | | | | | |
| L5/31 | Length to Bullet Diameter F | | | | | | |
| L6/26 | Overall Cartridge Length | 3.340 | | - .040 | | | |
| Cartridge Head | | | | | | | |
| R/2 | Rim Thickness | .050 | | - .011 | | | |
| /3 | Length of Cylindrical Rim Section | .034 | | - .010 | | | |
| R1/1 | Head Diameter | .532 | | - .010 | | | |
| R3/1A | Belt Diameter | .532 | | - .005 | | | |
| E/8 | Head Height | .220 | | - .008 | | | |
| E1/5 | Extractor Groove Diameter | .475 | | - .020 | | | |
| e min/6 | Extractor Groove Width | .037 | | + .010 | | | |
| Delta/7 | Extractor Groove Angle | 35° | | -6°-00'-00" | | | |
| f | Width of Rim Chamfer | .016 | | | | | |
| Beta/4 | Rim Chamfer Angle | 35° | | 20° | | | |
| Cartridge Body | | | | | | | |
| P1/22 | Underhead Diameter | | | | | | |
| P2/14 | Shoulder Diameter | .491 | | | | | |
| Cartridge Shoulder | | | | | | | |
| Alpha/15 | Shoulder Angle | 25° | | | | | |
| S | Length to Origin of Shoulder Angle | 2.5667 | | | | | |
| r1 min/17 | Shoulder Radius | .040 | | + .050 | | | |
| r2/25 | Neck Radius | .125 | | | | | |
| Cartridge Neck | | | | | | | |
| H1/20 | Diameter at Shoulder-Neck Intersection | .370 | | | | | |
| H2/24 | Diameter at Mouth | .369 | | - .008 | | | |
| Bullet | | | | | | | |
| G1/27 | Bullet Diameter | .339 | | - .003 | | | |
| G2/28 | Bullet Diameter at L4/29 | .330 | | | | | |
| L3+G | Length to Bore Diameter | 2.7275 | | | | | |
| SAAMI Datum Dimensions | | | | | | | |
| /9B | Length to first Body Diameter | .250 | | | | | |
| /10 | First Body Diameter | .5127 | | | | | |
| /11B | Length betw. 1st and 2nd Body Diameter | 1.670 | | | | | |
| /12 | Second Body Diameter | .4925 | | | | | |
| /18B | Datum Diameter | .420 | | | | | |
| /17 | Length to Datum Diameter | 2.1162 | | - .007 | | | |
| Minimum Chamber, SAE Units (in.) | | | | | | | |
| L1/57 | Length to Shoulder | 2.048 | | | | | |
| L2/64 | Length to Shoulder-Neck Intersection | 2.177 | | | | | |
| L3/66 | Length to Neck Chamfer | 2.524 | | + .002 | | | |
| Chamber Lengths | | | | | | | |
| R/51 | Counterbore Depth | .220 | | + .007 | | | |
| R1/50 | Counterbore Diameter | .535 | | + .012 | | | |
| R2 | Partial Counterbore Depth | | | | | | |
| R3 | Belt Counterbore Diameter | | | | | | |
| r/59 | Radius Body Diam.-Counterbore | | | | | | |
| Powder Chamber | | | | | | | |
| E | Length to Underhead Diameter | | | | | | |
| P1/56 | Body Diameter at Counterbore Intersection | .514 | | | | | |
| P2/58 | Shoulder Diameter | .492 | | | | | |
| Chamber Shoulder | | | | | | | |
| Alpha/60B | Shoulder Angle | 25° | | | | | |
| S | Length to Origin of Shoulder Angle | 2.5747 | | | | | |
| r1 max/61 | Shoulder Radius | .030 | | | | | |
| r2/68 | Neck Radius | .150 | | + .030 | | | |
| Chamber Neck | | | | | | | |
| H1/65 | Diameter at Shoulder-Neck Intersection | .3715 | | | | | |
| H2/67 | Diameter at Neck Chamfer | .3705 | | + .002 | | | |
| Throat Dimensions | | | | | | | |
| G1/71 | Throat/Freebore Start Diameter | .345 | | + .002 | | | |
| /75 | Diameter at Freeb.-Throat Intersection | | | | | | |
| G | Length from Neck Chamfer to Bore Diameter | .2275 | | | | | |
| Alpha1/69B | Neck Chamfer Angle | 45° | | | | | |
| h | Neck Chamfer Height | .0128 | | | | | |
| s | Length of Freebore + Neck Chamfer | | | | | | |
| i/72B | Throat Angle | 2° | | | | | |
| Barrel Dimensions | | | | | | | |
| F/82 | Bore Diameter | .330 | | + .002 | | | |
| Z/83 | Groove Diameter | .338 | | + .002 | | | |
| b/87 | Groove Width | .110 | | + .002 | | | |
| N/86 | Number of Grooves | 6 | | | | | |
| u/85 | Twist of Rifling and Direction | 10.000 RH | | | | | |
| Q/84 | Minimum bore and groove area | (in²) .0882 | | | | | |
| SAAMI Datum Dimensions | | | | | | | |
| /52B | Length to first Body Diameter | .250 | | | | | |
| /53 | First Body Diameter | .5136 | | | | | |
| /54B | Length from first to second Body Diameter | 1.670 | | | | | |
| /55 | Second Body Diameter | .4935 | | | | | |
| /62 | Length to Datum Diameter | 2.1253 | | + .010 | | | |
| /63B | Datum Diameter | .420 | | | | | |
| /70 | Length to Throat Diameter | 2.5368 | | + .015 | | | |
| /74 | Length to Freebore-Throat Intersection | | | | | | |
| /81 | Length to Bore Diameter | 2.7515 | | + .015 | | | |
| Miscellaneous Dimensions | | | | | | | |
| E _{max} | Maximum average energy | | | | | | |
| P _{max} | Maximum average pressure | | | | | | |
| P _{max} | Maximum average pressure | (CUP) 57200 | | | | | |
| HS | Maximum Headspace | | | | | | |
| delta L | Headspace Extension | | | | | | |
| M | Pressure Gauge Location | 1.750 | | | | | |
| | Case Capacity Water | .3315 in³ - 83.8 grs | | | | | |

