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Superseding AS3507A

Insert -Thin Wall , Self-Locking
Short and Long Length
Installation and Removal of

RATIONALE

AS3507B has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

- 1.1 This SAE Aerospace Standard (AS) provides minimum design, installation (by manual and power methods) and removal requirements for AS3504 and AS3505 thin wall inserts and is applicable when specified on engineering drawings or in procurement documents.

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

- 2.1.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA15096-001.

AS3504 Insert - Thin Wall, Short, Self-Locking, 1025 °F, Silver plated , UNS N07718, UNJ Thread

AS3505 Insert - Thin Wall, Long, Self-Locking, 1025 °F, Silver plated , UNS N07718, UNJ Thread

AS3508 Insert - Thin Wall, Short and Long Hole Preparation For

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3. INSERTS AND TAPPED HOLE PARTICULARS

- 3.1 The tapped hole particulars to AS3508, including serrations into which the inserts are installed will be controlled by the engineering drawing or procurement document.
- 3.2 Table 1 provides details of the insert part number in relation to the bolt thread diameter, nominal tapped hole diameter and insert lengths

TABLE 1 - Insert Selection and Dimensions

Bolt Thread Diameter	Short Insert	Length ± 0.10	Long Insert	Length ± 0.25	Nominal Tapped Hole Dia
0.1900-32UNJF	AS3504-01	0.290	AS3505-01	0.475	0.2500-28UNJF
0.2500-28UNJF	AS3504-02	0.380	AS3505-02	0.595	0.3125-24UNJF
0.3125-24UNJF	AS3504-03	0.470	AS3505-03	0.720	0.3750-24UNJF
0.3750-24UNJF	AS3504-04	0.560	AS3505-04	0.875	0.4375-20UNJF

- 3.3 Inserts installed into components manufactured from hard materials (e.g., steel, heat resisting alloy or titanium alloy) will need to have serrations produced in the counter-bore using a wobble broaching manufacturing method. The requirement for the serrations will be defined on the product definition and their profile shall be in accordance with Section 4.
- 3.3.1 Inserts installed into light alloys are to be fitted or refitted in accordance with the requirements of 9.2.6.
- 3.4 Table 2 and Figure 1 provides details of the insert part number and bolt thread diameter in relation to the number of serrations and their profile in the counterbore of the tapped hole. Refer to Appendix A for the recommended serration cutting tool part numbers for standard applications, restricted access or for use with adjustable tooling holders. Other tooling for non-standard applications may also be available, for details contact the relevant tooling experts or thin wall insert tooling suppliers.

4. HOLE SERRATION PROFILE (SHORT INSERTS):

Table 1 and Figure 1 provide details of the insert part number and associated bolt thread in relation to the serration profile in the counter bore of the installation hole.

TABLE 2 - Serration Profile Dimensions
(For recommended Serration profile gauge numbers see Appendix A Table A1)

Bolt Thread Diameter	Short Inserts	No. of Serrations	Dimension				AE°
			AA	ØAB	ØAC	AD	
0.1900-32 UNJF	AS3504-01	20	0.012	0.266	0.259	0.003	80.3
0.2500-28 UNJF	AS3504-02	24	0.012	0.337	0.327	0.0035	82.0
0.3125-24 UNJF	AS3504-03	29	0.014	0.402	0.390	0.004	83.5
0.3750-24UNJF	AS3504-05	34	0.015	0.459	0.448	0.004	84.5

