

ski-doo®

1998



Racing Handbook

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1998 RACER HANDBOOK

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◆ WARNING

This information relates to the preparation and use of snowmobiles in competitive events. Bombardier Inc. disclaims liability for all damages and/or injuries resulting from the improper use of the contents. We strongly recommend that these modifications be carried out and/or verified by a highly-skilled professional racing mechanic. It is understood that racing or modifications of any Bombardier-made snowmobile voids the vehicle warranty and that such modifications may render use of the vehicle illegal in other than sanctioned racing events under existing federal, provincial and state regulations.

KEEPING YOUR MACHINE LEGAL IS YOUR RESPONSIBILITY

Read and know your rule books.

SECTION 01 - HOW TO COMMUNICATE

GENERAL

If you have any suggestions on new information and ideas to improve next year's handbook, including any errors or omissions, please mail or fax to;

Ski-Doo Race Department
Bombardier Corp.,
P.O. Box 8035
Wausau, Wisc.
54402-8035.

For additional information or to pass on your feedback and suggestions please contact the following people using the racer report format.

Your information is important to us

Ovals, Drags, Speed runs, Cross-Country, Sno Cross		
Bill Rader	Phone hotline	715-847-6884
	Fax hotline	715-847-6869

Mountain, hill climb, deep snow		
Mark Thompson	Fax hotline	801-753-3034

To ensure timely and accurate response to questions we will respond by fax, whenever possible.

A wide range of excellent publications and special tools are available to support your racing activities.

See Section 06-1, Competition bulletins-racing parts, useful publications.

NOTE: Order all items through your local Ski Doo dealer.

SECTION 01 - HOW TO COMMUNICATE



OVAL, DRAGS, RADAR RUNS

ATTN: Bill Rader
FAX: 715-847-6869

Date: _____

Driver Name: _____ Driver Phone Number: _____

Dealership Name: _____ Dealer Phone Number: _____

Vehicle Type: _____ Odometer Reading: _____ Serial Number: _____

Race Type: _____ Class: _____

Location: _____ Finish Position: _____

Temperature: _____ Altitude: _____ Main Jet: _____

Surface Conditions: _____

Top Speed Observed: _____ RPM Observed: _____

OPTIONAL:

TRA: Spring: _____ DRIVEN: Spring: _____

Ramps: _____ Cam: _____

Adjuster Position: _____ Pre-Load: _____

Pins: _____ CHAINCASE Top: _____

Arm Type: _____ GEARING: Bottom: _____

LIST PROBLEMS OBSERVED AND RECOMMENDED SOLUTIONS OR SUGGESTIONS,
PLEASE INCLUDE SKETCHES:

"Your information is important to us".

SECTION 01 - HOW TO COMMUNICATE



CROSS-COUNTRY, SNO CROSS

ATT: Bill Rader
FAX: 715-847-6869

Date: _____

Driver Name: _____ Driver Phone Number: _____

Dealership Name: _____ Dealer Phone Number: _____

Vehicle Type: _____	Odometer Reading: _____	Serial Number: _____
Race Type: _____	Class: _____	
Location: _____	Finish Position: _____	
Temperature: _____	Altitude: _____	Main Jet: _____
Surface Conditions: _____		
Top Speed Observed: _____	RPM Observed: _____	

OPTIONAL:	
TRA: Spring: _____	DRIVEN: Spring: _____
Ramps: _____	Cam: _____
Adjuster Position: _____	Pre-Load: _____
Pins: _____	CHAINCASE Top: _____
Arm Type: _____	GEARING: Bottom: _____

LIST PROBLEMS OBSERVED AND RECOMMENDED SOLUTIONS OR SUGGESTIONS,
PLEASE INCLUDE SKETCHES:

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SECTION 01 - HOW TO COMMUNICATE



HILLCLIMB, MOUNTAIN

ATTN: Mark Thompson

FAX: 801-753-3034

Date: _____

Driver Name: _____ Driver Phone Number: _____

Dealership Name: _____ Dealer Phone Number: _____

Vehicle Type: _____ Odometer Reading: _____ Serial Number: _____

Race Type: _____ Class: _____

Location: _____ Finish Position: _____

Temperature: _____ Altitude: _____ Main Jet: _____

Surface Conditions: _____

Top Speed Observed: _____ RPM Observed: _____

OPTIONAL:

TRA: Spring: _____ DRIVEN: Spring: _____

Ramps: _____ Cam: _____

Adjuster Position: _____ Pre-Load: _____

Pins: _____ CHAINCASE Top: _____

Arm Type: _____ GEARING: Bottom: _____

LIST PROBLEMS OBSERVED AND RECOMMENDED SOLUTIONS OR SUGGESTIONS,
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SECTION 02 - WHAT'S NEW FOR 1998

Engines

		VEHICLE MODEL	TUNDRA II LT	TOURING E, SKANDIC 380, FORMULA S, FORMULA S ELEC.	TOURING LE	SKANDIC 500, FORMULA SL	
ENGINE TYPE			277	377	443	503	
	Number of Cylinders		1	2	2	2	
	Bore	mm (in)	72.00 (2.835)	62.00 (2.441)	67.5 (2.66)	72.00 (2.835)	
	Stroke	mm (in)	66.00 (2.598)	61.00 (2.402)	61.00 (2.402)	61.00 (2.402)	
	Displacement	cm ³ (in ³)	268.70 (16.40)	368.30 (22.48)	436.6 (26.64)	496.70 (30.31)	
	Compression Ratio (corrected)		6.70	6.80	6.4	6.20	
	Maximum Power Engine Speed ①		± 100 RPM	6900	6900	7000	7000
	Piston Ring Type		1 st /2 nd	ST/R	ST/R	ST/R	ST/R
	Ring End Gap	(new)	mm (in)	0.2 (.008)	0.2 (.008)	0.2 (.008)	0.2 (.008)
		(wear limit)	mm (in)	1.0 (.039)	1.0 (.039)	1.0 (.039)	1.0 (.039)
	Ring/Piston Groove Clearance	(new)	mm (in)	0.04 (.0016)	0.04 (.0016)	0.04 (.0016)	0.04 (.0016)
		(wear limit)	mm (in)	0.2 (.008)	0.2 (.008)	0.2 (.008)	0.2 (.008)
	Piston/Cylinder Wall Clearance	(new)	mm (in)	0.090 (.0031)	0.060 (.0024)	0.080 (.0031)	0.090 (.0035)
		(wear limit)	mm (in)	0.2 (.008)	0.2 (.008)	0.2 (.008)	0.2 (.008)
	Connecting Rod Big End Axial Play	(new)	mm (in)	0.20 (.0079)	0.20 (.0079)	0.20 (.0079)	0.2 (.0079)
		(wear limit)	mm (in)	1.0 (.0394)	1.0 (.0394)	1.0 (.0394)	1.0 (.0394)
Maximum Crankshaft End-play ②		mm (in)	0.3 (.0118)	0.3 (.0118)	0.3 (.0118)	0.3 (.0118)	
Maximum Crankshaft Deflection Measured at Center		mm (in)	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)	
Rotary Valve Timing ③		Opening Closing	N.A.	N.A.	N.A.	N.A.	
	Magneto Generator Output		W	160	240	240	
	Ignition Type			CDI	CDI	CDI	
	Spark Plug Make and Type			NGK BR9ES	NGK BR9ES	NGK BR9ES	
	Spark Plug Gap	mm (in)	0.45 (.018)	0.45 (.018)	0.45 (.018)	0.45 (.018)	
	Ignition Timing BTDC ④		mm (in)	2.52 (.099)	1.68 (.066)	1.38 (.054)	1.66 (.065)
	Trigger Coil ⑤			N.A.	140 – 180	140 – 180	140 – 180
	Generating Coil ⑤	Low Speed	Ω	40 – 76	N.A.	N.A.	N.A.
		High Speed	Ω	N.A.	230 – 330	230 – 330	230 – 330
	Lighting Coil ⑤		Ω	0.05 – 0.6	0.23 – 0.28	0.23 – 0.28	0.23 – 0.28
High Tension Coil ⑤	Primary	Ω	0.11 – 0.21	N.A.	N.A.	N.A.	
	Secondary	kΩ	4.9 – 7.5	5.1 – 6.3	5.1 – 6.3	5.1 – 6.3	
	Carburetor Type		PTO/MAG	VM 34-508	2 x VM 30-193	VM 34-511/512	VM 34-513/514
	Main Jet		PTO/MAG	190	140/140	200/190	180/170
	Needle Jet			159 O-8	159 P-0	159 P-0	159 P-0
	Pilot Jet			40	40	35	40
	Needle Identification – Clip Position			6DH4-2	6DP9-3	6DH2-3	6DH2-3
	Slide Cut-away			2.5	2.5	2.5	2.5
	Float Adjustment		± 1 mm (± .040in)	23.9 (.94)	23.9 (.94)	23.9 (.94)	23.9 (.94)
	Air Screw Adjustment		± 1/16 turn	1	1-1/4	1-1/2	1-7/8
	Idle Speed RPM		± 200 RPM	1200	1650	1650	1650
	Gas Type/Pump Octane Number			Unleaded/87	Unleaded/87	Unleaded/87	Unleaded/87
Gas/Oil Ratio			Injection	Injection	Injection	Injection	
	Type		Radial Fan	Axial Fan	Axial Fan	Axial Fan	
	Axial Fan Belt Adjustment	Deflection	mm (in)	N.A.	8 – 9 (.31 – .35)	8 – 9 (.31 – .35)	9 – 10 (.35 – .39)
		Force ⑥	kg (lbf)	N.A.	5 (11)	5 (11)	5 (11)
	Thermostat Opening Temperature		°C (°F)	N.A.	N.A.	N.A.	N.A.
Radiator Cap Opening Pressure		kPa (PSI)	N.A.	N.A.	N.A.	N.A.	
	ENGINE COLD N·m (lbf·ft)						
	Drive Pulley Retaining Screw ⑦			95 (70)	95 (70)	95 (70)	95 (70)
	Exhaust Manifold Nuts or Bolts			25 (18)	22 (16)	22 (16)	22 (16)
	Magneto Ring Nut			90 (66)	105 (77)	105 (77)	105 (77)
	Crankcase Nuts or Screws		M6 M8	— 22 (16)	10 (7) 22 (16)	10 (7) 22 (16)	— 22 (16)
	Crankcase/Engine Support Nuts or Screws			21 (15)	38 (28)	38 (28)	38 (28)
	Cylinder Head Nuts			26 (19)	22 (16)	22 (16)	22 (16)
Crankcase/Cylinder Nuts or Screws			N.A.	N.A.	N.A.	N.A.	
Axial Fan Shaft Nut			N.A.	50 (37)	50 (37)	50 (37)	






