VANGUARD STEEL LTD.

PRODUCT MANUAL

COLD FINISHED CARBON STEELS - 1018

AISI/SAE 1018 ASTM A 108 - UNS G 10180

TYPICAL ANALYSIS

C.	Mn.	P.	S.
.15/.20	.60/.90	.04 MAX	.05 MAX.

A LOW-CARBON STEEL, HAVING HIGHER MANGANESE CONTENT THAN CERTAIN OTHER LOW CARBON STEELS, SUCH AS 1020. BEING RICHER IN MANGANESE, 1018 IS A BETTER STEEL FOR CARBURIZED PARTS, SINCE IT PRODUCES A HARDER AND MORE UNIFORM CASE. IT ALSO HAS HIGHER MECHANICAL PROPERTIES AND BETTER MACHINING CHARACTERISTICS. THE HOT ROLLED BARS USED IN THE MANUFACTURE OF THIS PRODUCT ARE OF SPECIAL QUALITY.

MOST COLD FINISHED BARS ARE PRODUCED BY COLD DRAWING. IN THIS PROCESS, OVERSIZE HOT ROLLED BARS, WHICH HAVE BEEN CLEANED TO REMOVE SCALE, ARE DRAWN THROUGH DIES TO THE REQUIRED SIZE. THE LARGER SIZES ARE GENERALLY TURNED AND POLISHED, THE HOT ROLLED BARS HAVING BEEN MACHINE TURNED, RATHER THAN DRAWN, FOLLOWED BY ABRASIVE POLISHING. TURNED AND POLISHED BARS TEND TO HAVE A SOMEWHAT BRIGHTER FINISH THAN COLD DRAWN BARS.

TYPICAL APPLICATIONS

SUITABLE FOR PARTS REQUIRING COLD FORMING, SUCH AS CRIMPING, BENDING, OR SWAGING. ESPECIALLY SUITABLE FOR CARBURIZED PARTS REQUIRING SOFT CORE AND HIGH SURFACE HARDNESS, SUCH AS GEARS, PINIONS, WORMS, KING PINS, RATCHETS, DOGS, ETC.

MECHANICAL PROPERTIES

THE FOLLOWING VALUES ARE AVERAGE AND MAY BE CONSIDERED AS REPRESENTATIVE OF THE GRADE:

APPROXIMATE MECHANICAL PROPERTIES * ARE:

TENSILE STRENGTH, PSI	**80,000/100,000**
YIELD POINT, PSI.	**70,000/85,000**
ELONGATION, % IN 2"	**15/25**
REDUCTION IN AREA, %	**45/55**
BRINELL HARDNESS	**170/220**

* IN THE COLD DRAWN STATE ON A 1" CROSS SECTION.

(CONTINUED)

COLD FINISHED CARBON STEELS - 1018

AISI/SAE 1018 **ASTM A 108 - UNS G 10180**

MACHINABILITY

1018 HAS A MACHINABILITY RATING OF 78% OF AISI B-1112.
AVERAGE SURFACE CUTTING SPEED IS 130 FEET PER MINUTE.

WELDABILITY

THIS GRADE IS EASILY WELDED BY ALL THE WELDING PROCESSES, AND THE RESULTANT WELDS AND JOINTS ARE OF EXTREMELY HIGH QUALITY. THE GRADE OF WELDING ROD TO BE USED DEPENDS ON THE THICKNESS OF SECTION, DESIGN, SERVICE REQUIREMENTS, ETC.

HARDENING

THIS GRADE WILL RESPOND TO ANY OF THE STANDARD CARBURIZING METHODS AND SUBSEQUENT HEAT TREATMENTS. FOR A HARD CASE AND TOUGH CORE, THE FOLLOWING HEAT TREATMENT IS SUGGESTED: CARBURIZE AT 1650-1700º DEGREE FAHRENHEIT FOR APPROXIMATELY EIGHT HOURS, COOL IN BOX AND REHEAT TO 1400-1450º DEGREE FAHRENHEIT QUENCH IN WATER AND DRAW AT 300-350º DEGREE FAHRENHEIT.

SIZE TOLERANCE

ALL TOLERANCES ARE **MINUS**

DIAMETER	TOLERANCES	
1-1/2" DIA. AND UNDER	MINUS	0.002"
OVER 1-1/2" DIA. TO 2-1/2" DIA.	MINUS	0.003"
OVER 2-1/2" DIA. TO 4" DIA.	MINUS	0.004"
OVER 4" DIA. TO 6" DIA.	MINUS	0.005"
OVER 6" DIA. TO 8" DIA	MINUS	0.006"

VANGUARD STEEL LTD.