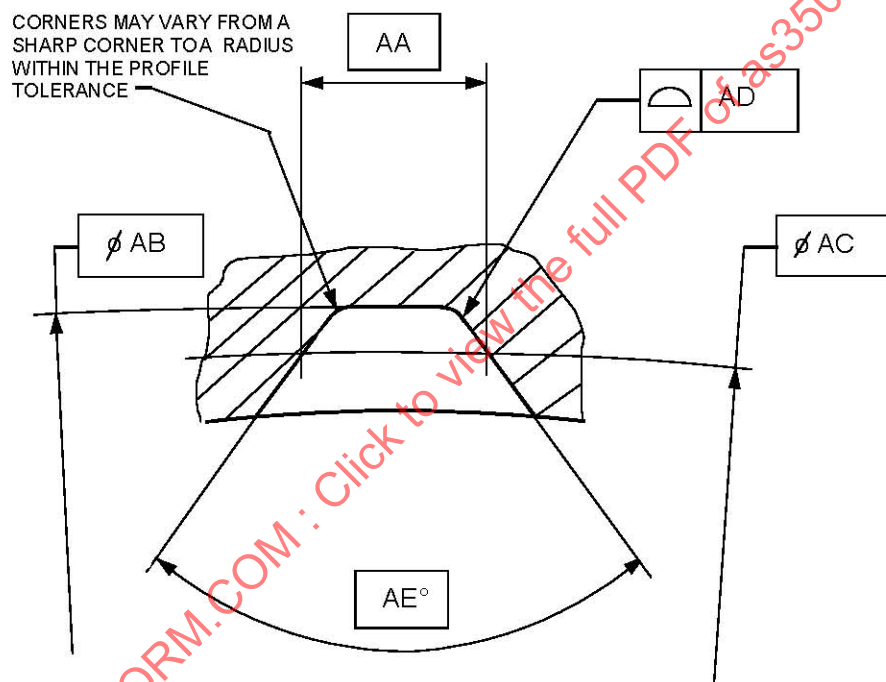


FIGURE 1 - Serration Profile

5. INSTALLATION OF INSERTS:

5.1 Pre-installation Requirements:

- 5.1.1 Prior to installation, check that the tapped hole, counterbore and serrations (if applicable) are free from burrs and foreign particles, grease, oil, etc. This will particularly apply to removal of the burrs produced by the cutting of the serrations.
- 5.1.2 The required insert shall be inspected to ensure that it is clean and free from protective grease, etc.
- 5.1.3 Inserts installed in steel, heat resisting alloy or titanium alloy components may be lightly smeared externally with clean engine oil (i.e., any of the recognized oils used for the engine lubrication system. If in any doubt, consult the Controlling Quality Engineer) to facilitate assembly into the tapped and serrated counterbored hole.
- 5.1.4 Inserts installed in aluminium or magnesium components must be lightly smeared externally with a suitable universal jointing compound to prevent electrolytic corrosion. A minimum of 10 minutes air drying time shall be allowed before installation of insert.

6. MINIMUM CRITERIA FOR THE INSTALLATION AND REMOVAL TOOLS AND THEIR METHODS OF APPLICATION:

- 6.1 The tooling and their methods of application described in this specification show the principles to be observed to achieve the satisfactory assembly and subsequent swaging or removal of the thin wall inserts.
- 6.2 The minimum dimensional requirements provided shall be achieved and on no account shall the design of the tools or their methods of application be such that damage may occur to the threads or the locking element of the thin wall insert or the component into which they are being inserted.
- 6.3 Always ensure the appropriate tool/insert size combinations have been chosen for either the insertion or swaging of the insert to ensure correct assembly. See 7.3 and 7.4 respectively.
- 6.4 During the swaging operation, the component into which the inserts are installed shall be adequately supported to ensure no flexing or distortion at the insert assembly face occurs. This particularly applies to drum shaped components which are prone to flexing.
- 6.5 Use of non-impact power swage tooling alleviates the requirements for supporting the structure

7. ASSEMBLY TOOLS AND GAUGES:

7.1 The tools and methods shown in this section for the installation, swaging and removal of thin wall inserts are **mandatory** (see Section 6) for standard installations. When installing inserts in counterbores or other applications, e.g., curved surfaces, where standard tooling is unsuitable, alternative tools are permissible but all the dimensions in the tables must be adhered to.

