parts list.

Detail Drawings

All individual items required to produce mechanical equipment need to be described in some detail to ensure that they are manufactured in accordance with the designers requirements. Proprietary items are selected from technical data sheets obtained from manufacturer /supplier. Items manufactured specifically for the application need to be made to detail drawings which include the geometry, material, heat treatment requirements, surface texture, size tolerances, geometric tolerances etc.

The detail drawing should include all of the necessary information to enable procurement, manufacture and should identify all of the relevant codes and standards. The item weight/mass should also be included for reference.

Depending on the level of detail, a detail drawing can comprise one drawing on a sheet or a number of separate drawings on one sheet. It is sometimes possible to combine the detail drawings onto the assembly drawing. The detail drawing must cross reference, both ways,to the parent assembly or arrangement drawing.

Fabrication Drawings

The fabrication drawing is a specific type of detail drawing. Some fabrication drawings are virtually assembly drawing e.g. when a number of items are assembled together as a fabrication. The fabrication drawing generally includes a material parts list identifying all of the materials used to build up the fabrication. All weld details are included using the standard symbolic representation of welds as shown in BS EN 22553. All of the materials should be identified in accordance with the relevant standards and codes.

The fabrication drawing should clearly describe in notes or in referenced documents the heat treatment and stress relieving requirements prior to, during and following the completion of the fabrication processes. The dimensions and relevant linear and geometric tolerances should be indicated.

A fabrication drawing sometimes only includes the fabrication details, the final machining details are then shown on a separate drawing. It is equally acceptable to show all manufacturing information on one drawing.

The items used to make up the fabrication will be identified with leader lines to balloons which include the item reference number linking to the parts list. The listed items on a fabrication drawing do not identify items which can be disassembled, as on assembly and arrangement drawings. The numbering system should reflect this difference. Methods of numbering items on fabrication drawings include using lower case alphabet letters e.g a,b,c or optionally as sub units of the fabrication item number e.g 1/1, 1/2 1/3 ... or 1/a , 1/b, 1/c...

Item Identification

The method of identifying the parts must be clear and unambiguous. The equipment as represented on the general arrangement drawing and the sub-assemblies as shown on the arrangement and assembly drawing should be clearly identified with plant item numbers. The relevant drawing numbers are obtained by reference to the plant items list. Plant items are annotated by leader lines to a double balloon.

Typically a conveyor may have a plant item number e.g.H1040 and be shown on a drawing e.g. drawing number A0 12500.

The detail drawings are sub items of the arrangement drawings and are identified on the arrangement and assembly drawings. Typically an item say a conveyor frame may be identified from the conveyor plant item number e.g. H1040/3 . Optionally it may be identified using the arrangement drawing number e.g. A0 12500 /3. The frame will also have a discrete detail drawing number e.g A2 12503

The fabricated items which are based on sub-parts welded together should be identified as details but the individual sub-parts should be identified in a different way to avoid ambiguity. One option is to number the fabricated sub-parts alphabetically e.g a, b, c ...or as a combination of the fabrication detail number and the part number i.e 3/a , 3/b.... These sub-parts do not need to be identified as separate parts because following fabrication they will not exist as separate parts. If the sub-parts are complicated shapes or machined items and they cannot be described in sufficient detail on the fabrication drawing they should be drawn as separate detail drawings but still identified as sub-parts of the fabrication detail.

Links Providing information on Drawing Diagrams and Symbols

1. Volvo Drawing Standards.....Document on European-Standard-based drawing procedures
2. The Design Process...A review of the design process including drawing examples.(Not BS 8888)
3. Drawing Tools...Notes on Drawing using CoralDraw
4. Cadalot...Lots of Advice and Lessons from a Drawing expert

This Page is being developed

Home
Drawing Page

Send Comments to Roy@roymech.co.uk

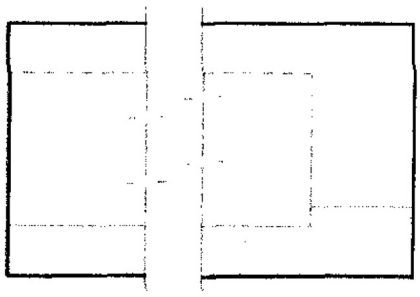
view which is most recognisable during manufacture or use. i.e. the front view of a house or the side view of a car.

