

# Piping PDMS Job Note

Number: **PDMS- 014**

Rev: **01**

Date: **18<sup>th</sup> April 2008**

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PDMS Module: **PARAGON SPECON ISODRAFT**

Description: "**New**" **Bolting Method**

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## 1.1 HOW IT WORKS

Each flanged component has a **BLRF** array which points to a **BOLTSET**. The boltset contains information for each of the bolt holes in the flange. When a flanged joint is encountered during isometric production PDMS uses the information stored in the boltset to determine the amount of bolt length and bolt diameter required for each hole of each component. The preferred bolt type for the component is also stored in the boltset.

Once PDMS has determined the bolt length for each of the components, the bolt types are examined and the most superior type is fixed for the joint. This type is then referenced in the bolt specification to determine the bolt required from the corresponding **BOLTREF** in the spec.

The single bolt (**SBOL**) determined from the specification is then referenced to determine what (if any) additional length(s) needs to be added to the accumulated fitting lengths.

The total accumulated length is then checked against the lengths held in the length table for the bolt and a final required length established according to the following rules:-

- If there is an exact match with the calculated length then use that length.
- If there is a length within +1mm of the calculated length then use that length
- Otherwise use the next length above the accumulated length.

The item code to be shown on the isometric is then extracted from the corresponding UDA in the length table.

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## 1.2 CATALOGUE REQUIREMENTS

### **BOLT SETS**

Bolting information for a component is stored in the Bolt Set (**BTSE**).

Each hole is referenced by a Bolt Point (**BLTP**) which stores the following information:

<b>NUMB</b>	Bolt-Hole Number
<b>BDIA</b>	Bolt Diameter (In millimetres to 2 decimal places)
<b>BTHK</b>	Bolt Length through the component
<b>BTYPE</b>	Bolt Type

In order to simplify the input of data, the **BTSEs** have been categorised by flange standard/rating. This fixes the number of holes and the bolt diameter for each size, leaving only the bolt thickness and bolt type as possible variables.

### **BTHK**

The **BTHK** utilises parameters already used by the component in the catalogue. This removes the need to create separate **BTSEs** for different facings or for a manufacturer's specific requirement. In this way components such as relief valves, which may have an extra throat thickness, do not require a separate **BTSE**.

It does mean, however, that the parameter used for flange thickness/bolt must be controlled so that the total number of **BTSEs** is reduced.

Hence the following convention has been used:-

For single bore components:

Any of PARAM 4, 5, 6, or 7 is used for flange thickness/Bolt

For two bore components

Any 2 of PARAM 4, 5, 6, or 7 is used for the flange thickness/Bolt (one for each bore)

For three bore components

Any 3 of PARAM 4, 5, 6, or 7 is used for the flange thickness/Bolt (one for each bore)

For four bore components

PARAM 4 is used for the 1st flange thickness/Bolt

PARAM 5 is used for the 2nd flange thickness/Bolt

PARAM 6 is used for the 3rd flange thickness/Bolt

PARAM 7 is used for the 4th flange thickness/Bolt

This method does however mean the information needs to be kept in four separate BTSE references (one for each thickness parameter).

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### **BTYPE**

This can be one of the following:-

<b>BOLT</b> (default)	<b>priority 3</b>
<b>MACH</b>	<b>priority 2</b>
<b>STUD</b>	<b>priority 2</b>
<b>CAP</b>	<b>priority 1</b>
<b>JACK</b>	<b>priority 1</b>
<b>TAP</b>	<b>priority 1</b>

A built in priority system will ensure that a priority 2 **BTYPE** will take precedence over a priority 3 and a priority 1 **BTYPE** will take precedence over both priority 2 and priority 3.

Generally, the bolt type is governed by the piping specification but the length calculation method is the same for all types. For this reason most **BTSEs** have the bolt type set to **BOLT** for each hole and the bolt specification default will determine whether a studbolt or hex head bolt is to be used.

For tapped holes, where a specific bolt type is required, the type is set to **TAP** and a separate entry is made in the bolt specification to override the default.

In principal any hole with a **BTYPE** other than **BOLT** will cause PDMS to use that other bolt. Thus, any of the other types may be used for a component to cause an override to occur.

Since each hole is handled independently it is possible to mix **BTYPEs** within the set.

For example, a Butterfly valve may require through bolts for some holes, and hex head screws for the rest.

**(NOTE: In special cases the use of a “dummy” component may be considered to trigger a specific bolt selection)**

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## **1.3     NUMBERING FORMAT**

Where a choice is restricted by the system, the digits chosen have been fixed.

Where there is no restriction digits have been used in alphabetical order. Any additional entries should use the next available letter. This is much easier to control than trying to make things 'meaningful'.