7.2 Recommended tooling manufacturers and tool numbers are shown in Appendix A.

7.3 Installation Drive Tool:

7.3.1 Figure 2 shows an example of the installation drive tool configuration and Table 3 gives the relevant tool dimensions and part numbers to ensure the correct tool size is used for screwing the insert into the tapped hole.

7.3.2 The driving feature shall be hexagonal but other tool features may vary depending upon the manufacturer.

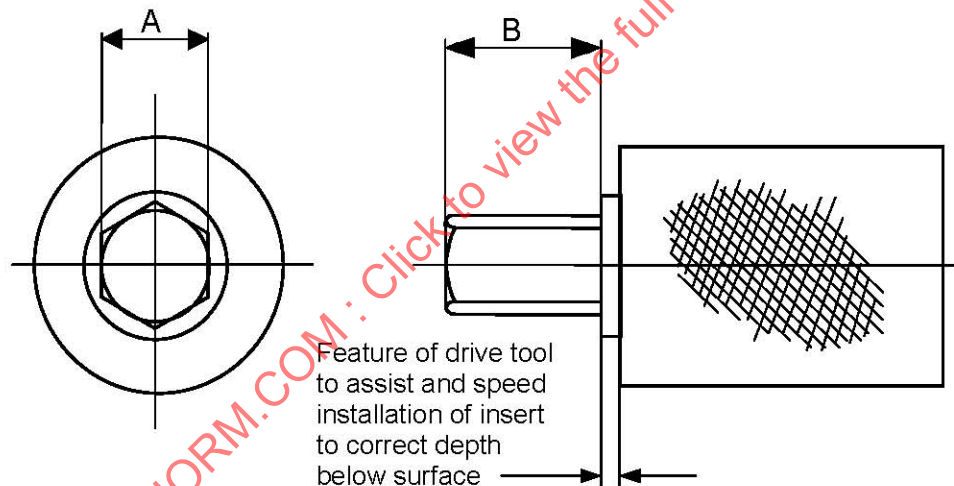


FIGURE 2 - Installation Drive Tool

TABLE 3 - Installation Drive Tool Dimensions
(For recommended drive tools see Appendix A Table A2)

Short Insert	Long Insert	A		B
		Min	Max	
AS3504-01	AS3505-01	0.144	0.154	0.178
AS3504-02	AS3505-02	0.199	0.209	0.227
AS3504-03	AS3505-03	0.251	0.258	0.266
AS3504-04	AS3505-04	0.307	0.317	0.331

7.4 Swage Tool:

7.4.1 Figure 3 shows an example of the swage tool configuration and Table 4 gives the relevant tool dimensions to ensure the correct tool size is used for swaging the insert into the parent component. The tool numbers specified are for standard reach tools for inserts installed in flanges with standard chamfers on the insert holes. Inserts installed into counterbored holes will require modified longer reach tools.

7.4.2 The swage tool has a protective nylon washer, see Figure 3, which acts as a stop during the swaging operation and helps protect the surface of the component from damage. This **must** be replaced when dimension C max is exceeded.

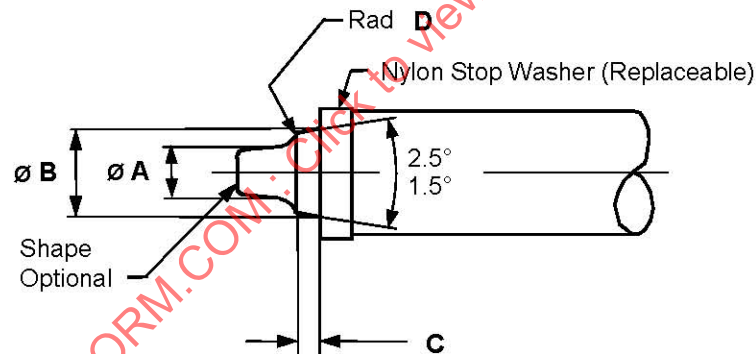


FIGURE 3 - Swage Tool

TABLE 4 - Swage Tool Dimensions
(For recommended Swage tool numbers see Appendix A Table A3)

