MILITARY HANDBOOK

CRITERIA FOR PREPARATION OF GEAR AND SPLINE ENGINEERING DRAWINGS

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CONTENTS - Continued

CONTENTS - Continued

FIGURES

CONTENTS - Continued

1. SCOPE

1.1 Purpose. The purpose of this handbook is to standardize the specification of gears and splines on engineering drawings and related documents. In so doing, it will clarify interpretation of these items making them more suitable for competitive procurement by both, the Government and prime contractors responsible for the quality of gear products procured under subcontracts.

1.2 Scope. This handbook covers parallel, intersecting, and nonintersecting axes gears, whose respective pitch surfaces of revolution are cylinders, cones and hyperboloida. It limits its coverage of splines to involute, parallel sided and straight nonparallel sided tooth forms. It does not attempt to cover either helical or tapered splines. Coverage of gear and spline types is, however, broad enough to permit adequate specification of special gear and spline configurations by supplementing or modifying comparable types within the scope of this handbook.

1.3 Application. This handbook is applicable to all non engineering drawings and related documents utilized in the procurement of gears and splines. It is intended as a reference guide to be used in bot,h the development of new engineering drawings and related documents, and in the review and/or revision of those already .in existence. It is also applicable to any contract in which it is specifically referenced.

1.4 General. Because this handbook will be. utilized in both the specification of new gears and splines as well as updating of existing data. flexibility is sometimes required for the latter. This flexibility is provided by permitting certain types of data to be considered as non-mandatory in the updating of existing data. The type of data under discussion is data not absolutely essential to the manufacture and inspection of the product. While this data may be very helpful in the expansion or alteration of product application by the design engineer. it is often difficult to obtain. Original design criteria and calculations required to establish this data are frequently no longer available. Gear and spline design sheets, formulas. and tables were included in this pamphlet primarily for new designs. However. the user will find them convenient for reestablishing design criteria required for updating existing gear and spline specifications.

1.5 Cost reduction techniques. The use of cost reduction techniques in engineering drawing preparation maybe used when these techniques do not impair the reproducibility quality of MIL-M-9868, clarity and design disclosure requirements for the kind(s) and levels of engineering drawings being prepared. Specifically, techniques currently identified as photographic drafting and use of permanently adhering, non-fading, front printed and mounted decals and paste-ons for repetitive features should be used to the maximum extent practicable.

P		GEAR DESIGN SHEET SG-1 EXTERNAL SPUR GEAR TOOTH DIMENSIONS STANDARD CENTER DISTANCE	DATE:
Ø			SHEET 1 OF 3

Pressure Angle *	Ø		inv Ø		cos Ø		
Diametral Pitch *	P		sin Ø		tan Ø		
Gear Backlash at D	B_G		Circular Pitch	$p = \pi \div P$			
Pinion Backlash at D	B_P		Base Pitch	$p_b = \pi \cos Ø \div P$			
Addendum	a	$1 \div P$	Other		$\cos (90^o/N_G)$		
Dedendum	b	$1.25 \div P$	Other		$\cos (90^o/N_P)$		
Clearance	$\bar{c}$	$\bar{c} = b - a$		π (see note 3) =			
AGMA Quality/Class Number			Measuring Wire Diameter *	d_w			
Gear Major Diameter Runout	Q_G		Gear Major Diameter Tolerance	ΔD_{oG}			
Pinion Major Diameter Runout	Q_P		Pinion Major Diameter Tolerance	ΔD_{oP}			

TERMINOLOGY	FORMULA		SYMBOL	GEAR (G)	PINION (P)
Part Number *			-		
Drawing Number *			-	Rev.	Rev.
Number of Teeth *			N		
Pitch Diameter *	$N \div P$		D		
Base Diameter *	$D \cos Ø$		D_b		
Center Distance *	$(N_G + N_P) \div 2P$		C		+ .00
Tooth Thickness At Pitch Diameter * (Round off to 4 Decimal Places)	$\frac{\pi}{2P} - B_{min}$	Max	t		
*	$\frac{\pi}{2P} - B_{max}$	Min			
Major Diameter *	$D + 2a$	Max	D_o		
*	$D_{o_{max}} - \Delta D_o$	Min			
Minimum Tooth Tip Chamfer or Radius Height			Δtip_{min}		
Maximum Tooth Tip Chamfer or Radius Height			Δtip_{max}		
$\sec Ø_o$	$D_{o_{max}} \div D_b$		$\sec Ø_o$		
$\text{inv } Ø_o$	Table of Functions		$\text{inv } Ø_o$		
Tooth Thickness at D_o	$D_{o_{max}}\left(\frac{t_{min}}{D} + \text{inv } Ø - \text{inv } Ø_o\right)$		t_o		

P		GEAR DESIGN SHEET SG-1 EXTERNAL SPUR GEAR TOOTH DIMENSIONS STANDARD CENTER DISTANCE	SHEET 2 OF 3
Ø			

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
Top Land	$t_o - 2\,\Delta tip_{max}$ (should be greater than .005)			
Profile Major Diameter * / *	$D_{o_{max}} - 2\,\Delta tip_{min}$ Max $D_{o_{min}} - 2\,\Delta tip_{max}$ Min	D_M		
$x = 2C_{min} \sin Ø$	$y = \sqrt{D^2_{MG_{max}} - D^2_{bG}}$	$z = \sqrt{D^2_{MP_{max}} - D^2_{bP}}$		
$x_1 = 2C_{max} \sin Ø$	$y_1 = \sqrt{D^2_{MG_{min}} - D^2_{bG}}$	$z_1 = \sqrt{D^2_{MP_{min}} - D^2_{bP}}$		
NOTE: x and x_1 must be greater than y and y_1 and z and z_1 respectively.				
Active Profile Diameter * / *	$\sqrt{(x - z)^2 + D^2_{bG}} - Q_P$ Gear $\sqrt{(x - y)^2 + D^2_{bP}} - Q_G$ Pinion	APD		
Hob Displacement for Backlash	$B_{max} \div 2 \tan Ø$	Δe		
Minor Diameter * / *	$D - 2b$ $D - 2b - 2\,\Delta e$ Max / Min	D_R		
Form Diameter Max *	$\sqrt{\left(D_{R_{max}} + 2\bar{c}\right)^2 + \left(\frac{D - D_{R_{max}} - 2\bar{c}}{\tan Ø}\right)^2}$ $\left(D - D_{R_{max}} - 2\bar{c}\right.$ must be a positive value$\left.\right)$	D_F		
Contact ratio	$\left(y_1 + z_1 - x_1\right) \div 2p_b$ To assure continuity of action, value must be greater than 1.05, preferably 1.2 or greater.	m_p		
W_G ; W_P (may be positive or negative values)	$W_G = \text{inv } Ø + \frac{d_w}{D_{bG}} - \frac{\pi}{N_G}$ $W_P = \text{inv } Ø + \frac{d_w}{D_{bP}} - \frac{\pi}{N_P}$	W_G W_P		