PRODUCT MANUAL

COLD FINISHED CARBON STEELS - 12L14

AISI/SAE 12L14 **UNS G 12144**

TYPICAL ANALYSIS

C.	Mn.	P.	S.
.15 MAX.	.85/1.15	.04/.09	.26/.35

C 12L14 IS ESSENTIALLY RESULPHURIZED AND REPHOSPHORIZED SCREW MACHINE STOCK TO WHICH LEAD HAS BEEN ADDED.

TYPICAL APPLICATIONS

USED TO MAXIMUM ADVANTAGE FOR PARTS WHERE CONSIDERABLE MACHINING IS REQUIRED SUCH AS BUSHINGS, INSERTS, COUPLINGS, AND HYDRAULIC HOSE FITTINGS. WITH GOOD DUCTILITY, THESE GRADES ARE SUITABLE FOR PARTS INVOLVING BENDING, CRIMPING, OR RIVETING.

MECHANICAL PROPERTIES

THE FOLLOWING ARE AVERAGE VALUES FOR 1" ROUND AND MAY BE CONSIDERED AS REPRESENTATIVE:

TENSILE STRENGTH, PSI	**87,500**
YIELD POINT, PSI.	**75,000**
ELONGATION, % IN 2"	**15**
REDUCTION IN AREA, %	**50**
BRINELL HARDNESS	**163/179**

MACHINABILITY

12L14 HAS A MACHINABILITY RATING OF 198% OF AISI B-1112.
AVERAGE SURFACE CUTTING SPEED IS 325 FEET PER MINUTE.

WELDABILITY

DUE TO HIGH SULPHUR CONTENT, THESE GRADES ARE NOT CONSIDERED AS WELDABLE

HARDENING

ALTHOUGH THESE GRADES WILL RESPOND TO CONVENTIONAL TREATMENTS, THEY ARE NOT CONSIDERED CASE-HARDENING STEELS. BETTER RESULTS CAN BE OBTAINED FROM 1117 OR 1018

COLD FINISHED CARBON STEELS-1045 TG&P

AISI 1045 PRECISION GROUND SHAFTING **UNS G 10450**
COLD DRAWN, GROUND AND POLISHED SHAFTING SUPPLIED IN FIBRE TUBES

TYPICAL ANALYSIS

C.	Mn.	P.	S.	Si.
.43/.50	.60/.90	.04 MAX.	.05 MAX.	.15/.35

PRECISION GROUND SHAFTING REPRESENTS THE HIGHEST DEGREE OF OVER-ALL ACCURACY, CONCENTRICITY, STRAIGHTNESS, AND SURFACE PERFECTION ATTAINABLE IN COMMERCIAL PRACTICE. AFTER BEING GROUND ON A CENTERLESS GRINDER, BARS ARE POLISHED TO A SURFACE FINISH OF RMS 25 MAX.

TYPICAL APPLICATIONS

ALL FORMS OF CLOSE TOLERANCE SHAFTING. THIS PRODUCT IS ALSO REFERRED TO AS PUMP SHAFTING, DUE TO ITS HIGH DEGREE OF STRAIGHTNESS, THAT IS SO IMPORTANT IN HIGH-SPEED SHAFTING APPLICATIONS. PRECISION SHAFTING IS ALSO USED FOR MOTOR SHAFTS, CAMSHAFTS MILL SHAFTS, AND SIMILAR APPLICATIONS WHERE HIGH-SPEED WORK NECESSITATES STRAIGHTNESS AND ACCURACY ALONG WITH THE ABILITY TO BE MACHINED UNSYMETRICALLY WITH PRACTICALLY NO DANGER OF WARPING.

MECHANICAL PROPERTIES

THE FOLLOWING ARE AVERAGE VALUES AND MAY BE CONSIDERED AS REPRESENTATIVE:

	1"	3"	7"
TENSILE STRENGTH, PSI.	**115,00**	**102,500**	**90,000**
YIELD STRENGTH, PSI.	**85,000**	**79,000**	**59,000**
ELONGATION, % IN 2"	**19%**	**17%**	**18%**
REDUCTION IN AREA, %	**32%**	**42%**	**35%**
BRINELL HARDNESS	**223**	**212**	**187**

MACHINABILITY

MACHINABILITY RATING IS APPROXIMATELY 70% OS AISI B-1112. AVERAGE SURFACE CUTTING SPEED IS 95 TO 105 FEET PER MINUTE.

(CONTINUED)

COLD FINISHED CARBON STEELS-1045 TG&P

AISI 1045 PRECISION GROUND SHAFTING **UNS G 10450**
COLD DRAWN, GROUND AND POLISHED SHAFTING SUPPLIED IN FIBRE TUBES

SHEAR STRENGTH

THE ULTIMATE SHEAR STRENGTH IS APPROXIMATELY 66% OF THE ULTIMATE TENSILE STRENGTH.