Short Insert	Long Insert	$\varnothing A$ max	$\varnothing B$ ± 0.0006	C ± 0.005	rad D ± 0.010
AS3504-01	AS3505-01	0.146	0.2116	0.072	0.026
AS3504-02	AS3505-02	0.197	0.2805	0.070	0.032
AS3504-03	AS3505-03	0.256	0.3455	0.067	0.039
AS3504-04	AS3505-04	0.315	0.4085	0.091	0.043

7.4.3 The use of incorrect tools will cause damage to the insert and parent material. It may also cause the flange(s) of the component to be distorted.

8. ASSEMBLY PROCEDURE:

8.1 Insertion:

8.1.1 Screw the insert into tapped hole in a clockwise direction using the appropriate drive tool selected from Table 3 (Figure 2) until the insert is 0.015 to 0.025 (for manual installation) or 0.020 to 0.025 (for power tool installation) below surface of parent metal as shown in Figure 4. Check that the insert is flush with or just below the bottom of the chamfer.

8.1.2 Due to the configuration of the inserts, they may be "crimped" externally into an elliptical shape by the manufacturer to achieve the self-locking effect on the internal thread. This may make the insert a tight fit into the tapped hole and it may be necessary to apply additional torque. This shall be only up to a maximum of 4.5 lbfin using hand pressure only. If the insertion force is high it has been found to be beneficial to run a tap into the tapped hole that is at the upper end of the tolerance range (e.g., a GH 5 tap)

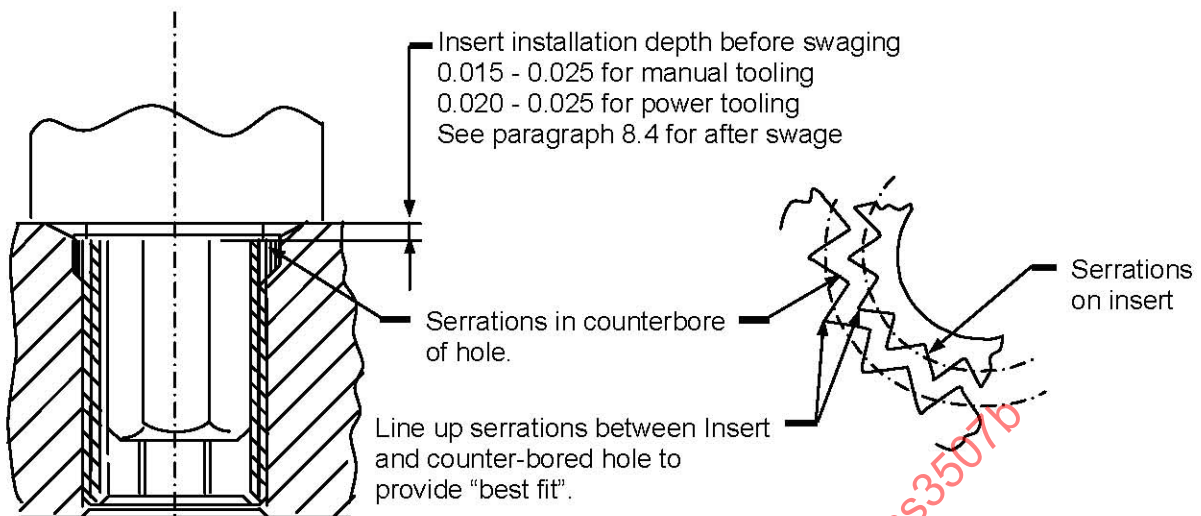


FIGURE 4 - Insert Setting Depth

FIGURE 5 - Serration Alignment for "Best Fit"

8.2 Insert Alignment Prior to Swaging:

- 8.2.1 Before swaging the insert ensure the mating component is well supported, especially in the area the inserts are installed. This does not apply when using non impact power swage tooling
- 8.2.2 Where a serrated counterbore is used, i.e. with the short inserts AS3504 series in titanium, nickel and steel alloys, it is essential that the insert serrations line up to provide "best fit" with the counter-bore serrations while maintaining the 0.015 to 0.020 installation depth below the surface of the parent metal (see Figures 4 and 5). Where possible use 10 x 1 magnification plus illumination as an aid for fitting and inspection.
 - 8.2.2.1 In some installations, the quality of the serrations may be better defined on one side of the counter-bored hole than the other. In these cases, the insert serrations shall be aligned with the better-defined serrations on the hole to obtain the "best fit".

