



DE HAVILLAND AIRCRAFT
OF CANADA LIMITED

BOMBARDIER
Toronto Site

PPS 1.09 - DRILLING AND REAMING

- Issue 31 - This standard supersedes PPS 1.09, Issue 30.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
 - Direct PPS related questions to christie.chung@dehavilland.com or (416) 375-7641.
 - This PPS is effective as of the distribution date.

THIS PPS IS CO-OWNED BY DE HAVILLAND AIRCRAFT OF CANADA LIMITED AND BOMBARDIER INC.

Prepared By: _____ (Christie Chung) _____ September 16, 2020

De Havilland Canada PPS Group

Approved By: _____ (Stephen Mabee) _____ September 24, 2020

De Havilland Canada M&P Engineering

(Kenneth Quon) _____ September 24, 2020

Bombardier Inc. M&P Engineering

The information, technical data and designs disclosed in this document (the "information") are either the exclusive property of De Havilland Aircraft of Canada Limited and Bombardier Inc. or are subject to the proprietary rights of others. The information is not to be used for design or manufacture or disclosed to others without the express prior written consent of both De Havilland Aircraft of Canada Limited and Bombardier Inc. The holder of this document, by its retention and use, agrees to hold the information in confidence. These restrictions do not apply to persons having proprietary rights in the information, to the extent of those rights.

Signed original on file. Validation of paper prints is the responsibility of the user.

**Issue 31 - Summary of Changes (over the previous issue)**

The following summaries are not detailed and are intended only to assist in alerting PPS users to changes which may affect them; refer to the applicable sections of this PPS for detailed procedure and requirements.

- Specified this is a jointly owned PPS by both De Havilland Aircraft of Canada Limited and Bombardier Inc.
- Specified use of BAMS 569-001 at frozen revision B.
- Specified the term “MRB” (Material Review Board) is considered to include DHC/BA MRB and DHC/BA delegated MRB.
- Added new TS.561.11.67 standard end mill reamer.
- Added new TS.561.11.68 stubby end mill reamers.



TABLE OF CONTENTS

Sections	Page
1 SCOPE	5
2 HAZARDOUS MATERIALS.....	5
3 REFERENCES	5
4 MATERIALS AND EQUIPMENT	6
4.1 Materials.....	6
4.2 Equipment	6
5 PROCEDURE	7
5.1 General.....	7
5.2 Lubrication	8
5.3 Drilling Notes	9
5.4 Feeds and Speeds	12
5.5 Edge Finishing of Drilled or Reamed Holes	13
5.6 Tool Wear or Breakage	13
5.7 Care of Tools	13
6 REQUIREMENTS	14
7 DHC/BA SAFETY PRECAUTIONS.....	16
8 PERSONNEL REQUIREMENTS	16
Figures	
FIGURE 1 - EDGE DISTANCE FOR FASTENER HOLES	8
FIGURE 3 - DRILL STOP ASSEMBLY (TYP.).....	12
FIGURE 2 - DRILL GUIDE BLOCKS	10
FIGURE 4 - USE OF GO/NO-GO GAUGES	15
Tables	
TABLE 1 - SLIP RENEWABLE BUSHINGS.....	11
TABLE 2 - STANDARD TAP DRILL SIZES	17
TABLE 3 - NO LAND DRILLS	17
TABLE 4 - DOUBLE MARGIN DRILLS - NON-PILOTED	18
TABLE 5 - DOUBLE MARGIN DRILLS WITH CUTTING PILOTS	21
TABLE 6 - DOUBLE MARGIN DRILLS WITH NON-CUTTING PILOTS	28
TABLE 7 - PILOTED TWIST DRILLS.....	32
TABLE 8 - STANDARD NON-PILOTED REAMERS	34
TABLE 9 - PILOTED REAMERS	36
TABLE 10 - STANDARD END MILL REAMERS	47

**Table of Contents Cont'd**

Tables	Page
TABLE 11 - STUBBY END MILL REAMERS	49
TABLE 12 - DECIMAL EQUIVALENT OF LETTER AND FRACTIONAL SIZE DRILLS	52
TABLE 13 - MINIMUM ACCEPTABLE EDGE DISTANCE	53
TABLE 14 - STANDARD STEP DRILLS	54
TABLE 15 - UNIBIT STEP DRILLS	54
TABLE 16 - RECOMMENDED SPEEDS AND FEEDS FOR DRILLING (NOTE 1 & NOTE 2)	55
TABLE 17 - SPECIAL CARBIDE DRILL/REAMERS	55
TABLE 18 - HOLE DIAMETER TOLERANCE FOR DRILLED HOLES OTHER THAN FASTENER HOLES (I.E., TOOLING, LIGHTENING, ETC.)	56



1 SCOPE

- 1.1 This Production Process Standard (PPS) specifies recommended tooling speeds, lubrication and general procedures for drilling and reaming ferrous and non-ferrous metals.
 - 1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS shall be followed to ensure compliance with all applicable specifications. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing. The requirements specified in this PPS are necessary to fulfil the engineering design and reliability objectives.
 - 1.1.2 Refer to [PPS 13.26](#) for the subcontractor provisions applicable to this PPS.
- 1.2 This PPS is co-owned by De Havilland Aircraft of Canada Limited (DHC) and Bombardier Inc. (BA) due to its applicability for both the DHC DASH 8 and BA Lear 45 programs. Frozen revisions of Bombardier documents (e.g., BAERD GEN, BAMS, etc.) specified herein apply only to the DASH 8 program.
- 1.3 Except as noted below, refer to [PPS 10.39](#) for the procedure and requirements for drilling holes in fibre reinforced composite parts manufactured according to [PPS 10.04](#), [PPS 10.15](#), [PPS 10.35](#), [PPS 10.43](#), or [PPS 10.48](#).
 - For holes up to 1/4" in diameter, if the modified Brad Point type twist drill specified by [PPS 10.39](#) is not available it is acceptable to use standard HSS twist drills as specified herein.
 - For parts to be drilled in situ with a metal backing or facing, drill holes using a standard HSS twist drill as specified herein.

2 HAZARDOUS MATERIALS

- 2.1 Before receipt at DHC or BA, all materials shall be approved and assigned Material Safety Data Sheet (MSDS) numbers by the DHC/BA Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact DHC/BA Environment, Health and Safety Department.

3 REFERENCES

- 3.1 ANSI/ASME B94.11M - Twist Drills.
- 3.2 BAMS 569-001, Rev. B - Lubricants/Coolants.
- 3.3 [PPS 1.33](#) - Countersinking for Flush Head Fasteners.
- 3.4 [PPS 1.37](#) - Set-Up and Operation of Portable Automatic Drillmotors.
- 3.5 [PPS 10.04](#) - Wet Lay-Up of Glass Fabric/Polyester Resin Laminates.



- 3.6 [PPS 10.15](#) - Wet Lay-Up Fabrication of Epoxy Resin/Glass Fabric Reinforced Laminates.
- 3.7 [PPS 10.35](#) - Fabrication of 250°F Cure Epoxy Resin Pre-Impregnated, Fibre Reinforced Composite Parts.
- 3.8 [PPS 10.39](#) - Machining of Fibre Reinforced Composite Parts.
- 3.9 [PPS 10.43](#) - Fabrication of 350°F Cure Epoxy Resin Pre-Impregnated, Fibre Reinforced Composite Parts.
- 3.10 [PPS 10.48](#) - Fabrication of 280°F Cure, Phenolic Resin Pre-Impregnated, Fibre Reinforced Composite Parts.
- 3.11 [PPS 13.26](#) - General Subcontractor Provisions.
- 3.12 [PPS 16.02](#) - Application of Hot Dip Strippable Compound.
- 3.13 [PPS 27.02](#) - Edge Finishing Aluminum Alloy Parts.
- 3.14 [PPS 27.04](#) - Edge Finishing Titanium Alloy Parts.561
- 3.15 [PPS 27.08](#) - Edge Finishing Magnesium Alloy Parts.
- 3.16 [PPS 27.10](#) - Edge Finishing Steel, Nickel and Copper Alloy Parts.

4 MATERIALS AND EQUIPMENT

4.1 Materials

- 4.1.1 Drilling lubricant - Boelube (solid: 70200 or 70201; liquid: 70104 or 70106), Relton A-9 or BAMS 569-001 Rev. B, Class C or D.
- 4.1.2 Wick dispenser (e.g., HHL).
- 4.1.3 Expandable protective sleeving (e.g., Dupont Vexar).

4.2 Equipment

- 4.2.1 Drillmotors, drill presses, drill guides, etc. as required to carry out production drilling and reaming operations.
- 4.2.2 Drill hole colour chart (e.g., SD 8881).
- 4.2.3 Plug gauges (e.g., Frank Cox Sales Ltd. P#####). Each plug gauge used at DHC/BA has a distinct inventory number. Plug sizes are marked on the gauge ends.
- 4.2.4 High power drill motor, 0.75 HP (e.g., Cleco Power Tools Model #136-DO-14).



5 PROCEDURE

5.1 General

- 5.1.1 For the purposes of this PPS, the term “MRB” (Material Review Board) is considered to include DHC/BA MRB and DHC/BA delegated MRB.
- 5.1.2 Refer to the fastener PPS for the pre-drill and final drill hole size requirements for installation of standard fasteners.
- 5.1.3 When using drill jigs or fixtures that have colour coded hole diameter identification markings, refer to the drill hole colour chart for the correct drill size.
- 5.1.4 Unless otherwise specified, refer to [Table 2](#) for tap drill sizes.
- 5.1.5 Refer to [Table 4](#), [Table 5](#), [Table 6](#) and [Table 7](#) for listings of typical drills available at DHC/BA.
- 5.1.6 Refer to [Table 8](#) and [Table 9](#) for listings of standard non-piloted and piloted reamers available at DHC/BA.
- 5.1.7 For a listing of end mill reamers available at DHC/BA, refer to [Table 10](#) (Standard) and [Table 11](#) (Stubby).
- 5.1.8 For a listing of step drills available at DHC/BA, refer to [Table 14](#) (Standard) and [Table 15](#) (Unibit). Step drills are used to open-up pre-drilled holes to final size in one drilling operation.
- 5.1.9 Refer to [Table 17](#) for a listing of special carbide drill/reamers.
- 5.1.10 Unless otherwise specified by the engineering drawing or fastener PPS, when drilling fastener holes refer to [Table 13](#) for the required minimum edge distance as shown in [Figure 1](#).
- 5.1.11 Use drillmotors with standard twist drill bits for pre-drilling or for producing open tolerance holes in sheet metal for the installation of rivets (except Hi-Shear), standard AN and MS bolts, anchor nuts, Camloc fasteners and Dzus fasteners.
- 5.1.12 If possible, use a drill press to drill holes for fasteners requiring close tolerance holes. If it is not possible to use a drill press, pre-drill the hole using a suitable drill guide block and then drill or ream to final size. For each 1/8” of final hole diameter, pre-drilled holes shall be approximately 0.003” smaller than final reamed holes. It is acceptable to step ream the hole when it is not possible to prepare the hole using standard twist drills or double margin drills.

- 5.1.13 In aluminum structure, piloted double margin drills may be used in place of reamers provided that adequate fixturing is used (i.e., drill templates, drill guide blocks, etc.). When using a piloted double margin drill in place of a reamer, use the same procedure as that specified for reamers (i.e., feed rate, spindle speed, lubrication, etc.). Use of a drill motor with a minimum 0.75 HP (ref. [paragraph 4.2.4](#)) is strongly recommended when using double margin drills in place of reamers.
- 5.1.14 If countersinking is specified by the engineering drawing, countersink holes according to [PPS 1.33](#).
- 5.1.15 For hole preparation using Spacematic or Q-matic drillmotors, refer to [PPS 1.37](#).
- 5.1.16 It is acceptable to drill and ream holes using locally available equivalent drills, reamers and drill guide blocks provided that the hole tolerance requirements of the fastener PPS are met when verified using gauges/equipment calibrated in Imperial units (i.e., inches).

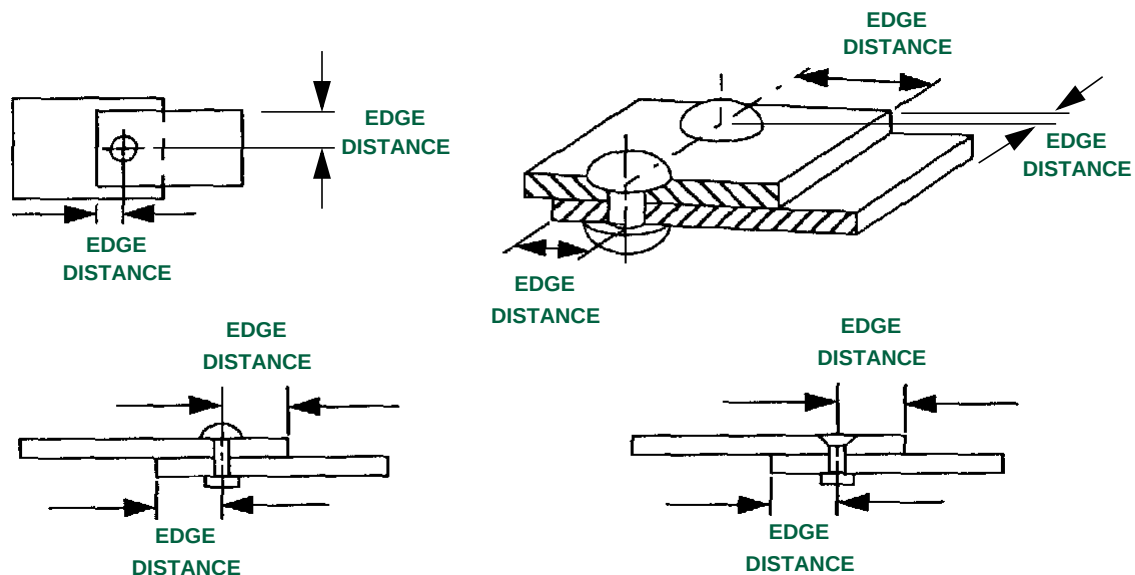


FIGURE 1 - EDGE DISTANCE FOR FASTENER HOLES

5.2 Lubrication

- 5.2.1 When drilling with drillmotors assembled with standard twist drills, lubrication of the drill is not required.
- 5.2.2 When using Spacematic drillmotors which are not equipped with automatic drill lubricators, lubricate drills manually with drilling lubricant.
- 5.2.3 When using double margin drills, lubricate drills with drilling lubricant every 6 to 10 holes.
- 5.2.4 If a drill press is used, lubricate drills with drilling lubricant.



- 5.2.5 Lubricate reamers with drilling lubricant before reaming each fastener hole.
- 5.2.6 It is acceptable to lubricate drills and reamers by inserting a non-rotating drill or reamer into a wick dispenser (ref. [paragraph 4.1.2](#)) filled with fabric soaked in liquid drilling lubricant.