P		GEAR DESIGN SHEET SG-1 EXTERNAL SPUR GEAR TOOTH DIMENSIONS STANDARD CENTER DISTANCE			SHEET 3 OF 3
Ø					

TERMINOLOGY	FORMULA		SYMBOL	GEAR (G)	PINION (P)
Involute at Wire Center	$W_G + \frac{t_{G_{max}}}{D_G}$; $W_P + \frac{t_{P_{min}}}{D_P}$	Max	inv $Ø_w$		
	$W_G + \frac{t_{G_{min}}}{D_G}$; $W_P + \frac{t_{P_{min}}}{D_P}$	Min			
sec $Ø_w$	Table of Functions	Max / Min	sec $Ø_w$		
tan $Ø_{w_{max}}$	Table of Functions		tan $Ø_w$		
Wire Contact Diameter	$\sqrt{(D_b \tan Ø_w - d_w)^2 + D_b^2}$		D_c		
Measurement over * Wires (Even Teeth) *	$D_b \sec Ø_w + d_w$	Max / Min	M_E		
Wire Clearance	$d_{w_c} = .5(M_{E_{min}} - 2d_w - D_{R_{max}})$ (value must be positive)		d_{w_c}		
Measurement over * Wires (Odd Teeth) *	$D_b \cos(90^o/N) \sec Ø_w + d_w$	Max / Min	M_o		
Face Width *			F		
COARSE PITCH GEARS				GEAR (G)	PINION (P)
Maximum Runout Tolerance of Pitch Diameter			*		
Lead Tolerance Across Face Width			*		
Pitch (Tooth-to-Tooth Spacing) Tolerance			*		
Profile Tolerance			*		

NOTES:

1. All values designated with an asterisk (*) shall be shown on drawing.
2. To insure accuracy, calculate to a minimum of seven decimal places.
3. Use π to a minimum of seven decimal places.
4. These calculations were performed to _____ decimal places.

P		GEAR DESIGN SHEET SG-2 EXTERNAL SPUR GEAR TOOTH DIMENSIONS NON-STANDARD CENTER DISTANCE	DATE:
Ø			SHEET 1 OF 4

Pressure Angle *	Ø		inv Ø		cos Ø	
Diametral Pitch *	P		tan Ø			
Gear Backlash at D_x	B_{xG}		Circular Pitch at D_x	$p_x = \pi D_x \div N$		
Pinion Backlash at D_x	B_{xP}		Base Pitch	$p_b = \pi \cos Ø \div P$		
Addendum	a	$1 \div P$	Other		$\cos (90^o/N_G)$	
Dedendum	b	$1.25 \div P$	Other		$\cos (90^o/N_P)$	
Clearance	$\bar{c}$	$\bar{c} = b - a$		Measuring Wire Diameter *	d_w	
AGMA Quality/Class Number			Operating Center Distance *		C_x	+.00
Operating Pitch Diameter *	$2NC_x \div (N_G + N_P)$		D_{xG}		D_{xP}	
$\sec Ø_x = D_x \div D_b$			Operating Pressure Angle *		$Ø_x$	
π (see note 3) =			inv $Ø_x$		sin $Ø_x$	
Gear Major Diameter Runout	Q_G		Gear Major Diameter Tolerance		ΔD_{oG}	
Pinion Major Diameter Runout	Q_P		Pinion Major Diameter Tolerance		ΔD_{oP}	

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
Part Number *		-		
Drawing Number *		-	Rev.	Rev.
Number of Teeth *		N		
Nominal Pitch Diameter *	$N \div P$	D		
Base Diameter *	$D \cos Ø$	D_b		
Actual Tooth Thickness at D_x	$.5p_x - B_{xG_{min}}$; $.5p_x - B_{xP_{min}}$ Max $.5p_x - B_{xG_{max}}$; $.5p_x - B_{xP_{max}}$ Min	t_x		
Actual Tooth Thickness at D * (Round off to 4 Decimal Places) *	$D\left(\frac{t_x}{D_x} + \text{inv } Ø_x - \text{inv } Ø\right)$ Max / Min	t		
Hob Displacement for Backlash	$\left(t - \frac{\pi}{2P}\right) \div 2 \tan Ø$ Max / Min	Δe		

P		GEAR DESIGN SHEET SG-2 EXTERNAL SPUR GEAR TOOTH DIMENSIONS NON-STANDARD CENTER DISTANCE			SHEET 2 OF 4
Ø					

TERMINOLOGY	FORMULA		SYMBOL	GEAR (G)	PINION (P)
Major Diameter *	$D + 2a + 2\Delta e_{max}$	Max	D_o		
*	$D_{o_{max}} - \Delta D_o$	Min			
Minimum Tooth Tip Chamfer or Radius Height			Δtip_{min}		
Maximum Tooth Tip Chamfer or Radius Height			Δtip_{max}		
$\sec \emptyset_o$	$D_{o_{max}} \div D_b$		$\sec \emptyset_o$		
$\text{inv } \emptyset_o$	Table of Functions		$\text{inv } \emptyset_o$		
Tooth Thickness at D_o	$D_{o_{max}}\left(\frac{t_{min}}{D} + \text{inv } \emptyset - \text{inv } \emptyset_o\right)$		t_o		
Top Land	$t_o - 2\Delta tip_{max}$ (should be greater than .005)		L_T		
Profile Major Diameter *	$D_{o_{max}} - 2\Delta tip_{min}$	Max	D_M		
*	$D_{o_{min}} - 2\Delta tip_{max}$	Min			
$x = 2C_{x_{min}} \sin \emptyset_x$	$y = \sqrt{D^2_{MG_{max}} - D^2_{bG}}$		$z = \sqrt{D^2_{MP_{max}} - D^2_{bP}}$		
$x_1 = 2C_{x_{max}} \sin \emptyset_x$	$y_1 = \sqrt{D^2_{MG_{min}} - D^2_{bG}}$		$z_1 = \sqrt{D^2_{MP_{min}} - D^2_{bP}}$		
NOTE: x and x_1 must be greater than y and y_1 and z and z_1 respectively.					
Active Profile Diameter *	$\sqrt{(x - z)^2 + D^2_{bG}} - Q_P$	Gear	APD		
*	$\sqrt{(x - y)^2 + D^2_{bP}} - Q_G$	Pinion			
Nominal Tooth Thickness at D	$D\left(\frac{.5p_x}{D_x} + \text{inv } \emptyset_x - \text{inv } \emptyset\right)$		t_{nom}		
Hob Displacement at Zero Backlash	$\left(t_{nom} - \frac{\pi}{2P}\right) \div 2 \tan \emptyset$		Δe_{nom}		
Minor Diameter *	$D - 2b + 2\Delta e_{nom}$	Max	D_R		
*	$D - 2b + 2\Delta e_{min}$	Min			

