Thread Stripping Analysis using the BOLTCALC Program

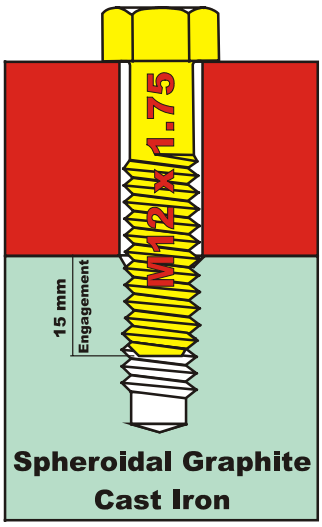
When an external thread (such as a bolt) is engaged into an internal thread (nut or tapped hole) and the fastener tightening, there are, in general, three ways in which the assembly can fail. By tensile fracture – usually across the threaded section, by the internal thread shearing and thirdly, by the external thread shearing.

The height of a standard nut has been established on the basis that the load to cause thread stripping is greater than the tensile fracture load. (Assuming that the appropriate property class of nut is matched to the bolt.)

The reason for this design criteria is that bolt fracture is sudden and it is apparent that a replacement part is needed. Thread stripping is progressive and can occur over a period of time. Thus, at the time of assembly it may not be apparent that anything is wrong. The risk is then that a defective product may enter service.

The BOLTCALC program will check if thread stripping will occur and the minimum length of thread engagement needed to ensure that the bolt will fracture first.

In this example an M12 bolt (property class 10.9) is used to secure a bracket to a casting that is made from spheroidal graphite cast iron of tensile strength 500 N/mm^2.

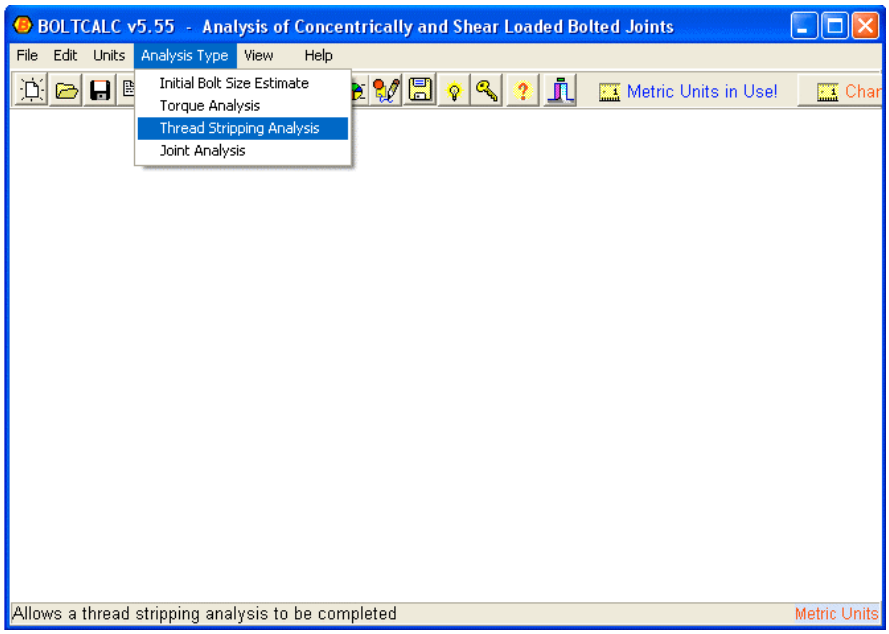


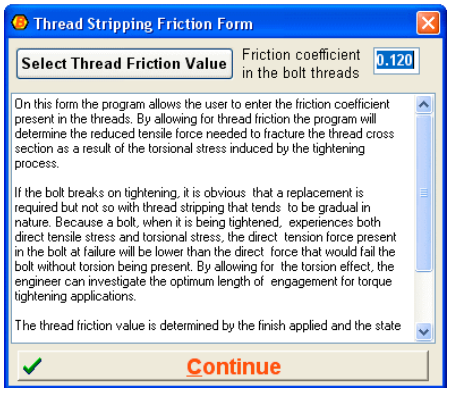
The tolerance class of the bolt thread is 6g and that of the internal thread is 6H. A tapping drill of 10.2 mm diameter was used to form the internal thread. The bolt has a black oxide finish.