5.3 Drilling Notes

- 5.3.1 Firmly secure parts together using clamps or Clecocs before stack drilling.
- 5.3.2 Do not reverse the direction of the drill or reamer while withdrawing the drill from the hole. Rotate slowly in the normal cutting direction.
- 5.3.3 If possible, always use the shortest drills with the shortest flutes to maintain holes perpendicular to the surface.
- 5.3.4 To obtain the best possible tolerance and finish, and to prevent tool breakage, support thin gauge material from the opposite side. Permit drills and reamers to travel a minimum distance after breakthrough.
- 5.3.5 When using drillmotors for drilling close tolerance fastener holes, if possible pre-drill the holes using a drill guide block fitted with an ASA slip bushing to ensure that the drilled hole is perpendicular to the surface of the parts. Use a TS.519.10.10 drill guide block on flat or curved surfaces. On flat surfaces TS.519.10.11 (MK1 to MK 11), TS.519.10.15 or AT 589EA drill guide blocks may also be used. Pre-drilling is not required when using Spacematic drillmotors.
- 5.3.6 Ensure alignment of the holes by pre-drilling and final drilling or reaming mating parts simultaneously. If possible, pre-drill and final drill or ream from the side of the work against which the head of the fastener will seat.
- 5.3.7 Do not use drills that are bent, burred, scratched, dull or improperly sharpened.
- 5.3.8 Use drilling aids, such as drill bushings or guide blocks (see [Figure 2](#)) to obtain proper hole angularity, tolerance, concentricity and finish. Refer to [Table 1](#) for a listing of ASA slip renewable bushings available at DHC/BA.

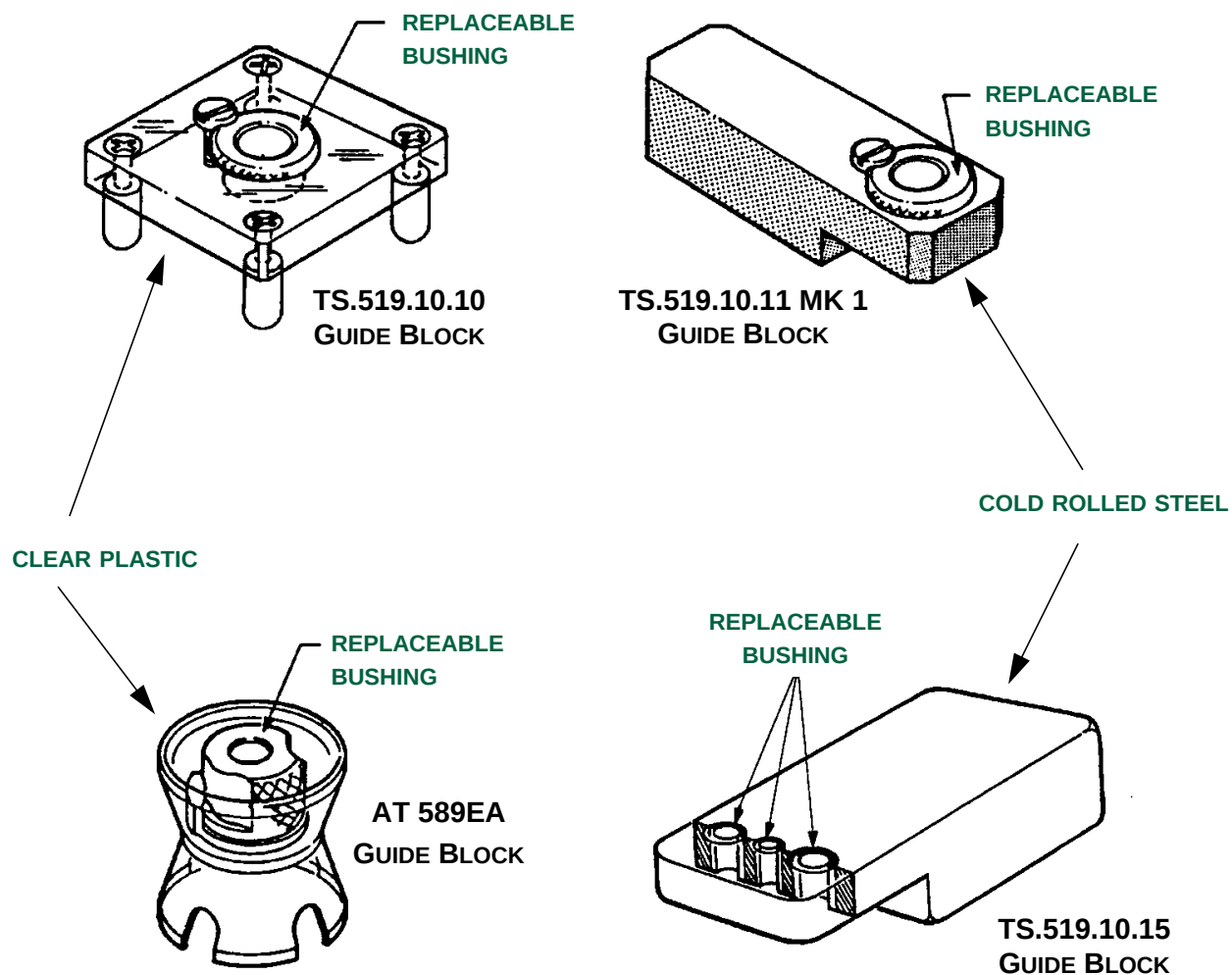


FIGURE 2 - DRILL GUIDE BLOCKS

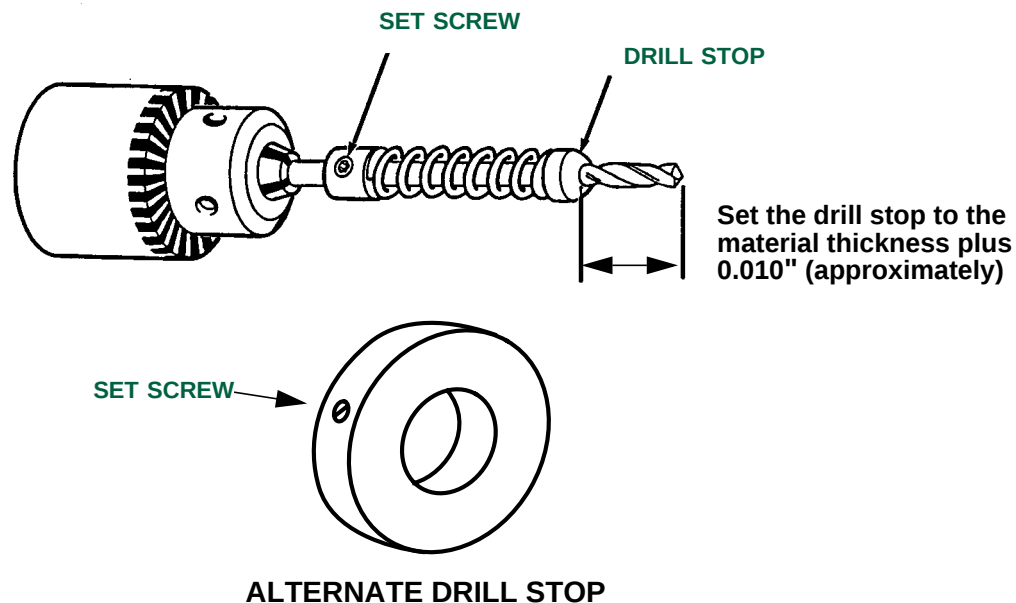


TABLE 1 - SLIP RENEWABLE BUSHINGS

PRE-DRILL SIZE	BUSHING
0.098" (#40)	ASA.0980-SF-32-12
	ASA.0980-SF-32-16
0.1440" (#27)	ASA.1440-SF-32-8
0.1625"	ASA.1625-SF-32-8
0.1770" (#16)	ASA.1770-SF-32-8
0.1870"	ASA.1870-SF-32-8
0.1910" (#11)	ASA.1910-SF-32-8
0.2031" (13/64")	ASA.2031-SF-32-8

PRE-DRILL SIZE	BUSHING
0.2040" (#6)	ASA.2040-SF-32-12
	ASA.2040-SF-32-16
0.2280" (#1)	ASA.2280-SF-32-8
0.2344" (15/64")	ASA.2344-SF-32-8
0.2465"	ASA.2465-SF-32-8
0.2900" (L)	ASA.2900-SF-32-8
0.3090"	ASA.3090-SF-32-8
0.3480" (S)	ASA.3437-SF-32-8 (opened up to 0.3480")

- 5.3.9 Do not use drillmotors that have wobbly chucks or loose, worn bearings as these cause excessive vibration and run-out of the drill.
- 5.3.10 Use the correct type of drill for the material being drilled (e.g., cobalt drills on titanium, stainless steel, nickel, or their alloys, carbide drills on high strength steels, etc.).
- 5.3.11 The surface of the material to be drilled shall be smooth, clean and free of sand, grit, burrs, machining chips, etc.
- 5.3.12 When necessary, use a drill stop (see [Figure 3](#)) during drilling to prevent accidental damage to the aircraft structure caused by the drill point striking the back structure after the drill has penetrated through the material being drilled.

**FIGURE 3 - DRILL STOP ASSEMBLY (TYP.)**

- 5.3.13 When using double margin drills or reamers, it is recommended that a test hole be drilled in a piece of scrap material of approximately the same thickness and alloy composition as the work, to determine that a hole within the required tolerance can be produced. Also, check the first-off in a pattern of holes.
- 5.3.14 It is not recommended to drill holes larger than 1/4" diameter in aluminum or 3/16" diameter in steel or titanium alloys using a drillmotor. For such holes use of a drill press is recommended.
- 5.3.15 If possible, disassemble mating parts after final drilling and remove all cuttings from faying surfaces.

5.4 Feeds and Speeds

- 5.4.1 When using variable speed drilling equipment, refer to [Table 16](#) for recommended feeds and spindle speeds for drilling various materials. Vary the feed depending upon the diameter of drill and type of material being drilled. Harder materials require a slower feed than softer materials such as aluminum and copper. The proper feed will produce a chip rather than powder.
- 5.4.2 For reaming operations, the spindle speed shall be approximately 1/3 to 1/2 that used for drilling and the feed shall be approximately twice that used for drilling.
- 5.4.3 Choose drilling equipment capable of attaining the spindle speed recommended in [Table 16](#) without stalling.



- 5.4.4 When hand drilling, use just sufficient force to keep the drill cutting continuously. Excessive force may distort thin gauge material and cause elongation or oversized holes. Excessive force in thick members may cause tool breakage.
- 5.4.5 Do not start a drillmotor while it is against the work surface. Ensure that the drill motor is operated at a consistent speed during the entire drilling operation. Avoid “triggering” (or pulsing of the drillmotor speed) as this causes elongated holes and tends to harden the surface of work-hardenable materials.
- 5.4.6 Do not permit the drill point to dwell on the metal without cutting. Immediately apply cutting feed to the drill when contacting the material.
- 5.4.7 If chattering occurs when drilling or reaming, use a slower speed and check the rigidity of the tooling set-up.
- 5.4.8 When drilling holes through a combination of dissimilar alloys (such as aluminum and steel), always use the speed and feed for the harder alloy. If possible, drill from the harder material side. If this is not possible, it is acceptable to ream the hole to meet the required finish and tolerance.
- 5.4.9 When drilling deep holes, clear the chips frequently to prevent clogging of the drill flutes. Reduce speeds and feeds for deep hole drilling.

5.5 Edge Finishing of Drilled or Reamed Holes

- 5.5.1 After drilling and/or reaming, edge finish fastener holes according to the fastener PPS and all other drilled or reamed holes according to [PPS 27.02](#), [PPS 27.04](#), [PPS 27.08](#), or [PPS 27.10](#).

5.6 Tool Wear or Breakage

- 5.6.1 The following are possible reasons for excessive wear or breakage of tools:
- Speed too high for the hardness of the material being cut.
 - Feed either too heavy, causing overloading of the cutting edges, or too light, causing the cutting edges to scrape rather than cut.
 - Work surface scaly or having surface hard spots.
 - Poor support of work or tool causing springing and chatter.
 - Incorrect tool for the material being cut.

5.7 Care of Tools

- 5.7.1 Take care when handling drills to prevent scarring or chipping of their cutting edges. Partitioned trays or stands to hold drills will lengthen their effective life. It is acceptable to protect large drills which are bin-stacked for storage, by hot-dip coating according to [PPS 16.02](#).



- 5.7.2 It is recommended that reamers be kept in the protective tubular containers in which they are supplied; apply hot-dip coating or protect using expandible protective sleeving (ref. [paragraph 4.1.3](#)) to prevent nicking or scratching. It is also recommended that when stacking protected reamers in bins or boxes some protective material separate them. Take care while transporting reamers to and from jobs and while using them at machines.
- 5.7.3 Sharpen or replace dull tools as necessary.

6 REQUIREMENTS

- 6.1 Unless otherwise specified by the engineering drawing or fastener PPS, drilled fastener holes shall meet the minimum edge distance (see [Figure 1](#)) as specified in [Table 13](#).
- 6.2 Unless otherwise specified by the engineering drawing, the diameter of fastener holes shall meet the tolerances specified in the fastener PPS's. When drilling a pattern of fastener holes, on a sample basis check at random (across the entire pattern) the number of holes specified by the applicable fastener PPS for conformance to the hole limit requirements. Check hole diameter for conformance to the hole limits using a GO/NO-GO gauge (see [Figure 4](#)), a plug gauge or other hole measuring gauge. If the hole is oversize it shall be referred to MRB for written authorization (e.g., fastpath RNC) to repair and for use of the applicable oversize fastener.
- 6.2.1 While checking holes using a GO/NO-GO gauge or other hole measuring gauge, also check visually for hole ovality. For holes with a visually evident oval or out of round shape, check the hole diameter at several positions using suitable hole measurement equipment (e.g., vernier calliper, hole micrometer, etc.) to determine the minor and major diameters of the hole. The minor and major diameters of the hole shall be within the minimum and maximum hole diameter tolerances, respectively. If the minor or major diameters of any oval hole in the sample are not within the minimum and maximum hole diameter tolerance, check every hole in the pattern for conformance to the hole limit requirements and visually for ovality as specified herein. Refer all non-conforming holes to MRB for disposition.