P		GEAR DESIGN SHEET SG-2 EXTERNAL SPUR GEAR TOOTH DIMENSIONS NON-STANDARD CENTER DISTANCE		SHEET 3 OF 4	
Ø					
TERMINOLOGY		FORMULA	SYMBOL	GEAR (G)	PINION (P)
Form Diameter Maximum *		$\sqrt{\left(D_{R_{max}} + 2\bar{c}\right)^2 + \left(\frac{D - D_{R_{max}} - 2\bar{c}}{\tan \phi}\right)^2}$ ($D - D_{R_{max}} - 2\bar{c}$ must be a positive value)	D_F		
Contact Ratio		$\left(y_1 + z_1 - x_1\right) \div 2p_b$ To assure continuity of action, value must be greater than 1.05 preferably 1.2 or greater	m_p		
W_G ; W_P (may be a positive or negative value)		$W_G = \text{inv } \phi + \frac{d_w}{D_{bG}} - \frac{\pi}{N_G}$ $W_P = \text{inv } \phi + \frac{d_w}{D_{bP}} - \frac{\pi}{N_P}$	W_G W_P		
Involute at Wire Center		$W_G + \frac{t_{G_{max}}}{D_G}$; $W_P + \frac{t_{P_{max}}}{D_P}$ $W_G + \frac{t_{G_{min}}}{D_G}$; $W_P + \frac{t_{P_{min}}}{D_P}$ Max / Min	$\text{inv } \phi_w$		
$\sec \phi_w$		Table of Functions Max / Min	$\sec \phi_w$		
$\tan \phi_{w_{max}}$		Table of Functions	$\tan \phi_w$		
Wire Contact Diameter		$\sqrt{\left(D_b \tan \phi_w - d_w\right)^2 + D_b^2}$	D_c		
Measurement Over Wires (Even Teeth) *		$D_b \sec \phi_w + d_w$ Max / Min	M_E		
Wire Clearance		$d_{w_c} = .5\left(M_{e_{min}} - 2d_w - D_{R_{max}}\right)$ (value must be positive)	d_{w_c}		
Measurement over Wires (Odd Teeth) *		$D_b \cos(90^o/N) \sec \phi_w + d_w$ Max / Min	M_o		
Face Width *			F		

P		GEAR DESIGN SHEET SG-2 EXTERNAL SPUR GEAR TOOTH DIMENSIONS NON-STANDARD CENTER DISTANCE	SHEET 4 OF 4
Ø			

COARSE PITCH GEARS	GEAR (G)	PINION (P)
Maximum Runout Tolerance of Pitch Diameter *		
Lead Tolerance Across Face Width *		
Pitch (Tooth-to-Tooth Spacing) Tolerance *		
Profile Tolerance *		

NOTES:

1. All values designated with an asterisk (*) shall be shown on drawing.
2. To insure accuracy, calculate to a minimum of seven decimal places.
3. Use π to a minimum of seven decimal places.
4. These calculations were performed to _____ decimal places.

P		GEAR DESIGN SHEET SG-3 EXTERNAL SPUR GEAR TOOTH DIMENSIONS LONG ADDENDUM–SHORT ADDENDUM STANDARD CENTER DISTANCE	DATE:
Ø			SHEET 1 OF 4

Pressure Angle *	Ø		inv Ø		cos Ø		
Diametral Pitch *	P		sin Ø		tan Ø		
Gear Backlash at D	B_G		Circular Pitch	$p = \pi \div P$			
Pinion Backlash at D	B_P		Base Pitch	$p_b = \pi \cos Ø \div P$			
Addendum	a	$1 \div P$	Other		$\cos (90^o/N_G)$		
Dedendum	b	$1.25 \div P$	Other		$\cos (90^o/N_P)$		
Clearance	$\bar{c}$	$\bar{c} = b - a$		π (see note 3) =			
AGMA Quality/Class Number			Measuring Wire Diameter *	d_w			
Gear Major Diameter Runout	Q_G		Gear Major Diameter Tolerance	ΔD_{oG}			
Pinion Major Diameter Runout	Q_P		Pinion Major Diameter Tolerance	ΔD_{oP}			

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
Part Number *		-		
Drawing Number *		-	Rev.	Rev.
Number of Teeth *		N		
Pitch Diameter *	$N \div P$	D		
Base Diameter *	$D \cos Ø$	D_b		
Center Distance *	$(N_G + N_P \div 2P)$	C		+.00
Hob Displacement (Show Plus or Minus)	$e_G = -e_P$; $e_{P_{max}} = .5D_G \sin^2 Ø - a$ $e_P \leqq e_{P_{max}}$; $e_{P_{min}} = a - .5D_P \sin^2 Ø$ $e_{P_{min}} \angle e_P \angle e_{P_{max}}$	e		
Hob Displacement for Backlash	$B_{min} \div 2 \tan Ø$ Min $B_{max} \div 2 \tan Ø$ Max	Δe		
Total Hob Displacement (may be plus or minus)	$e - \Delta e_{min}$ Max $e - \Delta e_{max}$ Min	E		

P		GEAR DESIGN SHEET SG-3 EXTERNAL SPUR GEAR TOOTH DIMENSIONS LONG ADDENDUM-SHORT ADDENDUM STANDARD CENTER DISTANCE			SHEET 2 OF 4
Ø					