WELDABILITY

DUE TO HIGH CARBON CONTENT, THIS MATERIAL IS NOT READILY WELDED. WITH THIN SECTIONS AND FLEXIBLE DESIGN, GAS OR ARC WELDING MAY BE USED WITHOUT PREHEATING, BUT IN JOINTS OVER 1/4" TO 3/4" THICK, PREHEATING IS NECESSARY. TO DEVELOP EQUIVALENT STRENGTH IN A WELD, A LOW ALLOY FILLER IS RECOMMENDED. THE GRADE OF WELDING ROD TO BE USED DEPENDS ON THICKNESS OF SECTION, DESIGN, SERVICE REQUIREMENTS, ETC.

SIZE TOLERANCE

ALL TOLERANCES ARE **MINUS**

DIAMETER	TOLERANCES	
1-1/2" DIA. AND UNDER	MINUS	0.001"
OVER 1-1/2" DIA. TO UNDER 2-1/2" DIA.	MINUS	0.0015"
OVER 2-1/2" DIA. TO 3" DIA.	MINUS	0.002"
OVER 3" DIA. TO 4" DIA.	MINUS	0.003"
OVER 4" DIA. TO 6" DIA	MINUS	0.005"
OVER 6" DIA. TO 7" DIA	MINUS	0.006"

AVAILABLE IN METRIC AND IMPERIAL SIZES

CHROMED PLATED SHAFTING-1045

AISI/SAE 1045 CHROME PLATED SHAFTING-SUPPLIED IN FIBRE TUBES

TYPICAL ANALYSIS

C.	Mn.	P.	S.	Si.
.43/.50	.60/.90	.04 MAX.	.05 MAX.	.15/.35

THE STEEL USED IS C1045/1050 COLD FINISHED SHAFTING TO ASTM A-108-90A.
SIZE TOLERANCES ARE TO ASTM STANDARD SPECIFICATIONS A 29/A 29M
PRECISION GROUND SHAFTING REPRESENTS THE HIGHEST DEGREE OF OVER-ALL ACCURACY, CONCENTRICITY, STRAIGHTNESS, AND SURFACE PERFECTION ATTAINABLE IN COMMERCIAL PRACTICE. AFTER BEING GROUND ON A CENTERLESS GRINDER, BARS ARE POLISHED TO A SURFACE FINISH OF RMS. 25 MAX.
THE BARS ARE HARD CHROME PLATED BY ELECTROLYTICALLY DEPOSITED LAYERS OF CHROMIUM METAL ON THE SURFACE AND CONFERS THE IMPORTANT PROPERTIES OF CORROSION RESISTANCE AND WEAR RESISTANCE. BEING THAT IT IS VERY SMOOTH IT HAS A LOW COEFFICIENCY TO FRICTION.

CHROME PLATING

FINISHED THICKNESS OF CHROME	**.001" MINIMUM PER SIDE**
HARDNESS OF CHROME	**69-71 RC**
SURFACE FINISH	**RMS. 16 MAX.**

TYPICAL APPLICATIONS

HYDRAULIC SHAFTING, PUMP SHAFTS, PISTON RODS, ETC.

MECHANICAL PROPERTIES

YIELD STRENGTH, PSI	**1/2" TO 15/16" DIA.**	**75,000 APPROX..**
	1" TO 4" DIA.	**100,000 MIN.**
	4-1/4" TO 6" DIA.	**50,000 MIN.**

(CONTINUED)

CHROMED PLATED SHAFTING-1045

AISI/SAE 1045 CHROME PLATED SHAFTING-SUPPLIED IN FIBRE TUBES

SIZE TOLERANCE

ALL TOLERANCES ARE **MINUS**

DIAMETER	TOLERANCES	
1-1/2" DIA. AND UNDER	MINUS	0.0015"
OVER 1-1/2" DIA. TO UNDER 2-1/2" DIA.	MINUS	0.002"
OVER 2-1/2" DIA. TO 3" DIA.	MINUS	0.0025"
OVER 3" DIA. TO 4" DIA.	MINUS	0.0035"
OVER 4" DIA.	MINUS	0.005"

AVAILABLE IN METRIC AND IMPERIAL SIZES

INDUCTION HARDENED SHAFTING - 1045

AISI/SAE 1045 INDUCTION HARDENED AND CHROME PLATED SHAFTING

INDUCTION HARDENED AND CHROME PLATED SHAFTING, SUPPLIED IN FIBRE TUBES

TYPICAL ANALYSIS

C.	Mn.	P.	S.	Si.
.43/.50	.60/.90	.04 MAX.	.05 MAX.	.15/.35

A COLD DRAWN, PRECISION GROUND AND POLISHED SHAFTING, SEAM FREE SURFACE FINISH IS FIRST INDUCTION HARDENED TO A CASE DEPTH OF .050" TO .090" RESULTING IN A SURFACE HARDNESS OF APPROXIMATELY ROCKWELL C 5O MINIMUM, THEREBY ENSURING THE PROPERTIES OF THE BAR. THE EXTRA HARDNESS ENSURES SUPERIOR WEAR RESISTANCE. THE BARS ARE HARD CHROMED IN THE SAME MANNER AS CHROME PLATED SHAFTING ALLOWING THE SAME ADVANTAGES OF CORROSION AND WEAR RESISTANCE, BUT WITH THE INDUCTION HARDENING, THE BARS WILL GIVE SUPERIOR SERVICE.