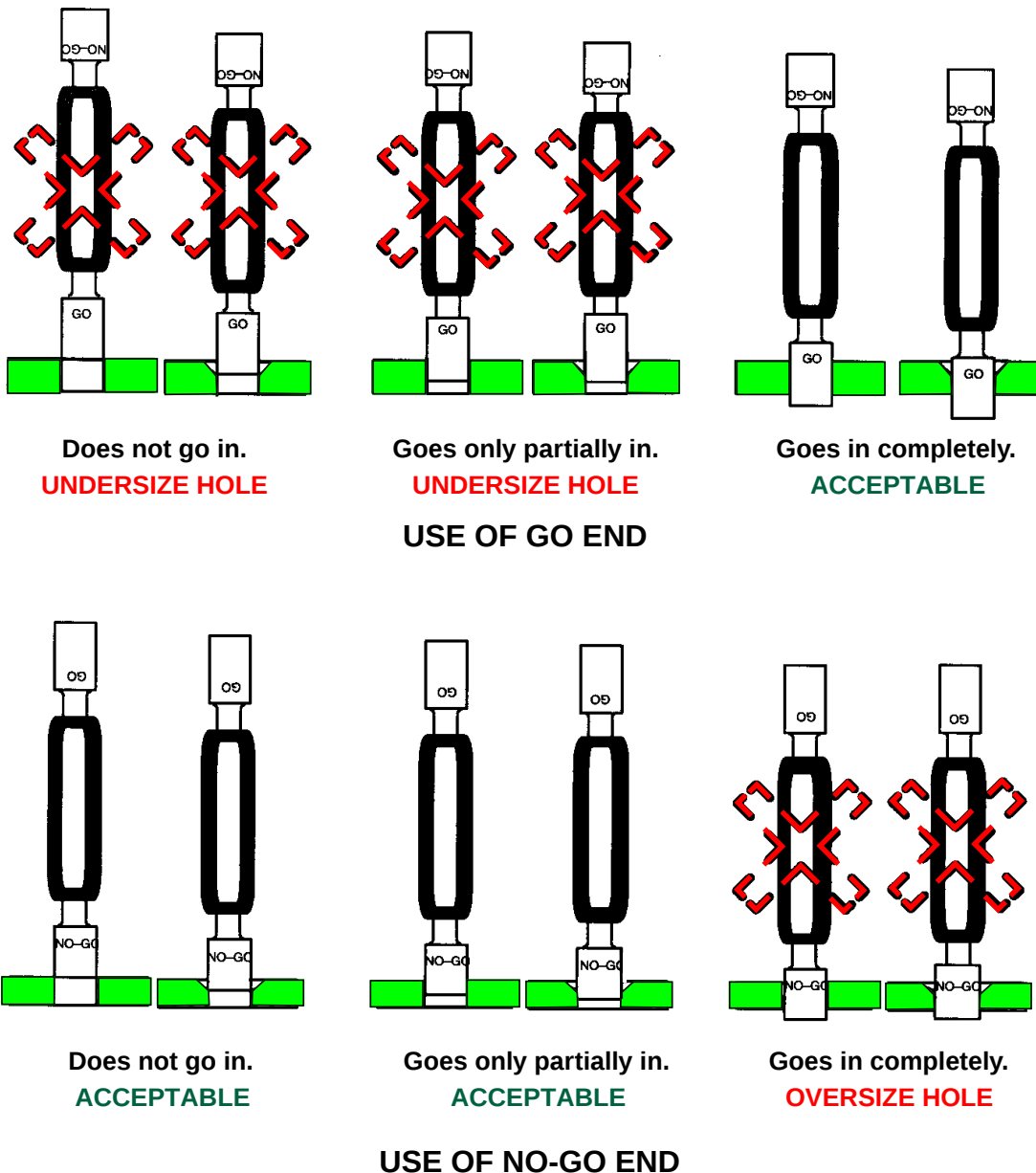


FIGURE 4 - USE OF GO/NO-GO GAUGES

- 6.3 Unless otherwise specified by the engineering drawing, for all holes other than fastener holes (tooling, lightening, etc.), the hole tolerances specified in [Table 18](#) shall be met.
- 6.4 Drilled and reamed holes shall meet the tolerance requirements for concentricity and angularity specified on the engineering drawing or PPS.



- 6.5 Fastener holes shall be edge finished as specified in the fastener PPS. All other drilled or reamed holes shall be edge finished according to [PPS 27.02](#), [PPS 27.04](#), [PPS 27.08](#) or [PPS 27.10](#).
- 6.6 Unless otherwise specified by the engineering drawing or fastener PPS, the surface finish of fastener holes shall be 125 R_a (roughness average) or finer.

7 DHC/BA SAFETY PRECAUTIONS

- 7.1 *The safety precautions specified herein are specific to DHC/BA to meet Canadian Federal and Provincial government environmental, health and safety regulations. It is strongly recommended that other facilities consider these safety precautions; however, suppliers, subcontractors and partners are responsible for ensuring that their own environmental, health and safety precautions satisfy the appropriate local government regulations.*
- 7.2 *Observe standard plant safety precautions when performing the procedure specified herein.*
- 7.3 *Disconnect air lines from pneumatic drillmotors when changing drills or reamers or when tightening them in the chuck.*
- 7.4 *If accidental eye contact with lubricant occurs, flush immediately (15 minutes minimum) with large quantities of water at an eye wash station and report to the Health Centre.*
- 7.5 *If ingestion of lubricant occurs, immediately drink plenty of water and contact the Health Centre.*

8 PERSONNEL REQUIREMENTS

- 8.1 Personnel responsible for drilling and reaming shall have a good working knowledge of the applicable procedure and requirements as specified herein and shall have exhibited their competency to their supervisor.



TABLE 2 - STANDARD TAP DRILL SIZES

THREAD SIZE	TAP DRILL SIZE	THREAD SIZE	TAP DRILL SIZE	THREAD SIZE	TAP DRILL SIZE
4-40	#44 (0.086")	5/8-18	9/16" (0.5625")	1 3/4-12	1.6598"
6-32	#36 (0.1065")	3/4-10	0.6496"	1 7/8-8	1.7397"
8-32	#29 (0.136")	3/4-16	11/16" (0.6875")	1 7/8-12	1.7848"
10-24	#26 (0.147")	7/8 -9	49/64" (0.7656")	2-8	1.8647"
10-32	#22 (0.157")	7/8-14	51/64" (0.7969")	2-12	1.9098"
1/4-20	#8 (0.199")	1-8	7/8" (0.875")	2 1/8-8	1.9897"
1/4-28	#3 (0.213")	1-12	59/64" (0.9218")	2 1/8-12	2.0348"
5/16-18	F (0.257")	1 1/8-8	0.9897"	2 1/4-8	2.1147"
5/16-24	I (0.272")	1 1/8-12	1.0348"	2 1/4-12	2.1598"
3/8-16	5/16 (0.3125")	1 1/4-8	1.1598"	2 3/8-12	2.2848"
3/8-24	Q (0.332")	1 1/4-12	1.1598"	2 1/2-8	2.3647"
7/16-14	U (0.368")	1 3/8-8	1.2397"	2 1/2-12	2.4098"
7/16-20	W (0.386")	1 3/8-12	1.2848"	2 5/8-12	2.5348"
1/2-13	27/64" (0.4219")	1 1/2-8	1.3647"	2 3/4-8	2.6147"
1/2-20	29/64" (0.4531")	1 1/2-12	1.4098"	2 3/4-12	2.6598"
9/16-12	31/64" (0.4844")	1 5/8-8	1.4897"	2 7/8-12	2.7848"
9/16-18	1/2" (0.500")	1 5/8-12	1.5348"	3-8	2.8647"
5/8-11	17/32" (0.5313")	1 3/4-8	1.6147"	3-12	2.9098"

Note 1. Unless otherwise specified, hole size shall be within the tolerances specified in [Table 18](#).

TABLE 3 - NO LAND DRILLS

DRILL DIAMETER	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD & MK NUMBER
0.1250"	Jobber	Jobber	TS.561.11.34 MK 7
0.1600"	Jobber	Jobber	TS.561.11.34 MK 1
0.1850"	Jobber	Jobber	TS.561.11.34 MK 2
0.1875"	Jobber	Jobber	TS.561.11.34 MK 6
0.2455"	Jobber	Jobber	TS.561.11.34 MK 3
0.3085"	Jobber	Jobber	TS.561.11.34 MK 4
0.3740"	6.75"	4.25"	TS.561.11.34 MK 5



TABLE 4 - DOUBLE MARGIN DRILLS - NON-PILOTED

DRILL DIAMETER	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1)
0.0930"	Taper	Taper	TS.561.11.22 MK 1
0.1285"	1.25"	0.75"	TS.561.11.40 MK 1
	2.00"	1.50"	TS.561.11.40 MK 6
	Jobber	Jobber	TS.561.11.22 MK 2
0.1440"	1.25"	0.75"	TS.561.11.22 MK 62
0.1540"	Jobber	Jobber	TS.561.11.22 MK 3
0.1560"	1.25"	0.75"	TS.561.11.40 MK 5
	2.00"	1.50"	TS.561.11.40 MK 10
0.1590"	Jobber	Jobber	TS.561.11.22 MK 57
0.1610"	1.25"	0.75"	TS.561.11.40 MK 2
	2.00"	1.50"	TS.561.11.40 MK 7
0.1625"	Jobber	Jobber	TS.561.11.22 MK 4
0.1650"	Jobber	Jobber	TS.561.11.22 MK 5
0.1660"	Jobber	Jobber	TS.561.11.22 MK 6
0.1780"	Jobber	Jobber	TS.561.11.22 MK 49
0.1800"	Taper	Taper	TS.561.11.22 MK 55
0.1810"	Jobber	Jobber	TS.561.11.22 MK 7
0.1850"	1.25"	0.75"	TS.561.11.40 MK 4
	2.00"	1.50"	TS.561.11.40 MK 9
	Jobber	Jobber	TS.561.11.22 MK 58
0.1860"	Jobber	Jobber	TS.561.11.22 MK 8
0.1870"	Jobber	Jobber	TS.561.11.22 MK 9
0.1875"	Jobber	Jobber	TS.561.11.22 MK 10
0.1880"	Jobber	Jobber	TS.561.11.22 MK 11
0.1885"	Jobber	Jobber	TS.561.11.22 MK 12
0.1890"	Jobber	Jobber	TS.561.11.22 MK 13
0.1895"	Jobber	Jobber	TS.561.11.22 MK 15
	7.00"	4.50"	TS.561.11.22 MK 14



TABLE 4 - DOUBLE MARGIN DRILLS - NON-PILOTED

DRILL DIAMETER	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1)
0.1910"	1.25"	0.75"	TS.561.11.40 MK 3
	2.00"	1.50"	TS.561.11.40 MK 8
	Jobber	Jobber	TS.561.11.22 MK 16
	7.00"	Taper	TS.561.11.22 MK 61
0.1935"	4.25"	Jobber	TS.561.11.22 MK 60
0.1960"	Jobber	Jobber	TS.561.11.22 MK 17
	Taper	Taper	TS.561.11.22 MK 18
0.2000"	Jobber	Jobber	TS.561.11.22 MK 19
0.2010"	Jobber	Jobber	TS.561.11.22 MK 20
0.2025"	Jobber	Jobber	TS.561.11.22 MK 21
0.2160"	Jobber	Jobber	TS.561.11.22 MK 22
0.2180"	Jobber	Jobber	TS.561.11.22 MK 23
0.2210"	3.25"	1.50"	TS.561.11.22 MK 59
0.2280"	2.00"	1.50"	TS.561.11.40 MK 12
	6.00"	2.50"	TS.561.11.42 MK 1 (Note 4)
	6.00"	Taper	TS.561.11.22 MK 64
0.2360"	Jobber	Jobber	TS.561.11.22 MK 51
0.2380"	Screw Mach.	Screw Mach.	TS.561.11.22 MK 53 (Note 2)
0.2465"	Jobber	Jobber	TS.561.11.22 MK 24
0.2470"	Jobber	Jobber	TS.561.11.22 MK 25
0.2480"	Jobber	Jobber	TS.561.11.22 MK 26
0.2490"	Jobber	Jobber	TS.561.11.22 MK 27
0.2495"	Jobber	Jobber	TS.561.11.22 MK 28
0.2500"	1.30"	0.90"	TS.561.11.22 MK 56 (Note 2)
	2.00"	Screw Mach.	TS.561.11.22 MK 52 (Note 2)
	Jobber	Jobber	TS.561.11.22 MK 29
0.2540"	Jobber	Jobber	TS.561.11.22 MK 30
0.2559"	Jobber	Jobber	TS.561.11.22 MK 31
0.2600"	4.12"	2.00"	TS.561.11.22 MK 32



TABLE 4 - DOUBLE MARGIN DRILLS - NON-PILOTED

DRILL DIAMETER	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1)
0.2620"	Jobber	Jobber	TS.561.11.22 MK 33
0.2650"	Jobber	Jobber	TS.561.11.22 MK 34
0.2770"	Jobber	Jobber	TS.561.11.22 MK 35
0.2812"	Jobber	Jobber	TS.561.11.22 MK 47
0.2900"	6.00"	Taper	TS.561.11.22 MK 63
0.2915"	Jobber	Jobber	TS.561.11.22 MK 54
0.3090"	Jobber	Jobber	TS.561.11.22 MK 36
0.3110"	Jobber	Jobber	TS.561.11.22 MK 37
0.3120"	Jobber	Jobber	TS.561.11.22 MK 38
0.3125"	2.00"	1.50"	TS.561.11.40 MK 11
	2.75"	2.00"	TS.561.11.22 MK 44 (Note 2)
	Jobber	Jobber	TS.561.11.22 MK 39
0.3230"	Jobber	Jobber	TS.561.11.22 MK 40
0.3450"	Jobber	Jobber	TS.561.11.22 MK 50
0.3480"	Jobber	Jobber	TS.561.11.22 MK 48
0.3740"	Jobber	Jobber	TS.561.11.22 MK 41
0.4040"	Jobber	Jobber	TS.561.11.22 MK 42
0.5000"	7.25"	Taper	TS.561.11.22 MK 45
0.5150"	Jobber	Jobber	TS.561.11.22 MK 43
0.5625"	7.25"	Taper	TS.561.11.22 MK 46

Note 1. Shaded cells indicate cobalt drills. Non-shaded cells indicate high speed steel drills.

Note 2. These drills have a reduced shank diameter (0.187") and length. Standard shank diameter for drills 0.250" and over in diameter is 0.250".