TERMINOLOGY	FORMULA		SYMBOL	GEAR (G)	PINION (P)
Tooth Thickness at Pitch Diameter (Round off to 4 Decimal Places) *	$.5p + 2E_{max} \tan Ø$ $.5p + 2E_{min} \tan Ø$	Max Min	t		
Major Diameter *	$D + 2a + 2e$ $D_{o_{max}} - \Delta D_o$	Max Min	D_o		
Minimum Tooth Tip Chamfer or Radius Height			Δtip_{min}		
Maximum Tooth Tip Chamfer or Radius Height			Δtip_{max}		
$\sec Ø_o$	$D_{o_{max}} \div D_b$		$\sec Ø_o$		
$\text{inv } Ø_o$	Table of Functions		$\text{inv } Ø_o$		
Tooth Thickness at D_o	$D_{o_{max}} \left(\frac{t_{min}}{D} + \text{inv } Ø - \text{inv } Ø_o \right)$		t_o		
Top Land	$t_o - 2\Delta tip_{max}$ (should be greater than .005)		L_T		
Profile Major Diameter *	$D_{o_{max}} - 2\Delta tip_{min}$ $D_{o_{min}} - 2\Delta tip_{max}$	Max Min	D_M		
$x = 2C_{min} \sin Ø$	$y = \sqrt{D^2_{MG_{max}} - D^2_{bG}}$		$z = \sqrt{D^2_{MP_{max}} - D^2_{bP}}$		
$x_1 = 2C_{max} \sin Ø$	$y_1 = \sqrt{D^2_{MG_{min}} - D^2_{bG}}$		$z_1 = \sqrt{D^2_{MP_{min}} - D^2_{bP}}$		
NOTE: x and x_1 must be greater than y and y_1 and z and z_1 respectively.					
Active Profile Diameter *	$\sqrt{(x - z)^2 + D^2_{bG}} - Q_P$ $\sqrt{(x - y)^2 + D^2_{bP}} - Q_G$	Gear Pinion	APD		

P		GEAR DESIGN SHEET SG-3 EXTERNAL SPUR GEAR TOOTH DIMENSIONS LONG ADDENDUM-SHORT ADDENDUM STANDARD CENTER DISTANCE SHEET 3 OF 4			
Ø					
TERMINOLOGY		FORMULA		SYMBOL	GEAR (G) / PINION (P)
Minor Diameter	*	$D - 2b + 2e$	Max	D_R	
	*	$D - 2b + 2E_{min}$	Min		
Form Diameter Maximum	*	$\sqrt{\left(D_{R_{max}} + 2\bar{c}\right)^2 + \left(\frac{D - D_{R_{max}} - 2\bar{c}}{\tan \emptyset}\right)^2}$ $\left(D - D_{R_{max}} - 2\bar{c}\right.$ must be a positive value$\left.\right)$		D_F	
Contact Ratio		$\left(y_1 + z_1 - x_1 \div 2p_b\right)$ To assure continuity of action, value must be greater than 1.05 preferably 1.2 or greater		m_p	
W_G ; W_P (may be a positive or negative value)		$W_G = \text{inv } \emptyset + \frac{d_w}{D_{bG}} - \frac{\pi}{N_G}$ $W_P = \text{inv } \emptyset + \frac{d_w}{D_{bP}} - \frac{\pi}{N_P}$		W_G W_P	
Involute at Wire Center		$W_G + \frac{t_{G_{max}}}{D_G}$; $W_P + \frac{t_{P_{max}}}{D_P}$ $W_G + \frac{t_{G_{min}}}{D_G}$; $W_P + \frac{t_{P_{min}}}{D_P}$	Max Min	inv $\emptyset_w$	
sec $\emptyset_w$		Table of Functions	Max Min	sec $\emptyset_w$	
tan $\emptyset_{w_{max}}$		Table of Functions		tan $\emptyset_w$	
Wire Contact Diameter		$\sqrt{\left(D_b \tan \emptyset_w - d_w\right)^2 + D_b^2}$		D_c	
Measurement Over Wires (Even Teeth)	*	$D_b \sec \emptyset_w + d_w$	Max Min	M_E	
	*				
Wire Clearance		$d_{w_c} = .5\left(M_{e_{min}} - 2d_w - D_{R_{max}}\right)$ (value must be positive)		d_{w_c}	

P		GEAR DESIGN SHEET SG-3 EXTERNAL SPUR GEAR TOOTH DIMENSIONS LONG ADDENDUM-SHORT ADDENDUM STANDARD CENTER DISTANCE	SHEET 4 OF 4
Ø			

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
Measurement over * Wires (Odd * Teeth)	$D_b \cos(90^o/N)\sec\emptyset_w + d_w$ Max / Min	M_o		
Face Width *		F		

COARSE PITCH GEARS	GEAR (G)	PINION (P)
Maximum Runout Tolerance of Pitch Diameter *		
Lead Tolerance Across Face Width *		
Pitch (Tooth-to-Tooth Spacing) Tolerance *		
Profile Tolerance *		

NOTES:

1. All values designated with an asterisk (*) shall be shown on drawing.
2. To insure accuracy, calculate to a minimum of seven decimal places.
3. Use π to a minimum of seven decimal places.
4. These calculations were performed to _____ decimal places.

P_n		GEAR DESIGN SHEET HG-1 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS STANDARD CENTER DISTANCE	DATE:
ϕ_n			SHEET 1 OF 4

Normal Diametral Pitch *	P_n		Helix Angle *	ψ			
Normal Pressure Angle *	ϕ_n		$\sin \psi$		$\cos \psi$		
$\tan \phi = \tan \phi_n \div \cos \psi$			$\sin \phi_n$		$\tan \phi_n$		
Transverse Pressure Angle	ϕ		$\cos \psi_b = \sin \phi_n \div \sin \phi$				
Normal Backlash of Gear	B_{nG}		$\sin \phi$		$\cos \phi$		
Normal Backlash of Pinion	B_{nP}		$\text{inv } \phi$		π (see note 3) =		
Addendum	a	$1 \div P_n$	Other		Normal Circular Pitch	$p_n = \pi \div P_n$	
Dedendum	b	$1.25 \div P_n$	Other		Circular Pitch	$p = \pi \div P_n \cos \psi$	
Clearance	$\bar{c}$	$\bar{c} = b - a$			AGMA Quality/Class Number		
Base Pitch	$p_b = p \cos \phi$				Measuring Wire Diameter *	d_w	
Gear Major Diameter Runout	Q_G				Gear Major Diameter Tolerance	ΔD_{oG}	
Pinion Major Diameter Runout	Q_P				Pinion Major Diameter Tolerance	ΔD_{oP}	