SECTION 02 - WHAT'S NEW FOR 1998

Vehicles

		VEHICLE MODEL	TUNDRA II LT	TOURING E	FORMULA S, FORMULA S ELEC.
		ENGINE TYPE	277	377	377
		Chain Drive Ratio	14/25	18/44	21/44
	Chain	Pitch in	1/2	3/8	3/8
		Type/Links Qty/Plates Qty	Single/62	Silent/70/11	Silent/72/11
	Drive Pulley	Type of Drive Pulley	Bombardier Lite	Bombardier Lite	Bombardier Lite
		Ramp Identification	N.A.	N.A.	N.A.
		Calibration Screw Position or Calibration Part ②	1143 2 x C	1181 1 x C	1181 1 x C
		Spring Color	Turquoise	Green/Green	Red/Blue
		Spring Length ± 1.5 mm (± .060 in)	85.3 (3.36)	72.0 (2.83)	96 (3.78)
		Clutch Engagement ± 200 RPM	3100	2500	3500
		Driven Pulley Spring Preload ± 0.7 kg (± 1.5 lb)	3.6 (7.9)	4.8 (10.6)	4.8 (10.6)
		Cam Angle degree	37.8°	44°	44°
		Pulley Distance Z (+0, -1) mm ((+0, -1/32) in)	37 (1-29/64)	25.5 (1)	25.5 (1)
	Offset	X ± 0.4 mm (± 1/64 in)	36 (1-27/64)	33.4 (1-5/16)	33.4 (1-5/16)
		Y - X MIN. MAX.	- 0 (- 0) + 1.5 (+ .059)	+ 0.5 (+ .020) + 1.5 (+ .059)	+ 0.5 (+ .020) + 1.5 (+ .059)
		Drive Belt Part Number (P/N)	414 8276 00	415 0606 00	415 0606 00
		Drive Belt Width (new) ③ mm (in)	33.3 (1-5/16)	34.7 (1-3/8)	34.7 (1-3/8)
		Drive Belt Adjustment	Deflection ± 5 mm (± 13/64 in)	32 (1-1/4)	32 (1-1/4)
			Force ④ kg (lbf)	6.8 (15)	11.3 (25)
	Track	Width cm (in)	38.1 (15)	38.1 (15)	38.1 (15)
		Length cm (in)	354 (139)	345 (136)	307 (121)
		Profile Height mm (in)	—	18.4 (.724)	18.4 (.724)
		Adjustment	Deflection mm (in)	35 - 40 (1-3/8 - 1-9/16)	35 - 40 (1-3/8 - 1-9/16)
Force ⑤ kg (lbf)	7.3 (16)		7.3 (16)	7.3 (16)	
		Suspension Type	Track	Torque Reaction Slide	SC-10 Touring
			Ski	Telescopic Strut	DSA
		Length cm (in)	284.5 (112)	292 (115)	272.5 (107.3)
		Width cm (in)	95.3 (37.5)	115.6 (45.5)	115.6 (45.5)
		Height cm (in)	114 (44.9)	122 (48.0)	112 (44.1)
		Ski Stance cm (in)	81.3 (32.0)	101.6 (40)	101.6 (40)
		Mass (dry) kg (lb)	171 (377)	205 (452)	Formula S: 195 (430) Formula S Elec.: 204 (449)
		Ground Contact Area cm ² (in ²)	7864 (1219)	7227 (1120)	6503 (1008)
		Ground Contact Pressure kPa (PSI)	2.13 (.309)	2.78 (.403)	Formula S: 2.94 (.426) Formula S Elec.: 3.08 (.447)
		Frame Material	Steel	Aluminum	Aluminum
		Bottom Pan Material	Polyethylene High Density	Impact Copolymer	Impact Copolymer
		Hood Material	Polyethylene High Density	RRIM Polyurethane	RRIM Polyurethane
	Battery V (A•h)		N.A.	12 (22)	Formula S Elec.: 12 (22) Formula S: N.A.
	Headlight W		H4 60/55	H4 60/55	H4 60/55
	Taillight and Stoplight W		8/27	8/27	8/27
	Tachometer and Speedometer Bulb W		N.A.	5	5
	Fuel and Temperature Gauge Bulb W		N.A.	N.A.	N.A.
	Fuse	Starter Solenoid A	N.A.	30	Formula S Elec.: 30 Formula S: N.A.
Tachometer A		N.A.	N.A.	N.A.	
	Fuel Tank L (U.S. gal)		26 (6.9)	40 (10.6)	40 (10.6)
	Chaincase Gearbox mL (U.S.oz)		250 (8.5)	250 (8.5)	250 (8.5)
	Cooling System L (U.S. oz)		N.A.	N.A.	N.A.
	Injection Oil Reservoir L (U.S. oz)		1.9 (64)	2.55 (86)	2.55 (86)

SECTION 02 - WHAT'S NEW FOR 1998

Vehicles

		VEHICLE MODEL	TOURING LE	SKANDIC 380	SKANDIC 500	FORMULA SL	
		ENGINE TYPE	443	377	503	503	
	Chain Drive Ratio		21/44	21/44	21/44	22/44	
	Chain	Pitch in	3/8	3/8	3/8	3/8	
		Type/Links Qty/Plates Qty	Silent/72/11	Silent/72/11	Silent/72/11	Silent/72/11	
	Drive Pulley	Type of Drive Pulley		TRA	Bombardier Lite	TRAC	TRAC
		Ramp Identification		291 ①	N.A.	291 ①	291 ①
		Calibration Screw Position or Calibration Part ②		2	1181 1 x C, 1 x S21	3	3
		Spring Color		Red/Blue	Green/Green	Red/Yellow	Yellow/Red
		Spring Length ± 1.5 mm (± .060 in)		89.0 (3.50)		87.9 (3.46)	121.1 (4.77)
	Clutch Engagement ± 200 RPM		2900	2500	2900	3300	
	Driven Pulley Spring Preload ± 0.7 kg (± 1.5 lb)		4.8 (10.6)	4.8 (10.6)	4.8 (10.6)	4.8 (10.6)	
	Cam Angle degree		44°	44°	44°	44°	
	Pulley Distance Z (+0, -1) mm ((+0, -1/32) in)		16.5 (21/32)	25.5 (1)	16.5 (21/32)	16.5 (21/32)	
	Offset	X	± 0.4 mm (± 1/64 in)	35.0 (1-3/8)	33.4 (1-5/16)	35.0 (1-3/8)	35.0 (1-3/8)
		Y - X	MIN. MAX.	+ 1 (+ .039) + 2 (+ .079)	+ 0.5 (+ .020) + 1.5 (+ .059)	+ 1 (+ .039) + 2 (+ .079)	+ 1 (+ .039) + 2 (+ .079)
	Drive Belt Part Number (P/N)		415 0606 00	415 0606 00	415 0606 00	415 0606 00	
	Drive Belt Width (new) ③		mm(in)	34.7 (1-3/8)	34.7 (1-3/8)	34.7 (1-3/8)	34.7 (1-3/8)
	Drive Belt Adjustment		Deflection ± 5 mm (± 13/64 in)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)
			Force ④	11.3 (25)	11.3 (25)	11.3 (25)	11.3 (25)
	Track	Width		cm (in)	38.1 (15)	38.1 (15)	38.1 (15)
		Length		cm (in)	345 (136)	345 (136)	345 (136)
Profile Height		mm (in)	18.4 (.724)	23.2 (.913)	23.2 (.913)		
Adjustment		Deflection	mm (in)	35 - 40 (1-3/8 - 1-9/16)	35 - 40 (1-3/8 - 1-9/16)	35 - 40 (1-3/8 - 1-9/16)	
		Force ⑤	kg (lbf)	7.3 (16)	7.3 (16)	7.3 (16)	
Suspension Type		Track	SC-10 Touring	SC-10 Touring	SC-10 Touring	SC-10 Sport	
		Ski	DSA	DSA	DSA	DSA	
	Length		cm (in)	294 (115.7)	294 (115.7)	294 (115.7)	
	Width		cm (in)	120.7 (47.5)	108 (42.5)	108 (42.5)	
	Height		cm (in)	122 (48.0)	122 (48.0)	122 (48.0)	
	Ski Stance		cm (in)	106.7 (42)	94 (37)	94 (37)	
	Mass (dry)		kg (lb)	208 (457)	214 (471)	221 (486)	
	Ground Contact Area		cm² (in²)	7227 (1120)	7227 (1120)	7227 (1120)	
	Ground Contact Pressure		kPa (PSI)	2.82 (.409)	2.90 (.421)	3.06 (.435)	
	Frame Material			Aluminum	Aluminum	Aluminum	
	Bottom Pan Material			Impact Copolymer	Impact Copolymer	Impact Copolymer	
	Hood Material			RRIM Polyurethane	RRIM Polyurethane	RRIM Polyurethane	
	Battery		V (A•h)	12 (22)	N.A.	N.A.	
	Headlight		W	H4 60/55	H4 60/55	H4 60/55	
	Taillight and Stoplight		W	8/27	8/27	8/27	
	Tachometer and Speedometer Bulb		W	2 x 3	2 x 3	2 x 3	
	Fuel and Temperature Gauge Bulb		W	N.A.	N.A.	N.A.	
	Fuse	Starter Solenoid	A	30	N.A.	N.A.	
Tachometer		A	N.A.	N.A.	N.A.		
	Fuel Tank		L (U.S. gal)	40 (10.6)	40 (10.6)	40 (10.6)	
	Chaincase/Gearbox		mL (U.S. oz)	250 (8.5)	250 (8.5)	250 (8.5)	
	Cooling System		L (U.S. oz)	N.A.	N.A.	N.A.	
	Injection Oil Reservoir		L (U.S. oz)	2.55 (86)	2.55 (86)	2.55 (86)	

SECTION 02 - WHAT'S NEW FOR 1998

ENGINE TECHNICAL DATA LEGEND

BTDC: Before Top Dead Center

CDI: Capacitor Discharge Ignition

K: Kilo (x 1000)

MAG: Magneto Side

N.A.: Not Applicable

PTO: Power Take Off Side

R: Rectangular

ST: Semi-trapez

- ① The maximum horsepower RPM is applicable on the vehicle. It may be different under certain circumstances and BOMBARDIER INC. reserves the right to modify it without obligation.
- ② Crankshaft end-play is not adjustable on these models except Tundra II LT. Specification is given for verification purposes only.
- ③ Rotary valve to crankcase clearance: 0.27 – 0.48 mm (.011 – .019 in).
- ④ At 6000 RPM (engine cold) with headlamp turned on.
- ⑤ All resistance measurements must be performed with parts at room temperature (approx. 20°C (68°F)). Temperature greatly affects resistance measurements.
- ⑥ Force applied midway between pulleys to obtain specified deflection.
- ⑦ Drive pulley retaining screw: torque to 90 to 100 N•m (66 to 74 lbf•ft), install drive belt, accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake; repeat 5 times. Recheck the torque of 90 to 100 N•m (66 to 74 lbf•ft).