Note 3. Refer to ANSI/ASME B94.11M for industry standard "Jobber", "Taper" and "Screw Mach." overall drill lengths and flute lengths

Note 4. TS.561.11.42 are special double margin drills intended for drilling holes in aluminum/titanium stack-ups



TABLE 5 - DOUBLE MARGIN DRILLS WITH CUTTING PILOTS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD AND MK NUMBER (NOTE 1 & NOTE 2)
0.1235"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.16 MK 32
0.1280"	0.098" (#40)	0.125"	Jobber	Jobber	TS.561.11.16 MK 100
		0.375"	Jobber	Jobber	TS.561.11.16 MK 91
			Taper	Taper	TS.561.11.16 MK 136
0.1285"	0.098" (#40)	0.120"	Jobber	Jobber	TS.561.11.18 MK 20
		0.500"	Jobber	Jobber	TS.561.11.16 MK 130
0.1410"	0.128"	0.500"	Jobber	Jobber	TS.561.11.16 MK 66
0.1440"	0.128"	0.500"	Jobber	Jobber	TS.561.11.16 MK 79
0.1540"	0.147" (#26)	0.500"	Jobber	Jobber	TS.561.11.16 MK 20
	0.125" (1/8")	0.250"	0.900"	0.650"	TS.561.11.16 MK 72
0.1550"	0.144" (#27)	0.500"	Jobber	Jobber	TS.561.11.16 MK 33
0.1562"	0.125" (1/8")	0.375"	Taper	Taper	TS.561.11.16 MK 8
0.1590"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.16 MK 127
	0.128"	0.200"	1.3"	1.0"	TS.561.11.16 MK 148
		0.375"	Jobber	Jobber	TS.561.11.16 MK 95
	0.1285"	0.375"	2.50"	2.0"	TS.561.11.16 MK 149
	0.144" (#27)	0.500"	Jobber	Jobber	TS.561.11.16 MK 92
0.1605"	0.128"	0.375"	Jobber	Jobber	TS.561.11.16 MK 102
			Taper	Taper	TS.561.11.16 MK 103
0.1610"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.16 MK 128
	0.125" (1/8")	0.250"	3.25"	2.125"	TS.561.11.16 MK 101
0.1625"	0.125" (1/8")	0.250"	1.40"	1.050"	TS.561.11.16 MK 70
			Jobber	Jobber	TS.561.11.16 MK 71
		0.375"	Jobber	Jobber	TS.561.11.16 MK 68
	0.128"	0.375"	2.50"	Jobber	TS.561.11.16 MK 98
			Taper	Taper	TS.561.11.16 MK 69
	0.144" (#27)	0.500"	Jobber	Jobber	TS.561.11.16 MK 48
0.1650"	0.147" (#26)	0.375"	Jobber	Jobber	TS.561.11.16 MK 21
	0.144" (#27)	0.500"	Jobber	Jobber	TS.561.11.16 MK 53



TABLE 5 - DOUBLE MARGIN DRILLS WITH CUTTING PILOTS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD AND MK NUMBER (NOTE 1 & NOTE 2)
0.1660"	0.098" (#40)	0.375"	Jobber	Jobber	TS.561.11.18 MK 22
	0.144" (#27)	0.375"	Jobber	Jobber	TS.561.11.16 MK 38
0.1710"	0.156"	0.500"	Jobber	Jobber	TS.561.11.16 MK 58
0.1720"	0.144" (#27)	0.500"	Jobber	Jobber	TS.561.11.16 MK 67
0.1730"	0.128"	0.250"	Jobber	Jobber	TS.561.11.16 MK 88
0.1770"	0.125" (1/8")	0.500"	Jobber	Jobber	TS.561.11.16 MK 117
	0.154"	0.375"	6.00"	Jobber	TS.561.11.16 MK 140
	0.156"	0.500"	Jobber	Jobber	TS.561.11.16 MK 80
0.1780"	0.164"	0.500"	Jobber	Jobber	TS.561.11.16 MK 59
0.1800"	0.128"	0.375"	Jobber	Jobber	TS.561.11.16 MK 99
0.1810"	0.169"	0.375"	Jobber	Jobber	TS.561.11.16 MK 43
0.1820"	0.156"	0.375"	Jobber	Jobber	TS.561.11.16 MK 74
0.1850"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.16 MK 129
	0.156"	0.375"	Jobber	Jobber	TS.561.11.16 MK 97
0.1860"	0.125" (1/8")	0.600"	2.80"	2.20"	TS.561.11.18 MK 18
	0.128"	0.375"	Taper	Taper	TS.561.11.16 MK 134
			Jobber	Jobber	TS.561.11.16 MK 14
	0.156"	0.375"	Jobber	Jobber	TS.561.11.16 MK 78
0.1870"	0.125" (1/8")	0.380"	Jobber	Jobber	TS.561.11.16 MK 28
	0.156"	0.375"	Jobber	Jobber	TS.561.11.16 MK 29
	0.161" (#20)	0.500"	2.10" max	1.500"	TS.561.11.18 MK 2
	0.162"	0.250"	1.40"	0.900"	TS.561.11.18 MK 11
	0.177" (#16)	0.500"	Jobber	Jobber	TS.561.11.16 MK 49
0.1875"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.16 MK 126
	0.128"	0.375"	Jobber	Jobber	TS.561.11.16 MK 3
	0.156"	0.375"	2.50"	2.0"	TS.561.11.16 MK 150
			Jobber	Jobber	TS.561.11.16 MK 1
			Taper	Taper	TS.561.11.16 MK 9
	0.168"	0.500"	Taper	Taper	TS.561.11.16 MK 18



TABLE 5 - DOUBLE MARGIN DRILLS WITH CUTTING PILOTS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD AND MK NUMBER (NOTE 1 & NOTE 2)
0.1890"	0.128"	0.375"	2.60"	2.000"	TS.561.11.16 MK 96
	0.156"	0.375"	Taper	Taper	TS.561.11.16 MK 10
	0.177" (#16)	0.375"	Jobber	Jobber	TS.561.11.16 MK 34
0.1895"	0.173" (#17)	0.375"	Jobber	Jobber	TS.561.11.16 MK 6
	0.177" (#16)	0.500"	Jobber	Jobber	TS.561.11.16 MK 54
0.1900"	0.177" (#16)	0.500"	Jobber	Jobber	TS.561.11.16 MK 94
0.1910"	0.098" (#40)	0.250"	Jobber	Jobber	TS.561.11.16 MK 85
		0.500"	Jobber	Jobber	TS.561.11.16 MK 131
0.1935"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.16 MK 132
0.2000"	0.177" (#16)	0.500"	Jobber	Jobber	TS.561.11.16 MK 39
	0.187"	0.500"	Jobber	Jobber	TS.561.11.18 MK 13
	0.189" (#12)	0.500"	Jobber	Jobber	TS.561.11.16 MK 30
0.2010"	0.187"	0.250"	1.40"	0.900"	TS.561.11.18 MK 12
0.2015"	0.186"	0.500"	Taper	Taper	TS.561.11.16 MK 19
0.2030"	0.188"	0.375"	Jobber	Jobber	TS.561.11.16 MK 60
0.2155"	0.200"	0.500"	Jobber	Jobber	TS.561.11.18 MK 14
0.2160"	0.203"	0.375"	Jobber	Jobber	TS.561.11.16 MK 44
0.2180"	0.156"	0.500"	Jobber	Jobber	TS.561.11.16 MK 137
	0.187"	0.500"	2.10" max	1.500"	TS.561.11.18 MK 3
0.2188"	0.191" (#11)	0.500"	Jobber	Jobber	TS.561.11.16 MK 90
0.2190"	0.205"	0.500"	Jobber	Jobber	TS.561.11.16 MK 73
0.2280"	0.154"	0.375"	6.00"	Jobber	TS.561.11.16 MK 139
	0.188"	0.375"	1.75"	1.250"	TS.561.11.18 MK 27
			2.25"	1.750"	TS.561.11.18 MK 28
			Jobber	Jobber	TS.561.11.16 MK 81
	0.191" (#11)	0.250"	Jobber	Jobber	TS.561.11.16 MK 87
			10.00"	Jobber	TS.561.11.16 MK 133
	0.210"	0.375"	Jobber	Jobber	TS.561.11.16 MK 105



TABLE 5 - DOUBLE MARGIN DRILLS WITH CUTTING PILOTS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD AND MK NUMBER (NOTE 1 & NOTE 2)
0.2344"	0.177" (#16)	0.500"	Jobber	Jobber	TS.561.11.16 MK 122
	0.185" (#13)	0.500"	Jobber	Jobber	TS.561.11.16 MK 123
	0.187"	0.375"	2.50"	2.0"	TS.561.11.16 MK 151
		0.500"	Jobber	Jobber	TS.561.11.16 MK 119
	0.218"	0.500"	Jobber	Jobber	TS.561.11.16 MK 125
0.2380"	0.218"	0.500"	2.10" max	1.500"	TS.561.11.18 MK 10
0.2460"	0.191" (#11)	0.500"	Jobber	Jobber	TS.561.11.16 MK 65
	0.218"	0.500"	6.00"	2.20"	TS.561.11.18 MK 33
0.2465"	0.191" (#11)	0.375"	1.50"	1.000"	TS.561.11.18 MK 24
			2.00"	1.500"	TS.561.11.18 MK 25
			2.50"	2.00"	TS.561.11.16 MK 146
					TS.561.11.18 MK 26
			Jobber	Jobber	TS.561.11.16 MK 4
			Taper	Taper	TS.561.11.16 MK 138
		0.600"	2.80"	2.200"	TS.561.11.18 MK 17
0.2480"	0.191" (#11)	0.375"	Jobber	Jobber	TS.561.11.16 MK 2
		0.500"	Jobber	Jobber	TS.561.11.18 MK 1
			Taper	Taper	TS.561.11.16 MK 13
0.2485"	0.228" (#1)	0.500"	Jobber	Jobber	TS.561.11.16 MK 35
0.2490"	0.187"	0.500"	2.10" max.	1.500"	TS.561.11.18 MK 15
0.2495"	0.187"	0.375"	Jobber	Jobber	TS.561.11.16 MK 22
	0.189" (#12)	0.500"	Taper	Taper	TS.561.11.16 MK 84
	0.228" (#1)	0.500"	Jobber	Jobber	TS.561.11.16 MK 55
	0.231" (13/64")	0.375"	Jobber	Jobber	TS.561.11.16 MK 15
	0.234" (A)	0.375"	Jobber	Jobber	TS.561.11.16 MK 7
		0.500"	Taper	Taper	TS.561.11.16 MK 12
0.2500"	0.191"	0.375"	Jobber	Jobber	TS.561.11.16 MK 141
	0.218"	0.500"	2.10" max	1.500"	TS.561.11.18 MK 4



TABLE 5 - DOUBLE MARGIN DRILLS WITH CUTTING PILOTS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD AND MK NUMBER (NOTE 1 & NOTE 2)
0.2530"	0.228" (#1)	0.375"	Jobber	Jobber	TS.561.11.16 MK 93
0.2570"	0.187"	0.500"	2.50" max.	2.000"	TS.561.11.18 MK 32
0.2610"	0.228" (#1)	0.500"	Jobber	Jobber	TS.561.11.16 MK 40
0.2630"	0.248"	0.500"	Jobber	Jobber	TS.561.11.16 MK 61
0.2645"	0.228" (#1)	0.500"	Jobber	Jobber	TS.561.11.16 MK 50
0.2650"	0.128"	0.375"	Jobber	Jobber	TS.561.11.16 MK 75
	0.250" (1/4" or E)	0.500"	2.10" max	1.500"	TS.561.11.18 MK 5
0.2770"	0.264"	0.500"	Jobber	Jobber	TS.561.11.16 MK 45
0.2810"	0.250" (1/4" or E)	0.500"	2.10" max	1.500"	TS.561.11.18 MK 6
0.2900"	0.190"	0.500"	Jobber	Jobber	TS.561.11.16 MK 109
	0.246"	0.500"	Jobber	Jobber	TS.561.11.16 MK 142
	0.250" (1/4" or E)	0.500"	1.50"	1.000"	TS.561.11.18 MK 29
			2.00"	1.500"	TS.561.11.18 MK 30
			2.50"	2.000"	TS.561.11.16 MK 147
					TS.561.11.18 MK 31
			Jobber	Jobber	TS.561.11.16 MK 82
0.2968"	0.234" (A)	0.375"	2.50"	2.0"	TS.561.11.16 MK 152
0.2969"	0.234" (A)	0.500"	Jobber	Jobber	TS.561.11.16 MK 120
	0.250" (1/4" or E)	0.500"	Jobber	Jobber	TS.561.11.16 MK 116
	0.280"	0.500"	Jobber	Jobber	TS.561.11.16 MK 124
0.3090"	0.191" (#11)	0.375"	Jobber	Jobber	TS.561.11.16 MK 5
	0.246" (D)	0.500"	Jobber	Jobber	TS.561.11.16 MK 64
	0.248"	0.500"	10.0"	Jobber	TS.561.11.16 MK 144
	0.250" (1/4" or E)	0.375"	Jobber	Jobber	TS.561.11.16 MK 16
		0.500"	Taper	Taper	TS.561.11.16 MK 89
	0.281" (K)	0.500"	2.10" max	1.500"	TS.561.11.18 MK 7
0.3110"	0.290" (L)	0.500"	Jobber	Jobber	TS.561.11.16 MK 51
	0.290" (L)	0.500"	Jobber	Jobber	TS.561.11.16 MK 36



TABLE 5 - DOUBLE MARGIN DRILLS WITH CUTTING PILOTS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD AND MK NUMBER (NOTE 1 & NOTE 2)
0.3120"	0.249"	0.500"	2.10" max	1.500"	TS.561.11.18 MK 16
	0.250" (1/4" or E)	0.500"	3.00"	2.500"	TS.561.11.18 MK 23
			11.00"	Jobber	TS.561.11.16 MK 31
	0.290" (L)	0.500"	Jobber	Jobber	TS.561.11.16 MK 56
0.3125"	0.250" (1/4" or E)	0.500"	2.75"	1.750"	TS.561.11.18 MK 21
	0.281" (K)	0.500"	Taper	Taper	TS.561.11.16 MK 11
0.3130"	0.250" (1/4" or E)	1.000"	Jobber	Jobber	TS.561.11.16 MK 135
	0.290" (L)	0.375"	Jobber	Jobber	TS.561.11.16 MK 41
0.3260"	0.310"	0.500"	Jobber	Jobber	TS.561.11.16 MK 62
0.3280"	0.316" (O)	0.500"	Jobber	Jobber	TS.561.11.16 MK 46
0.3330"	0.1910"	0.375"	Jobber	Jobber	TS.561.11.16 MK 143
0.3430"	0.187"	0.500"	Jobber	Jobber	TS.561.11.16 MK 112
	0.309"	0.500"	2.10" max	1.500"	TS.561.11.18 MK 8
0.3480"	0.309"	0.500"	10.0"	Jobber	TS.561.11.16 MK 145
	0.312"	0.500"	Jobber	Jobber	TS.561.11.16 MK 83
0.3549"	0.250" (1/4" or E)	0.500"	Jobber	Jobber	TS.561.11.18 MK 19
0.3590"	0.290" (L)	0.500"	Jobber	Jobber	TS.561.11.16 MK 110
	0.343"	0.500"	Jobber	Jobber	TS.561.11.16 MK 113
0.3594"	0.250" (1/4" or E)	0.500"	Jobber	Jobber	TS.561.11.18 MK 9
	0.296"	0.375"	2.50"	2.0"	TS.561.11.16 MK 153
		0.500"	Jobber	Jobber	TS.561.11.16 MK 115
	0.312"	0.500"	Jobber	Jobber	TS.561.11.16 MK 121
		0.750"	8.00"	5.500"	TS.561.11.16 MK 24
0.3700"	0.343"	0.500"	Jobber	Jobber	TS.561.11.16 MK 104
0.3710"	0.348" (S)	0.500"	Jobber	Jobber	TS.561.11.16 MK 52
0.3712"	0.312"	0.500"	Jobber	Jobber	TS.561.11.16 MK 17
0.3735"	0.348" (S)	0.500"	Jobber	Jobber	TS.561.11.16 MK 37
0.3745"	0.348" (S)	0.500"	Jobber	Jobber	TS.561.11.16 MK 57