Scale 1:1.06

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Picture 57 : Printed QuickDESIGN Standard Datasheet

(Dimensions shown do not represent standard's data)

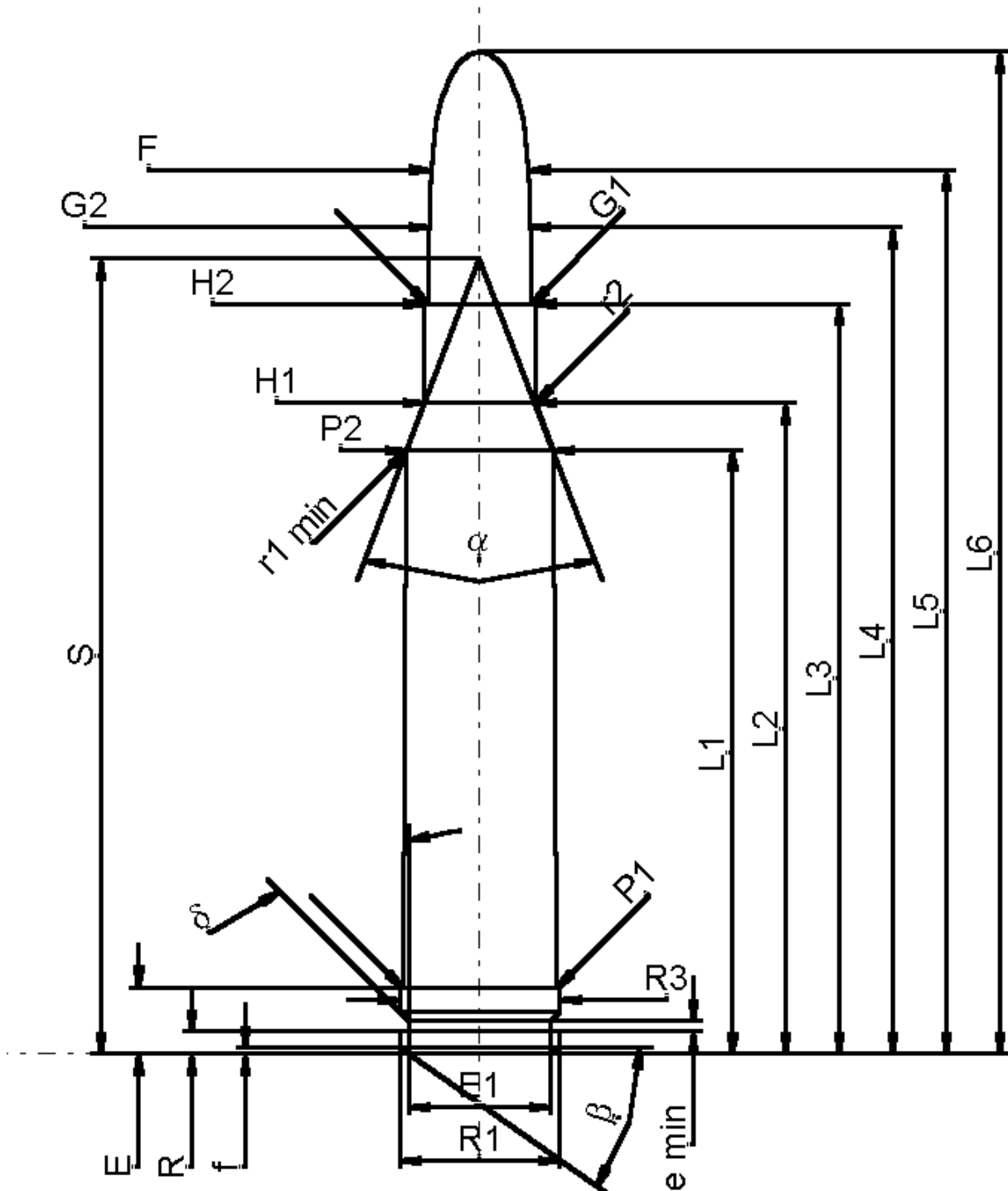


Printed by QuickDESIGN V2010.40

Picture 58 : Printed Bullet Data Sheet

Metrics Symbols and their Definition

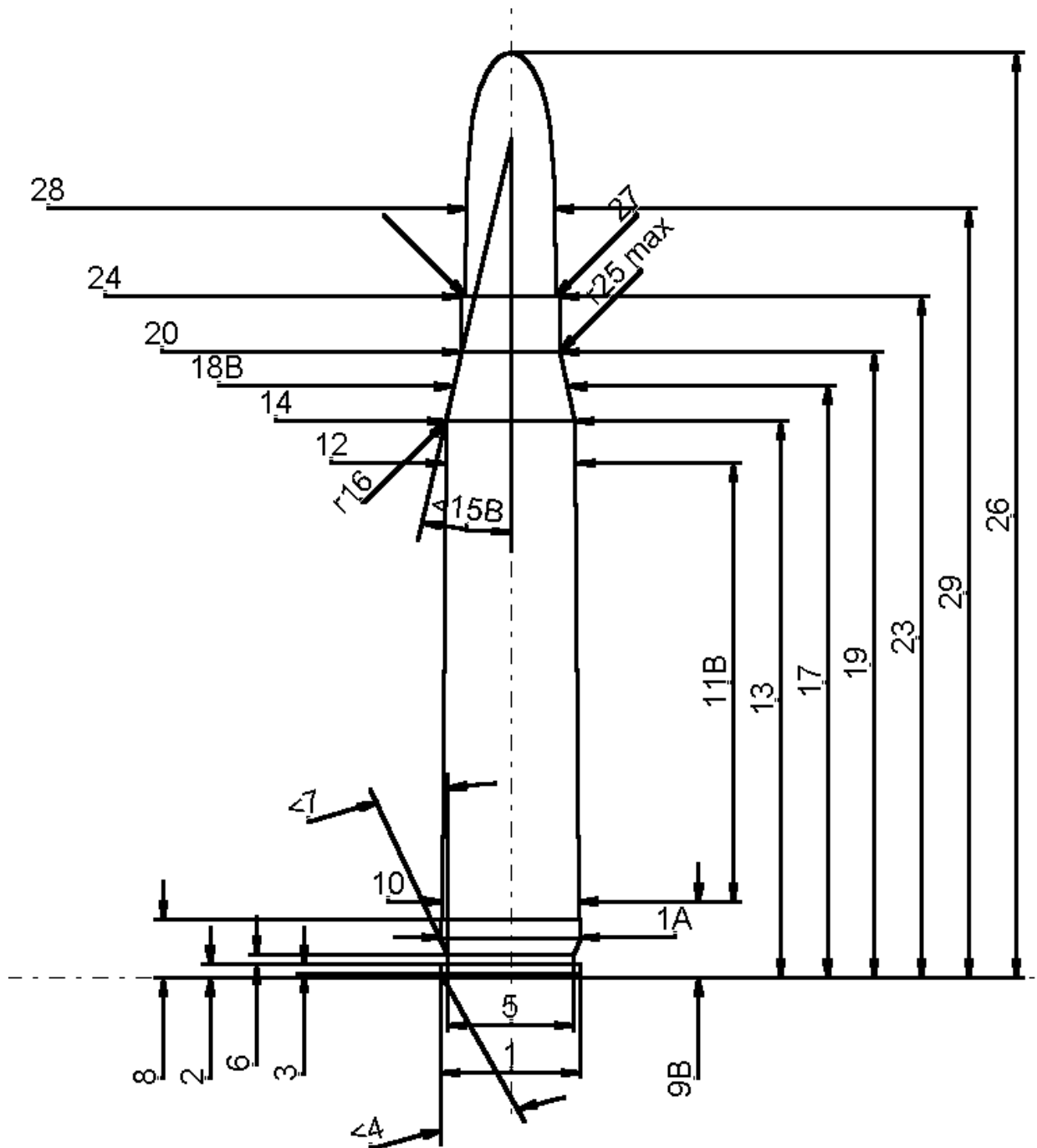
1. Cartridge Symbols



Picture 59 : Cartridge with CIP Metrics and Symbols

CIP symbols are defined by CIP commissions. They are used in German Gun Law and taken from this public source.

(Schemes and symbols may be changed by decisions of regulating body, so actually published symbols may vary and differ from symbols shown here).



Picture 60 : Cartridge with SAAMI Metrics and Symbols

The SAAMI numbering was defined by the author himself because SAAMI uses a non-consistent numbering scheme.

(Schemes and symbols may be changed by decisions of regulating body, so actually published symbols may vary and differ from symbols shown here).