8.3 Swaging:

- 8.3.1 To swage and lock insert in place apply sufficient force to the appropriate swage tool selected from Table 4 (Figure 3) using one of the following methods.
 - 8.3.1.1 First preference for swaging of inserts **shall be power tooling** (a list of recommended power swaging tools is shown in Appendix A Table A4), but where this is not practical manual swaging may be used, i.e. hammer or mechanical press. The insert is correctly swaged and locked when the gauging criteria shown in 8.4 and Figures 6 and 7 is achieved.

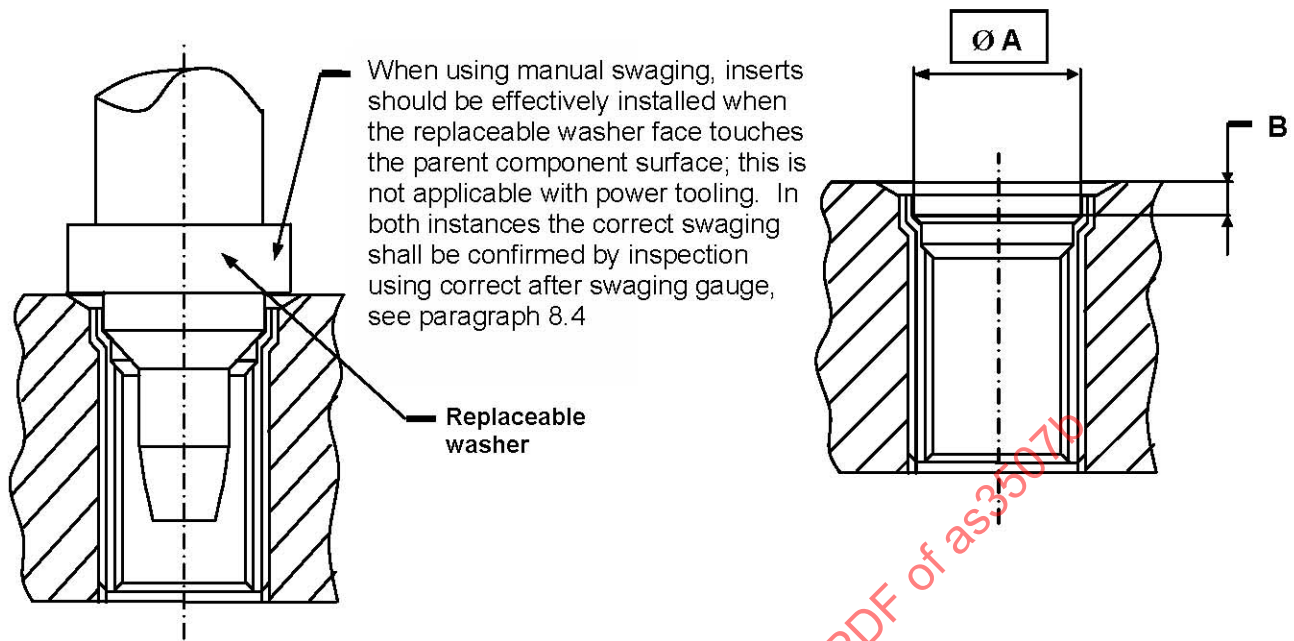


FIGURE 6 - Swaging of Insert

FIGURE 7 - After Swage Dimensions

After swage inspection

8.3.2 After the insert has been swaged, it shall conform to the dimensional requirements of Figure 7 and Table 5. Inserts installed using a power tool will exhibit tooling steps caused by the split swaging jaws. The dimensional requirements "A" and "B" shall be inspected using one of the after swage checking gauges specified in Table 5 and shown in Figure 8, inserts installed using the power tooling will need to be inspected using the power tool after swage gauge (this gauge can also be used to inspect inserts installed by manual methods). When inserts are installed into non-standard counter-bored holes, special checking gauges shall be required to check correct installation.