Lines Used on Drawings..

Line Types

Line	Description.....	Application
	Continuous Thick	Outline Edge
	Continuous Thin	Intersection.. Dimension.. Projection Leader.. Hatching
	Continuous Freehand	Limits of Partial or interrupted view
	Continuous Thin With Zigzags	Shortened Sections
	Dashed Thick	Hidden Outlines Hidden Edges
	Dashed Thin	Hidden Outlines Hidden Edges
	Chain Thin	Centre lines Lines of Symmetry
	Chain Thick	Special Surfaces
	Chain Thin Thick ends	Cutting Planes
	Chain Thin double-dashed	Centroidal Lines Initial Outlines Prior to Forming /Machining

FIGURE SHOWING LINETYPES



Line Thicknesses

Two thicknesses of line should be used on a drawing. The "thick" line should be at least twice as thick as the "thin" line. The thickness of the line should be based on the sizes... 0,18mm 0,25mm 0,35mm 0,5mm 0,7mm 1,0mm 1.4mm and 2mm

Line spacing

The minimum space between parallel lines should always be greater than twice the thickness of the heaviest line.

Leader Lines

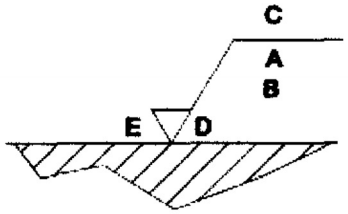
Leader Lines terminate

- With a dot if they end within the outline of the item being identified.
- With an arrow if they end on the outline
- Without a dot or an arrow when pointing at a dimensions line

Relevant Standard..

BS EN ISO 1302:2002 Geometrical product specifications (GPS). Indication of surface texture in technical product documentation

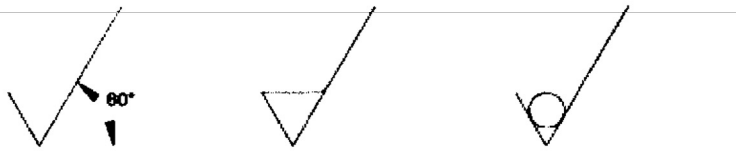
General indication of surface texture on drawings



A	**SURFACE TEXTURE REQUIREMENTS - 1**
B	**SURFACE TEXTURE REQUIREMENTS - 2**
C	**MANUFACTURING PROCESS - TURNED, GROUND, PLATED ...**
D	**SURFACE LAY AND ORIENTATION**
E	**MACHINING ALLOWANCE**

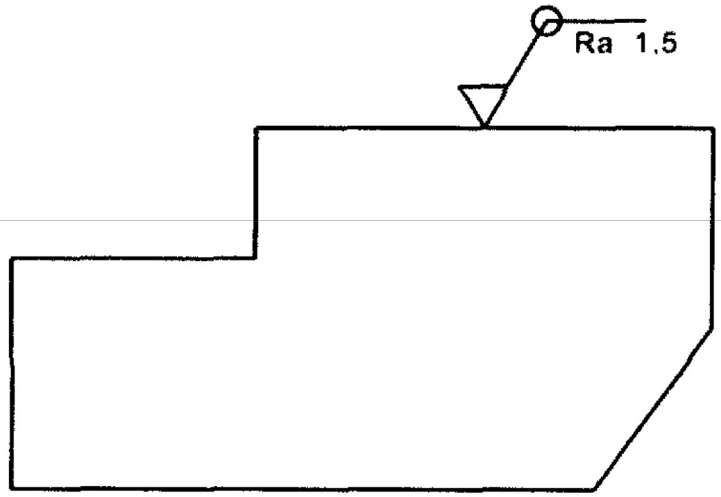
For notes on surface roughness use link Surface Roughness Notes

Requirement for machining



BASIC SYMBOL | **SURFACE TO MACHINED** | **MATERIAL REMOVAL NOT ALLOWED**

Symbol for surface texture all component surfaces



The Symbol indicates that all of the component surfaces are to be machined...