TABLE 5 - DOUBLE MARGIN DRILLS WITH CUTTING PILOTS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD AND MK NUMBER (NOTE 1 & NOTE 2)
0.3760"	0.348" (S)	0.500"	Jobber	Jobber	TS.561.11.16 MK 42
0.3880"	0.372"	0.500"	Jobber	Jobber	TS.561.11.16 MK 63
0.3906"	0.1875" (3/16")	0.500"	Jobber	Jobber	TS.561.11.16 MK 77
	0.309"	0.375"	Jobber	Jobber	TS.561.11.16 MK 25
0.3910"	0.379"	0.500"	Jobber	Jobber	TS.561.11.16 MK 47
0.3970"	0.250" (1/4" or E)	0.500"	Jobber	Jobber	TS.561.11.16 MK 86
0.4062"	0.359"	0.500"	Jobber	Jobber	TS.561.11.16 MK 114
	0.390"	0.500"	Jobber	Jobber	TS.561.11.16 MK 118
0.4375"	0.193"	1.750"	Taper	Taper	TS.561.11.16 MK 26
0.4840"	0.359"	0.500"	Jobber	Jobber	TS.561.11.16 MK 111
0.5312"	0.375" (3/8")	0.500"	Jobber	Jobber	TS.561.11.16 MK 106
0.5625"	0.375" (3/8")	0.750"	10.00"	7.500"	TS.561.11.16 MK 23
0.5937"	0.375" (3/8")	0.500"	Jobber	Jobber	TS.561.11.16 MK 108
0.6250"	0.437"	1.750"	Taper	Taper	TS.561.11.16 MK 27
0.6562"	0.375" (3/8")	0.500"	Jobber	Jobber	TS.561.11.16 MK 107
1.010"	0.500" (1/2")	2.000"	8.00"	6.000"	TS.561.11.16 MK 76
Note 1. Shaded cells indicate cobalt drills. Non-shaded cells indicate high speed steel drills. Shaded cells with bold text indicates both cobalt and high speed steel drills available. Note 2. TS.561.11.18 drills have a reduced shank diameter (0.187" or less). TS.561.11.16 drills have a standard shank diameter (0.250" or less). TS.561.11.35 drills have a combination 5/16" hex flat and 1/4-28 threaded shank. Note 3. Refer to ANSI/ASME B94.11M for industry standard "Jobber", "Taper" and "Screw Mach." overall drill lengths and flute lengths					



TABLE 6 - DOUBLE MARGIN DRILLS WITH NON-CUTTING PILOTS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD AND MK NUMBER (NOTE 1)
0.1285"	0.098" (#40)	0.500"	2.00"	1.350"	TS.561.11.48 MK 33
				1.500"	TS.561.11.35 MK 33
0.1590"	0.098" (#40)	0.500"	2.00"	1.350"	TS.561.11.48 MK 28
				1.500"	TS.561.11.35 MK 28
0.1610"	0.098" (#40)	0.500"	2.00"	1.350"	TS.561.11.48 MK 30
				1.500"	TS.561.11.35 MK 30
0.1770"	0.125" (1/8")	0.500"	2.00"	1.350"	TS.561.11.48 MK 1
				1.500"	TS.561.11.35 MK 1
			2.50"	1.850"	TS.561.11.48 MK 2
				2.000"	TS.561.11.35 MK 2
			3.00"	2.350"	TS.561.11.48 MK 3
				2.500"	TS.561.11.35 MK 3
0.1850"	0.098" (#40)	0.500"	2.00"	1.350"	TS.561.11.48 MK 29
				1.500"	TS.561.11.35 MK 29
0.1875"	0.1285" (#30)	0.500"	1.70"	1.050"	TS.561.11.48 MK 36
				1.200"	TS.561.11.35 MK 36
0.1910"	0.098" (#40)	0.500"	2.00"	1.350"	TS.561.11.48 MK 31
				1.500"	TS.561.11.35 MK 31
0.1935"	0.098" (#40)	0.500"	2.00"	1.350"	TS.561.11.48 MK 32
				1.500"	TS.561.11.35 MK 32
0.2180"	0.161"	0.500"	2.00"	1.350"	TS.561.11.48 MK 34
				1.500"	TS.561.11.35 MK 34
			2.50"	1.850"	TS.561.11.48 MK 35
				2.000"	TS.561.11.35 MK 35



TABLE 6 - DOUBLE MARGIN DRILLS WITH NON-CUTTING PILOTS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD AND MK NUMBER (NOTE 1)
0.2340"	0.177" (#16)	0.17"	1.75"	1.100"	TS.561.11.48 MK 41
		0.50"	2.00"	1.350"	TS.561.11.48 MK 13
				1.500"	TS.561.11.35 MK 13
			2.50"	1.850"	TS.561.11.48 MK 14
				2.000"	TS.561.11.35 MK 14
			3.00"	2.350"	TS.561.11.48 MK 15
				2.500"	TS.561.11.35 MK 15
	0.187"	0.50"	2.00"	1.350"	TS.561.11.48 MK 4
				1.500"	TS.561.11.35 MK 4
			2.50"	1.850"	TS.561.11.48 MK 5
				2.000"	TS.561.11.35 MK 5
			3.00"	2.350"	TS.561.11.48 MK 6
				2.500"	TS.561.11.35 MK 6
0.2344"	0.185" (#13)	0.50"	2.50"	1.850"	TS.561.11.48 MK 24
				2.000"	TS.561.11.35 MK 24
			3.00"	2.350"	TS.561.11.48 MK 25
				2.500"	TS.561.11.35 MK 25
0.2430"	0.1875" (3/16")	0.50"	1.70"	1.050"	TS.561.11.48 MK 37
				1.200"	TS.561.11.35 MK 37
0.2500"	0.125"	0.25"	2.00"	1.25"	TS.561.11.50 MK 1



TABLE 6 - DOUBLE MARGIN DRILLS WITH NON-CUTTING PILOTS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD AND MK NUMBER (NOTE 1)
0.2960"	0.234" (A)	0.25"	1.75"	1.100"	TS.561.11.48 MK 40
		0.40"	1.75"	1.100"	TS.561.11.48 MK 39
				1.250"	TS.561.11.35 MK 39
		0.50"	1.70"	1.050"	TS.561.11.48 MK 38
				1.200"	TS.561.11.35 MK 38
			2.00"	1.350"	TS.561.11.48 MK 7
				1.500"	TS.561.11.35 MK 7
			2.50"	1.850"	TS.561.11.48 MK 8
				2.000"	TS.561.11.35 MK 8
			3.00"	2.350"	TS.561.11.48 MK 9
				2.500"	TS.561.11.35 MK 9
0.2960"	0.250" (1/4" or E)	0.500"	2.00"	1.350"	TS.561.11.48 MK 16
				1.500"	TS.561.11.35 MK 16
			2.50"	1.850"	TS.561.11.48 MK 17
				2.000"	TS.561.11.35 MK 17
			3.00"	2.350"	TS.561.11.48 MK 18
				2.500"	TS.561.11.35 MK 18
0.2969"	0.280"	0.500"	2.50"	1.850"	TS.561.11.48 MK 26
				2.000"	TS.561.11.35 MK 26
			3.00"	2.350"	TS.561.11.48 MK 27
				2.500"	TS.561.11.35 MK 27



TABLE 6 - DOUBLE MARGIN DRILLS WITH NON-CUTTING PILOTS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD AND MK NUMBER (NOTE 1)
0.3590"	0.296"	0.500"	2.00"	1.350"	TS.561.11.48 MK 19
				1.500"	TS.561.11.35 MK 19
			2.50"	1.850"	TS.561.11.48 MK 20
				2.000"	TS.561.11.35 MK 20
			3.00"	2.350"	TS.561.11.48 MK 21
				2.500"	TS.561.11.35 MK 21
	0.312"	0.500"	2.00"	1.350"	TS.561.11.48 MK 10
				1.500"	TS.561.11.35 MK 10
			2.50"	1.850"	TS.561.11.48 MK 11
				2.000"	TS.561.11.35 MK 11
			3.00"	2.350"	TS.561.11.48 MK 12
				2.500"	TS.561.11.35 MK 12
	0.343"	0.500"	2.50"	1.850"	TS.561.11.48 MK 22
				2.000"	TS.561.11.35 MK 22
			3.00"	2.350"	TS.561.11.48 MK 23
				2.500"	TS.561.11.35 MK 23
0.4070"	0.356"	0.500"	3.75"	2.75"	TS.561.11.49 MK 1
Note 1. Shaded cells indicate cobalt drills. Non-shaded cells indicate high speed steel drills.					



TABLE 7 - PILOTED TWIST DRILLS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD
0.1250"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.15 MK 12
0.1360"	0.093"	0.250"	23.00"	Jobber	TS.561.11.15 MK 13
0.1440"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.15 MK 39
	0.128"	0.500"	Jobber	Jobber	TS.561.11.15 MK 40
0.1540"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.15 MK 18
0.1562"	0.125" (1/8")	0.500"	Jobber	Jobber	TS.561.11.15 MK 1
			Taper	Taper	TS.561.11.15 MK 4
0.1610"	0.098" (#40)	0.375"	Jobber	Jobber	TS.561.11.15 MK 45
	0.128"	0.375"	Jobber	Jobber	TS.561.11.15 MK 44
0.1770"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.15 MK 41
	0.125" (1/8")	0.500"	Jobber	Jobber	TS.561.11.15 MK 35
	0.128"	0.500"	Jobber	Jobber	TS.561.11.15 MK 42
0.1800"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.15 MK 19
0.1875"	0.156"	0.500"	Jobber	Jobber	TS.561.11.15 MK 2
			Taper	Taper	TS.561.11.15 MK 5
0.1910"	0.098" (#40)	0.120"	1.00"	0.62"	TS.561.11.15 MK 15
		0.150"	Taper	Taper	TS.561.11.15 MK 52
		0.250"	Jobber	Jobber	TS.561.11.15 MK 14
0.1990"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.15 MK 21
0.2055"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.15 MK 20
0.2210"	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.15 MK 22
0.2500"	0.094"	0.500"	Jobber	Jobber	TS.561.11.15 MK 10
	0.098" (#40)	0.500"	Jobber	Jobber	TS.561.11.15 MK 23
	0.125" (1/8")	0.500"	Jobber	Jobber	TS.561.11.15 MK 9
	0.156"	0.500"	Jobber	Jobber	TS.561.11.15 MK 17
	0.191" (#11)	0.500"	Jobber	Jobber	TS.561.11.15 MK 8
	0.219"	0.500"	Taper	Taper	MK 7TS.561.11.15
0.2570"	0.191" (#11)	0.500"	Jobber	Jobber	TS.561.11.15 MK 3
0.2812"	0.250" (1/4" or E)	0.500"	Taper	Taper	TS.561.11.15 MK 6



TABLE 7 - PILOTED TWIST DRILLS

DRILL DIAMETER	PILOT DIAMETER	PILOT LENGTH	DRILL LENGTH	FLUTE LENGTH	TOOL STANDARD
0.2960"	0.234" (A)	0.500"	Jobber	Jobber	TS.561.11.15 MK 36
	0.250" (1/4" or E)	0.500"	Jobber	Jobber	TS.561.11.15 MK 37
0.3230"	0.125" (1/8")	0.620"	Jobber	Jobber	TS.561.11.15 MK 24
0.3430"	0.1875" (3/16")	0.500"	Taper	Taper	TS.561.11.15 MK 32
	0.309"	0.500"	Taper	Taper	TS.561.11.15 MK 28
0.3480"	0.191" (#11)	0.500"	Jobber	Jobber	TS.561.11.15 MK 43
0.3580"	0.125" (1/8")	0.620"	Jobber	Jobber	TS.561.11.15 MK 25
0.3590"	0.3125" (5/16")	0.500"	Jobber	Jobber	TS.561.11.15 MK 38
0.3906"	0.125" (1/8")	0.620"	Jobber	Jobber	TS.561.11.15 MK 26
0.4219"	0.128"	0.250"	Jobber	Jobber	TS.561.11.15 MK 11
0.4531"	0.191" (#11)	0.250"	Jobber	Jobber	TS.561.11.15 MK 16
0.4844"	0.375" (3/8")	2.000"	7.00"	Jobber	TS.561.11.15 MK 50
0.5000"	0.4375" (7/16")	2.250"	8.00"	5.38"	TS.561.11.15 MK 48
				5.42"	TS.561.11.15 MK 47
0.5156"	0.125" (1/8")	0.620"	Jobber	Jobber	TS.561.11.15 MK 27
0.5469"	0.375" (3/8")	1.000"	7.00"	Jobber	TS.561.11.15 MK 51
0.5625"	0.5625" (9/16")	0.000"	4.00"	2.37"	TS.561.11.15 MK 29
0.5630"	0.250" (1/4" or E)	0.500"	Jobber	Jobber	TS.561.11.15 MK 46
0.6719"	0.4375" (7/16")	2.250"	8.00"	5.38"	TS.561.11.15 MK 49
0.6875"	0.1875" (3/16")	0.300"	3.50"	2.50"	TS.561.11.15 MK 30
1.000"	0.1875" (3/16")	0.300"	4.00"	3.00"	TS.561.11.15 MK 31
Note 1. Refer to ANSI/ASME B94.11M for industry standard "Jobber", "Taper" and "Screw Mach." overall drill lengths and flute lengths					