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
Part Number *		-		
Drawing Number *		-	Rev.	Rev.
Number of Teeth *		N		
Pitch Diameter *	$N \div P_n \cos \psi$	D		
Base Diameter *	$D \cos \phi$	D_b		
Center Distance *	$(N_G + N_P) \div 2P_n \cos \psi$	C		+.00
Normal Tooth Thickness at Pitch Diameter (Round off to 4 Decimal Places) *	$.5p_n - B_{nG_{min}}$; $.5p_n - B_{nP_{min}}$ Max $.5p_n - B_{nG_{max}}$; $.5p_n - B_{nP_{max}}$ Min	t_n		
Transverse Arc Tooth Thickness	$t_{nG_{max}} \div \cos\psi$; $t_{nP_{max}} \div \cos\psi$ Max $t_{nG_{min}} \div \cos\psi$; $t_{nP_{min}} \div \cos\psi$ Min	t		

P_n		GEAR DESIGN SHEET HG-1 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS STANDARD CENTER DISTANCE			SHEET 2 OF 4
$\emptyset_n$					

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
Major Diameter * / *	$D + 2a$ (Max) / $D_{o_{max}} - \Delta D_o$ (Min)	D_o		
Minimum Tooth Tip Chamfer or Radius Height		Δtip_{min}		
Maximum Tooth Tip Chamfer or Radius Height		Δtip_{max}		
$\sec \emptyset_o$	$D_{o_{max}} \div D_b$	$\sec \emptyset_o$		
$\text{inv } \emptyset_o$	Table of Functions	$\text{inv } \emptyset_o$		
Tooth Thickness at D_o	$D_{o_{max}} \left(\frac{t_{min}}{D} + \text{inv } \emptyset - \text{inv } \emptyset_o \right)$	t_o		
Top Land	$t_o - 2\Delta\, tip_{max}$ (should be greater than .010)	L_T		
Profile Major Diameter * / *	$D_{o_{max}} - 2\Delta\, tip_{min}$ (Max) / $D_{o_{min}} - 2\Delta\, tip_{max}$ (Min)	D_M		
$x = 2C_{min} \sin \emptyset$	$y = \sqrt{D^2_{MG_{max}} - D^2_{bG}}$		$z = \sqrt{D^2_{MP_{max}} - D^2_{bP}}$	
$x_1 = 2C_{max} \sin \emptyset$	$y_1 = \sqrt{D^2_{MG_{min}} - D^2_{bG}}$		$z_1 = \sqrt{D^2_{MP_{min}} - D^2_{bP}}$	
NOTE: x and x_1 must be greater than y and y_1 and z and z_1 respectively.				
Active Profile Diameter * / *	$\sqrt{(x - z)^2 + D^2_{bP}} - Q_P$ (Gear) / $\sqrt{(x - y)^2 + D^2_{bP}} - Q_G$ (Pinion)	APD		
Hob Displacement for Backlash	$B_{nG_{max}} \div 2\tan \emptyset_n$; $B_{nP_{max}} \div 2\tan \emptyset_n$	Δe		
Minor Diameter * / *	$D - 2b$ (Max) / $D - 2b - 2\Delta e$ (Min)	D_R		

P_n		GEAR DESIGN SHEET HG-1 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS STANDARD CENTER DISTANCE			SHEET 3 OF 4
ϕ_n					
TERMINOLOGY		FORMULA		SYMBOL	GEAR (G)	PINION (P)
Form Diameter * Max		$\sqrt{\left(D_{R_{max}} + 2\bar{c}\right)^2 + \left(\frac{D - D_{R_{max}} - 2\bar{c}}{\tan \phi}\right)^2}$ ($D - D_{R_{max}} - 2\bar{c}$ must be a positive value)		D_F		
Face Width *				F		
Total Contact Ratio		$\left[\left(y_1 + z_1 - x_1\right) \div 2p_b\right] + \frac{F \sin \psi}{P_n}$		m_p		
W_G ; W_P (may be positive or negative values)		$W_G = \text{inv } \phi + \frac{d_w \sec \psi_b}{D_{bG}} - \frac{\pi}{N_G}$		W_G		
		$W_P = \text{inv } \phi + \frac{d_w \sec \psi_b}{D_{bP}} - \frac{\pi}{N_P}$		W_P		
Involute at Wire Center		$W_G + \frac{t_{G_{max}}}{D_G}$; $W_P + \frac{t_{P_{max}}}{D_P}$	Max	$\text{inv } \phi_w$		
		$W_G + \frac{t_{G_{min}}}{D_G}$; $W_P + \frac{t_{P_{min}}}{D_P}$	Min			
$\sec \phi_w$		Table of Functions	Max / Min	$\sec \phi_w$		
$\tan \phi_{w_{max}}$		Table of Functions		$\tan \phi_w$		
Wire Contact Diameter		$\sqrt{\left(D_b \tan \phi_w - d_w \cos \psi_b\right)^2 + D_b^2}$		D_c		
Measurement * Over Wires * (Even Teeth)		$D_b \sec \phi_w + D_w$	Max / Min	M_E		
Wire Clearance		$d_{w_c} = .5\left(M_{E_{min}} - 2d_w - D_{R_{max}}\right)$ (value must be positive)		d_{w_c}		

P_n		GEAR DESIGN SHEET HG-1 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS STANDARD CENTER DISTANCE			SHEET 4 OF 4
$\emptyset_n$					

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
Measurement * Over One Wire * (Odd Teeth)	$\frac{1}{2}$ M_E Max / Min	M_O		
Lead *	$\pi N \div P_n \sin \psi$	L		

COARSE PITCH GEARS		GEAR (G)	PINION (P)
Maximum Runout Tolerance of Pitch Diameter	*		
Lead Tolerance Across Face Width	*		
Pitch (Tooth-To-Tooth Spacing) Tolerance	*		
Profile Tolerance	*		

NOTES:

1. All values designated with an asterisk (*) shall be shown on drawing.
2. To insure accuracy, calculate to a minimum of seven decimal places.
3. Use π to a minimum of seven decimal places.
4. These calculations were performed to _____ decimal places.