Definitions of Symbols for CIP and SAAMI Cartridges

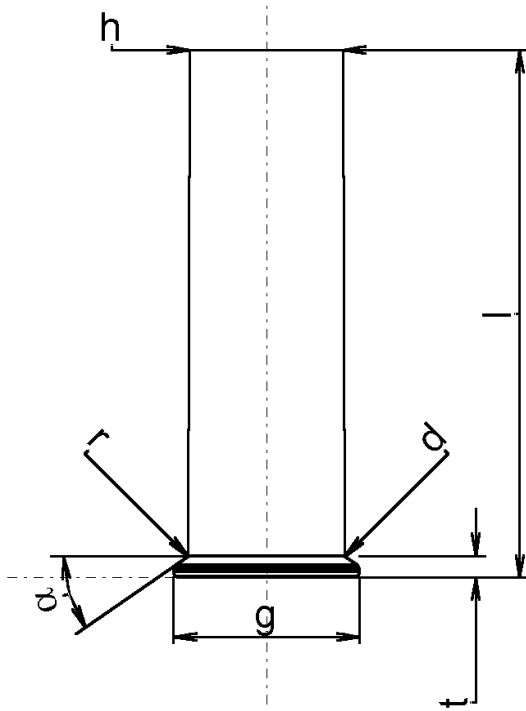
CIP SAAMI Definition

| | | |
|------------|-----|---|
| L1 | 13 | Distance between case head and diameter P2, SAAMI reference dimension |
| L2 | 19 | Distance between case head and collar (neck) diameter H1, SAAMI reference dimension |
| L3 | 23 | Total length of case |
| L4 | 29 | Distance between case head and diameter G2 |
| L5 | 31 | Distance between case head and diameter F (bore diameter) |
| L6 | 26 | Total length of the cartridge |
| | | |
| R | 2 | Thickness of case rim |
| R1 | 1 | Diameter of case rim |
| R3 | 1A | Diameter of case head (Magnum Belt) |
| E | 8 | Thickness of case head |
| E1 | 5 | Diameter of extractor groove |
| e min | 6 | Width of extractor groove |
| δ | 7 | Half angle of extractor groove (between E1 and P1) |
| f | | Width of case rim chamfer |
| β | 4 | Angle of case rim chamfer |
| | | |
| P1 | 22 | Diameter at the end of case rim before extractor groove or at the distance E of case body |
| P2 | 14 | Case diameter at distance L1, (intersection dimension), SAAMI reference dimension |
| | | |
| α | 15B | Angle of junction cone, Shoulder angle, SAAMI basic dimension |
| S | | Length of the peak junction cone |
| r1 min | 17 | Radius of junction at the extremities of diameter P2, Shoulder radius |
| r2 | 25 | Radius of junction between junction cone and collar, Neck radius |
| | | |
| H1 | 20 | Diameter of collar at distance L2, Neck diameter at shoulder (intersection dimension) |
| H2 | 24 | Diameter at case mouth at distance L3, Neck diameter at mouth |
| G1 | 27 | Diameter of the projectile at case mouth |
| G2 | 28 | Diameter of the projectile at distance L4 |
| F | 30 | Diameter of the projectile at distance L5 (Bore diameter) |
| | | |
| r | 33 | Underhead Radius at transition from body to rim for SAAMI shotgun cartridges |
| α_S | 32 | Underhead Angle, chamfer at rim of shotgun cartridges |