TABLE 8 - STANDARD NON-PILOTED REAMERS

REAMER DIAMETER	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD
0.1865"	4.50"	1.13"	TS.561.11.12 MK 37
0.1890"	4.50"	1.12"	TS.561.11.12 MK 28
0.1900"	5.00"	1.25"	TS.561.11.12 MK 6
0.1925"	5.00"	1.25"	TS.561.11.12 MK 15
0.2090"	5.00"	1.25"	TS.561.11.12 MK 32
0.2280"	6.00"	1.50"	TS.561.11.12 MK 33
0.2510"	6.00"	1.50"	TS.561.11.12 MK 17
0.2520"	6.00"	1.50"	TS.561.11.12 MK 16
0.2950"	6.00"	1.50"	TS.561.11.12 MK 19
	10.00"	2.50"	TS.561.11.12 MK 40
0.3085"	10.00"	2.50"	TS.561.11.12 MK 46
0.3125"	10.00"	3.00"	TS.561.11.12 MK 24
0.3144"	6.00"	3.00"	TS.561.11.12 MK 61
0.3145"	6.00"	1.50"	TS.561.11.12 MK 10
0.3160"	6.00"	1.50"	TS.561.11.12 MK 22
0.3580"	10.00"	2.50"	TS.561.11.12 MK 41
0.3710"	10.00"	2.50"	TS.561.11.12 MK 47
0.3735"	7.00"	1.75"	TS.561.11.12 MK 59
0.3750"	7.00"	1.75"	TS.561.11.12 MK 60
0.3770"	7.00"	1.75"	TS.561.11.12 MK 13
0.3780"	7.00"	1.75"	TS.561.11.12 MK 4
0.3807"	7.00"	1.75"	TS.561.11.12 MK 34
0.3980"	7.00"	1.75"	TS.561.11.12 MK 31
0.4000"	7.00"	1.75"	TS.561.11.12 MK 29
0.4091"	7.00"	1.75"	TS.561.11.12 MK 23
0.4219"	10.00"	2.50"	TS.561.11.12 MK 42
0.4335"	10.00"	2.50"	TS.561.11.12 MK 48
0.4370"	7.00"	1.75"	TS.561.11.12 MK 58
0.4375"	7.00"	1.75"	TS.561.11.12 MK 57



TABLE 8 - STANDARD NON-PILOTED REAMERS

REAMER DIAMETER	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD
0.4395"	7.00"	1.75"	TS.561.11.12 MK 8
0.4420"	7.00"	2.00"	TS.561.11.12 MK 21
0.4844"	10.00"	2.50"	TS.561.11.12 MK 43
0.4960"	10.00"	2.50"	TS.561.11.12 MK 49
0.4990"	8.00"	2.00"	TS.561.11.12 MK 12
0.5020"	8.00"	2.00"	TS.561.11.12 MK 7
0.5469"	10.00"	2.50"	TS.561.11.12 MK 44
0.5580"	10.00"	2.50"	TS.561.11.12 MK 50
0.5630"	8.00"	2.00"	TS.561.11.12 MK 11
0.5640"	8.00"	2.00"	TS.561.11.12 MK 5
0.5650"	8.00"	2.00"	TS.561.11.12 MK 3
0.5670"	8.00"	2.00"	TS.561.11.12 MK 18
0.5730"	8.00"	2.00"	TS.561.11.12 MK 20
0.5930"	8.00"	2.00"	TS.561.11.12 MK 14
0.6094"	10.00"	2.50"	TS.561.11.12 MK 45
0.6205"	10.00"	2.50"	TS.561.11.12 MK 51
0.6264"	9.00"	2.25"	TS.561.11.12 MK 36
0.6273"	9.00"	2.25"	TS.561.11.12 MK 9
0.6280"	9.00"	2.25"	TS.561.11.12 MK 2
0.6570"	9.00"	2.25"	TS.561.11.12 MK 1
0.6900"	9.00"	2.25"	TS.561.11.12 MK 27
0.7510"	9.50"	2.50"	TS.561.11.12 MK 30
0.7555"	9.50"	2.50"	TS.561.11.12 MK 54
0.7812"	9.50"	4.00"	TS.561.11.12 MK 39
0.8125"	9.50"	4.00"	TS.561.11.12 MK 38
0.8141"	9.50"	3.50"	TS.561.11.12 MK 35
0.8310"	9.50"	2.50"	TS.561.11.12 MK 25
0.8745"	10.00"	2.62"	TS.561.11.12 MK 52
0.9400"	10.00"	2.62"	TS.561.11.12 MK 26



TABLE 8 - STANDARD NON-PILOTED REAMERS

REAMER DIAMETER	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD
0.9997"	10.50"	2.75"	TS.561.11.12 MK 53
1.5004"	4.50"	2.25"	TS.561.11.12 MK 55
1.5004"	6.00"	2.25"	TS.561.11.12 MK 56

TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.1235"	0.0980" (#40)	0.310"	5.50"	0.87"	TS.561.11.13 MK 12
0.1550"	0.1440" (#27)	0.370"	4.00"	1.00"	TS.561.11.13 MK 13
0.1590"	0.1250" (1/8")	0.250"	2.00"	1.25"	TS.561.11.13 MK 135
	0.1440" (#27)	0.500"	2.00"	1.50"	TS.561.11.36 MK 1
					TS.561.11.36 MK 54
					TS.561.11.51 MK 1
					TS.561.11.51 MK 54
		0.500"	2.50"	2.00"	TS.561.11.36 MK 2
					TS.561.11.36 MK 55
					TS.561.11.51 MK 2
					TS.561.11.51 MK 55
		0.500"	3.00"	2.50"	TS.561.11.36 MK 3
					TS.561.11.36 MK 57
					TS.561.11.51 MK 3
					TS.561.11.51 MK 57
		0.500"	4.00"	2.00"	TS.561.11.13 MK 85
					TS.561.11.13 MK 81
		0.500"	6.00"	2.00"	TS.561.11.13 MK 112
0.1605"	0.1440" (#27)	0.500"	6.00"	1.75"	TS.561.11.13 MK 137
0.1610"	0.1440" (#27)	0.500"	6.00"	1.75"	TS.561.11.13 MK 57
0.1615"	0.1440" (#27)	0.380"	2.50"	1.25"	TS.561.11.13 MK 130
		0.500"	4.50"	1.12"	TS.561.11.13 MK 20
0.1625"	0.1440" (#27)	0.166"	4.50"	1.12"	TS.561.11.13 MK 54



TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.1650"	0.1440" (#27)	0.500"	4.50"	1.12"	TS.561.11.13 MK 25
			6.00"	1.75"	TS.561.11.13 MK 56
0.1770"	0.1560"	0.500"	3.00"	2.00"	TS.561.11.13 MK 100
			3.00"	2.50"	TS.561.11.36 MK 41
					TS.561.11.51 MK 41
0.1850"	0.1590" (#21)	0.250"	2.00"	1.25"	TS.561.11.13 MK 136
	0.1770" (#16)	0.500"	2.00"	1.50"	TS.561.11.36 MK 4
					TS.561.11.36 MK 58
					TS.561.11.51 MK 4
					TS.561.11.51 MK 58
			2.50"	2.00"	TS.561.11.36 MK 5
					TS.561.11.36 MK 59
					TS.561.11.51 MK 5
					TS.561.11.51 MK 59
			3.00"	2.00"	TS.561.11.13 MK 101
				2.50"	TS.561.11.36 MK 6
					TS.561.11.36 MK 42
					TS.561.11.51 MK 6
					TS.561.11.51 MK 42
			4.00"	2.00"	TS.561.11.13 MK 86
			6.00"	2.00"	TS.561.11.13 MK 113
0.1860"	0.1770" (#16)	0.500"	6.00"	1.75"	TS.561.11.13 MK 58
0.1865"	0.1600"	0.370"	6.00"	1.12"	TS.561.11.13 MK 49
	0.1770" (#16)	0.380"	2.50"	1.25"	TS.561.11.13 MK 131
		0.500"	4.50"	1.12"	TS.561.11.13 MK 21
0.1870"	0.1770" (#16)	0.500"	6.00"	1.75"	TS.561.11.13 MK 59
0.1875"	0.1770" (#16)	0.500"	6.00"	2.00"	TS.561.11.13 MK 122
	0.1820" (#14)	0.370"	4.50"	1.12"	TS.561.11.13 MK 128
0.1885"	0.1770" (#16)	0.189"	4.50"	1.12"	TS.561.11.13 MK 55



TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.1890"	0.1770" (#16)	0.370"	4.50"	1.12"	TS.561.11.13 MK 14
0.1960"	0.1800" (#16)	0.500"	5.00"	1.25"	TS.561.11.13 MK 141
0.1985"	0.1770" (#16)	0.500"	4.50"	1.12"	TS.561.11.13 MK 26
	0.1850" (#13)	0.500"	2.00"	1.50"	TS.561.11.36 MK 48
					TS.561.11.51 MK 48
			2.50"	2.00"	TS.561.11.36 MK 49
					TS.561.11.51 MK 49
			6.00"	2.00"	TS.561.11.13 MK 107
0.1990"	0.1850" (#13)	0.500"	6.00"	2.00"	TS.561.11.13 MK 114
0.2000"	0.1850" (#13)	0.500"	2.00"	1.50"	TS.561.11.36 MK 16
					TS.561.11.51 MK 16
			2.50"	2.00"	TS.561.11.36 MK 17
					TS.561.11.51 MK 17
			3.00"	2.50"	TS.561.11.36 MK 18
					TS.561.11.51 MK 18
			6.00"	2.00"	TS.561.11.13 MK 90
	0.1860"	0.370"	5.00"	1.25"	TS.561.11.13 MK 41
0.2030"	0.1910" (#11)	0.370"	5.00"	1.25"	TS.561.11.13 MK 38
0.2035"	0.1875" (3/16")	0.310"	5.00"	1.25"	TS.561.11.13 MK 3
0.2140"	0.1980"	0.500"	2.00"	1.50"	TS.561.11.36 MK 50
					TS.561.11.51 MK 50
			2.50"	2.00"	TS.561.11.36 MK 51
					TS.561.11.51 MK 51
			6.00"	2.00"	TS.561.11.13 MK 108
			6.00"	2.00"	TS.561.11.13 MK 115



TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.2160"	0.2000"	0.370"	5.00"	1.25"	TS.561.11.13 MK 42
		0.500"	2.00"	1.50"	TS.561.11.36 MK 38
					TS.561.11.51 MK 38
			2.50"	2.00"	TS.561.11.36 MK 39
					TS.561.11.51 MK 39
			3.00"	2.50"	TS.561.11.36 MK 40
					TS.561.11.51 MK 40
			6.00"	2.00"	TS.561.11.13 MK 94
0.2360"	0.2170"	0.500"	2.50"	2.00"	TS.561.11.36 MK 60
					TS.561.11.51 MK 60
0.2450"	0.2340" (A)	0.500"	2.00"	1.50"	TS.561.11.36 MK 7
					TS.561.11.51 MK 7
0.2450"	0.2340" (A)	0.500"	2.50"	2.00"	TS.561.11.36 MK 8
					TS.561.11.51 MK 8
			3.00"	2.50"	TS.561.11.36 MK 9
					TS.561.11.36 MK 9
			4.00"	2.00"	TS.561.11.13 MK 87
			6.00"	2.00"	TS.561.11.13 MK 82
0.2455"	0.2180"	0.240"	10.00"	1.50"	TS.561.11.13 MK 77
0.2460"	0.2280" (#1)	0.500"	6.00"	1.50"	TS.561.11.13 MK 60
0.2465"	0.2280" (#1)	0.380"	2.50"	1.25"	TS.561.11.13 MK 132
		0.500"	1.75"	1.25"	TS.561.11.13 MK 123
			2.25"	1.75"	TS.561.11.13 MK 124
			6.00"	1.50"	TS.561.11.13 MK 22
			10.00"	1.50"	TS.561.11.13 MK 121
			12.00"	1.50"	TS.561.11.13 MK 162
0.2470"	0.2280" (#1)	0.500"	6.00"	1.50"	TS.561.11.13 MK 61
0.2485"	0.2280" (#1)	0.500"	6.00"	1.50"	TS.561.11.13 MK 15



TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.2495"	0.2280" (#1)	0.500"	6.00"	1.50"	TS.561.11.13 MK 27
	0.2340" (A)	0.400"	6.00"	1.50"	TS.561.11.13 MK 6
	0.2380" (B)	0.500"	2.10"	1.50"	TS.561.11.13 MK 30
0.2500"	0.2180"	0.500"	2.10"	1.50"	TS.561.11.13 MK 8
	0.2190"	1.750"	9.00"	4.50"	TS.561.11.13 MK 36
0.2510"	0.2385"	0.500"	2.10"	1.50"	TS.561.11.36 MK 61
					TS.561.11.51 MK 61
			2.50"	2.00"	TS.561.11.36 MK 62
					TS.561.11.51 MK 62
0.2530"	0.2330"	0.750"	6.00"	1.50"	TS.561.11.13 MK 138
0.2570"	0.2490"	0.370"	6.00"	1.50"	TS.561.11.13 MK 39
0.2610"	0.2445"	0.500"	2.00"	1.50"	TS.561.11.36 MK 19
					TS.561.11.51 MK 19
			2.50"	2.00"	TS.561.11.36 MK 20
					TS.561.11.51 MK 20
			3.00"	2.50"	TS.561.11.36 MK 22
					TS.561.11.51 MK 22
			6.00"	2.00"	TS.561.11.13 MK 91
	0.2470"	0.370"	6.00"	1.50"	TS.561.11.13 MK 43
0.2620"	0.2500" (1/4" or E)	0.310"	6.00"	1.50"	TS.561.11.13 MK 2
0.2640"	0.250"	0.370"	6.00"	1.25"	TS.561.11.13 MK 163
0.2653"	0.1910"	0.370"	6.00"	1.50"	TS.561.11.13 MK 161



TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.2760"	0.2610" (G)	0.500"	2.00"	1.50"	TS.561.11.36 MK 29
					TS.561.11.51 MK 29
			2.50"	2.00"	TS.561.11.36 MK 30
					TS.561.11.51 MK 30
			3.00"	2.50"	TS.561.11.36 MK 31
					TS.561.11.51 MK 31
			6.00"	2.00"	TS.561.11.13 MK 95
0.2770"	0.2610" (G)	0.370"	6.00"	1.50"	TS.561.11.13 MK 44
0.2950"	0.2770" (J)	0.500"	6.00"	1.50"	TS.561.11.13 MK 32
0.2960"	0.2340" (A)	0.500"	1.70"	1.20"	TS.561.11.36 MK 63
					TS.561.11.51 MK 63
0.2969"	0.2810" (K)	0.750"	4.00"	2.00"	TS.561.11.13 MK 71
0.3070"	0.2960"	0.500"	4.00"	2.00"	TS.561.11.13 MK 88
			6.00"	2.00"	TS.561.11.13 MK 83
0.3075"	0.2950"	0.150"	1.50"	1.00"	TS.561.11.36 MK 65
					TS.561.11.51 MK 65
	0.2960"	0.250"	1.75"	1.25"	TS.561.11.51 MK 66
		0.500"	1.70"	1.20"	TS.561.11.36 MK 64
					TS.561.11.51 MK 64
			2.00"	1.50"	TS.561.11.36 MK 10
					TS.561.11.51 MK 10
			2.50"	2.00"	TS.561.11.36 MK 11
					TS.561.11.51 MK 11
			3.00"	2.50"	TS.561.11.36 MK 12
					TS.561.11.51 MK 12
0.3077"	0.2960"	0.500"	4.00"	1.75"	TS.561.11.13 MK 111
			6.00"	2.00"	TS.561.11.13 MK 110
0.3085"	0.2900" (L)	0.500"	6.00"	1.50"	TS.561.11.13 MK 62



TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.3090"	0.2810" (K)	0.500"	2.10"	1.50"	TS.561.11.13 MK 10
			6.00"	1.50"	TS.561.11.13 MK 31
0.3090"	0.2900" (L)	0.500"	1.50"	1.00"	TS.561.11.13 MK 125
			2.00"	1.50"	TS.561.11.13 MK 126
			2.50"	1.25"	TS.561.11.13 MK 133
				2.00"	TS.561.11.13 MK 127
			6.00"	1.50"	TS.561.11.13 MK 23
			7.00"	1.75"	TS.561.11.13 MK 139
			8.00"	1.50"	TS.561.11.13 MK 129
	0.2950" (M)	0.500"	6.00"	1.50"	TS.561.11.13 MK 37
0.3095"	0.2900" (L)	0.500"	6.00"	1.50"	TS.561.11.13 MK 63
0.3110"	0.2900" (L)	0.500"	6.00"	1.50"	TS.561.11.13 MK 16
0.3120"	0.2900" (L)	0.500"	6.00"	1.50"	TS.561.11.13 MK 28
	0.2960"	0.750"	4.00"	2.00"	TS.561.11.13 MK 72
0.3125"	0.2650"	0.500"	2.10"	1.50"	TS.561.11.13 MK 9
	0.2960"	0.500"	2.00"	1.50"	TS.561.11.36 MK 45
					TS.561.11.51 MK 45
			2.50"	2.00"	TS.561.11.36 MK 46
					TS.561.11.51 MK 46
			3.00"	2.50"	TS.561.11.36 MK 47
					TS.561.11.51 MK 47
0.3230"	0.3090"	0.370"	6.00"	1.50"	TS.561.11.13 MK 45
		0.750"	6.00"	2.00"	TS.561.11.13 MK 106
	0.3145"	0.750"	4.00"	1.50"	TS.561.11.13 MK 4



TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.3235"	0.3070"	0.500"	2.00"	1.50"	TS.561.11.36 MK 23
					TS.561.11.51 MK 23
			2.50"	2.00"	TS.561.11.36 MK 24
					TS.561.11.51 MK 24
			3.00"	2.50"	TS.561.11.36 MK 25
					TS.561.11.51 MK 25
			6.00"	2.00"	TS.561.11.13 MK 92
					TS.561.11.13 MK 145
0.3244"	0.3100"	0.500"	6.00"	2.00"	TS.561.11.13 MK 145
0.3245"	0.3090"	0.500"	7.00"	1.75"	TS.561.11.13 MK 140
0.3380"	0.3230" (P)	0.500"	2.00"	1.50"	TS.561.11.36 MK 32
					TS.561.11.51 MK 32
			2.50"	2.00"	TS.561.11.36 MK 33
					TS.561.11.51 MK 33
0.3380"	0.3230" (P)	0.500"	3.00"	2.50"	TS.561.11.36 MK 34
					TS.561.11.51 MK 34
			6.00"	2.00"	TS.561.11.13 MK 96
0.3400"	0.3230" (P)	0.370"	6.00"	1.50"	TS.561.11.13 MK 46
	0.3256"	0.500"	6.00"	2.00"	TS.561.11.13 MK 151
0.3520"	0.2500" (1/4" or E)	0.500"	7.00"	2.00"	TS.561.11.13 MK 104
0.3590"	0.3430"	0.500"	8.00"	5.00"	TS.561.11.13 MK 50
0.3594"	0.3430"	0.750"	4.00"	2.00"	TS.561.11.13 MK 73
		1.000"	12.00"	2.00"	TS.561.11.13 MK 157
0.3600"	0.3430"	0.500"	7.00"	1.75"	TS.561.11.13 MK 34



TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.3690"	0.3590"	0.500"	2.00"	1.50"	TS.561.11.36 MK 13
					TS.561.11.51 MK 13
			2.50"	2.00"	TS.561.11.36 MK 14
					TS.561.11.51 MK 14
			3.00"	2.50"	TS.561.11.36 MK 15
					TS.561.11.51 MK 15
0.3695"	0.3590"	0.500"	4.00"	2.00"	TS.561.11.13 MK 89
			6.00"	2.00"	TS.561.11.13 MK 84
0.3695"	0.3590"	0.500"	6.00"	2.00"	TS.561.11.13 MK 142
0.3700"	0.2590"	0.500"	6.00"	2.00"	TS.561.11.13 MK 116
0.3705"	0.3480" (S)	0.500"	7.00"	1.75"	TS.561.11.13 MK 64
0.3710"	0.3430"	0.500"	2.10"	1.50"	TS.561.11.13 MK 11
			7.00"	1.75"	TS.561.11.13 MK 78
	0.3480" (S)	0.500"	2.50"	1.25"	TS.561.11.13 MK 134
			7.00"	1.75"	TS.561.11.13 MK 24
	0.3600"	0.500"	7.00"	1.75"	TS.561.11.13 MK 33
0.3720"	0.3480" (S)	0.500"	7.00"	1.75"	TS.561.11.13 MK 65
0.3722"	0.3590"	0.370"	7.00"	1.75"	TS.561.11.13 MK 53
0.3735"	0.3480" (S)	0.500"	7.00"	1.75"	TS.561.11.13 MK 17
0.3745"	0.3480" (S)	0.500"	7.00"	1.75"	TS.561.11.13 MK 29
	0.3590"	0.750"	4.00"	2.00"	TS.561.11.13 MK 74
		1.000"	12.00"	2.00"	TS.561.11.13 MK 158
0.3750"	0.3580" (T)	0.750"	5.00"	2.50"	TS.561.11.13 MK 1
	0.3590"	0.500"	2.00"	1.50"	TS.561.11.36 MK 44
					TS.561.11.51 MK 44
			2.50"	2.00"	TS.561.11.36 MK 43
					TS.561.11.51 MK 43
			7.00"	1.75"	TS.561.11.13 MK 18
0.3840"	0.3745"	0.750"	4.00"	1.75"	TS.561.11.13 MK 5



TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.3850"	0.3690"	0.500"	2.00"	1.50"	TS.561.11.36 MK 26
					TS.561.11.51 MK 26
			2.50"	2.00"	TS.561.11.36 MK 27
					TS.561.11.51 MK 27
			3.00"	2.50"	TS.561.11.36 MK 28
					TS.561.11.51 MK 28
			6.00"	2.00"	TS.561.11.13 MK 93
0.3860"	0.3710"	0.370"	7.00"	1.75"	TS.561.11.13 MK 47
0.3869"	0.3725"	0.500"	6.00"	2.00"	TS.561.11.13 MK 146
0.3906"	0.3750" (3/8")	0.500"	7.00"	1.75"	TS.561.11.13 MK 19
0.4000"	0.3530"	0.500"	2.00"	1.50"	TS.561.11.36 MK 35
					TS.561.11.51 MK 35
			2.50"	2.00"	TS.561.11.36 MK 36
					TS.561.11.51 MK 36
			3.00"	2.50"	TS.561.11.36 MK 37
					TS.561.11.51 MK 37
	0.3850"	0.500"	2.50"	2.00"	TS.561.11.36 MK 52
					TS.561.11.51 MK 52
			3.00"	2.50"	TS.561.11.36 MK 53
					TS.561.11.51 MK 53
			6.00"	2.00"	TS.561.11.13 MK 97
0.4020"	0.3860" (W)	0.370"	7.00"	1.75"	TS.561.11.13 MK 48
0.4025"	0.3881"	0.500"	6.00"	2.00"	TS.561.11.13 MK 152
0.4310"	0.4210"	0.500"	6.00"	2.00"	TS.561.11.13 MK 98
0.4320"	0.4060"	0.500"	3.75"	3.00"	TS.561.11.13 MK 166
			6.00"	2.00"	TS.561.11.13 MK 102
0.4335"	0.4060"	0.500"	7.00"	1.75"	TS.561.11.13 MK 66
0.4345"	0.4060"	0.500"	7.00"	1.75"	TS.561.11.13 MK 67
0.4375"	0.4210"	4.000"	10.00"	7.50"	TS.561.11.13 MK 7



TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.4378"	0.4219"	0.250"	7.00"	1.75"	TS.561.11.13 MK 164
0.4440"	0.4375" (7/16")	0.500"	7.00"	1.75"	TS.561.11.13 MK 40
0.4490"	0.4330"	0.500"	7.00"	1.75"	TS.561.11.13 MK 68
0.4494"	0.4350"	0.500"	6.00"	2.00"	TS.561.11.13 MK 147
0.4645"	0.4330"	0.500"	7.00"	1.75"	TS.561.11.13 MK 69
0.4650"	0.4506"	0.500"	6.00"	2.00"	TS.561.11.13 MK 153
0.4844"	0.4680"	0.750"	4.00"	2.00"	TS.561.11.13 MK 75
		1.000"	12.00"	2.00"	TS.561.11.13 MK 159
0.4940"	0.4840"	0.500"	6.00"	2.00"	TS.561.11.13 MK 99
0.4960"	0.4685"	0.500"	8.00"	2.00"	TS.561.11.13 MK 118
0.4995"	0.3750"	2.000"	7.00"	3.50"	TS.561.11.13 MK 144
	0.4840"	0.500"	6.00"	2.00"	TS.561.11.13 MK 109
			8.00"	2.00"	TS.561.11.13 MK 70
		0.750"	4.00"	2.00"	TS.561.11.13 MK 105
					TS.561.11.13 MK 76
					TS.561.11.13 MK 160
0.5000"	0.4840"	0.500"	6.00"	2.00"	TS.561.11.13 MK 103
0.5003"	0.4844"	0.310"	8.00"	2.00"	TS.561.11.13 MK 165
0.5119"	0.4975"	0.500"	6.00"	2.00"	TS.561.11.13 MK 148
0.5275"	0.5131"	0.500"	6.00"	2.00"	TS.561.11.13 MK 154
0.5580"	0.5305"	0.500"	6.00"	2.00"	TS.561.11.13 MK 119
0.5620"	0.375"	1.000"	7.00"	2.50"	TS.561.11.13 MK 143
0.5739"	0.5595"	0.500"	6.00"	2.00"	TS.561.11.13 MK 149
0.5895"	0.5751"	0.500"	6.00"	2.00"	TS.561.11.13 MK 155
0.6205"	0.5935"	0.500"	6.00"	2.00"	TS.561.11.13 MK 120
0.6272"	0.5600"	1.000"	9.00"	2.25"	TS.561.11.13 MK 52
0.6364"	0.6220"	0.500"	6.00"	2.00"	TS.561.11.13 MK 150
0.6520"	0.6376"	0.5000"	6.00"	2.00"	TS.561.11.13 MK 156



TABLE 9 - PILOTED REAMERS

REAMER DIAMETER	PILOT DIAMETER	PILOT LENGTH	REAMER LENGTH	FLUTE LENGTH	TOOL STANDARD (NOTE 1 & NOTE 2)
0.6875"	0.4375" (7/16")	2.250"	8.00"	5.38"	TS.561.11.13 MK 117
0.8154"	0.7960"	4.000"	12.00"	8.00"	TS.561.11.13 MK 35
0.8161"	0.6240"	3.000"	9.50"	5.00"	TS.561.11.13 MK 51
Note 1. Shaded cells indicate cobalt reamers. Black cells indicate carbide reamers. Shaded cells with bold text indicates both cobalt and high speed steel drills available. All other reamers high speed steel (HSS). Note 2. TS.561.11.36 and TS561.11.51 drills have a combination 5/16" hex flat and 1/4-28 threaded shank.					

TABLE 10 - STANDARD END MILL REAMERS

REAMER DIAMETER	SHANK DIAMETER	SHANK END DIAMETER	FLUTE LENGTH	REAMER LENGTH	TOOL STANDARD
0.1610"	0.160"	0.160"	1.1"	4"	TS.561.11.67 MK 1
0.1660"	0.165"	0.165"	1.1"	4"	TS.561.11.67 MK 2
0.1695"	0.169"	0.169"	1.1"	4"	TS.561.11.67 MK 3
0.1719"	0.171"	0.171"	1.1"	4"	TS.561.11.67 MK 4
0.1730"	0.172"	0.172"	1.1"	4"	TS.561.11.67 MK 5
0.1770"	0.176"	0.176"	1.1"	4"	TS.561.11.67 MK 6
0.1800"	0.179"	0.179"	1.1"	4"	TS.561.11.67 MK 7
0.1820"	0.181"	0.181"	1.1"	4"	TS.561.11.67 MK 8
0.1850"	0.184"	0.184"	1.1"	4"	TS.561.11.67 MK 9
0.1875"	0.186"	0.186"	1.1"	4"	TS.561.11.67 MK 10
0.1890"	STANDARD	0.187"	1.1"	4"	TS.561.11.67 MK 11
0.1910"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 12
0.1935"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 13
0.1960"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 14
0.1990"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 15
0.2010"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 16
0.2031"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 17
0.2055"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 18
0.2090"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 19
0.2130"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 20



TABLE 10 - STANDARD END MILL REAMERS

REAMER DIAMETER	SHANK DIAMETER	SHANK END DIAMETER	FLUTE LENGTH	REAMER LENGTH	TOOL STANDARD
0.2187"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 21
0.2210"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 22
0.2280"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 23
0.2340"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 24
0.2380"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 25
0.2420"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 26
0.2460"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 27
0.2500"	STANDARD	0.187"	1.3"	5"	TS.561.11.67 MK 28
0.2570"	STANDARD	0.187"	1.3"	5	TS.561.11.67 MK 29
0.2610"	STANDARD	0.187"	1.3"	5	TS.561.11.67 MK 30
0.2656"	STANDARD	0.187"	1.3"	5	TS.561.11.67 MK 31
0.2660"	STANDARD	0.187"	1.3"	5	TS.561.11.67 MK 32
0.2720"	STANDARD	0.187"	1.3"	5	TS.561.11.67 MK 33
0.2770"	STANDARD	0.187"	1.3"	5	TS.561.11.67 MK 34
0.2812"	STANDARD	0.187"	1.3"	5	TS.561.11.67 MK 35
0.2900"	STANDARD	0.187"	1.3"	5	TS.561.11.67 MK 36
0.2950"	STANDARD	0.187"	1.3"	5	TS.561.11.67 MK 37
0.2969"	STANDARD	0.187"	1.3"	5	TS.561.11.67 MK 38
0.3020"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 39
0.3230"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 40
0.3320"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 41
0.3390"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 42
0.3480"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 43
0.3580"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 44
0.3680"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 45
0.3750"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 46
0.3860"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 47
0.3970"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 48