### **BTSE**

Digits 1 & 2	<b>BS</b>	<b>Bolt Set</b>	
Digit 3		<u>Bolt Type</u>	<u>Spec BTYP</u>
	<b>B</b>	<b>Bolt (default)</b>	<b>BOLT</b>
	<b>C</b>	<b>Cap Screw</b>	<b>CAP</b>
	<b>L</b>	<b>Tapped Hole (Wafer Lug Valve)</b>	<b>TAP</b>
	<b>M</b>	<b>Machine Screw</b>	<b>MACH</b>
	<b>S</b>	<b>Studbolt</b>	<b>STUD</b>
	<b>T</b>	<b>Tapped Hole</b>	<b>TAP</b>
Digit 4		<u>Flange Standard</u>	
	<b>A</b>	<b>ASME B16.5</b>	
	<b>B</b>	<b>ASME B16.47</b>	
	<b>C</b>	<b>API</b>	
	<b>D</b>	<b>SAE</b>	
Digit 5		<u>Rating</u>	
		<b>From Standard PDMS Coding</b>	
Digit 6		<u>Parameter Number</u>	
		<b>4, 5, 6, or 7</b>	
Digit 7		<u>Nominal Bore</u>	
		<b>From Standard PDMS Coding</b>	

### **BLTP**

The **BLTP** uses the number of the **BTSE** with a suffix **–PTn** where **n** is the number of the hole.

(Holes are numbered clockwise around the flange starting at the top)

## **1.4     SINGLE BOLT**

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The single bolt (**SBOL**) defines the additional items (nuts, washers and extra thread), used in conjunction with the flange dimensions to calculate the required bolt length plus reference to a length table. Since washers are not normally used, and the nut and extra thread are consistent, it is possible to define the **SBOL** in terms of its type, dimensional standard, material, and diameter.

**SBOLs** are members of a **BLIS**

### **BLIS**

Digits 1 & 2     **BB Bolt**

Digit 3            Length Standard (for access to client length tables)  
**A Default**

Digit 4            Length Units  
**I Inch Lengths**  
**M Millimetre Lengths**

Digit 5            Bolt Type  
**C Cap Screw**  
**H Hex Head Bolt + Nut**  
**J Jack Screw**  
**S Studbolt**  
**T Hex Head Bolt - no nut – (Tapped Hole)**

Digit 6            Bolt Material Standard  
**A ASTM A193-B7**  
**B ASTM A320-B8**  
**C ASTM A320-L7**  
**D ASTM F468-5**

Digit 7            Nut Material Standard  
**A ASTM A193-B8**  
**B ASTM A194-2H**  
**C ASTM A194-4**  
**D ASTM A194-7**  
**E ASTM A467-5**

NOTE: Where no nut required use 0

### **SBOL**

Numbering of the **SBOL** is identical to the **BLIS** with an additional digit for bolt diameter.

Digit 8            Diameter            **See Table**

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## 1.5 LENGTH TABLE

The length table (**LTAB**) defines the preferred lengths of bolt for each diameter and the stock code to be printed on the isometric Bill of Materials and MTO reports. The numbering format is identical to that for **SBOL** except that the 2nd digit is **L** instead of **B**.

### LTAB

Digits 1 & 2    **BL Length Table**

Digit 3        length standard (for access to client length tables)  
**A Client A**

Digit 4        Length Units  
**I Inch Lengths**  
**M Millimetre Lengths**

Digit 5        Bolt Type  
**C Cap Screw**  
**H Hex Head Bolt**  
**S Studbolt**  
**T Hex Head Bolt - no nut – (Tapped Hole)**

Digit 6        Bolt Material Standard  
**A ASTM A193-B7**  
**B ASTM A320-B8**  
**C ASTM A320-L7**  
**D ASTM F468-5**

Digit 7        Nut Material Standard  
**A ASTM A193-B8**  
**B ASTM A194-2H**  
**C ASTM A194-4**  
**D ASTM A194-7**  
**E ASTM A467-5**

NOTE: Where no nut required use 0

### DTAB

Numbering of the **DTAB** is identical to the **LTAB** with an additional digit for bolt diameter.

Digit 8        Diameter                      **See Diameter Table**

## 1.6 DIAMETER TABLE

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The following table has been created so that the same **BOLTREFs** and **SBOLs** will give the correct diameter of bolt whether Imperial or Metric diameters are required on output. In either case the PDMS input for diameter is in metric but will convert correctly on output. The diameter must be input in the same format (i.e. 2 decimal places) on all PDMS forms.