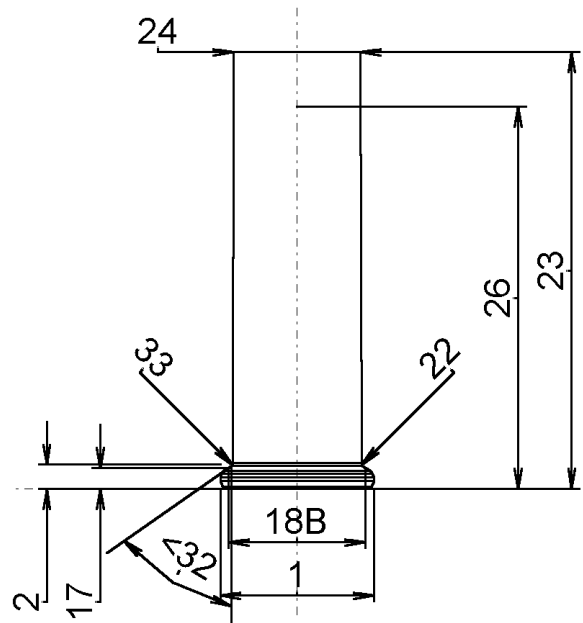
SAAMI only definitions

| | |
|-----|---|
| 3 | Length of Cylindrical Rim Section |
| 9B | Length to first Body Diameter, basic dimension |
| 10 | First Body Diameter |
| 11B | Length between 1st and 2nd Body Diameter, basic dimension |
| 12 | Second Body Diameter |
| 17 | Length to Datum Diameter |
| 18B | Datum Diameter, basic dimension |