Will either the internal or external thread strip before the bolt will break?

Below: Start BOLTCALC ensuring that the units are set to metric. On the main menu do to 'Analysis Type' and then click on the entry marked 'Thread Stripping Analysis'. A form will appear that requests the value of the friction coefficient in the bolt threads. (The reason why this is important is that it influences the bolt failure load when the fastener is being torqued.)

Click on the button marked 'Select Thread Friction Value'





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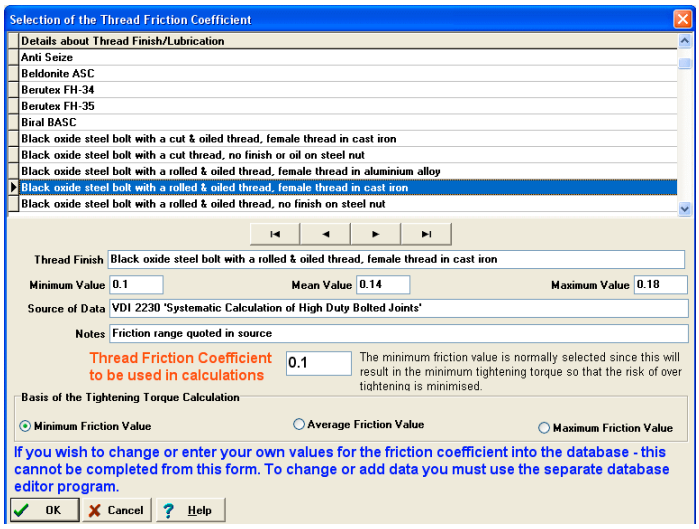
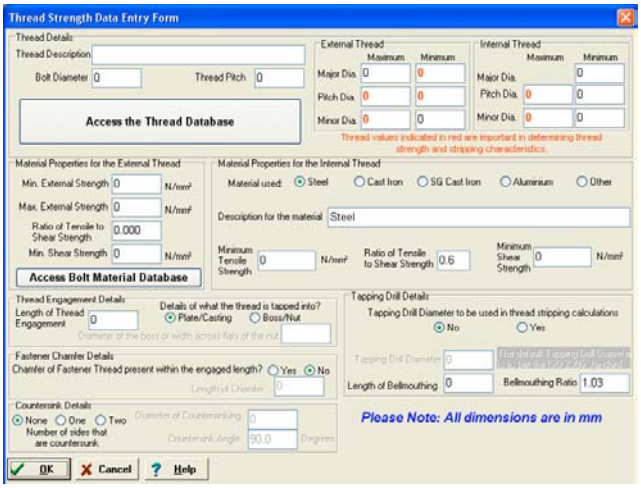
Thread Stripping Analysis using the BOLTCALC Program (continued)

(Side) The Thread Friction Coefficient Form will appear. Select the entry shown and then click the 'Ok' button.

(Below) On clicking 'Continue' from the Thread Stripping Friction Form, the Thread Strength Data Entry Form will appear. To enter details about the thread, click on the button marked 'Access the Thread Database'.

