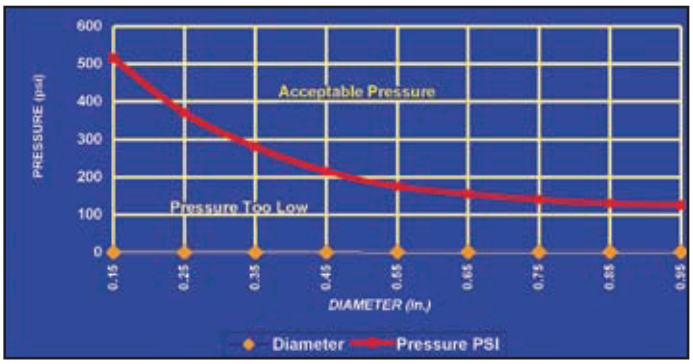
Legacy Technical Information

High Performance Solid Carbide Drills

All components of the drilling system contribute to the achievement of the quality of the hole produced and the productivity that can be realized. In order to maximize success the following should be considered.

1. Toolholding – High quality tool holders should be used. Hydraulic chucks, shrink-fit holders, or milling chucks should be used. Total indicated tool run out measured at the point should be less than .001".
2. Machine – A rigid machine with a high quality spindle is required.
3. Workholding – The workpiece must be held rigidly so that it cannot deflect or vibrate during drilling
4. Drilling and Chamfering – A chamfer should be added to a hole only after drilling, never before.
5. The drill should be perpendicular to the surface being drilled. An inclined or rough surface should be pre-machined with an end mill to make it perpendicular before drilling.
6. Drilling On Turning Machines – When drilling on a turning machine the drill must be on center. The tolerance range for centrality should not exceed ±.001. When drilling more than 3XD the drill may require a speed reduction.
7. Coolant – Legacy drills are high penetration drills. To perform to their potential they must be properly cooled. A high pressure and high volume with a quality high lubricity coolant will aid chip removal, enhance tool life and, increase hole quality.
    - Without adequate coolant, drills can heat up quickly and expand, sometimes leading to the drill seizing in the hole.
    - Heat at the drill point can cause coolant to vaporize resulting in thermal damage to the point. Coolant pressure should be high enough to break this barrier keeping the point within acceptable operating parameters.
    - See Minimum Favorable Coolant Pressure chart below.



Factory Reconditioning is available. Contact your Morse Distributor For Details.