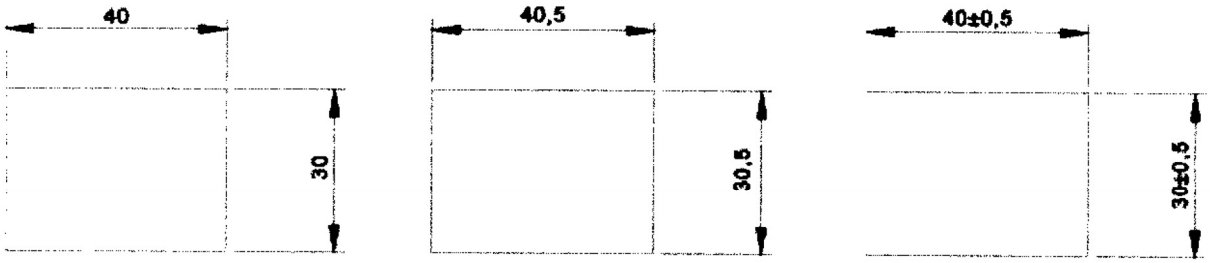
Threads

MALE THREADS

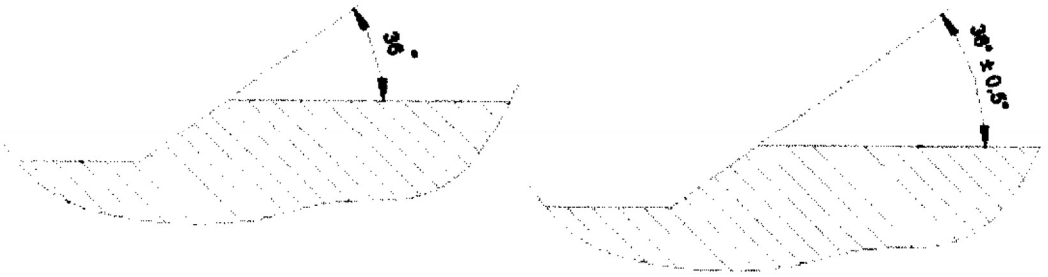
FEMALE THREADS SECTION AND HIDDEN

Dimensioning

Linear Dimensioning

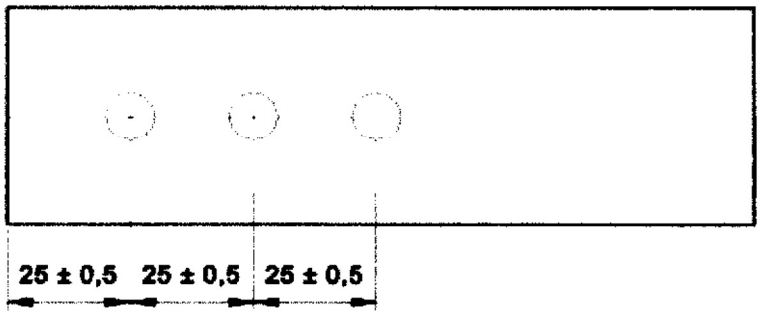


Angular Dimensioning

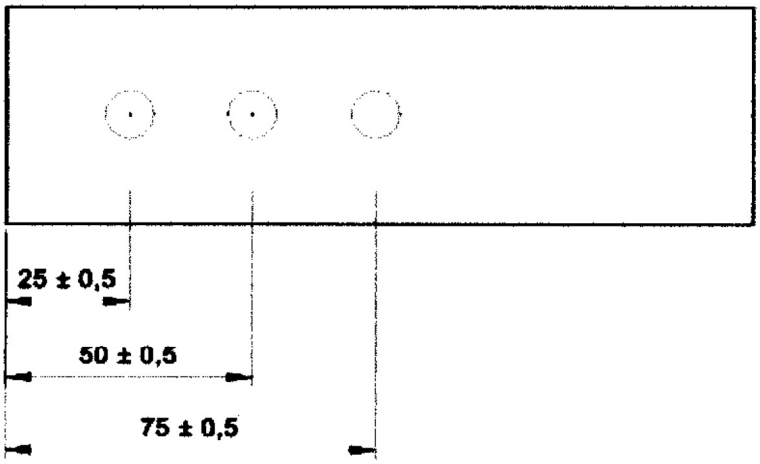