VEHICLE TECHNICAL DATA LEGEND

DSA: Direct Shock Action

RRIM: Reinforced Reaction Injection Molding







TRA: Total Range Adjustable drive pulley

N.A.: Not Applicable

- ① Lever with roller pin (P/N 417 0043 09) (Hollow).
- ② For Bombardier Lite drive pulleys:
 - 1157 = Block, red push type 38 g (P/N 417 1157 00)
 - 1181 = Block, black screw type 39.6 g (P/N 417 1181 00)
 - 1143 = Block, red screw type 41.8 g (P/N 417 1143 00)
 - W = Washer 1.8 g (P/N 417 1158 00)
 - C = Cap 1.65 g (P/N 417 1145 00)
 - S3.4 = Weight, screw type 3.4 g (P/N 417 1144 00)
 - S21 = Weight, screw type 21 g (P/N 417 1204 00)
- ③ Minimum allowable width may not be less than 3.0 mm (1/8 in) of new drive belt.
- ④ Force applied midway between pulleys to obtain specified deflection.
- ⑤ Force or downward pull applied to track to obtain specified tension deflection.







SECTION 02 - WHAT'S NEW FOR 1998

Engines

		VEHICLE MODEL	MX Z 440	MX Z 500	MX Z 583	MX Z 670		
		ENGINE TYPE	443	494	583	670		
		Number of Cylinders	2	2	2	2		
		Bore	67.5 (2.6575)	69.5 (2.736)	76.0 (2.992)	78.0 (3.071)		
		Stroke	61.0 (2.402)	65.8 (2.59)	64.0 (2.520)	70.0 (2.760)		
		Displacement	436.6 (26.64)	499.3 (30.47)	580.7 (35.44)	668.97 (40.82)		
		Compression Ratio (corrected)	6.4	6.8	6.7	6.2		
		Maximum Power Engine Speed ①	± 100 RPM	7000	7800	7900		
		Piston Ring Type	1 st /2 nd	ST/R	ST/R	ST/R		
		Ring End Gap	New	0.2 (.008)	0.25 (.010)	0.25 (.010)		
			Wear Limit	1.0 (.039)	1.0 (.039)	1.0 (.039)		
		Ring/Piston Groove Clearance	New	0.04 (.0016)	0.04 (.0016)	0.04 (.0016)		
			Wear Limit	0.2 (.0079)	0.2 (.0079)	0.2 (.0079)		
		Piston/Cylinder Wall Clearance	New	0.06 (.0024)	0.11 (.0043)	0.11 (.0043)		
			Wear Limit	0.2 (.008)	0.15 (.0059)	0.15 (.0059)		
		Connecting Rod Big End Axial Play	New	0.2 (.0079)	0.39 (.0156)	0.39 (.0156)		
			Wear Limit	1.0 (.0394)	1.2 (.0472)	1.2 (.0472)		
		Maximum Crankshaft End-play ②	0.3 (.012)	0.3 (.012)	0.3 (.012)	0.3 (.012)		
		Maximum Crankshaft Deflection	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)		
		Rotary Valve Timing ③ and P/N 420 924 XXX	Opening Closing	N.A. 140° - 71° 502	140° - 71° 502	144° - 72° 500		
		Magneto Generator Output	W	240	220	220		
		Ignition Type		CDI	CDI	CDI	CDI	
		Spark Plug Make and Type		NGK BR9ES	NGK BR9ES	NGK BR9ES	NGK BR9ES	
		Spark Plug Gap		0.45 (.018)	0.45 (.018)	0.45 (.018)	0.45 (.018)	
		Ignition Timing BTDC ④		1.38 (.054)	1.81 (.071)	1.75 (.069)	1.93 (.076)	
		Trigger Coil ⑤		Ω	140 - 180	190 - 300	190 - 300	
		Generating Coil ⑤		Ω	230 - 330	10 - 17	10 - 17	
		Lighting Coil ⑤		Ω	0.23 - 0.28	0.20 - 0.35	0.20 - 0.35	
		High Tension Coil ⑤	Primary	Ω	N.A.	0.3 - 0.7		
			Secondary	kΩ	5.1 - 6.3	8 - 16	8 - 16	
		Carburetor Type	PTO/MAG	VM 34 509/510	VM 38 380/381	VM 40 99/100	2 x VM 40 101	
		Main Jet	PTO/MAG	205/195	330/300	280/260	310	
		Needle Jet		159 P-0	480-Q4	224-AA2	224 AA-3	
		Pilot Jet		35	50	60	60	
		Needle Identification — clip position		6DH2-3	6DHY48-3	7ECY1-3	7EDY1-3	
		Slide Cut-away		2.5	2.5	2.5	2.5	
		Float Adjustment	± 1 mm (± .040 in)	23.9 (.94)	18.1 (.71)	18.1 (.71)	18.1 (.71)	
		Air Screw Adjustment	± 1/16 Turn	1-1/2	1.5	2	2.25	
		Idle Speed	± 200 RPM	1650	1800	1800	1700	
		Gas Type/Pump Octane Number		Unleaded/87	Unleaded/87	Unleaded/87	Unleaded/87	
Gas/Oil Ratio		Injection	Injection	Injection	Injection			
		Type	Axial Fan	Liquid	Liquid	Liquid		
		Axial Fan Belt Adjustment	Deflection ⑥	mm (in)	8 - 9 (.31 - .35)	N.A.	N.A.	
			Force	kg (lbf)	5 (11)	N.A.	N.A.	
		Thermostat Opening Temperature		°C (°F)	N.A.	42 (108)	42 (108)	42 (108)
Radiator Cap Opening Pressure		kPa (PSI)	N.A.	90 (13)	90 (13)	90 (13)		
		Drive Pulley Retaining Screw		⑦	⑦	⑦	⑦	
		Exhaust Manifold Nuts or Bolts		22 (16)	23 (17)	23 (17)	23 (17)	
		Magneto Ring Nut		105 (77)	125 (92)	125 (92)	125 (92)	
		Crankcase Nuts or Screws	M6	10 (7)	9 (6.5)	9 (6.5)	9 (6.5)	
			M8	22 (16)	29 (21)	29 (21)	29 (21)	
		Crankcase/Engine Support Nuts or Screws			38 (28)	39 (29)	39 (29)	39 (29)
		Cylinder Head Nuts			22 (16)	29 (21)	29 (21)	29 (21)
Crankcase/Cylinder Nuts or Screws			N.A.	29 (21)	29 (21)	29 (21)		
Axial Fan Shaft Nut			50 (37)	N.A.	N.A.	N.A.		








SECTION 02 - WHAT'S NEW FOR 1998

Engines

		VEHICLE MODEL	FORMULA 500, FORMULA 500 DE LUXE	FORMULA 583 DE LUXE	FORMULA Z 583	FORMULA Z 670	
		ENGINE TYPE	494	583	583	670	
		Number of Cylinders	2	2	2	2	
		Bore mm (in)	69.5 (2.736)	76.0 (2.992)	76.0 (2.992)	78.0 (3.071)	
		Stroke mm (in)	65.8 (2.59)	64.0 (2.52)	64.0 (2.52)	70.0 (2.760)	
		Displacement cm ³ (in ³)	499.3 (30.47)	580.7 (35.44)	580.7 (35.44)	668.97 (40.82)	
		Compression Ratio (corrected)	6.8	6.7	6.7	6.2	
		Maximum Power Engine Speed ① ± 100 RPM	7800	7900	7900	7700	
		Piston Ring Type 1 st /2 nd	ST/R	ST/N.A.	ST/N.A.	ST/R	
		Ring End Gap	New mm (in)	0.25 (.010)	0.25 (.010)	0.25 (.010)	0.25 (.010)
			Wear Limit mm (in)	1.0 (.039)	1.0 (.039)	1.0 (.039)	1.0 (.039)
		Ring/Piston Groove Clearance	New mm (in)	0.04 (.0016)	0.04 (.0016)	0.04 (.0016)	0.04 (.0016)
			Wear Limit mm (in)	0.2 (.0079)	0.2 (.0079)	0.2 (.0079)	0.2 (.0079)
		Piston/Cylinder Wall Clearance	New mm (in)	0.11 (.0043)	0.11 (.0043)	0.11 (.0043)	0.10 (.0039)
			Wear Limit mm (in)	0.15 (.0059)	0.15 (.0059)	0.15 (.0059)	0.15 (.0059)
		Connecting Rod Big End Axial Play	new mm (in)	0.39 (.0156)	0.39 (.0156)	0.39 (.0156)	0.39 (.0156)
			wear limit mm (in)	1.2 (.0472)	1.2 (.0472)	1.2 (.0472)	1.2 (.0472)
		Maximum Crankshaft End-play ② mm (in)	0.3 (.012)	0.3 (.012)	0.3 (.012)	0.3 (.012)	
		Maximum Crankshaft Deflection mm (in)	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)	
		Rotary Valve Timing ③ and P/N 420 924 XXX	Opening 135° – 64° Closing 509	140° – 71° 502	140° – 71° 502	144° – 72° 500	
		Magneto Generator Output W	220	220	220	220	
		Ignition Type	CDI	CDI	CDI	CDI	
		Spark Plug Make and Type	NGK BR9ES	NGK BR9ES	NGK BR9ES	NGK BR9ES	
		Spark Plug Gap mm (in)	0.45 (.018)	0.45 (.018)	0.45 (.018)	0.45 (.018)	
		Ignition Timing BTDC ④ mm (in)	1.81 (.071)	1.75 (.069)	1.75 (.069)	1.93 (.076)	
		Trigger Coil ⑤ Ω	190 – 300	190 – 300	190 – 300	190 – 300	
		Generating Coil ⑤ Ω	10 – 17	10 – 17	10 – 17	10 – 17	
		Lighting Coil ⑤ Ω	0.20 – 0.35	0.20 – 0.35	0.20 – 0.35	0.20 – 0.35	
		High Tension Coil ⑤	Primary Ω	0.3 – 0.7	0.3 – 0.7	0.3 – 0.7	0.3 – 0.7
			Secondary kΩ	8 – 16	8 – 16	8 – 16	8 – 16
		Carburetor Type	PTO/MAG	VM 38 378/379	VM 38 386/387	VM 40 99/100	2 x VM 40 102
		Main Jet	PTO/MAG	330/300	270/260	280/260	290
		Needle Jet		480-Q3	480-P7	224 AA-2	224 AA-3
		Pilot Jet		50	50	60	60
		Needle Identification — clip position		6DHY48-3	6DEY4-2	7ECY1-3	7EDY1-3
		Slide Cut-away		2.5	2.5	2.5	2.5
		Float Adjustment ± 1 mm (± .040 in)		18.1 (.71)	18.1 (.71)	18.1 (.71)	18.1 (.71)
		Air Screw Adjustment ± 1/16 Turn		1.5	2.0	2.0	2.25
		Idle Speed ± 200 RPM		1800	1800	1800	1700
		Gas Type/Pump Octane Number		Unleaded/87	Unleaded/87	Unleaded/87	Unleaded/87
Gas/Oil Ratio		Injection	Injection	Injection	Injection		
		Type	Liquid	Liquid	Liquid	Liquid	
		Axial Fan Belt Adjustment	Deflection ⑥ mm (in)	N.A.	N.A.	N.A.	N.A.
			Force kg (lbf)	N.A.	N.A.	N.A.	N.A.
		Thermostat Opening Temperature °C (°F)		42 (108)	42 (108)	42 (108)	42 (108)
		Radiator Cap Opening Pressure kPa (PSI)	90 (13)	90 (13)	90 (13)	90 (13)	
		ENGINE COLD N·m (lbf·ft)					
		Drive Pulley Retaining Screw		⑦	⑦	⑦	⑦
		Exhaust Manifold Nuts or Bolts		23 (17)	23 (17)	23 (17)	23 (17)
		Magneto Ring Nut		125 (92)	125 (92)	125 (92)	125 (92)
		Crankcase Nuts or Screws	M6	9 (6.5)	9 (6.5)	9 (6.5)	9 (6.5)
			M8	29 (21)	23 (17)	23 (17)	29 (21)
		Crankcase/Engine Support Nuts or Screws		39 (29)	39 (29)	39 (29)	39 (29)
		Cylinder Head Nuts		29 (21)	29 (21)	29 (21)	29 (21)
Crankcase/Cylinder Nuts or Screws		29 (21)	29 (21)	29 (21)	29 (21)		
		Axial Fan Shaft Nut	N.A.	N.A.	N.A.	N.A.	