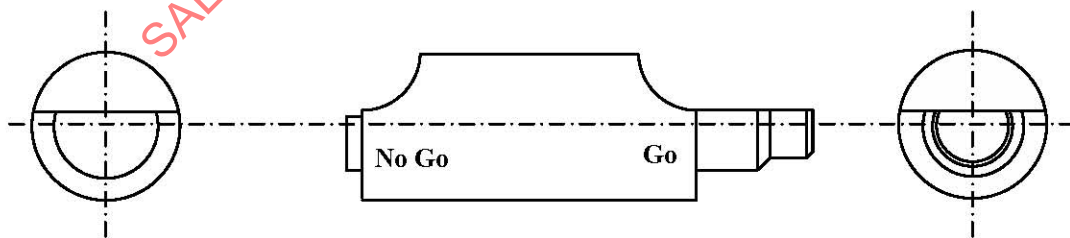


FIGURE 8 - After Swage Checking Gauge

TABLE 5 - After Swage Checking Dimensions
(For recommended after swage checking gauge numbers see Appendix A Tables A5 and A6)

Short Inserts	Long Inserts	ØA min	'B' depth min
AS3504-01	AS3505-01	0.207	0.067
AS3504-02	AS3505-02	0.276	0.065
AS3504-03	AS3505-03	0.341	0.062
AS3504-04	AS3505-04	0.403	0.086

- 8.3.3 After swaging, inspect the insert and surrounding metal for damage. Flaking or damage to the silver coating is permitted in the counterbore of the insert only, however, any loose flakes of silver shall be carefully removed and shall not be permitted to contact the surfaces of the parent component.
- 8.3.4 The insert thread shall be checked for damage, which may have occurred during swaging, by using the correct sized thread mandrel or bolt (see Table 1 for bolt thread diameter). This shall be screwed into the insert by hand only until resistance is felt from the integral locking element and then removed. If difficulties are experienced with starting the threaded mandrel or bolt into the insert, on no account shall the internal thread be cleaned out with a threaded tap. The insert shall be removed (see Section 9) and a new insert fitted (see Section 8).
- 8.3.5 If, after swaging and inspecting, it is necessary to remove the insert, this shall be carried out in accordance with Section 9.
- 8.4 Inspection for Minimum Locking Torque:
- 8.4.1 The minimum self locking torque for the installed insert shall conform to Table 6 and may be checked using the torque test mandrel as specified in Figure 9 and Table 6; alternatively a standard engine bolt manufactured from Alloy 718 material, selected such that its pitch diameter is within the lower part of the tolerance band (see Table 6) may be used. The test mandrel or bolt shall be lubricated with engine oil, and shall be periodically checked for wear and damage; any test mandrel or bolt falling outside the tolerances in Table 6 shall not be used for this check.

NOTE: When the minimum torque has been verified DO NOT continue to screw mandrel through insert.

- 8.4.2 The sample size/frequency for this check may be controlled by a statistically based sampling plan, and the quantities sampled could be reduced with increasing confidence in the thin wall Insert assembly and shall be the responsibility of Manufacturing Engineering/Quality.