CHAIN-PARALLEL DIMENSIONING

CHAIN DIMENSIONING

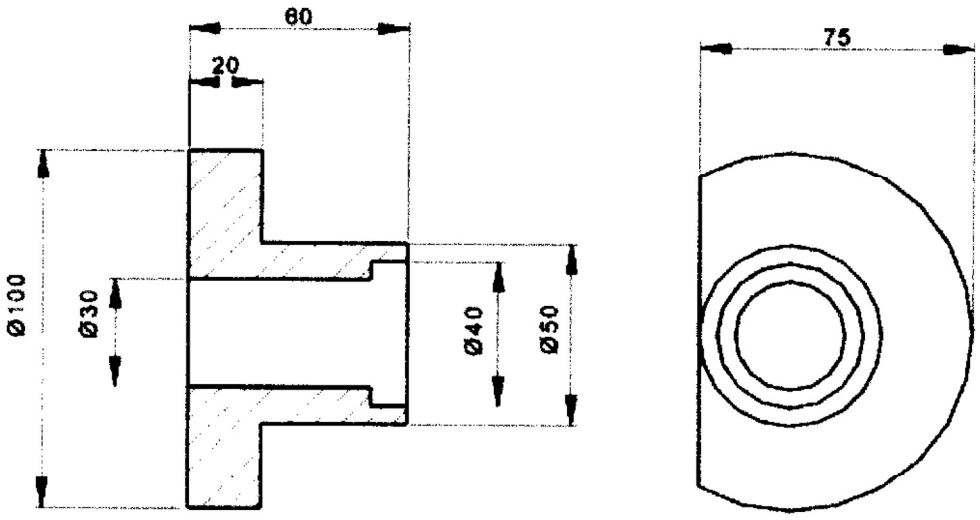


PARALLEL DIMENSIONING



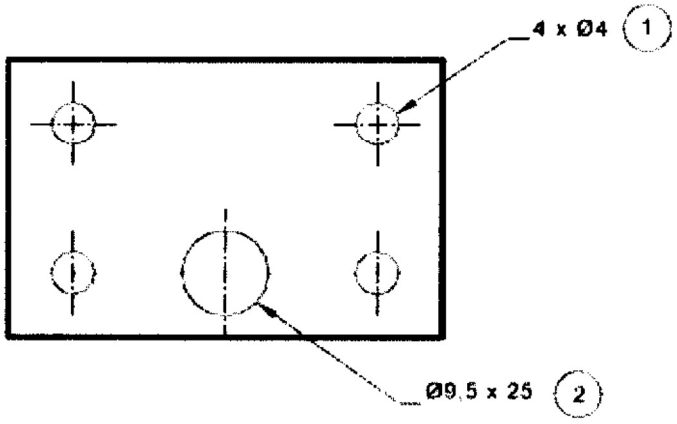
Examples of chain and parallel dimensioning are above below. The advantage of parallel dimensioning is that there is no build-up of tolerances.