SECTION 02 - WHAT'S NEW FOR 1998

Engines

		VEHICLE MODEL	SUMMIT 500	SUMMIT 583	SUMMIT 670	GRAND TOURING 500		
		ENGINE TYPE	494	583	670	494		
		Number of Cylinders	2	2	2	2		
		Bore	mm (in)	69.5 (2.736)	76.0 (2.992)	78.0 (3.071)	69.5 (2.736)	
		Stroke	mm (in)	65.8 (2.59)	64.0 (2.520)	70.0 (2.760)	65.8 (2.59)	
		Displacement	cm ³ (in ³)	499.3 (30.47)	580.7 (35.44)	668.97 (40.82)	499.3 (30.47)	
		Compression Ratio (corrected)		6.8	6.7	6.2	6.8	
		Maximum Power Engine Speed ①	± 100 RPM	7800	7800	7700	7800	
		Piston Ring Type	1 st /2 nd	ST/R	ST/N.A.	ST/R	ST/R	
		Ring End Gap	New	mm (in)	0.25 (.010)	0.25 (.010)	0.25 (.0098)	0.25 (.010)
			Wear Limit	mm (in)	1.0 (.039)	1.0 (.039)	1.0 (.039)	1.0 (.039)
		Ring/Piston Groove Clearance	New	mm (in)	0.04 (.0016)	0.04 (.0016)	0.04 (.0016)	0.04 (.0016)
			Wear Limit	mm (in)	0.2 (.0079)	0.2 (.0079)	0.2 (.0079)	0.2 (.0079)
		Piston/Cylinder Wall Clearance	New	mm (in)	0.11 (.0043)	0.11 (.0043)	0.10 (.0039)	0.11 (.0043)
			Wear Limit	mm (in)	0.15 (.0059)	0.15 (.0059)	0.15 (.0059)	0.15 (.0059)
		Connecting Rod Big End Axial Play	New	mm (in)	0.39 (.0156)	0.39 (.0154)	0.39 (.0154)	0.39 (.0154)
Wear Limit	mm (in)		1.2 (.0472)	1.2 (.0472)	1.2 (.0472)	1.2 (.0472)		
Maximum Crankshaft End-play ②	mm (in)	0.3 (.012)	0.3 (.012)	0.3 (.012)	0.3 (.012)			
Maximum Crankshaft Deflection	mm (in)	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)			
Rotary Valve Timing ③ and P/N 420 924 XXX	Opening Closing	135° – 64° 509	135° – 64° 509	144° – 72° 500	135° – 64° 509			
		Magneto Generator Output	W	220	220	220	220	
		Ignition Type		CDI	CDI	CDI	CDI	
		Spark Plug Make and Type		NGK BR9ES	NGK BR9ES	NGK BR9ES	NGK BR9ES	
		Spark Plug Gap	mm (in)	0.45 (.018)	0.45 (.018)	0.45 (.018)	0.45 (.018)	
		Ignition Timing BTDC ④	mm (in)	1.81 (.071)	1.75 (.069)	1.93 (.076)	1.81 (.071)	
		Trigger Coil ⑤	Ω	190 – 300	190 – 300	190 – 300	190 – 300	
		Generating Coil ⑤	Ω	10 – 17	10 – 17	10 – 17	10 – 17	
		Lighting Coil ⑤	Ω	0.20 – 0.35	0.20 – 0.35	0.20 – 0.35	0.20 – 0.35	
		High Tension Coil ⑤	Primary	Ω	0.3 – 0.7	0.3 – 0.7	0.3 – 0.7	0.3 – 0.7
Secondary	kΩ		8 – 16	8 – 16	8 – 16	8 – 16		
		Carburetor Type	PTO/MAG	VM 38 (H.A.C.) 384/385	VM 38 (H.A.C.) 388/ 389	VM 40 (H.A.C.) 103/ 104	VM 38 382/383	
		Main Jet	PTO/MAG	350/330	330/320	380/370	320/290	
		Needle Jet		480-Q6	480 P-8	224 AA-4	480-Q3	
		Pilot Jet		75	75	75	50	
		Needle Identification — clip position		6DHY48-4	6FEY-2	7DPI1-3	6DHY48-3	
		Slide Cut-away		2.5	2.5	2.5	2.5	
		Float Adjustment	± 1 mm (± .040 in)	18.1 (.71)	18.1 (.71)	18.1 (.71)	18.1 (.71)	
		Air Screw Adjustment	± 1/16 Turn	2.0	2.25	2.25	1.25	
		Idle Speed	± 200 RPM	1800	1800	1900	1800	
		Gas Type/Pump Octane Number		Unleaded/87	Unleaded/87	Unleaded/87	Unleaded/87	
		Gas/Oil Ratio		Injection	Injection	Injection	Injection	
		Type		Liquid	Liquid	Liquid	Liquid	
		Axial Fan Belt Adjustment	Deflection ⑥	mm (in)	N.A.	N.A.	N.A.	N.A.
			Force	kg (lbf)	N.A.	N.A.	N.A.	N.A.
		Thermostat Opening Temperature	°C (°F)	42 (108)	42 (108)	42 (108)	42 (108)	
Radiator Cap Opening Pressure	kPa (PSI)	90 (13)	90 (13)	90 (13)	90 (13)			
		Drive Pulley Retaining Screw		⑦	⑦	⑦	⑦	
		Exhaust Manifold Nuts or Bolts		23 (17)	23 (17)	23 (17)	23 (17)	
		Magneto Ring Nut		125 (92)	125 (92)	125 (92)	100 (74)	
		Crankcase Nuts or Screws	M6	9 (6.5)	9 (6.5)	9 (6.5)	9 (6.5)	
			M8	29 (21)	23 (17)	29 (21)	29 (21)	
		Crankcase/Engine Support Nuts or Screws		39 (29)	39 (29)	39 (29)	39 (29)	
		Cylinder Head Nuts		29 (21)	29 (21)	29 (21)	29 (21)	
		Crankcase/Cylinder Nuts or Screws		29 (21)	29 (21)	29 (21)	29 (21)	
Axial Fan Shaft Nut		N.A.	N.A.	N.A.	N.A.			






SECTION 02 - WHAT'S NEW FOR 1998

Engines

		VEHICLE MODEL	GRAND TOURING 583	SKANDIC WT	SKANDIC SWT	SKANDIC WT LC	
		ENGINE TYPE	583	503	503	494	
	Number of Cylinders		2	2	2	2	
	Bore		mm (in)	76.0 (2.992)	72.0 (2.835)	72.0 (2.835)	69.5 (2.736)
	Stroke		mm (in)	64.0 (2.52)	61.0 (2.402)	61.0 (2.402)	65.8 (2.59)
	Displacement		cm ³ (in ³)	580.7 (35.44)	496.7 (30.31)	496.7 (30.31)	499.3 (30.47)
	Compression Ratio (corrected)			6.7	6.2	6.2	6.8
	Maximum Power Engine Speed ①		± 100 RPM	7900	6800	6500	7000
	Piston Ring Type		1 st /2 nd	ST/N.A.	ST/R	ST/R	ST/R
	Ring End Gap	New	mm (in)	0.25 (.010)	0.2 (.0079)	0.2 (.0079)	0.25 (.010)
		Wear Limit	mm (in)	1.0 (.039)	1.0 (.039)	1.0 (.039)	1.0 (.039)
	Ring/Piston Groove Clearance	New	mm (in)	0.04 (.0016)	0.04 (.0016)	0.04 (.0016)	0.04 (.0016)
		Wear Limit	mm (in)	0.2 (.0079)	0.2 (.0079)	0.2 (.0079)	0.2 (.0079)
	Piston/Cylinder Wall Clearance	New	mm (in)	0.11 (.0045)	0.9 (.0035)	0.9 (.0035)	0.11 (.0043)
		Wear Limit	mm (in)	0.15 (.0059)	0.2 (.0079)	0.2 (.0079)	0.15 (.0059)
	Connecting Rod Big End Axial Play	New	mm (in)	0.39 (.0154)	0.2 (.0079)	0.2 (.0079)	0.39 (.0154)
		Wear Limit	mm (in)	1.2 (.0472)	1.0 (.0394)	1.0 (.0394)	1.2 (.0472)
Maximum Crankshaft End-play ②		mm (in)	0.3 (.012)	0.3 (.012)	0.3 (.012)	0.3 (.012)	
Maximum Crankshaft Deflection		mm (in)	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)	
Rotary Valve Timing ③ and P/N 420 924 XXX		Opening Closing	140° – 71° 502	N.A.	N.A.	148° – 52° 509	
	Magneto Generator Output		W	220	240	240	220
	Ignition Type			CDI	CDI	CDI	CDI
	Spark Plug Make and Type			NGK BR9ES	NGK BR9ES	NGK BR8ES	NGK BR9ES
	Spark Plug Gap		mm (in)	0.45 (.018)	0.45 (.018)	0.45 (.018)	0.45 (.018)
	Ignition Timing BTDC ④		mm (in)	1.75 (.069)	1.66 (.065)	1.66 (.065)	1.81 (.071)
	Trigger Coil ⑤		Ω	190 – 300	140 – 180	140 – 180	190 – 300
	Generating Coil ⑤		Ω	10 – 17	230 – 330	230 – 330	10 – 17
	Lighting Coil ⑤		Ω	0.20 – 0.35	0.23 – 0.28	0.23 – 0.28	0.20 – 0.35
High Tension Coil ⑤	Primary	Ω	0.3 – 0.7	N.A.	N.A.	0.3 – 0.7	
	Secondary	kΩ	8 – 16	5.1 – 6.3	5.1 – 6.3	8 – 16	
	Carburetor Type		PTO/MAG	VM 38 386/387	2 x VM 34	VM 32	VM 34
	Main Jet		PTO/MAG	270/260	210	230	250/220
	Needle Jet			480-P7	159 P4	159 O-0	159-P2
	Pilot Jet			50	40	25	30
	Needle Identification — clip position			6DEY4-2	6DH2-3	6DH8-4	6DH4-3
	Slide Cut-away			2.5	2.5	3.0	2.5
	Float Adjustment		± 1 mm (± .040 in)	18.1 (.71)	36.5 (1.44)	23.9 (.94)	36.5 (1.44)
	Air Screw Adjustment		± 1/16 Turn	2.0	1.0	1.5	1.0
	Idle Speed		± 200 RPM	1800	1900	1650	1900
	Gas Type/Pump Octane Number			Unleaded/87	Unleaded/87	Unleaded/87	Unleaded/87
Gas/Oil Ratio			Injection	Injection	Injection	Injection	
	Type			Liquid	Axial Fan	Axial Fan	Liquid
	Axial Fan Belt Adjustment	Deflection ⑥	mm (in)	N.A.	9 – 10 (.35 – .39)	9 – 10 (.35 – .39)	N.A.
		Force	kg (lbf)	N.A.	5 (11)	5 (11)	N.A.
	Thermostat Opening Temperature		°C (°F)	42 (108)	N.A.	N.A.	42 (108)
Radiator Cap Opening Pressure		kPa (PSI)	90 (13)	N.A.	N.A.	90 (13)	
	ENGINE COLD N·m (lbf·ft)						
	Drive Pulley Retaining Screw			⑦	⑦	⑦	⑦
	Exhaust Manifold Nuts or Bolts			23 (17)	22 (16)	22 (16)	22 (16)
	Magneto Ring Nut			125 (92)	105 (77)	105 (77)	125 (92)
	Crankcase Nuts or Screws	M6		9 (6.5)	—	—	9 (6.5)
		M8		23 (17)	22 (16)	22 (16)	21 (16)
	Crankcase/Engine Support Nuts or Screws			39 (29)	39 (29)	39 (29)	39 (29)
Cylinder Head Nuts			29 (21)	22 (16)	22 (16)	29 (21)	
Crankcase/Cylinder Nuts or Screws			29 (21)	N.A.	N.A.	29 (21)	
Axial Fan Shaft Nut			N.A.	48 (35)	48 (35)	N.A.	