TABLE 10 - STANDARD END MILL REAMERS

REAMER DIAMETER	SHANK DIAMETER	SHANK END DIAMETER	FLUTE LENGTH	REAMER LENGTH	TOOL STANDARD
0.4063"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 49
0.4130"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 50
0.4219"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 51
0.4375"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 52
0.2150"	STANDARD	0.187"	1.3"	6	TS.561.11.67 MK 53
0.3090"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 54
0.3248"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 55
0.3701"	STANDARD	0.187"	1.6"	6	TS.561.11.67 MK 56
0.4016"	STANDARD	0.187"	1.6"	6"	TS.561.11.67 MK 57
0.4331"	STANDARD	0.187"	1.6"	6"	TS.561.11.67 MK 58
0.4490"	STANDARD	0.187"	1.85"	6"	TS.561.11.67 MK 59
0.4646"	STANDARD	0.187"	1.85"	6"	TS.561.11.67 MK 60

TABLE 11 - STUBBY END MILL REAMERS

REAMER DIAMETER	SHANK DIAMETER	SHANK END DIAMETER	FLUTE LENGTH	REAMER LENGTH	TOOL STANDARD
0.1610"	0.160"	0.160"	1.1"	3"	TS.561.11.68 MK 1
0.1660"	0.165"	0.165"	1.1"	3"	TS.561.11.68 MK 2
0.1695"	0.169"	0.169"	1.1"	3"	TS.561.11.68 MK 3
0.1719"	0.171"	0.171"	1.1"	3"	TS.561.11.68 MK 4
0.1730"	0.172"	0.172"	1.1"	3"	TS.561.11.68 MK 5
0.1770"	0.176"	0.176"	1.1"	3"	TS.561.11.68 MK 6
0.1800"	0.179"	0.179"	1.1"	3"	TS.561.11.68 MK 7
0.1820"	0.181"	0.181"	1.1"	3"	TS.561.11.68 MK 8
0.1850"	0.184"	0.184"	1.1"	3"	TS.561.11.68 MK 9
0.1875"	0.187"	0.187"	1.1"	3"	TS.561.11.68 MK 10
0.1890"	STANDARD	0.187"	1.1"	3"	TS.561.11.68 MK 11
0.1910"	STANDARD	0.187"	1.1"	3"	TS.561.11.68 MK 12
0.1935"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 13



TABLE 11 - STUBBY END MILL REAMERS

REAMER DIAMETER	SHANK DIAMETER	SHANK END DIAMETER	FLUTE LENGTH	REAMER LENGTH	TOOL STANDARD
0.1960"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 14
0.1990"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 15
0.2010"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 16
0.2031"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 17
0.2055"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 18
0.2090"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 19
0.2130"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 20
0.2187"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 21
0.2210"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 22
0.2280"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 23
0.2340"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 24
0.2380"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 25
0.2420"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 26
0.2460"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 27
0.2500"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 28
0.2570"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 29
0.2610"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 30
0.2656"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 31
0.2660"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 32
0.2720"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 33
0.2770"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 34
0.2812"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 35
0.2900"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 36
0.2950"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 37
0.2969"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 38
0.3020"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 39
0.3230"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 40
0.3320"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 41



TABLE 11 - STUBBY END MILL REAMERS

REAMER DIAMETER	SHANK DIAMETER	SHANK END DIAMETER	FLUTE LENGTH	REAMER LENGTH	TOOL STANDARD
0.3390"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 42
0.3480"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 43
0.3580"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 44
0.3680"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 45
0.3750"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 46
0.3860"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 47
0.3970"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 48
0.4063"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 49
0.4130"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 50
0.4219"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 51
0.4375"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 52
0.2150"	STANDARD	0.187"	1.3"	3"	TS.561.11.68 MK 53
0.3090"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 54
0.3248"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 55
0.3701"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 56
0.4016"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 57
0.4331"	STANDARD	0.187"	1.6"	3"	TS.561.11.68 MK 58
0.4490"	STANDARD	0.187"	1.85"	3"	TS.561.11.68 MK 59
0.4646"	STANDARD	0.187"	1.85"	3"	TS.561.11.68 MK 60

Note 1. Reamers are made from cobalt steel to cut aluminum alloy.



TABLE 12 - DECIMAL EQUIVALENT OF LETTER AND FRACTIONAL SIZE DRILLS

DRILL SIZE	DIA.	DRILL SIZE	DIA.	DRILL SIZE	DIA.	DRILL SIZE	DIA.	DRILL SIZE	DIA.
80	0.0135"	50	0.0700"	22	0.1570"	G	0.2610"	31/64"	0.4844"
79	0.0145"	49	0.0730"	21	0.1590"	17/64"	0.2656"	1/2"	0.500"
1/64"	0.0156"	48	0.0760"	20	0.1610"	H	0.2660"	33/64"	0.5156"
78	0.0160"	5/64"	0.0781"	19	0.1660"	I	0.2720"	17/32"	0.5312"
77	0.0180"	47	0.0785"	18	0.1695"	J	0.2770"	35/64"	0.5468"
76	0.0200"	46	0.0810"	11/64"	0.1719"	K	0.2810"	9/16"	0.5625"
75	0.0210"	45	0.0820"	17	0.1730"	9/32"	0.2812"	37/64"	0.5781"
74	0.0225"	44	0.0860"	16	0.1770"	L	0.2900"	19/32"	0.5937"
73	0.0240"	43	0.0890"	15	0.1800"	M	0.2950"	39/64"	0.6093"
72	0.0250"	42	0.0935"	14	0.1820"	19/64"	0.2969"	5/8"	0.6250"
71	0.0260"	3/32"	0.0938"	13	0.1850"	N	0.3020"	41/64"	0.6406"
70	0.0280"	41	0.0960"	3/16"	0.1875"	5/16"	0.3125"	21/32"	0.6562"
69	0.0292"	40	0.0980"	12	0.1890"	O	0.3160"	43/64"	0.6718"
68	0.0310"	39	0.0995"	11	0.1910"	P	0.3230"	11/16"	0.6875"
1/32"	0.0312"	38	0.1015"	10	0.1935"	21/64"	0.3281"	45/64"	0.7031"
67	0.0320"	37	0.1040"	9	0.1960"	Q	0.3320"	23/32"	0.7187"
66	0.0330"	36	0.1065"	8	0.1990"	R	0.3390"	47/64"	0.7343"
65	0.0350"	7/64"	0.1094"	7	0.2010"	11/32"	0.3438"	3/4"	0.7500"
64	0.0360"	35	0.1100"	13/64"	0.2031"	S	0.3480"	49/64"	0.7656"
63	0.0370"	34	0.1110"	6	0.2040"	T	0.3580"	25/32"	0.7812"
62	0.0380"	33	0.1130"	5	0.2055"	23/64"	0.3594"	51/64"	0.7968"
61	0.0390"	32	0.1160"	4	0.2090"	U	0.3680"	13/16"	0.8125"
60	0.0400"	31	0.1200"	3	0.2130"	3/8"	0.3750"	53/64"	0.8281"
59	0.0410"	1/8	0.1250"	7/32"	0.2188"	V	0.3770"	27/32"	0.8437"
58	0.0420"	30	0.1285"	2	0.2210"	W	0.3860"	55/64"	0.8593"
57	0.0430"	29	0.1360"	1	0.2280"	25/64"	0.3906"	7/8"	0.8750"
56	0.0465"	28	0.1405"	A	0.2340"	X	0.3970"	57/64"	0.8906"
3/64"	0.0468"	9/64"	0.1406"	15/64"	0.2344"	Y	0.4040"	29/32"	0.9062"
55	0.0520"	27	0.1440"	B	0.2380"	13/32"	0.4062"	59/64"	0.9218"
54	0.0550"	26	0.1470"	C	0.2420"	Z	0.4130"	15/16"	0.9375"
53	0.0595"	25	0.1495"	D	0.2460"	27/64"	0.4219"	61/64"	0.9531"
1/16"	0.0625"	24	0.1520"	E or 1/4"	0.2500"	7/16"	0.4375"	31/32"	0.9687"
52	0.0635"	23	0.1540"	F	0.2570"	29/64"	0.4531"	63/64"	0.9843"
51	0.0670"	5/32"	0.1562"			15/32"	0.4688"		



TABLE 13 - MINIMUM ACCEPTABLE EDGE DISTANCE

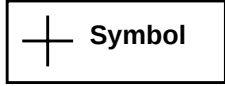
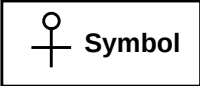
NOMINAL FASTENER DIAMETER	MINIMUM ACCEPTABLE EDGE DISTANCE (NOTE 1)		
	 Symbol STANDARD FASTENERS	 Symbol CRITICAL STRESS FASTENERS	FASTENERS INSTALLED IN CASTINGS OR NON-METALLIC MATERIALS
3/32"	0.165"	0.190"	0.280"
1/8"	0.220"	0.250"	0.375"
5/32"	0.275"	0.315"	0.470"
3/16"	0.330"	0.370"	0.565"
1/4"	0.440"	0.500"	0.750"
5/16"	0.550"	0.625"	0.940"
3/8"	0.660"	0.750"	1.125"
"D" (NOTE 2)	1.75D	2D	3D
Note 1. For standard or critical stress fasteners installed in castings or non-metallic materials the minimum edge distance is the minimum edge distance specified for fasteners installed in castings or non-metallic materials. Note 2. For fastener sizes not included in this table, the minimum acceptable edge distance is 1.75, 2 or 3 times the nominal fastener diameter as shown above.			

TABLE 14 - STANDARD STEP DRILLS

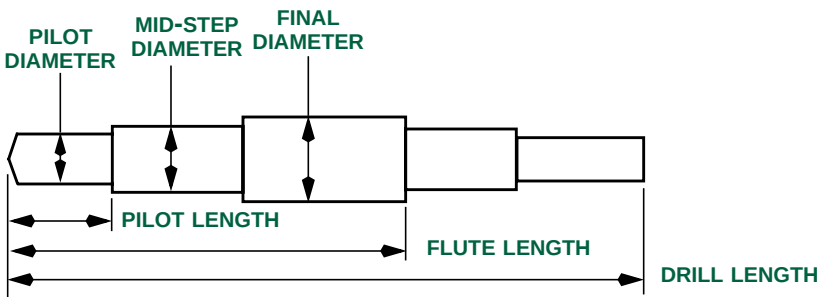
						
FINAL DIAMETER	PILOT DIAMETER	MID-STEP DIAMETER	PILOT LENGTH	FLUTE LENGTH	DRILL LENGTH	TS.561.11.45 MK NUMBER
0.4219"	0.3125"	0.3750"	0.25"	4.37"	5.37"	MK 3
0.4844"	0.3750"	0.4375"	0.31"	4.87"	5.87"	MK 4
0.6094"	0.3750"	0.4844"	2.00"	4.37"	7.00"	MK 2
0.7969"	0.4375"	0.6094"	0.75"	3.87"	5.76"	MK 1

TABLE 15 - UNIBIT STEP DRILLS

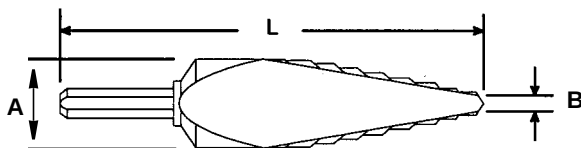
			
UNIBIT STEP DRILL TS. 561.11.31	FINAL DIAMETER "A"	PILOT DIAMETER "B"	NOMINAL LENGTH "L"
MK 1	0.7188"	0.187"	2.57"
MK 2	0.7125"	0.187"	2.57"



TABLE 16 - RECOMMENDED SPEEDS AND FEEDS FOR DRILLING (NOTE 1 & NOTE 2)

MATERIAL TO BE DRILLED		DRILL DIAMETER						
		up to 3/16"	3/16" to 1/4"	1/4" to 5/16"	5/16" to 3/8"	3/8" to 1/2"	1/2" to 3/4"	3/4" to 1"
		RECOMMENDED FEED RATE (per spindle revolution)						
		0.001" to 0.004"		0.004" to 0.007"			0.007" to 0.015"	
		RECOMMENDED SPINDLE SPEED (RPM)						
Aluminum & Magnesium		4000	3000	2400	2000	1500	1200	850
Brass & Bronze	ordinary	3000	2300	1800	1500	1100	800	575
	high tensile	2000	1500	1200	1000	750	550	400
Monel metal or high nickel steel		800	600	500	400	300	200	100
Steel, steel alloy & heat treated steel	Mild steel	1800	1350	1100	900	700	500	350
	Forgings	800	600	500	400	300	200	100
	Rc 35 to 40	700	550	425	325	275	175	125
	Rc 40 to 45	600	450	375	300	225	150	100
Stainless Steel	free machining	1100	850	675	550	425	N/A	N/A
	Work hardening	600	450	375	300	225	150	100
Titanium & Titanium alloy sheet		110	850	675	550	425	300	225
Note 1. Refer to Table 12 for conversion of Letter and Fractional size drills to decimal equivalents. Note 2. For reaming operations the spindle speed should be 1/3 to 1/2 that used for drilling and the feed rate should be approximately twice that used for drilling.								

TABLE 17 - SPECIAL CARBIDE DRILL/REAMERS

DRILL/REAMER DIAMETER	DRILL/REAMER LENGTH	FLUTE LENGTH	TS.561.11.43 MK NUMBER
0.1562"	6.00"	1.50"	MK 1
0.1695"	6.00"	1.50"	MK 2
0.1730"	6.00"	1.50"	MK 3
0.1910"	6.00"	1.50"	MK 4
0.3110"	6.00"	1.50"	MK 5



TABLE 18 - HOLE DIAMETER TOLERANCE FOR DRILLED HOLES OTHER THAN FASTENER HOLES (I.E., TOOLING, LIGHTENING, ETC.)

DRILLED HOLE TOLERANCE	
HOLE DIAMETER RANGE	TOLERANCE
0.013" to 0.125"	+ 0.004" / - 0.000"
0.126" to 0.250"	+ 0.005" / - 0.000"
0.251" to 0.500"	+ 0.006" / - 0.000"
0.501" to 0.750"	+ 0.008" / - 0.000"
0.751" to 1.000"	+ 0.010" / - 0.000"
1.001" & larger	Number of decimal places in drawing dimension: 1 decimal place: + 0.1" / - 0.0" 2 decimal places: + 0.03" / - 0.00" 3 decimal places: + 0.010" / - 0.000"
Note 1. The values specified in this table are applicable only to drilled holes other than fastener holes (i.e., tooling, lightening, etc.).	