Dimensioning Diameters



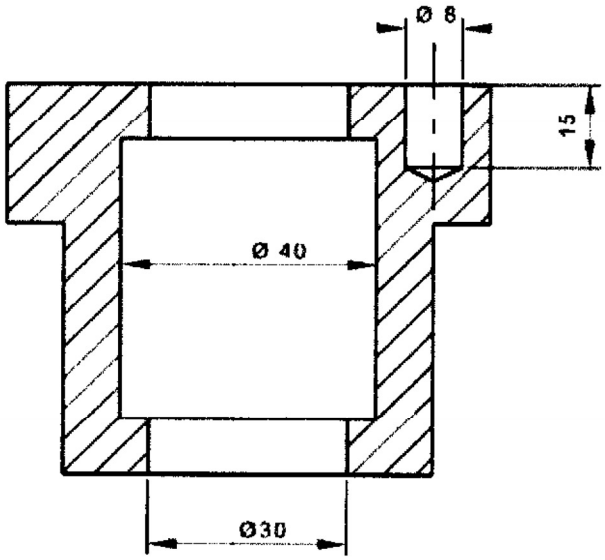
Dimensions of diameters are shown on view providing greatest clarity

Dimensioning Holes

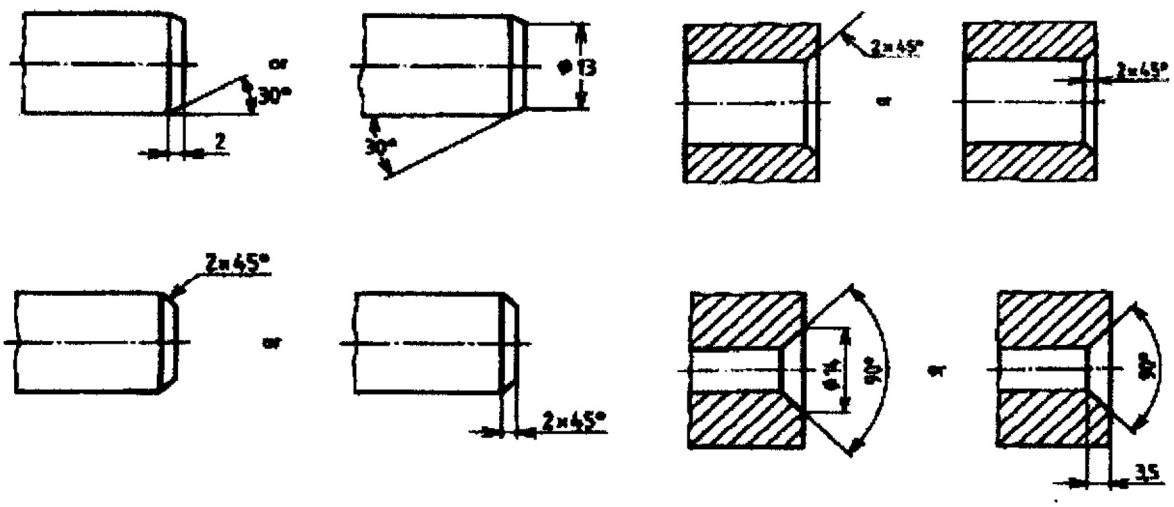


(1) 4 OFF HOLES 4 DIA THROUGH

(2) HOLE 9.5 DIA X 25 DEEP (DEPTH RELATES TO CYLINDERICAL PART OF HOLE)



Dimensioning Chamfers/Countersinks



Home

Notes On Title Blocks

Drawing Title Blocks

BS ISO 7200 Technical Drawings- Title Blocks identifies the title block requirements to be used on engineering drawings.... The drawing sheet size should be in accordance with "BS EN ISO 5457 TD- Sizes and layout of drawing sheets" Drawing Sheet Sizes

A title block is the form on which the actual drawing is a section. The title block includes the border and the various sections for providing quality, administrative and technical information. The importance of the title block cannot be minimised as it includes all the information which enables the drawing to be intepreted, identified and archived.

The title should include sufficient information to identify the type of drawing e.g general arrangement, or detail. It should also clearly describe in a precise way what the drawing portrays

The notes below relate to the title boxes included on in the title block to convey the necessary information. The standard drawing sizes and layouts are described elsewhere.

The basic requirements for a title block located at the bottom right hand corner of a drawing are

1. The registration or ID number
2. The drawing title
3. The Legal Owner of the Drawing

These items should be written in a rectangle which is at the most 170mm wide.