Shotgun Cartridge Symbols



Picture 61 : CIP Shotgun Shell

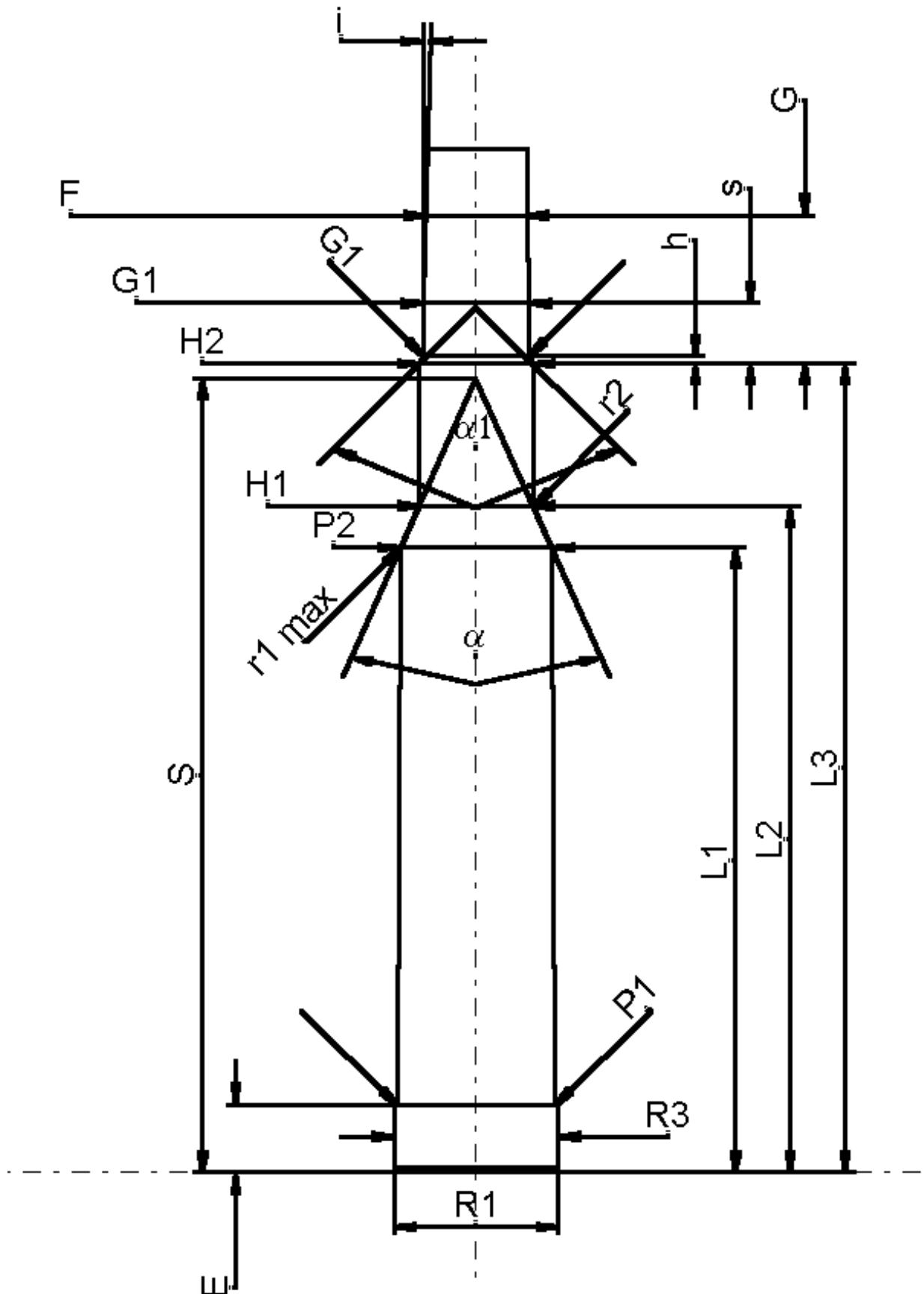


Picture 62 : SAAMI Shotgun Shell

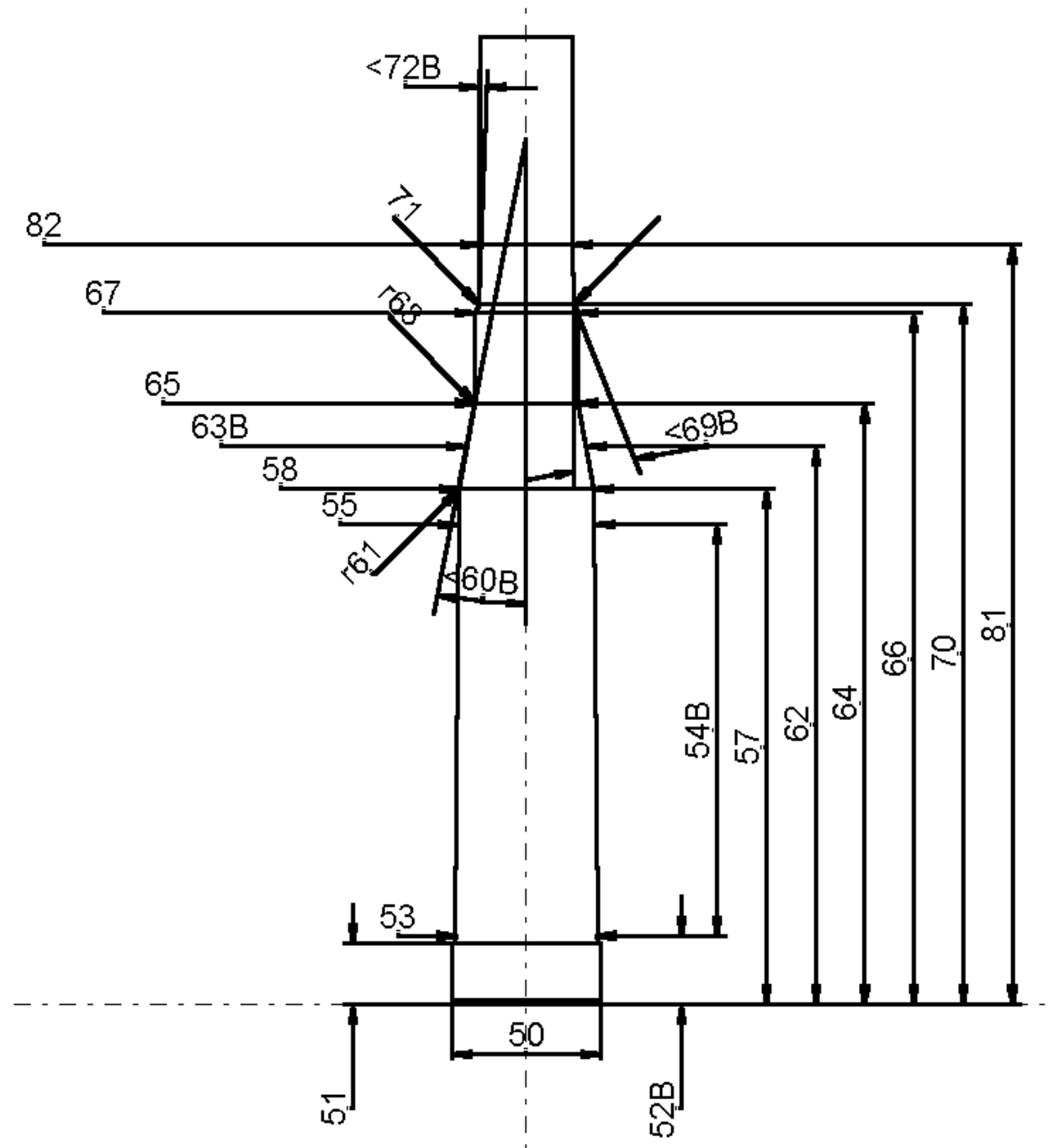
CIP SAAMI Definition

| | | |
|------------|-----|---|
| l | 23 | Distance between case head and diameter h or diameter 24, maximum case length |
| | 26 | Overall shell length, folded or crimped condition |
| g | 1 | Head diameter |
| α 2 | 32 | Head angle, SAAMI basic dimension |
| d | 22 | Underhead diameter (intersection dimension) |
| t | 2 | Length to underhead diameter / head angle (intersection dimension) |
| r | 33 | Underhead radius (SAAMI only) |
| h | 24 | Shell body diameter |
| | 2 | Length to datum diameter |
| | 18B | Datum diameter, basic dimension |

2. Chamber Symbols



Picture 63 : Chamber with CIP Metrics and Symbols



Picture 64 : Chamber with SAAMI Metrics and Symbols

The SAAMI numbering was defined by the author himself because SAAMI uses a non-consistent numbering scheme. A “B” behind a symbol number denotes a basic dimension.

Definition of Symbols for CIP and SAAMI Chambers

CIP SAAMI Definition

| | | |
|------------|-----|--|
| L1 | 57 | Length of chamber at diameter P2, length to shoulder |
| L2 | 64 | Length of chamber at diameter H1, length to shoulder / neck intersection |
| L3 | 66 | Length of chamber at diameter H2, length to neck chamfer |
| R | 51 | Distance between breech face and the backward edge of barrel, counterbore depth, SAAMI headspace dimension |