SECTION 02 - WHAT'S NEW FOR 1998

Vehicles

		VEHICLE MODEL	MX Z 440	MX Z 500	MX Z 583	MX Z 670	
		ENGINE TYPE	443	494	583	670	
	Chain Drive Ratio		22/44	23/43	25/43	26/43	
	Chain	Pitch in	3/8	3/8	3/8	3/8	
		Type/Links Qty/Plates Qty		Silent 72/11	Silent 72/13	Silent 74/13	Silent 74/13
	Drive Pulley	Type of Drive Pulley		TRA	TRA	TRA	TRA
		Ramp Identification		291 ⑤	281 ⑤	286 ⑤	286 ⑥
		Calibration Screw Position or — calibration disc quantity		3	3	3	3
		Spring Color		Blue/Yellow	Violet/Yellow	Violet/Blue	Violet/Yellow
		Spring Length ± 1.5 mm (± .060 in)		115.1 (4.53)	157.9 (6.22)	114.6 (4.51)	157.9 (6.22)
		Clutch Engagement ± 200 RPM		3700	4100	4400	3800
	Driven Pulley Spring Preload ± 0.7 kg (± 1.5 lb)		6.1 (13.4)	7.0 (15.4)	7.0 (15.4)	7.0 (15.4)	
	Cam Angle Degree		47°	50°	50°	50°	
	Pulley Distance Z (+ 0, -1) mm (+ 0, -1/32) in		16.5 (21/32)	16.5 (21/32)	16.5 (21/32)	16.5 (21/32)	
	Offset	X ± 0.4 mm (± 1/64 in)		35.0 (1-3/8)	35.0 (1-3/8)	35.0 (1-3/8)	35.0 (1-3/8)
		Y - X	MIN. - MAX. mm (in)	+ 1 (+ .039) + 2 (+ .079)	1.0 - 2.0 (.039 - .079)	1.0 - 2.0 (.039 - .079)	1.0 - 2.0 (.039 - .079)
	Drive Belt Part Number (P/N)			414 0606 00	414 8607 00	414 8607 00	415 1063 00
	Drive Belt Width (new) ① mm (in)			35.2 (1-3/8)	35.3 (1-3/8)	35.3 (1-3/8)	35.0 (1-3/8)
	Drive Belt Adjustment	Deflection ± 5 mm (± 13/64 in)		32 (1-1/4)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)
		Force ② kg (lbf)		11.3 (25)	11.3 (25)	11.3 (25)	11.3 (25)
	Track	Width cm (in)		38.1 (15.0)	38.1 (15.0)	38.1 (15.0)	38.1 (15.0)
		Length cm (in)		307 (121)	307 (121)	307 (121)	307 (121)
Profile Height mm (in)		18.4 (.724)	23.2 (.913)	23.2 (.913)	23.2 (.913)		
Adjustment		Deflection mm (in)		35 - 40 (1-3/8 - 1-3/4)	35 - 40 (1-3/8 - 1-3/4)	35 - 40 (1-3/8 - 1-3/4)	35 - 40 (1-3/8 - 1-3/4)
		Force ③ kg (lbf)		7.3 (16)	7.3 (16)	7.3 (16)	7.3 (16)
Suspension Type	Track		SC-10 Sport	SC-10 XC	SC-10 XC	SC-10 XC	
	Ski		DSA	DSA	DSA	DSA	
	Length cm (in)		272.5 (107.3)	272.5 (107.3)	272.5 (107.3)	272.5 (107.3)	
	Width cm (in)		116.8 (46.0)	117.4 (46.2)	117.4 (46.2)	117.4 (46.2)	
	Height cm (in)		108 (42.5)	108 (42.5)	108 (42.5)	108 (42.5)	
	Ski Stance cm (in)		104.1 (41)	104.1 (41)	104.1 (41)	104.1 (41)	
	Mass (dry) kg (lb)		201 (442)	216 (475)	228 (502)	228 (502)	
	Ground Contact Area cm² (in²)		6566 (1018)	6671 (1034)	6671 (1034)	6671 (1034)	
	Ground Contact Pressure kPa (PSI)		3.00 (.435)	3.18 (.461)	3.35 (.486)	3.35 (.486)	
	Frame Material		Aluminum	Aluminum	Aluminum	Aluminum	
	Bottom Pan Material		Impact Copolymer	Impact Copolymer	Impact Copolymer	Impact Copolymer	
	Hood Material		RRIM Polyurethane	RRIM Polyurethane	RRIM Polyurethane	RRIM Polyurethane	
	Battery V (A•h)		N.A.	N.A.	N.A.	N.A.	
	Headlight W		H4 60/55	H4 60/55	H4 60/55	H4 60/55	
	Taillight and Stoplight W		8/27	8/27	8/27	8/27	
	Tachometer and Speedometer Bulbs W		2 x 3	2 x 3	2 x 3	2 x 3	
	Fuel and Temperature Gauge Bulbs W		N.A.	N.A.	N.A.	N.A.	
	Fuse	Starter Solenoid A		N.A.	N.A.	N.A.	N.A.
		Tachometer A		N.A.	N.A.	N.A.	N.A.
	Fuel Tank L (U.S. gal)		37 (9.8)	40 (10.6)	40 (10.6)	40 (10.6)	
	Chaincase/Gearbox mL (U.S. oz)		250 (8.5)	250 (8.5)	250 (8.5)	250 (8.5)	
	Cooling System ④ L (U.S. oz)		N.A.	4.7 (159)	4.7 (159)	4.7 (159)	
	Injection Oil Reservoir L (U.S. oz)		2.55 (86)	2.8 (95)	2.8 (95)	2.8 (95)	






SECTION 02 - WHAT'S NEW FOR 1998

Vehicles

		VEHICLE MODEL	FORMULA 500	FORMULA 500 DE LUXE	FORMULA 583 DE LUXE	FORMULA Z 583	
		ENGINE TYPE	494	494	583	583	
		Chain Drive Ratio	23/43	23/44	25/44	25/43	
	Chain	Pitch in	3/8	3/8	3/8	3/8	
		Type/Links Qty/Plates Qty	Silent 72/11	Silent 72/11	Silent 74/13	Silent 74/13	
	Drive Pulley	Type of Drive Pulley	TRA	TRA	TRA	TRA	
		Ramp Identification	286 ⑤	286 ⑤	286 ⑤	286 ⑤	
		Calibration Screw Position or — calibration disc quantity	3	3	3	3	
		Spring Color	Violet/Blue	Violet/Blue	Violet/Blue	Violet/Blue	
		Spring Length ± 1.5 mm (± .060 in)	114.6 (4.51)	114.6 (4.51)	114.6 (4.51)	114.6 (4.51)	
		Clutch Engagement ± 200 RPM	3800	3800	4100	4100	
		Driven Pulley Spring Preload ± 0.7 kg (± 1.5 lb)	7.0 (15.4)	7.0 (15.4)	7.0 (15.4)	7.0 (15.4)	
		Cam Angle Degree	50°	50°	50°	50°	
		Pulley Distance Z (+ 0, -1) mm (+ 0, -1/32) in	16.5 (21/32)	16.5 (21/32)	16.5 (21/32)	16.5 (21/32)	
	Offset	X ± 0.4 mm (± 1/64 in)	35.0 (1-3/8)	35.0 (1-3/8)	35.0 (1-3/8)	35.0 (1-3/8)	
		Y - X MIN. - MAX. mm (in)	1.0 - 2.0 (.039 - .079)	1.0 - 2.0 (.039 - .079)	1.0 - 2.0 (.039 - .079)	1.0 - 2.0 (.039 - .079)	
		Drive Belt Part Number (P/N)	414 8607 00	414 8607 00	414 8607 00	414 8607 00	
		Drive Belt Width (new) ① mm (in)	35.3 (1-3/8)	35.3 (1-3/8)	35.3 (1-3/8)	35.3 (1-3/8)	
		Drive Belt Adjustment	Deflection ± 5 mm (± 13/64 in)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)	
			Force ② kg (lbf)	11.3 (25)	11.3 (25)	11.3 (25)	
	Track	Width cm (in)	38.1 (15.0)	38.1 (15.0)	38.1 (15.0)	38.1 (15.0)	
		Length cm (in)	307 (121)	307 (121)	307 (121)	307 (121)	
		Profile Height mm (in)	18.4 (.724)	18.4 (.724)	23.2 (.913)	23.2 (.913)	
		Adjustment	Deflection mm (in)	35 - 40 (1-3/8 - 1-3/4)	35 - 40 (1-3/8 - 1-3/4)	35 - 40 (1-3/8 - 1-3/4)	35 - 40 (1-3/8 - 1-3/4)
			Force ③ kg (lbf)	7.3 (16)	7.3 (16)	7.3 (16)	7.3 (16)
		Suspension Type	Track	SC-10 Sport	SC-10 Sport	SC-10 Sport	
			Ski	DSA	DSA	DSA	
	Length cm (in)		272.5 (107.3)	272.5 (107.3)	272.5 (107.3)	272.5 (107.3)	
	Width cm (in)		120.7 (47.5)	120.7 (47.5)	120.7 (47.5)	120.7 (47.5)	
	Height cm (in)		108 (42.5)	108 (42.5)	108 (42.5)	108 (42.5)	
	Ski Stance cm (in)		106.7 (42)	106.7 (42)	106.7 (42)	106.7 (42)	
	Mass (dry) kg (lb)		212 (467)	228 (502)	239 (526)	227 (499)	
	Ground Contact Area cm² (in²)		6485 (1005)	6863 (1064)	6863 (1064)	6793 (1053)	
	Ground Contact Pressure kPa (PSI)		3.21 (.465)	3.26 (.473)	3.42 (.496)	3.24 (.470)	
	Frame Material		Aluminum	Aluminum	Aluminum	Aluminum	
	Bottom Pan Material		Impact Copolymer	Impact Copolymer	Impact Copolymer	Impact Copolymer	
	Hood Material		RRIM Polyurethane	RRIM Polyurethane	RRIM Polyurethane	RRIM Polyurethane	
	Battery V (A•h)		N.A.	12 (22)	12 (22)	N.A.	
	Headlight W		H4 60/55	H4 60/55	H4 60/55	H4 60/55	
	Taillight and Stoplight W		8/27	8/27	8/27	8/27	
	Tachometer and Speedometer Bulbs W		2 x 3	2 x 3	2 x 3	2 x 3	
	Fuel and Temperature Gauge Bulbs W		N.A.	N.A.	N.A.	3/3	
	Fuse	Starter Solenoid A	N.A.	30	N.A.	N.A.	
		Tachometer A	N.A.	N.A.	N.A.	N.A.	
	Fuel Tank L (U.S. gal)		40 (10.6)	40 (10.6)	40 (10.6)	40 (10.6)	
	Chaincase/Gearbox mL (U.S. oz)		250 (8.5)	250 (8.5)	250 (8.5)	250 (8.5)	
	Cooling System ④ L (U.S. oz)		4.7 (159)	4.7 (159)	4.7 (159)	4.7 (159)	
	Injection Oil Reservoir L (U.S. oz)		2.8 (95)	2.8 (95)	2.8 (95)	2.8 (95)	

