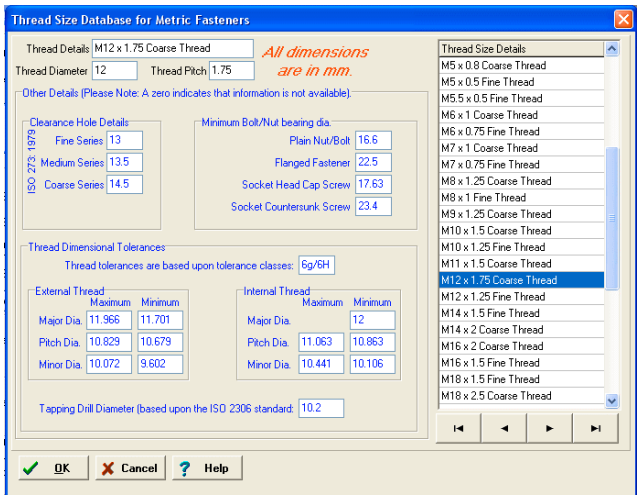


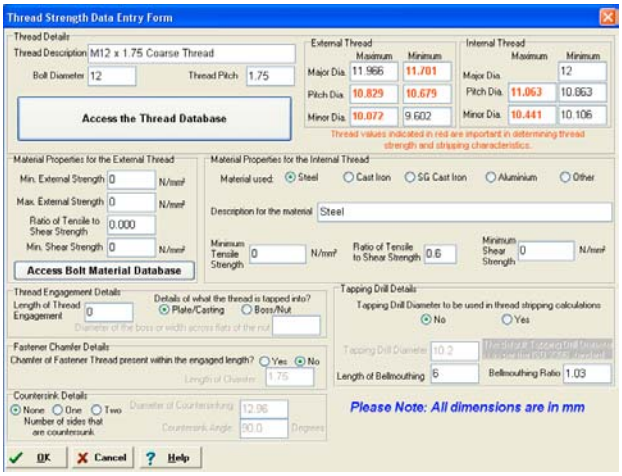


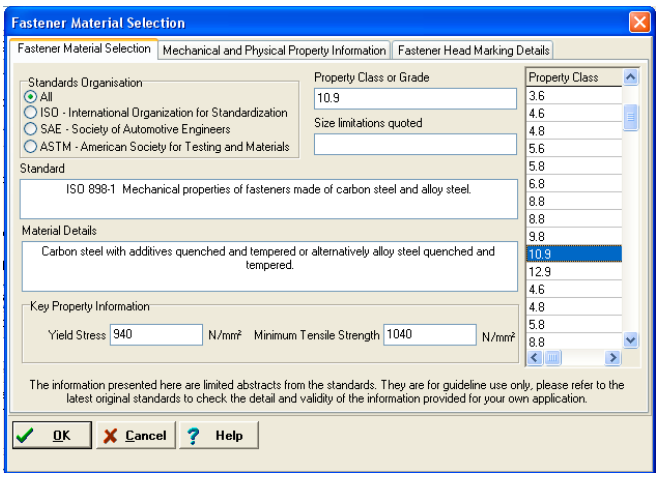
(Side) The Thread Size Database form will appear - select the M12 x 1.75 entry as shown. Details about this thread will appear on the form. Click the 'Ok' button to return to the previous form.

(Below) Details about the M12 thread selected will now be transferred to this form. To define the strength of the bolt click on the button marked 'Access Bolt Material Database'.

(Below- right) On the Fastener Material Selection form that now appears, select the 10.9 entry. Details about this property class will appear on the form. Click the 'Ok' button to accept.