| R1 | 50 | Breech diameter, counterbore diameter |
| R2 | | Breech depth, (counterbore depth) |
| R3 | | Diameter before the breech of Magnum cartridges, belt counterbore diameter |
| r | 59 | Radius of junction at chamber mouth or at body to counterbore intersection |
| E | | Distance between breech face and chamber mouth |
| P1 | 56 | Diameter at chamber mouth or at distance E; body diameter at counterbore intersection |
| P2 | 58 | Diameter at the beginning of junction cone at distance L1; shoulder diameter (intersection dimension) |
| α | 60B | Angle of junction cone; shoulder angle. SAAMI basic dimension |
| S | | Length of the peak of junction cone, center of shoulder angle |
| r1 max | 61 | Radius of junction at the extremities of diameter P2, shoulder radius |
| r2 | 68 | Radius of junction at collar, neck radius |
| H1 | 65 | Diameter at beginning of collar at distance L2, at shoulder / neck intersection |
| H2 | 67 | Diameter at distance L3, at neck chamfer |
| G1 | 71 | Diameter at commencement of rifling, throat diameter |
| G | | Distance between H2 and F |
| $\alpha 1$ | 69B | Angle of junction between H2 and G1, neck chamfer angle |
| h | | Distance between H2 and G1 (angle= $\alpha 1$) |
| s | | Distance between H2 and commencement of rifling at diameter G1 |
| i | 72B | Half angle of the inclination of commencement of rifling, throat angle |
| w | 73 | Width of cylinder gap. Distance from cylinder face to barrel end |
| F | 82 | Land diameter of bore of barrel, Bore diameter |