P_n		GEAR DESIGN SHEET HG-2 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS NON-STANDARD CENTER DISTANCE	DATE:
ϕ_n			SHEET 1 OF 4

Normal Diametral Pitch *	P_n		Helix Angle *	ψ			
Normal Pressure Angle *	ϕ_n		$\sin \psi$		$\cos \psi$		
$\sin \phi_n$		$\tan \phi_n$		$\tan \phi = \tan \phi_n \div \cos \psi$			
$\cos \phi_n$		Transverse Pressure Angle	ϕ		$\cos \phi$		
inv ϕ		$\sin \phi$		$\cos \psi_b = \sin \phi_n \div \sin \phi$			

Normal Gear Backlash at D	B_{nG}		Addendum	a	$1 \div P_n$	Other	
Normal Pinion Backlash at D	B_{nP}		Dedendum	b	$1.25 \div P_n$	Other	
Operating Center Distance *	C_x	+.00	Clearance	$\bar{c}$	b - a		
Operating Pitch Diameter *	$2NC_x \div (N_G + N_P)$	D_{xG}		D_{xP}			
Circular Pitch	$p = \pi \div P_n \cos \psi$		Base Pitch	$p_b = p \cos \phi$			
Normal Circular Pitch	$p_n = \pi \div P_n$		π (see note 3) =				
Circular Pitch at D_x	$p_x = \pi D_x \div N$		$\cos \phi_x = D_b \div D_x$				
Operating Pressure Angle *	ϕ_x		$\sin \phi_x$		$\text{inv } \phi_x$		
AGMA Quality/Class Number			Measuring Wire Diameter *	d_w			
Gear Major Diameter Runout	Q_G		Gear Major Diameter Tolerance	ΔD_{oG}			
Pinion Major Diameter Runout	Q_P		Pinion Major Diameter Tolerance	ΔD_{oP}			

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
Part Number *		-		
Drawing Number *		-	Rev.	Rev.
Number of Teeth *		N		
Pitch Diameter *	$N \div P_n \cos \psi$	D		
Base Diameter *	$D \cos \phi$	D_b		
Backlash In Transverse Plane at D_x	$B_{x_{min}} = \frac{B_{n_{min}} \cos \phi}{\cos \phi_n \cos \psi \cos \phi_x}$ (Min) $B_{x_{max}} = \frac{B_{n_{max}} \cos \phi}{\cos \phi_n \cos \psi \cos \phi_x}$ (Max)	B_x		

P_n		GEAR DESIGN SHEET HG-2 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS NON-STANDARD CENTER DISTANCE			SHEET 2 OF 4
$\emptyset_n$					

TERMINOLOGY	FORMULA		SYMBOL	GEAR (P)	PINION (P)
Actual Transverse Tooth Thickness at D_x	$.5p_x - B_{x_{min}}$ $.5p_x - B_{x_{max}}$	Max Min	t_x		
Normal Tooth Thickness at D (Round off to 4 Decimal Places) *	$D\left(\frac{t_x}{D_x} + \text{inv}\,\emptyset_x - \text{inv}\,\emptyset\right)\cos\psi$	Max Min	t_n		
Total Hob Displacement	$\left(t_n - \frac{\pi}{2P_n}\right) \div 2\tan\emptyset_n$	Max Min	Δe		
Major Diameter *	$D + 2a + 2\Delta e_{max}$ $D_{o_{max}} - \Delta D_o$	Max Min	D_o		
Minimum Tooth Tip Chamfer or Radius Height			Δtip_{min}		
Maximum Tooth Tip Chamfer or Radius Height			Δtip_{max}		
$\sec\emptyset_o$	$D_{o_{max}} \div D_b$		$\sec\emptyset_o$		
$\text{inv}\,\emptyset_o$	Table of Functions		$\text{inv}\,\emptyset_o$		
Tooth Thickness at D_o	$D_{o_{max}}\left(\frac{t_{n_{min}}}{D\cos\psi} + \text{inv}\,\emptyset - \text{inv}\,\emptyset_o\right)$		t_o		
Top Land	$t_o - 2\,\Delta tip_{max}$ (should be greater than .010)		L_T		
Profile Major Diameter *	$D_{o_{max}} - 2\,\Delta tip_{min}$ $D_{o_{min}} - 2\,\Delta tip_{max}$	Max Min	D_M		

$x = 2C_{x_{min}} \sin\emptyset_x$		$y = \sqrt{D^2_{MG_{max}} - D^2_{bG}}$		$z = \sqrt{D^2_{MP_{max}} - D^2_{bP}}$	
$x_1 = 2C_{x_{max}} \sin\emptyset_x$		$y_1 = \sqrt{D^2_{MG_{min}} - D^2_{bG}}$		$z_1 = \sqrt{D^2_{MP_{min}} - D^2_{bP}}$	

NOTE: x and x_1 must be greater than y and y_1 and z and z_1 respectively.

P_n		GEAR DESIGN SHEET HG-2 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS NON-STANDARD CENTER DISTANCE			SHEET 3 OF 4
ϕ_n					

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
Active Profile Diameter *	$\sqrt{(x - z)^2 + D_{bG}^2} - Q_P$ Gear	APD		
*	$\sqrt{(x - y)^2 + D_{bP}^2} - Q_G$ Pinion			
Normal Nominal Tooth Thickness at D	$D\left(\frac{.5p_x}{D_x} + \text{inv}\,\phi_x - \text{inv}\,\phi\right)\cos\not\phi$	t_{n_N}		
Hob Displacement at Zero Backlash	$\left(t_{n_N} - \frac{\pi}{2P_n}\right) \div 2\tan\phi_n$	Δe_{nom}		
Minor Diameter *	$D - 2b + 2\,\Delta e_{nom}$ Max	D_R		
*	$D - 2b + 2\,\Delta e_{min}$ Min			
Form Diameter Max *	$\sqrt{\left(D_{R_{max}} + 2\bar{c}\right)^2 + \left(\frac{D - D_{R_{max}} - 2\bar{c}}{\tan\phi}\right)^2}$ ($D - D_{R_{max}} - 2\bar{c}$ must be a positive value)	D_F		
Face Width *		F		
Total Contact Ratio	$\left[\left(y_1 + z_1 - x_1\right) \div 2p_b\right] + \frac{F \sin\not\phi}{p_n}$	m_p		
W_G ; W_P (may be positive or negative values)	$W_G = \text{inv}\,\phi_x + \frac{d_w}{D_{bG}\cos\not\phi_b} - \frac{\pi}{N_G}$	W_G		
	$W_P = \text{inv}\,\phi_x + \frac{d_w}{D_{bP}\cos\not\phi_b} - \frac{\pi}{N_P}$	W_P		
Involute at Wire Center	$W_G + \frac{t_{xG_{max}}}{D_{xG}}$; $W_P + \frac{t_{xP_{max}}}{D_{xP}}$ Max	$\text{inv}\,Q_w$		
	$W_G + \frac{t_{xG_{min}}}{D_{xG}}$; $W_P + \frac{t_{xP_{min}}}{D_{xP}}$ Min			