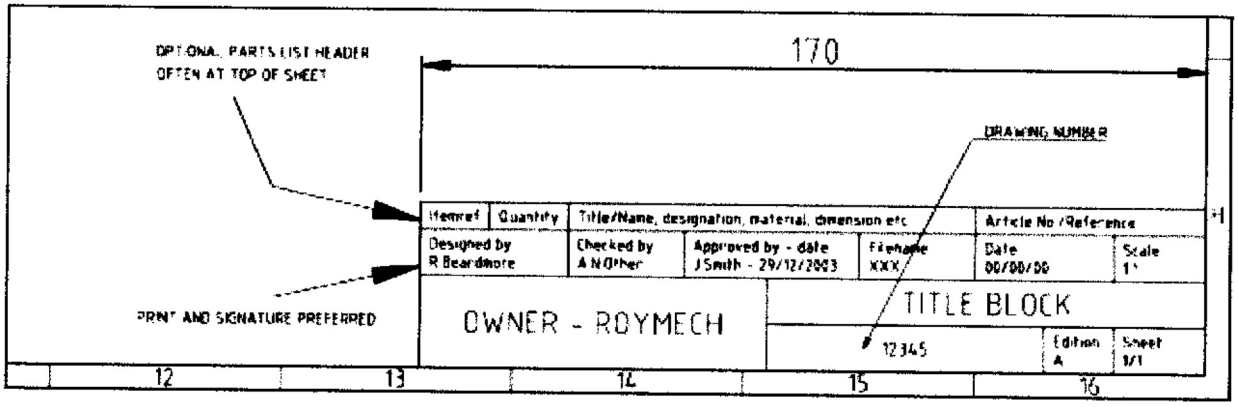
The tile block should also include boxes for the legal signatures of the originator and other persons involved production of the drawing to the required quality.

The drawing should also include a symbol identifying the projection. The main scale and the linear dimension units if other than "mm".

Mechanical drawings should list the standards use for: indicating the surface texture: welds: general tolerances and geometric tolerances, as notes referring directly the the relevant standards or a general note referring to the BS 8888. (BS 8888 lists all of the relevant standards.) BS 8888 should really only be referenced if the drawing is in full accordance.

The drawing title block should indicate the date of the first revision. In separate boxes to the title block the current revision with an outline description of the revision should be indicated. On completion of each drawing revision an additional revision box should be completed thus provide a detailed history of the drawing.

Typical Title Box



Typical Revision Box

Home

Mechanical Drawings

There are a number of drawing types associated with the mechanical engineering design process.

A list of the Drawing Types covered by these notes is provided below

1. General Arrangement Drawings
2. Arrangement Drawings
3. Assembly Drawings
4. Detail Drawings
5. Fabrication Drawings

These notes also include comments on item identification Identification

General Arrangement Drawings

This drawing shows overall views of the equipment and provides all of the information to produce transportation, layout and installation drawings. The drawing includes a list of the arrangement drawings. The drawing includes overall dimensions, installation details, overall weight/mass, weights of sub systems, and service supply details.

The general arrangement drawing includes references to the design documents. The drawing often also identifies relevant internal and external contract numbers. An example of a typical general arrangement drawing is a roller conveyor system comprising a number of conveyors with independent drives and guards.

The drawn separate assemblies and parts will be identified with leader lines to balloons which include the arrangement reference number linking to the list of arrangement drawings.

Arrangement Drawing

Arrangement drawing represent self contained units used to make up the system drawn on the general arrangement drawing. Examples of arrangement drawings include drawings of assembled conveyers, drive systems, elevating units etc. The drawing should show in, at least three orthographic views, clear details to show all of the components used to make up the equipment items and how the component parts are located and fastened together.

Arrangement drawings include a table (parts list) identifying assemblies, fabrication drawings, detail drawings and proprietary items used to make up the equipment. Arrangement drawings include overall dimension, the weight/mass of the equipment drawn, the lifting points. All information needed to construct, test, lift, transport, and install the equipment should be provided in notes or as referenced documents.