Legacy Technical Information

Speeds and Feeds

Material Group	Examples	Composition / Structure		Tensile Strength RM (MPa)	Hardness BRN	Cutting Speed (m/min) (sfm)	D = 4mm .1575	D = 6mm .2362	D = 8mm .3150	D = 12mm .4724	D = 16mm .6299	D = 20mm .7843
Unalloyed steel, cast steel, machining steel	1008, 1108, 1018, 10L18, 12L15, ASTM A426: Gr. CP1	C = 0.10 - 0.25	Annealed, Long Chipping	420	125	130 - 170 430 - 560	0.09 - 0.14 .004 - .006	0.12 - 0.19 .005 - .007	0.14 - 0.24 .006 - .009	0.20 - 0.32 .008 - .013	0.24 - 0.40 .009 - .016	0.31 - 0.50 .012 - .020
		C = 0.10 - 0.25	Annealed, Short Chipping	420	125	140 - 180 460 - 590	0.09 - 0.15 .004 - .006	0.13 - 0.20 .005 - .008	0.16 - 0.25 .006 - .010	0.22 - 0.34 .009 - .013	0.27 - 0.43 .011 - .017	0.34 - 0.54 .013 - .021
	1030, 1055, 1070, 1524, 1050, 1060, ASTM 352 Gr. LCA, ASTM 356 Gr. 1, 1536,	C = 0.25 - 0.55	Annealed, Long Chipping	640	190	110 - 150 360 - 490	0.09 - 0.15 .004 - .006	0.13 - 0.20 .005 - .008	0.16 - 0.25 .006 - .010	0.22 - 0.34 .009 - .013	0.27 - 0.43 .011 - .017	0.34 - 0.54 .013 - .021
		C = 0.25 - 0.55	Annealed, Short Chipping	640	190	120 - 170 390 - 560	0.11 - 0.18 .004 - .007	0.15 - 0.24 .006 - .009	0.18 -0.29 .007 - .011	0.24 - 0.39 .009 - .015	.29 - 0.47 .011 - .019	0.36 - 0.59 .014 - .023
		C = 0.25 - 0.55	Tempered	850	250	90 - 130 300 - 430	0.10 - 0.16 .004 - .006	0.14 - 0.22 .006 - .009	0.17 - 0.27 .007 - .011	0.24 - 0.37 .009 - .015	0.29 - 0.47 .011 - .019	0.38 - 0.60 .015 - .024
		C = 0.25 - 0.80	Annealed	915	270	80 - 120 260 - 390	0.10 - 0.16 .004 - .006	0.14 - 0.22 .006 - .009	0.17 - 0.27 .007 - .011	0.24 - 0.37 .009 - .015	0.29 - 0.47 .011 - .019	0.38 - 0.60 .015 - .024
	ASTM 352 Gr. LCA, ASTM 356 Gr. 1, 1536,	C = 0.25 - 0.80	Tempered	1020	300	80 - 120 260 - 390	0.10 - 0.16 .004 - .006	0.14 - 0.22 .006 - .009	0.17 - 0.27 .007 - .011	0.24 - 0.37 .009 - .015	0.29 - 0.47 .011 - .019	0.38 - 0.60 .015 - .024
Low-alloy steel, cast steel, machining steel	1330, 2515, 3140, 4130, 4140, 4320, 4340, 5140, 8620, 9315, 9840		Annealed	610	180	80 - 120 260 - 390	0.11 - 0.19 .004 - .007	0.15 - 0.25 .006 - .010	0.18 - 0.31 .007 - .012	0.24 - 0.42 .009 - .017	0.30 - 0.52 .012 - .020	0.38 - 0.65 .015 - .026
			Tempered	930	275	80 - 120 260 - 390	0.10 - 0.17 .004 - .007	0.14 - 0.23 .006 - .009	0.17 - 0.29 .007 - .011	0.23 - 0.38 .009 - .015	0.28 - 0.47 .011 - .019	0.35 - 0.59 .014 - .023
			Tempered	1020	300	80 - 120 260 - 390	0.09 - 0.15 .004 - .006	0.13 - 0.21 .005 - .008	0.16 - 0.25 .06 - .010	0.21 - 0.34 .008 - .013	0.26 - 0.42 .010 - .017	0.32 - 0.53 .013 - .021
			Tempered	1190	350	70 - 90 230 - 300	0.10 - 0.17 .004 - .007	0.14 - 0.23 .006 - .009	0.17 - 0.28 .007 - .011	0.23 - 0.37 .009 - .015	0.27 - 0.45 .011 - .018	0.34 - 0.57 .013 - .022
High-alloy steel, cast steel, high alloy tool steel	D2, M2, T15		Annealed	680	200	60 - 80 200 - 260	0.07 - 0.11 .003 - .004	0.09 - 0.16 .004 - .006	0.12 - 0.20 .005 - .008	0.16 - 0.27 .006 - .011	0.20 - 0.35 .008 - .014	0.26 - 0.45 .010 - .018
			Hardened and Tempered	1100	325	50 - 70 160 - 230	0.06 - 0.10 .002 - .004	0.09 - 0.15 .004 - .006	0.11 - 0.19 .004 - .007	0.15 - 0.26 .006 - .010	0.20 - 0.33 .008 - .013	0.26 - 0.43 .010 - .017
Gray cast iron	ASTM A48 Cl. 25, ASE J431c: Gr.G3000, ASTM A48 Cl. 30	Pearlitic / Ferritic			180	150 - 210 490 - 690	0.14 - 0.24 .006 - .009	0.19 - 0.31 .007 - .012	0.23 - 0.38 .009 - .015	0.30 - 0.49 .012 - .019	0.36 - 0.60 .014 - .024	0.45 - 0.74 .018 - .-29
		Pearlitic (Martensitic)			260	100 - 160 330 - 520	0.12 - 0.19 .005 - .007	0.16 - 0.26 .006 - .010	0.20 - 0.32 .008 - .013	0.26 - 0.43 .010 - .017	0.33 - 0.53 .013 - .021	0.41 - 0.67 .016 - .026
Ductile cast iron	ASTM A536 Gr. 60-40-18, SAE J434c: Gr.D5506		Ferritic		160	100 - 160 330 - 520	0.12 - 0.19 .005 - .007	0.16 - 0.25 .006 - .010	0.20 - 0.31 .008 - .012	0.25 - 0.40 .010 - .016	0.31 - 0.48 .012 - .019	0.38 - 0.60 .015 - .024
			Pearlitic		250	100 - 160 330 - 520	0.09 - 0.14 .004 - .006	0.12 - 0.19 .005 - .007	0.14 - 0.23 .006 - .009	0.19 - 0.31 .007 - .012	0.24 - 0.39 .009 - .015	0.30 - 0.49 .012 - 0.19
Malleable cast iron	ASTM A47 Gr.32510, SAE J158 Gr. M4504, M5003		Ferritic		130	120 - 180 390 - 590	0.12 - 0.19 .005 - .007	0.15 - 0.25 .006 - .010	0.19 - 0.30 .007 - .012	0.24 - 0.40 .009 - .016	0.30 - 0.48 .012 - .019	0.37 - 0.60 .015 - .024
			Pearlitic		230	120 - 180 390 - 590	0.10 - 0.17 .004 - .007	0.13 - 0.22 .005 - .009	0.16 - 0.27 .006 - .011	0.21 - 0.35 .008 - .014	0.25 - 0.43 .010 - .017	0.31 - 0.53 .012 - .021
Ferritic, Martenistic, and PH stainless steels	405, 410, 440C, 502, AM350, 17-4PH		Annealed		200	60 - 80 200 - 260	0.07 - 0.11 .003 - .004	0.09 - 0.16 .004 - .006	0.12 - 0.20 .005 - .008	0.16 - 0.27 .006 - .011	0.20 - 0.35 .008 - .014	0.26 - 0.45 .010 - .018
			Hardened and Tempered		325	50 -70 160 - 230	0.06 - 0.10 .002 - .004	0.09 - 0.15 .004 - .006	0.11 - 0.19 .004 - .007	0.15 - 0.26 .006 - .010	0.20 - 0.33 .008 - .013	0.26 - 0.43 .010 - .017

Better drilling productivity is obtained by knowing the properties of the work piece material. The hardness, chip forming characteristics, tensile strength, and machining characteristics help to select optimal machining parameters. Contact Morse Cutting Tools for more information.

SPEEDS and FEEDS are suggested starting points and may be increased or decreased depending on actual material and machining conditions. Start conservatively and increase until machining cycle is optimized.