P_n		GEAR DESIGN SHEET HG-2 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS NON-STANDARD CENTER DISTANCE	SHEET 4 OF 4
ϕ_n			

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
sec ϕ_w	Table of Functions Max / Min	sec ϕ_w		
tan $\phi_{w_{max}}$	Table of Functions	tan ϕ_w		
Wire Contact Diameter	$\sqrt{\left(D_b \tan \phi_w - d_w \cos \psi_b\right)^2 + D_b^2}$	D_c		
Measurement Over * Wires (Even Teeth) *	$D_b \sec \phi_w + d_w$ Max / Min	M_E		
Wire Clearance	$d_{w_c} = \left(.5\ M_{E_{min}} - 2d_w - D_{R_{max}}\right)$ (value must be positive)	d_{w_c}		
Measurement Over * One Wire (Odd Teeth) *	$\frac{1}{2} M_E$ Max / Min	M_o		
Lead *	$\pi N \div P_n \sin \psi$	L		

COARSE PITCH GEARS		GEAR (G)	PINION (P)
Maximum Runout Tolerance of Pitch Diameter	*		
Lead Tolerance Across Face Width	*		
Pitch (Tooth-to-Tooth Spacing) Tolerance	*		
Profile Tolerance	*		

NOTES:

1. All values designated with an asterisk (*) shall be shown on drawing.
2. To insure accuracy, calculate to a minimum of seven decimal places.
3. Use π to a minimum of seven decimal places.
4. These calculations were performed to _____ decimal places.

P_n		GEAR DESIGN SHEET HG-3 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS LONG ADDENDUM-SHORT ADDENDUM STANDARD CENTER DISTANCE	DATE:
ϕ_n			SHEET 1 OF 4

Normal Diametral Pitch *	P_n		Helix Angle *	ψ			
Normal Pressure Angle *	ϕ_n		$\sin\psi$		$\cos\psi$		
$\tan\phi = \tan\phi_n \div \cos\psi$			$\sin\phi_n$		$\tan\phi_n$		
Transverse Pressure Angle	ϕ		$\cos\psi_b = \sin\phi_n \div \sin\phi$				
Normal Gear Backlash at D	B_{nG}		$\sin\phi$		$\cos\phi$		
Normal Pinion Backlash at D	B_{nP}		$\text{inv}\,\phi$		π (see note 3) =		

Addendum	a	$1 \div P_n$	Other		Normal Circular Pitch	$p_n = \pi \div P_n$	
Dedendum	b	$1.25 \div P_n$	Other		Circular Pitch	$p = \pi \div P_n \cos\psi$	
Clearance	$\overline{c}$	$\overline{c} = b - a$			Measuring Wire Diameter *	d_w	
Base Pitch	$p_b = p \cos\phi$				AGMA Quality/Class Number		
Gear Major Diameter Runout	Q_G		Gear Major Diameter Tolerance	ΔD_{oG}			
Pinion Major Diameter Runout	Q_P		Pinion Major Diameter Tolerance	ΔD_{oP}			

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
Part Number *		-		
Drawing Number *		-	Rev.	Rev.
Number of Teeth *		N		
Pitch Diameter *	$N \div P_n \cos\psi$	D		
Base Diameter *	$D \cos\phi$	D_b		
Center Distance *	$(N_G + N_P) \div 2P_n \cos\psi$	C	+.00	
Hob Displacement (Show plus or minus)	$e_G = -e_P$; $e_{P_{max}} = .5D_G\sin^2\phi_n - a$ $e_P \leqq e_{P_{max}}$; $e_{P_{min}} = a - .5D_P\sin^2\phi_n$	e		
Hob Displacement for Backlash	$B_{nG_{min}} \div 2\tan\phi_n ; B_{nP_{min}} \div 2\tan\phi_n$ Min $B_{nG_{max}} \div 2\tan\phi_n ; B_{nP_{min}} \div 2\tan\phi_n$ Max	Δe		

P_n		GEAR DESIGN SHEET HG-3 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS LONG ADDENDUM-SHORT ADDENDUM STANDARD CENTER DISTANCE			SHEET 2 OF 4
ϕ_n					

TERMINOLOGY	FORMULA		SYMBOL	GEAR (G)	PINION (P)
Total Hob Displacement (may be plus or minus)	$e - \Delta e_{min}$ $e - \Delta e_{max}$	Max Min	E		
* Normal Tooth Thickness at D * (Round off to 4 Decimal Places)	$.5p_n + 2E_{max} \tan \phi_n$ $.5p_n + 2E_{min} \tan \phi_n$	Max Min	t_n		
Transverse Arc Tooth Thickness	$t_{n_{max}} \div \cos \psi$ $t_{n_{min}} \div \cos \psi$	Max Min	t		
* Major Diameter *	$D + 2a + 2e$ $D_{o_{max}} - \Delta D_o$	Max Min	D_o		
Minimum Tooth Tip Chamfer or Radius Height			Δtip_{min}		
Maximum Tooth Tip Chamfer or Radius Height			Δtip_{max}		
sec ϕ_o	$D_{o_{max}} \div D_b$		sec ϕ_o		
inv ϕ_o	Table of Functions		inv ϕ_o		
Tooth Thickness at D_o	$D_{o_{max}} \left(\frac{t_{min}}{D} + \text{inv } \phi - \text{inv } \phi_o \right)$		t_o		
Top Land	$t_o - 2\Delta tip_{max}$ (should be greater than .010)		L_T		
* Profile Major Diameter *	$D_{o_{max}} - 2\Delta tip_{min}$ $D_{o_{min}} - 2\Delta tip_{max}$	Max Min	D_M		

$x = 2C_{min} \sin \phi$		$y = \sqrt{D^2_{MG_{max}} - D^2_{bG}}$		$z = \sqrt{D^2_{MP_{max}} - D^2_{bP}}$	
$x_1 = 2C_{max} \sin \phi$		$y_1 = \sqrt{D^2_{MG_{min}} - D^2_{bG}}$		$z_1 = \sqrt{D^2_{MP_{min}} - D^2_{bP}}$	

NOTE: x and x_1 must be greater than y and y_1 and z and z_1 respectively.