SECTION 02 - WHAT'S NEW FOR 1998

Vehicles





		VEHICLE MODEL	FORMULA Z 670	SUMMIT 500	SUMMIT 583	SUMMIT 670	
		ENGINE TYPE	670	494	583	670	
	Chain Drive Ratio		26/43	22/43	22/44	23/43	
	Chain	Pitch in	3/8	3/8	3/8	3/8	
		Type/Links Qty/Plates Qty		Silent 74/13	Silent 72/11	Silent 72/13	Silent 72/13
	Drive Pulley	Type of Drive Pulley		TRA	TRA	TRA	TRA
		Ramp Identification		286 ⑥	285 ⑤	285 ⑤	286 ⑤
		Calibration Screw Position or — calibration disc quantity		3	5	5	5
		Spring Color		Violet/Yellow	Green/Blue	Green/Blue	Violet/Yellow
		Spring Length ± 1.5 mm (± .060 in)		157.9 (6.22)	147.4 (5.80)	147.4 (5.80)	157.9 (6.22)
		Clutch Engagement ± 200 RPM		3800	4500	4400	4100
	Driven Pulley Spring Preload ± 0.7 kg (±1.5 lb)		7.0 (15.4)	7.0 (15.4)	7.0 (15.4)	7.0 (15.4)	
	Cam Angle degree		50°	47°	50°	50°	
	Pulley Distance Z (+ 0, -1) mm (+ 0, -1/32) in		16.5 (21/32)	16.5 (21/32)	16.5 (21/32)	16.5 (21/32)	
	Offset	X ± 0.4 mm (± 1/64 in)		35.0 (1-3/8)	35.0 (1-3/8)	35.0 (1-3/8)	35.0 (1-3/8)
		Y - X	MIN. - MAX. mm (in)	1.0 - 2.0 (.039 - .079)	1.0 - 2.0 (.039 - .079)	1.0 - 2.0 (.039 - .079)	1.0 - 2.0 (.039 - .079)
	Drive Belt Part Number (P/N)			415 0990 00	415 8607 00	415 0990 00	415 0990 00
	Drive Belt Width (new) ① mm (in)			35.0 (1-3/8)	35.3 (1-3/8)	35.0 (1-3/8)	35.0 (1-3/8)
	Drive Belt Adjustment	Deflection ± 5 mm (± 13/64 in)		32 (1-1/4)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)
		Force ② kg (lbf)		11.3 (25)	11.3 (25)	11.3 (25)	11.3 (25)
	Track	Width cm (in)		38.1 (15.0)	38.1 (15.0)	38.1 (15.0)	38.1 (15.0)
		Length cm (in)		307 (121)	345.5 (136)	345.5 (136)	345.5 (136)
Profile Height mm (in)		22.4 (.882)	36.8 (1.449)	36.8 (1.449)	50.8 (2.000)		
Adjustment		Deflection mm (in)		35 - 40 (1-3/8 - 1-3/4)	35 - 40 (1-3/8 - 1-3/4)	35 - 40 (1-3/8 - 1-3/4)	35 - 40 (1-3/8 - 1-3/4)
		Force ③ kg (lbf)		7.3 (16)	7.3 (16)	7.3 (16)	7.3 (16)
Suspension Type	Track		FZ 670	SC-10 Mountain	SC-10 Mountain	SC-10 Mountain	
	Ski		DSA	DSA	DSA	DSA	
	Length cm (in)		272.5 (107.3)	293.9 (115.7)	293.9 (114.9)	293.9 (115.7)	
	Width cm (in)		120.7 (47.5)	107.3 (42.3)	107.3 (42.3)	107.3 (42.3)	
	Height cm (in)		108 (42.5)	113 (44.5)	113 (44.5)	113 (44.5)	
	Ski Stance cm (in)		106.7 (42)	94 (37)	94 (37)	94 (37)	
	Mass (dry) kg (lb)		225 (495)	220 (484)	226 (498)	229 (503)	
	Ground Contact Area cm² (in²)		6793 (1053)	7479.2 (1159.2)	7479.2 (1159.2)	7357 (1140)	
	Ground Contact Pressure kPa (PSI)		3.22 (.467)	2.89 (.419)	2.96 (.429)	3.05 (.442)	
	Frame Material		Aluminum	Aluminum	Aluminum	Aluminum	
	Bottom Pan Material		Impact Copolymer	Impact Copolymer	Impact Copolymer	Impact Copolymer	
	Hood Material		RRIM Polyurethane	RRIM Polyurethane	RRIM Polyurethane	RRIM Polyurethane	
	Battery V (A•h)		N.A.	N.A.	N.A.	N.A.	
	Headlight W		H4 60/55	H4 60/55	H4 60/55	H4 60/55	
	Taillight and Stoplight W		8/27	8/27	8/27	8/27	
	Tachometer and Speedometer Bulbs W		2 x 3	2 x 3	2 x 3	2 x 3	
	Fuel and Temperature Gauge Bulbs W		3/3	N.A.	N.A.	N.A.	
	Fuse	Starter Solenoid A		N.A.	N.A.	N.A.	N.A.
		Tachometer A		N.A.	N.A.	N.A.	N.A.
	Fuel Tank L (U.S. gal)		40 (10.6)	40 (10.6)	40 (10.6)	40 (10.6)	
	Chaincase/Gearbox mL (U.S. oz)		250 (8.5)	250 (8.5)	250 (8.5)	250 (8.5)	
	Cooling System ④ L (U.S. oz)		4.7 (159)	5.0 (169)	5.0 (169)	5.0 (169)	
	Injection Oil Reservoir L (U.S. oz)		2.8 (95)	2.8 (95)	2.8 (95)	2.8 (95)	