INDUCTION HARDENING

CASE DEPTH	**.050" TO .090"**
CASE HARDNESS	**RC 50 MINIMUM SURFACE HARDNESS**

CHROME PLATING

FINISHED THICKNESS OF CHROME	**.001" MINIMUM PER SIDE**
HARDNESS OF CHROME	**69-71 RC**
SURFACE FINISH	**RMS. 16 MAX.**

TYPICAL APPLICATIONS

HYDRAULIC SHAFTING, PUMP SHAFTS, PISTON RODS, ETC.

MECHANICAL PROPERTIES

YIELD STRENGTH, PSI	**1/2" TO 15/16" DIA.**	**75,000 APPROX..**
	1" TO 4" DIA.	**100,000 MIN.**
	4-1/4" TO 6" DIA.	**50,000 MIN.**

(CONTINUED)

INDUCTION HARDENED SHAFTING - 1045

AISI/SAE 1045 INDUCTION HARDENED AND CHROME PLATED SHAFTING

INDUCTION HARDENED AND CHROME PLATED SHAFTING, SUPPLIED IN FIBRE TUBES

SIZE TOLERANCE

ALL TOLERANCES ARE **MINUS**

DIAMETER	TOLERANCES	
1-1/2" DIA. AND UNDER	MINUS	0.0015"
OVER 1-1/2" DIA. TO UNDER 2-1/2" DIA.	MINUS	0.002"
OVER 2-1/2" DIA. TO 3" DIA.	MINUS	0.0025"
OVER 3" DIA. TO 4" DIA.	MINUS	0.0035"
OVER 4" DIA.	MINUS	0.005"

AVAILABLE IN METRIC AND IMPERIAL SIZES

COLD FINISHED ALLOY STEEL - 4140 TG & P.

AISI 4140 PRECISION GROUND SHAFTING (UNS G41400)

TURNED, GROUND AND POLISHED SHAFTING, SUPPLIED IN FIBRE TUBES

TYPICAL ANALYSIS

C.	Mn.	P.	S.	Si.	Cr.	Mo.
.38/.43	.75/1.00	.035 MAX.	.04 MAX.	.15/.35	.80/1.10	.15/.25

MANUFACTURED TO ASTM A434-90A CLASS BD.
HIGH STRENGTH PRECISION GROUND SHAFTING REPRESENTS THE HIGHEST DEGREE OF OVER-ALL ACCURACY, CONCENTRICITY, STRAIGHTNESS, AND SURFACE PERFECTION ATTAINABLE IN COMMERCIAL PRACTICE. AFTER BEING GROUND ON A CENTERLESS GRINDER, BARS ARE POLISHED TO A SURFACE FINISH OF RMS 25 MAX.

TYPICAL APPLICATIONS

ALL FORMS OF CLOSE TOLERANCE SHAFTING. MOTOR SHAFTS, CAMSHAFTS, HYDRAULIC SHAFTS, MILL SHAFTS, AND SIMILAR APPLICATIONS WHERE HIGH-SPEED WORK NECESSITATES STRAIGHTNESS AND ACCURACY ALONG WITH THE ABILITY TO BE MACHINED UNSYMMETRICALLY WITH PRACTICALLY NO DANGER OF WARPING; BOLTS, PINS, STUDS, ETC.

MECHANICAL PROPERTIES

THE FOLLOWING ARE AVERAGE VALUES AND MAY BE CONSIDERED AS REPRESENTATIVE:

	1-1/2"	2-1/4"	4-1/2"
TENSILE STRENGTH, PSI.	**155,300**	**150,900**	**140,700**
YIELD STRENGTH, PSI.	**132,600**	**133,600**	**116,700**
ELONGATION, % IN 2"	**15**	**17**	**14**
REDUCTION IN AREA, %	**57**	**54**	**49**
BRINELL HARDNESS	**321**	**321**	**288**

SIZE TOLERANCE

ALL TOLERANCES ARE **MINUS**

DIAMETER	TOLERANCES	
1-1/2" DIA. AND UNDER	MINUS	0.001"
OVER 1-1/2" DIA. TO UNDER 2-1/2" DIA.	MINUS	0.0015"
OVER 2-1/2" DIA. TO 3" DIA.	MINUS	0.002"
OVER 3" DIA. TO 4" DIA.	MINUS	0.003"
OVER 4" DIA.	MINUS	0.005"