P_n		GEAR DESIGN SHEET HG-3 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS LONG ADDENDUM-SHORT ADDENDUM STANDARD CENTER DISTANCE			SHEET 3 OF 4
ϕ_n					

TERMINOLOGY	FORMULA		SYMBOL	GEAR (G)	PINION (P)
Active Profile Diameter *	$\sqrt{(x - z)^2 + D_{bG}^2} - Q_P$	Gear	APD		
*	$\sqrt{(x - y)^2 + D_{bP}^2} - Q_G$	Pinion			
Minor Diameter *	$D - 2b + 2e$	Max	D_R		
*	$D - 2b + 2E_{min}$	Min			
Form Diameter Max *	$\sqrt{\left(D_{R_{max}} + 2\bar{c}\right)^2 + \left(\frac{D - D_{R_{max}} - 2\bar{c}}{\tan \phi}\right)^2}$ ($D - D_{R_{max}} - 2\bar{c}$ must be a positive value)		D_F		
Face Width *			F		
Total Contact Ratio	$\left[\left(y_1 + z_1 - x_1\right) \div 2p_b\right] + \frac{F \sin \psi}{p_n}$		m_p		
W_G ; W_P (may be positive or negative values)	$W_G = \text{inv } \phi + \frac{d_w}{D_{b_G} \cos \psi_b} - \frac{\pi}{N_G}$		W_G		
	$W_P = \text{inv } \phi + \frac{d_w}{D_{b_P} \cos \psi_b} - \frac{\pi}{N_P}$		W_P		
Involute at Wire Center	$W_G + \frac{t_{G_{max}}}{D_G}$; $W_P + \frac{t_{P_{max}}}{D_P}$	Max	$\text{inv } \phi_w$		
	$W_G + \frac{t_{G_{min}}}{D_G}$; $W_P + \frac{t_{P_{min}}}{D_P}$	Min			
$\sec \phi_w$	Table of Functions	Max Min	$\sec \phi_w$		
$\tan \phi_{w_{max}}$	Table of Functions		$\tan \phi_w$		

P_n		GEAR DESIGN SHEET HG-3 EXTERNAL HELICAL GEAR TOOTH DIMENSIONS LONG ADDENDUM-SHORT ADDENDUM STANDARD CENTER DISTANCE	SHEET 4 OF 4
ϕ_n			

TERMINOLOGY	FORMULA	SYMBOL	GEAR (G)	PINION (P)
Wire Contact Diameter	$\sqrt{\left(D_b \tan \phi_w - d_w \cos \psi_b\right)^2 + D_b^2}$	D_c		
Measurement Over Wires (Even Teeth) *	$D_b \sec \phi_w + d_w$ Max / Min	M_E		
Wire Clearance	$d_{w_c} = .5\left(M_{E_{min}} - 2d_w - D_{R_{max}}\right)$ (value must be positive)	d_{w_c}		
Measurement Over One Wire (Odd Teeth) *	$\frac{1}{2} M_E$ Max / Min	M_o		
Lead *	$\pi N \div P_n \sin \psi$	L		

COARSE PITCH GEARS		GEAR (G)	PINION (P)
Maximum Runout Tolerance of Pitch Diameter	*		
Lead Tolerance Across Face Width	*		
Pitch (Tooth-to-Tooth Spacing) Tolerance	*		
Profile Tolerance	*		

NOTES:

1. All values designated with an asterisk (*) shall be shown on drawing.
2. To insure accuracy, calculate to a minimum of seven decimal places.
3. Use π to a minimum of seven decimal places.
4. These calculations were performed to _____ decimal places.

6. NOTES

6.1 Supersession data. This handbook supersedes USA TACOM Pamphlet No. 11-46, 31 August 1973.

6.2 Subject term (key word) listing.

Engineering drawings, gear and spline
Gear and spline, preparation of engineering drawings
Spline and gear, preparation of engineering drawings

Custodian:
Army - AT
Air Force - 99

Review activities:
Army - ME

Preparing activity:
Army - AT

(Project 3020-0109)

APPENDIX

10.1 General. For convenience, the appendix contains tables, examples, formulas, etc., frequently used by the designer in the preparation of gear and spline drawings.

a. It is recommended that designers familiarize themselves with the instructions outlined in the text prior to the use of the tables and formulas.

b. To assist the designer in the interpretation of the requirements of this handbook, several examples of drawings are included in the appendix. These sample drawings shall be construed as informational only and are complete to the degree necessary to illustrate a condition. Actual drawings shall comply with the instructions set forth in the handbook.

c. Specification of measuring wire or ball sizes on drawings shall be to sizes listed in the table and/or according to the instructions contained in the appendix.

d. Involute profile controls require the specification of roll angles, as in profile charts. A table of roll angles is listed here for the convenience of the user.

e. Specific instructions for the use of all tables and formulas are outlined in the text.

10.2 Wire size policy. Recent practice has shown that measurement of gears, splines, and serrations is frequently accomplished through the use of two or three identical sized wires or pins. This method necessitates the use of proper diameter of measuring wire or pin in order to obtain reliable readings. The reasons for using this method are cost and procurement considerations, especially for small quantities. It is sometimes used in the early production of large orders.

a. It is desirable to use wires that contact the profile at or near the pitch diameters and/or reference diameter. With such wires the measurement at or near the pitch diameter is least affected by profile deviations. To illustrate this, consider figure 116 which shows a full line depicting a true outline and a dotted line showing a profile of the same pitch diameter but with a profile deviation. The same conditions would affect circular gears, splines, and serrations. The wire (B) contacts both outlines at or near the pitch diameter, and the measurement will be affected very little by profile deviations. It is evident from the same figure that a maximum wire (M) will give false results unless the profile deviation is considered in the computation.