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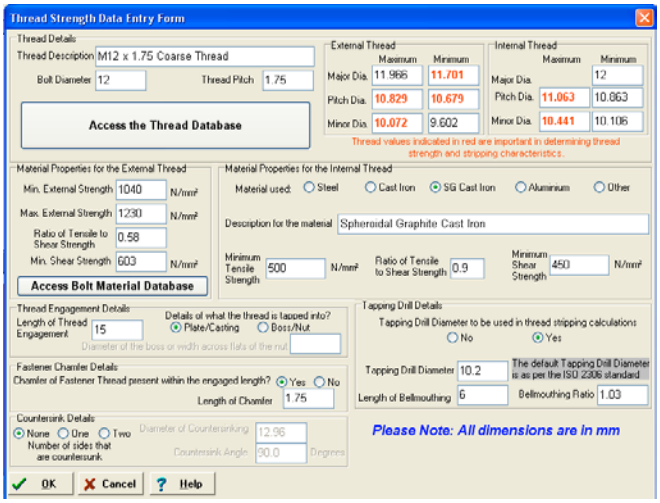
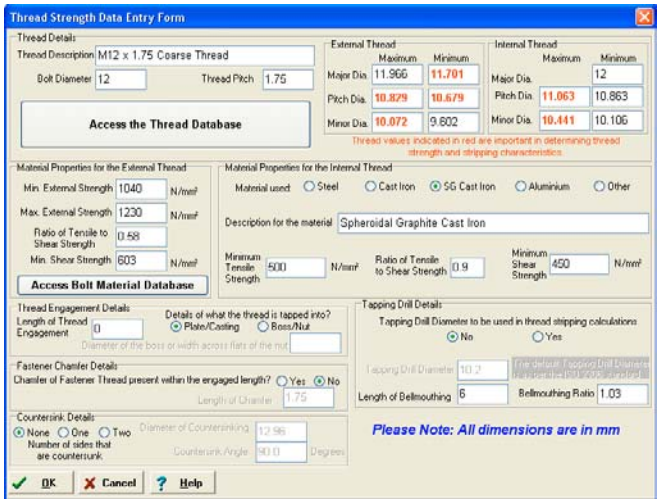
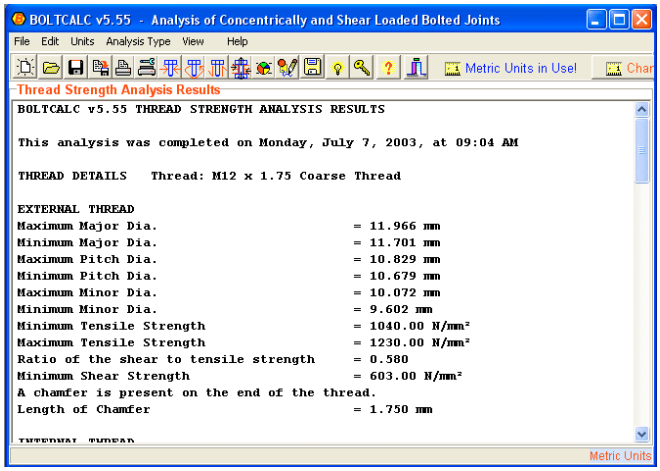
Thread Stripping Analysis using the BOLTCALC Program (continued)

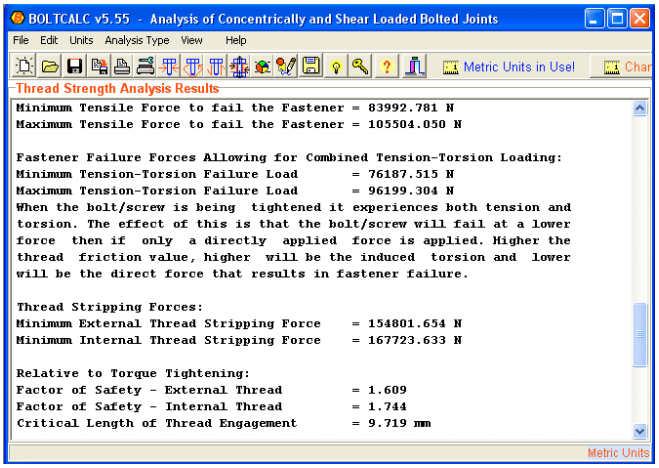
(Side) Details about the bolt strength will now be transferred onto this form. (Note that the property or thread values can be entered directly onto this form if known.) To enter details about the internal thread properties, click the button marked SG Cast Iron and enter 500 as the minimum tensile strength.

Below: Enter 15 as the thread engagement length and click on the Yes button to indicate that a chamfer is present at the end of the bolt thread - a default chamfer equal to the pitch of the thread is automatically included. Click the Yes button to indicate that a tapping drill diameter is used. Click the 'Ok' button on the form to allow the results to be calculated.









(Above) The results of the analysis will be presented, scroll down the form to check the results.

(Side) As can be seen from the results, the bolt will fail by tensile fracture before the threads will strip. The program calculates that this will occur for lengths of engagement longer than 9.7 mm. Hence the length of engagement could be reduced to 10 mm if wished.

The thread stripping analysis also includes facilities to allow for threads tapped into bosses and to allow for effects such as bell mouthing and countersinking of the tapping hole. Details about these effects can be found in the program's user guide or the help files that the program uses.

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