SECTION 02 - WHAT'S NEW FOR 1998

Vehicles

		VEHICLE MODEL	GRAND TOURING 500	GRAND TOURING 583	SKANDIC WT	SKANDIC SWT		
		ENGINE TYPE	494	583	503	503		
		Chain Drive Ratio	23/44	23/44	N.A.	N.A.		
	Pitch	in	3/8	3/8	N.A.	N.A.		
	Type/Links Qty/Plates Qty		Silent 72/11	Silent 72/13	N.A.	N.A.		
	Type of Drive Pulley		TRA	TRA	TRA	TRA		
	Ramp Identification		228 ⑤	285 ⑤	290 ⑦	146 ⑤		
	Calibration Screw Position or — calibration disc quantity		3	3	3	4		
	Spring Color		Blue/Green	Red/Orange	Yellow/Orange	Red/Yellow		
	Spring Length	± 1.5 mm (± .060 in)	105.7 (4.16)	91.2 (3.56)	105.7 (4.16)	87.9 (3.46)		
	Clutch Engagement		± 200 RPM	3600	3100	3000	2900	
		Driven Pulley Spring Preload	± 0.7 kg (± 1.5 lb)	7.0 (15.4)	7.0 (15.4)	7.0 (15.4)	6 (13.2)	
		Cam Angle	Degree	44°	47°	40°	40°	
		Pulley Distance Z	(+ 0, -1) mm (+ 0, -1/32) in	16.5 (21/32)	16.5 (21/32)	32.75 (1-19/64)	32.75 (1-19/64)	
	X	± 0.4 mm (± 1/64 in)	35.0 (1-3/8)	35.0 (1-3/8)	36.5 (1-7/16)	36.25 (1-27/64)		
	Y - X	MIN. - MAX.	mm (in)	1.0 - 2.0 (.039 - .079)	1.0 - 2.0 (.039 - .086)	1.0 - 2.0 (.039 - .079)		
		Drive Belt Part Number (P/N)	414 8607 00	414 8607 00	414 6338 00	414 6338 00		
		Drive Belt Width (new) ①	mm (in)	35.3 (1-3/8)	35.3 (1-3/8)	34.6 (1-3/8)	34.6 (1-3/8)	
		Deflection	± 5 mm (± 13/64 in)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)	
			Force ②	kg (lbf)	11.3 (25)	11.3 (25)	11.3 (25)	11.3 (25)
	Width		cm (in)	38.1 (15.0)	38.1 (15.0)	50.0 (19.7)	60.0 (23.6)	
	Length		cm (in)	345.5 (136)	345.5 (136)	396.8 (156.2)	394 (155.1)	
	Profile Height		mm (in)	18.4 (.724)	18.4 (.724)	23.0 (.906)	23.0 (.906)	
	Adjustment	Deflection	mm (in)	35 - 40 (1-3/8 - 1-3/4)	35 - 40 (1-3/8 - 1-3/4)	40 - 50 (1-9/16 - 1-31/32)	40 - 50 (1-9/16 - 1-31/32)	
		Force ③	kg (lbf)	7.3 (16)	7.3 (16)	7.3 (16)	7.3 (16)	
		Track	SC-10 Touring	SC-10 Touring	Skandic WT	Skandic WT		
		Ski	DSA	DSA	Telescopic Strut	Telescopic Strut		
		Length	cm (in)	297.8 (117.2)	291.9 (114.9)	302.0 (118.9)	315.0 (124.0)	
		Width	cm (in)	120.7 (47.5)	120.7 (47.5)	104.5 (41.1)	110.0 (43.3)	
		Height	cm (in)	128.3 (50.5)	128.3 (50.5)	122 (48)	122 (48)	
		Ski Stance	cm (in)	106.7 (42)	106.7 (42)	90.0 (35.4)	90.0 (35.4)	
		Mass (dry)	kg (lb)	245 (539)	251 (553)	259 (569)	275 (605)	
		Ground Contact Area	cm² (in²)	7579.2 (1170)	7579.2 (1170)	10793 (1672.9)	13986 (2167.8)	
		Ground Contact Pressure	kPa (PSI)	3.18 (.461)	3.26 (.473)	2.35 (.341)	1.93 (.280)	
		Frame Material		Aluminum	Aluminum	Steel	Steel	
		Bottom Pan Material		Impact Copolymer	Impact Copolymer	HD Polyethylene	HD Polyethylene	
		Hood Material		RRIM Polyurethane	RRIM Polyurethane	RRIM	Fiberglass	
		Battery	V (A•h)	12 (22)	12 (22)	12 (22)	12 (22)	
		Headlight	W	H4 60/55	H4 60/55	H4 60/55	H4 60/55	
		Taillight and Stoplight	W	8/27	8/27	8/27	8/27	
		Tachometer and Speedometer Bulbs	W	2 x 3	2 x 3	2 x 3	2 x 3	
		Fuel and Temperature Gauge Bulbs	W	3	3	N.A.	N.A.	
		Fuse	Starter Solenoid	A	30	30	20	20
			Tachometer	A	N.A.	N.A.	N.A.	N.A.
		Fuel Tank	L (U.S. gal)	40 (10.6)	40 (10.6)	42 (11.1)	42 (11.1)	
		Chaincase/Gearbox	mL (U.S. oz)	250 (8.5)	250 (8.5)	500 (17)	500 (17)	
		Cooling System ④	L (U.S. oz)	5.0 (169)	5.0 (169)	N.A.	N.A.	
		Injection Oil Reservoir	L (U.S. oz)	2.8 (95)	2.8 (95)	2.55 (86)	2.55 (86)	

Vehicles

		VEHICLE MODEL	SKANDIC WT LC	
		ENGINE TYPE	494	
		Chain Drive Ratio	N.A.	
Chain	Pitch	in	N.A.	
	Type/Links Qty/Plates Qty		N.A.	
Drive Pulley	Type of Drive Pulley		TRA	
	Ramp Identification		290 ⑥	
	Calibration Screw Position or — calibration disc quantity		4	
	Spring Color		Yellow/Blue	
	Spring Length	± 1.5 mm (± .060 in)	91.0 (3.58)	
	Clutch Engagement	± 200 RPM	3000	
		Driven Pulley Spring Preload	± 0.7 kg (±1.5 lb)	
		Cam Angle	Degree 40°	
		Pulley Distance Z	(+ 0, -1) mm (+ 0, -1/32) in 32.75 (1-19/64)	
Offset	X	± 0.4 mm (± 1/64 in)	36.5 (1-27/64)	
	Y - X	MIN. - MAX.	mm (in) 0.75 - 2.25 (.030 - .086)	
		Drive Belt Part Number (P/N)	414 6338 00	
		Drive Belt Width (new) ①	mm (in) 34.60 (1-3/8)	
Drive Belt Adjustment		Deflection	± 5 mm (± 13/64 in) 32 (1-1/4)	
		Force ②	kg (lbf) 11.3 (25)	
Track	Width	cm (in)	50.0 (19.7)	
	Length	cm (in)	396.8 (156.2)	
	Profile Height	mm (in)	23.0 (.906)	
	Adjustment	Deflection	mm (in)	40 - 50 (1-9/16 - 1-31/32)
		Force ③	kg (lbf)	7.3 (16)
Suspension Type		Track	Skandic WT	
		Ski	Telescopic Strut	
	Length	cm (in)	302.0 (118.9)	
	Width	cm (in)	104.5 (41.1)	
	Height	cm (in)	122 (48)	
	Ski Stance	cm (in)	90.0 (35.4)	
	Mass (dry)	kg (lb)	285 (627)	
	Ground Contact Area	cm² (in²)	10793 (1673)	
	Ground Contact Pressure	kPa (PSI)	2.59 (.376)	
	Frame Material		Steel	
	Bottom Pan Material		HD Polyethylene	
	Hood Material		RRIM	
	Battery	V (A•h)	12 (22)	
	Headlight	W	H4 60/55	
	Taillight and Stoplight	W	8/27	
	Tachometer and Speedometer Bulbs	W	2 x 3	
	Fuel and Temperature Gauge Bulbs	W	N.A.	
	Fuse	Starter Solenoid	A	20
		Tachometer	A	N.A.
	Fuel Tank	L (U.S. gal)	42 (11.1)	
	Chaincase/Gearbox	mL (U.S. oz)	500 (17)	
	Cooling System④	L (U.S. oz)	N.A.	
	Injection Oil Reservoir	L (U.S. oz)	2.55 (86)	

SECTION 02 - WHAT'S NEW FOR 1998

ENGINE LEGEND

BTDC: Before Top Dead Center

CDI: Capacitor Discharge Ignition

CTR: Center

K: Kilo (× 1000)

MAG: Magneto Side

N.A.: Not Applicable

PTO: Power Take Off Side

R: Rectangular

ST: Semi-trapez

- ① The maximum horsepower RPM applicable on the vehicle. It may be different under certain circumstances and **BOMBARDIER INC.** reserves the right to modify it without obligation.
- ② Crankshaft end-play is not adjustable on these models. Specification is given for verification purposes only.
- ③ Rotary valve to crankcase clearance: 0.27 — 0.48 mm (.011 — .019 in).
- ④ At 6000 RPM (engine cold) with headlamp turned on.
- ⑤ All resistance measurements must be performed with parts at room temperature (approx. 20°C (68°F)). Temperature greatly affects resistance measurements.
- ⑥ Force applied midway between pulleys to obtain specified tension deflection.
- ⑦ Drive pulley retaining screw: torque to 90 to 100 N•m (66 to 74 lbf•ft), install drive belt, accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake; repeat 5 times. Recheck the torque of 90 to 100 N•m (66 to 74 lbf•ft).

VEHICLE LEGEND

DSA: Direct Shock Action

RRIM: Reinforced Reaction Injection Molding

TRA: Total Range Adjustable

N.A.: Not Applicable

- ① Minimum allowable width may not be less than 3.0 mm (1/8 in) of new drive belt.
- ② Force applied midway between pulleys to obtain specified tension deflection.
- ③ Force or downward pull applied to track to obtain specified tension deflection.
- ④ Coolant mixture: 60% antifreeze/40% water.
- ⑤ Lever with roller pin P/N 417 0043 09 (hollow).
- ⑥ Lever with roller pin P/N 417 0043 08 (solid).
- ⑦ Lever with roller pin P/N 417 0043 03 (hollow).

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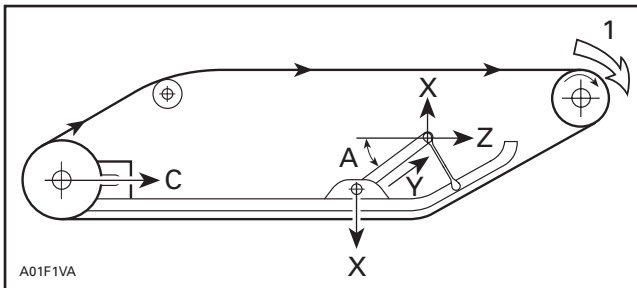
SECTION 03 - CHASSIS PREPARATION

SUSPENSION OPERATION/ WEIGHT TRANSFER

The purpose of any suspension system is to isolate the rider from the terrain while still allowing for complete control of the vehicle. A snowmobile rear suspension has the added requirements of providing weight transfer and maintaining correct track tension.

Weight transfer is essentially the shifting of weight to the track for better traction during acceleration, and to the skis for positive handling during cornering.

The physics that apply to all rear suspensions are basically the same. As we apply torque from the engine to the drive axle, the torque is transferred to the track and pulls it forward. That energy enters the suspension system at the rear axle and tries to pull it forward (force "C" in following illustration). The rear arm is a pivoting or sliding linkage that only provides vertical forces at the rear of the chassis, therefore, none of force "C" enters the chassis at the rear arm.



1. Drive axle torque

The front arm is mounted with a pivot to both the runners and the chassis. It is through this arm that the major reaction to the engine torque is applied. As the front arm begins to swivel from the load of force "C", it pushes down on the front of the track (force "X" in illustration). This reduces weight on the skis and applies more weight on the track for better traction. The rest of the force "C" enters the chassis through the front arm and accelerates the vehicle (force "Z").

If we keep force "C" constant, we can then vary the size of the vertical and horizontal forces at the front arm by varying angle "A". As angle "A" is made smaller, force "X" decreases, and force "Z" increases. This reduces the amount of torque reaction and more weight stays on the skis. As angle "A" is increased, force "X" increases. The skis then tend to lift more during acceleration and more weight is placed on the track.

We can vary angle "A", within limits, by adjusting the length of the limiter strap. The limiter strap is just that, a strap to limit the extension of the front of the suspension. Shortening the strap decreases angle "A" and is what we would do to set up a machine for more ski pressure. For more track pressure we would want to lengthen the strap to increase angle "A". The limiter adjustment has the largest affect on controlling the amount of weight transfer.

NOTE: Track tension must be checked whenever a major change is made to the limiter length.

Front arm spring pressure will also affect weight transfer. A stiffer spring and/or more preload will transfer more weight to the track. A softer spring and/or less preload will keep more weight on the skis. Springs must also be selected to provide absorption to the intended size of bumps to be encountered. A soft spring will increase ski pressure but may "bottom out" on large bumps, while a stiff spring will provide more track pressure but may produce a harsh ride.

NOTE: In this and other Ski-Doo texts, we refer to the front arm of the rear suspension and it's spring and shock absorber, as the center of the vehicle. The ski suspension is considered the front of the vehicle and the rear arm of the rear suspension and it's spring(s) and shock(s) are indicated as the rear of the vehicle.