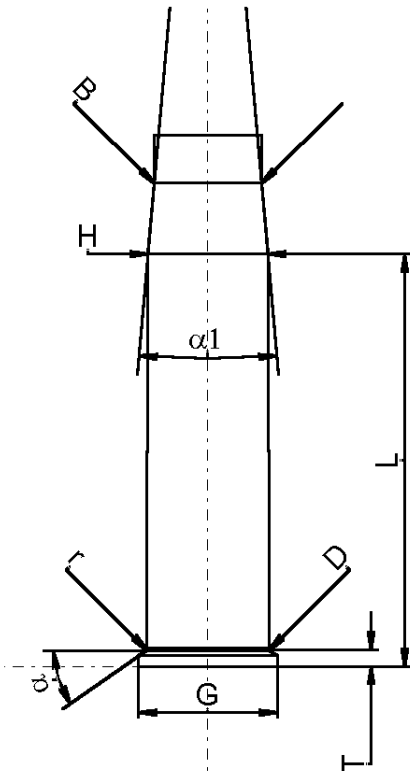
Following symbols are not found in drawing, only in datasheet:

| | | |
|---|----|--|
| Z | 83 | Diameter groove-to-groove of barrel |
| b | 87 | Width of grooves |
| N | 86 | Number of grooves |
| u | 85 | Pitch of rifling of grooves; twist of rifling and direction (optional) |
| Q | 84 | Bore section of barrel, bore and groove area |

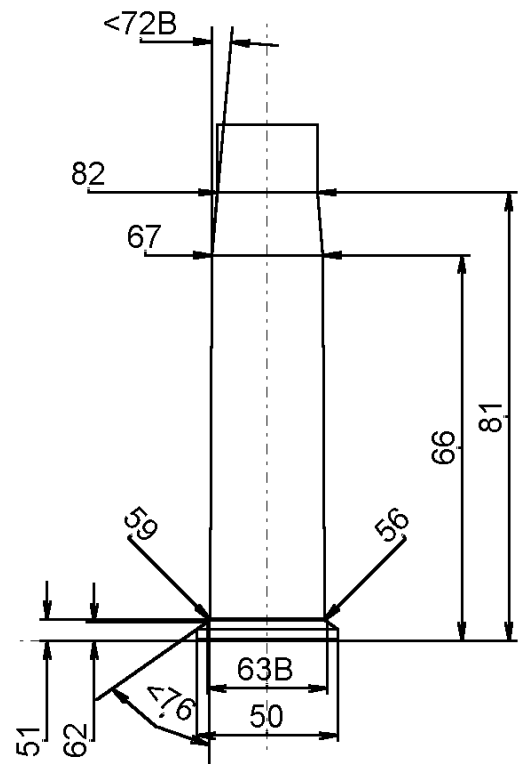
SAAMI only definitions

| | |
|-----|---|
| 52B | Length to first body diameter, basic dimension |
| 53 | First body diameter |
| 54B | Length from first to second body diameter, basic dimension |
| 55 | Second body diameter |
| 62 | Length to datum diameter, reference dimension |
| 63B | Datum diameter, basic dimension |
| 70 | Length to throat diameter (or to freebore), reference dimension |
| 74 | Length to freebore / throat Intersection |
| 75 | Diameter at freebore / throat Intersection |
| 81 | Length to bore diameter |

Shotgun Chamber Symbols



Picture 65 : CIP Shotgun Chamber



Picture 66 : SAAMI Shotgun Chamber

| CIP | SAAMI | Definition |
|------------|-------|---|
| L | 66 | Length to cone |
| | 81 | Length to bore diameter |
| D | 56 | Diameter at chamber mouth, underhead diameter (intersection) |
| r | 59 | Underhead radius |
| H | 67 | Cone diameter before case mouth |
| B | 82 | Bore diameter |
| T | 51 | Length to underhead diameter / head angle intersection |
| G | 50 | Counterbore diameter |
| $\alpha 1$ | 72B | Cone angle, CIP full angle, SAAMI half angle, Basic angle |
| α | 76 | Head angle, CIP to baseline, SAAMI to centerline, SAAMI basic dimension |
| | 62 | Length to datum diameter |
| | 63B | Datum diameter, basic dimension |

CIP Tables Classification

- ◆ **Table I** Rimless Cartridges for Rifles
- ◆ **Table II** Rimmed Cartridges for Rifles
- ◆ **Table III** Belted Cartridges for Rifles
- ◆ **Table IV** Cartridges for Pistols and Revolvers
- ◆ **Table V** Rimfire Cartridges
- ◆ **Table VI** Cartridges for Industrial Tools
- ◆ **Table VII** Cartridges for Smoothbore Firearms
- ◆ **Table VIII** Blank Cartridges for Alarm Weapons
- ◆ **Table IX** Cartridges with Dust Shot
- ◆ **Table X** Cartridges for other Arms
- ◆ **Table XI** Caseless Cartridges

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