The arrangement drawing may be a standard internal drawing which is repeatedly called up on different system general arrangement drawings.

The drawn separate assemblies and parts will be identified with leader lines to balloons which include the item reference number linking to the parts list.

Assembly Drawings

The assembly /sub-assembly drawings are drawings of discrete sub-systems showing in some detail how the component items fit together. Typical assembly drawings include gearbox drawings, roller drawings, guard system drawings.

The assembly drawing will generally include at least three orthographic views with sections as needed to clearly show all of the details and their relative positions. Overall and detail dimensions will be shown. The weight/mass of the assembly/sub-assembly will be noted. The drawing will include a parts list identifying all of the component details with quantities and materials and supply details. The assembly drawing will include a list of reference drawings and notes identifying the relevant codes and specifications and testing requirements.

The drawn separate items will be identified with leader lines to balloons which include the item reference number linking to the

Metric Screw Threads

Thread Designation

The complete designation of a screw thread gives

- the thread symbol e.g. M for Metric
- the thread size e.g. 6
- the thread pitch e.g. x 1
- the tolerance class e.g. 6H(Female) 6g (male)
- the length of thread if not dimensioned separately eg. x 30 LNG

Notes:
If the thread is standard course then the pitch need not be shown. However it is better that it is always shown
If the tolerance grade for the pitch diameter and the major diameter is the same then only one needs to be shown.
Threads right handed (clockwise turn to screw in) unless a -LH suffix is added to indicate left hand thread.
The Class of Fit is a measure of the degree of fit between mating internal and external threads.

Classes of Fit

Three main Classes of Fit are defined for metric screw threads :

- FINE: This has a tolerance class of 5H for internal threads and 4h for external threads.
- MEDIUM: This has a tolerance class of 6H for internal threads and 6g for external threads.
- COARSE: This has a tolerance class of 7H for internal threads and 8g for external threads.

If one class is shown for a male thread i.e 6g then the tolerance applies to the pitch dia and the major diameter. A dual tolerance is shown (5h6g) when a different tolerance is applied to the Pitch dia (5h) and the major dia (6h). The same principle applies to the female thread e.g. a tolerance grade (6H) applies to both pitch dia and the minor dia. A tolerance grade (6H7H) refers to 6H for the pitch dia and 7H for the minor dia.

The typical designation for a thread on a drawing is as follows

- M8 - 6e..This is a M8 course male thread with a 6e external(male) tolerance (before coating)
- M8 x 1 - 6e.. This is a M8 course male fine thread with a 6e external(male) tolerance (before coating)
- M8 - 6H... This is a M8 course female thread with a 6H internal(female) tolerance (not coated)
- M8 - 6H - LH This is a Left hand M8 course female thread with a 6H internal(female) tolerance (not coated)

Pipe Threads

The typical designation for a Pipe Threads

- R 1/2 External Taper - Sealing on Thread (BS 21)
- Rc 1/2 Internal Tape - Sealing on Thread(BS 21)
- Rp 1/2 Internal Parallel- Sealing on Thread (BS 21)
- G 1/2 A,B or ext External Parallel - Not Sealing on Threads -Additional seal required(BS2779)
- G 1/2(F = full thread) Internal Parallel Not Sealing on Threads -Additional seal required (BS2779)

Useful Links On Drawing/ Dimensioning

1. Volvo Drawing Standards.....Document on European-Standard-based drawing procedures
2. Engineering Graphics-Lines.....Not European but useful
3. Dimensioning Notes.....Not European but useful
4. Fastener.....Not European but useful. How to draw screw threads. etc
5. Maryland Metrics..Vast quantity of useful technical information on metric screws/threads in downloadable acrobat pages
6. Tolerancing screw threads..Very informative page on the Boltscience site

This Page is being developed

Home
Drawing Page

Send Comments to Roy@roymech.co.uk

Last Updated 19/07/2005