IS

ASTM

CODE	METRIC	IMPERIAL	PDMS INPUT
A	M8	-	8.00
B	M10	-	10.00
C	M12	-	12.00
D	M14	1/2	12.70
E	M16	5/8	15.88
F	M18	-	18.00
G	M20	3/4	19.05
H	M22	-	22.00
I	M24	7/8	22.23
J	M27	1	25.40
K	M30	1.1/8	28.58
L	M33	1.1/4	31.75
M	M36	1.3/8	34.93
N	M39	1.1/2	38.10
O	M42	1.5/8	41.28
P	M45	1.3/4	44.45
Q	M48	1.7/8	47.63
R	M52	2	50.80
S	M56	2.1/4	57.15
T	M60	-	60.00
U	M64	2.1/2	63.50
V	M68	-	68.00
W	M70	2.3/4	69.85
X	M72x6	3	76.20
Y	M76x6	3.1/8	79.38
Z	M80x6	3.1/2	88.90
1	M90	-	90.00

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### **BOLT SPECIFICATION**

The bolt specification is similar to the piping specification but is used differently by PDMS. The headings are of the same format but with BDIA and BTYP replacing PBOR and STYP

### **HEADING**

TYPE	NAME	BDIA	BTYP	CATREF	DETAIL	MATXT	CMPREF	BLTREF
------	------	------	------	--------	--------	-------	--------	--------

TYPE	will always be <b>BOLT</b>							
------	----------------------------	--	--	--	--	--	--	--

NAME	There is no definite established naming convention except for the spec name prefix but it is probably reasonable to use the SBOL name wherever possible.							
------	--	--	--	--	--	--	--	--

BDIA	always in mm to 2 decimal places							
------	----------------------------------	--	--	--	--	--	--	--

BTYP	The default (preferred) choice use <b>BOLT</b> . Use <b>CAP</b> , <b>TAP</b> ...etc for alternatives							
------	--	--	--	--	--	--	--	--

CATREF	Although not actually used by PDMS an entry must be made here. There are “dummy” components in the catalogue for this purpose. For example: <b>/ISBOLTA &amp; /IMBOLTA</b>							
--------	--	--	--	--	--	--	--	--

DETAIL	Bolt description to appear on reports							
--------	---------------------------------------	--	--	--	--	--	--	--

CMPREF	Bolts do not generally have a CMPREF so use =0							
--------	--	--	--	--	--	--	--	--

BLTREF	This is the SBOL for the required bolt and therefore the most important entry. It is from this that the final bolt will be derived.							
--------	---	--	--	--	--	--	--	--

### **PIPING SPECIFICATION**

In order to use the new bolting method and access the correct bolt spec. the piping specification must have two attributes set.

<b>Bspec</b>	must be set to the name of the bolt specification
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<b>Bltmethod</b>	must be set to <b>‘NEW’</b>
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These attributes are set in **PARAGON**

Bolt Diameter and Length Units to be used on Isometrics are set in **ISODRAFT**

### **IMPLEMENTATION**



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**Assumption:** A new piping specification has been received which includes flanged components to a standard/rating which has not previously been used. The Bolting for this specification is also new to the system.

## **A BTSE**

- 1) Create a new **CATA** for the Flange standard/rating required. This name can be descriptive.
- 2) Create a new **SECT** for the standard/rating/BTYP. This name may also be descriptive.
- 3) Create a new **BTSE** for the first nominal size assuming Parameter 4 will be used for the bolt thickness when the component is made.
- 4) Create a **BLTP** for each hole in order round the flange. Set the NUMB BDIA BTYP & BTHK

i. E.g. **NUMB 1 BDIA 12.70 BTYP BOLT BTHK PARAM 4**

- 5) Repeat for all sizes of flange.
- 6) Repeat from 2 for Parameters 5 6 & 7

## **B LTAB**

- 1) Create a new length table for the new bolt.
- 2) Create new **DTAB** for the first diameter of bolt

2.1) Set acceptable bolt lengths

**BLEN (105mm 110mm 120mm )**

2.2) Set stock codes (example using **:stocka**)

**:Stocka1 'xxx.xxx yyy.yyy zzz.zzz '**

Any number of lengths may be assigned to BLEN but the stock numbers are restricted by the number of characters and generally only ten entries can be made on one line of input. Further codes may be entered on separate lines by entering **:Stocka2** and **:Stocka3** on subsequent lines. If this needs to be used then the stock codes must be sequential in the same order as the lengths.

**Note: The parenthesis () and quotes " are compulsory.**

## **C SBOL**

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- 1) Create a **BLIS** for the new bolt.
- 2) Create a **SBOL** for each bolt diameter.

Set the length table reference

**Nstd** (name of **DTAB**)

Set the extra length (This is the length of bolt to protrude through the nut [2 threads])

**Xtra 10**

Set the length of any additional items (nut washers etc) This is generally only the nut for normal bolting, 2 nuts if tensioning is required, 0 if no nut required.

**Bitlen 38.5**

### **D COMPONENT**

Create or edit the components to include the correct **BLTREF**

### **E BOLT SPECIFICATION**

Create the bolt specification so that for each diameter of bolt the correct **SBOL** is set as the **BLTREF** for each type of bolt required.

BSPEC