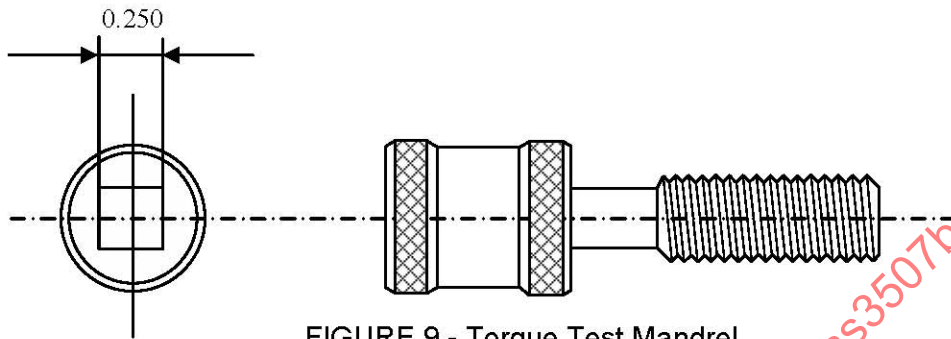


FIGURE 9 - Torque Test Mandrel

TABLE 6 - Torque Check Mandrel Pitch Diameter Dimensions, Self-Locking Torques
(For recommended torque check mandrel gauge numbers see Appendix A Table A7)

Test Bolt Thread Diameter (inches)	Insert Part Number		Test Bolt Pitch Diameter (inches) ②	Max Self-locking Torque (lbf in)	Min Self-locking Torque (lbf in)
	Short Insert	Long Insert			
0.1900 - 32 UNJF	AS3504-01	AS3505-01	0.1681 0.1674	15.0	3.3
0.2500 - 28 UNJF	AS3504-02	AS3505-02	0.2251 0.2243	30.0	5.3
0.3125 - 24 UNJF	AS3504-03	AS3505-03	0.2836 0.2827	60.0	9.7
0.3750 - 24 UNJF	AS3504-04	AS3505-04	0.3460 0.3450	80.0	14.2

② Selected see 8.4.1.

9. INSERT REMOVAL, REPLACEMENT AND ASSOCIATED TOOLS:

- 9.1 Removal of the insert can be achieved by removal of the swaged locking feature using various methods of which an example of a manual removal method is shown in Figure 10. There are other methods of removal. Whichever method is used, under no circumstances must the parent hole be damaged i.e. the serrations or thread.

- 9.2 Figure 10 and Table 7 give the removal cutter sizes to be used for each of the respective insert part numbers. The procedure is as follows:
- 9.2.1 Screw the removal tool into insert. The cutting edge of the tool will begin to cut through the counter-bore of the insert. Continue cutting until the removal tool bottoms in counter-bore of insert; great care will be required, particularly for light alloys to avoid damage by cutter tool.
- 9.2.2 Unscrew the removal tool and after removal of the serrated portion, remove the remnants of the insert using the extraction tool given in Table 8. It is also permissible to use a suitable screw extractor to remove the remnants of the insert. Discard all waste and scrap appropriately, Inspect the counterbored hole into which the new insert is to be assembled for damage and that it conforms to the dimensional requirements defined. Extreme care shall be taken to ensure no damage to the installation hole or surrounding surfaces occurs.

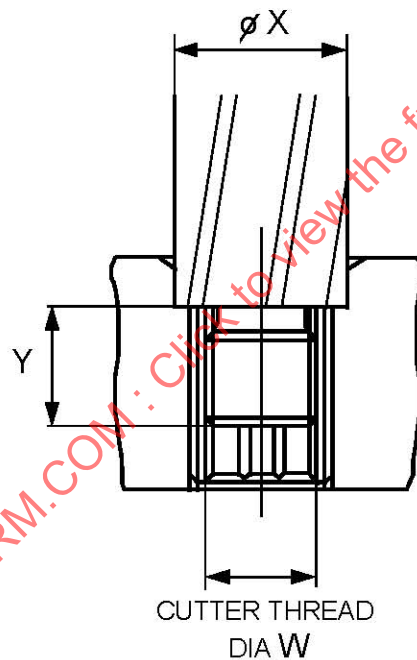


FIGURE 10 - Removal Tool for Fitted Inserts