Also, think of the center arm as a pivot point. During acceleration the rear arm will want to compress and the front suspension will want to extend (possibly raising the skis off the ground). Because of this "pivoting" affect, the rear spring and preload will also affect weight transfer (to a lesser amount than center arm changes). A softer rear spring and/or less preload will allow more weight transfer to the track and less ski pressure, while stiffer rear springs and/or more preload will allow less weight transfer to the track and more ski pressure.

Contrary to popular belief, it is not necessary to have the skis 2 feet off the ground to achieve good weight transfer. In fact, the energy used to lift the front of the vehicle is not available to push the vehicle forward.

The main function of the rear arm is to support the weight of the vehicle and rider, yet provide usable travel to absorb bumps and jumps. The springs are chosen depending on the linkage design of the rear arm and the intended load to be applied. Stiffer springs will be used on vehicles intended to carry heavier loads and on vehicles that plan to encounter large bumps, while vehicles used for lighter loads and on smaller bumps will use softer springs.

Springs for the front suspension are chosen in a similar fashion. A softer spring will provide less ski pressure and will be used on lighter vehicles while stiffer springs will provide more ski pressure and be used on heavier vehicles.

NOTE: Shock absorber valving and the type of shock used will also affect weight transfer. Refer to the shock absorber section for details.

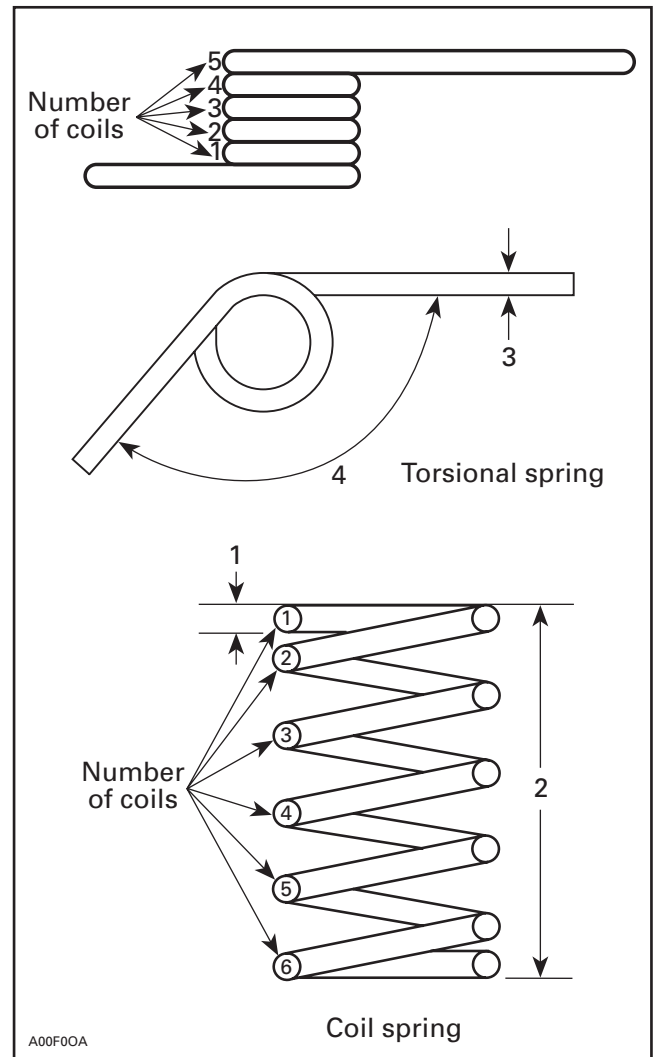
A.C.M.

The SC-10 High Performance and Cross Country Rear Suspensions incorporates the use of A.C.M. technology. Under hard acceleration, the A.C.M. linkage couples the front and rear arms moving the rails rearward, thus reducing ski lift. The A.C.M. can be used to increase and decrease weight transfer. Tightening the A.C.M. will decrease weight transfer. Loosening the A.C.M. will increase weight transfer.

SPRINGS

General

Generally, 2 types of springs are used on our suspensions. Coil springs and torsional springs. Refer to following illustration.



- 1. Wire diameter
- 2. Free length
- 3. Wire diameter
- 4. Opening angle

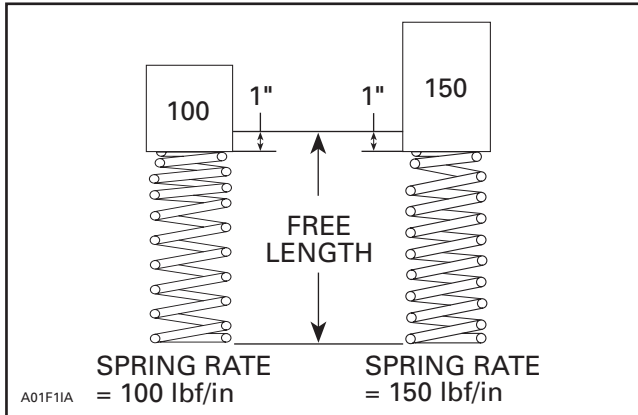
Several factors are used to determine the characteristics of a spring and they are similar for both the coil and torsional spring types. Wire diameter, material type, the number of coils and the physical shape of a spring all determine how a spring will act. Once these characteristics are built into a spring, they determine the spring rate and the free length in a coil spring or the opening angle and spring rate in a torsional spring.

Coil Springs

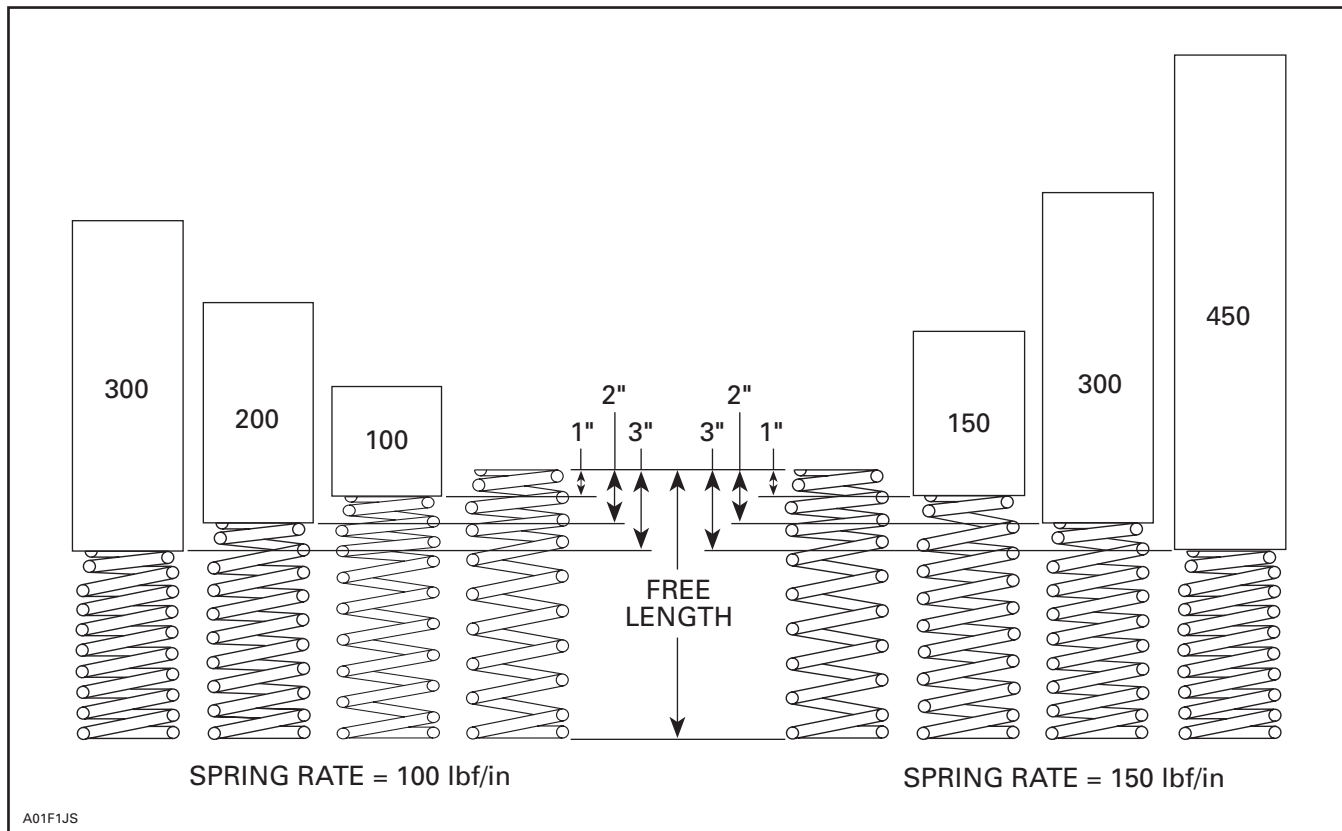
The free length of a coil spring is the length with no load applied to the spring.

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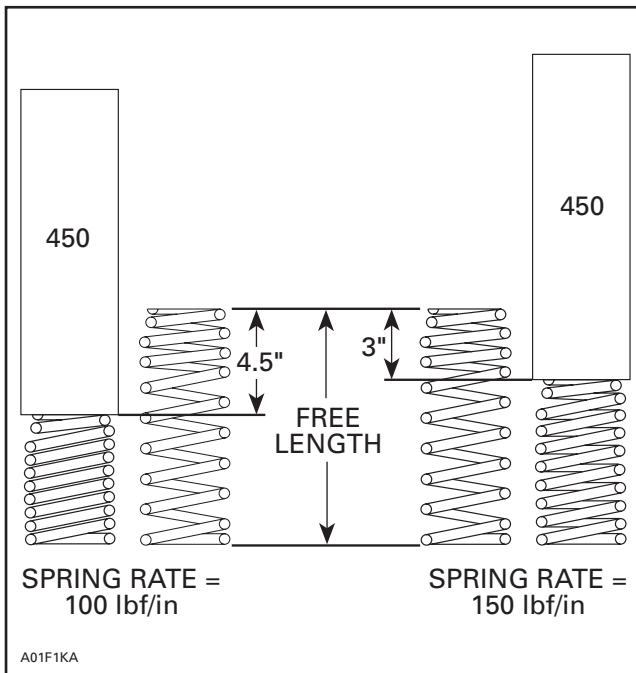
The spring rate of a coil spring is defined as the amount of force required to compress the spring one inch. If a 100 pound force compresses a spring 1 inch it is referred to as having a rate of 100 lbf/in (pounds per inch). If 150 pounds of force is required to compress a spring 1 inch then it would have a rate of 150 lbf/in (see following illustration).



Most springs are designed as a straight rate spring. This means that the spring requires the same force to compress the last one inch of travel as the first one inch of travel. Example: A 100 lbf/in rate spring will compress one inch for every 100 pounds applied. A force of 200 pounds will compress the spring 2 inches. A 300 pound force will compress the spring 3 inches and so on. The 150 lbf/in rate spring will require 150 pounds to compress the spring each one inch. To compress this spring 3 inches it will require a force of 450 pounds (see following illustration).

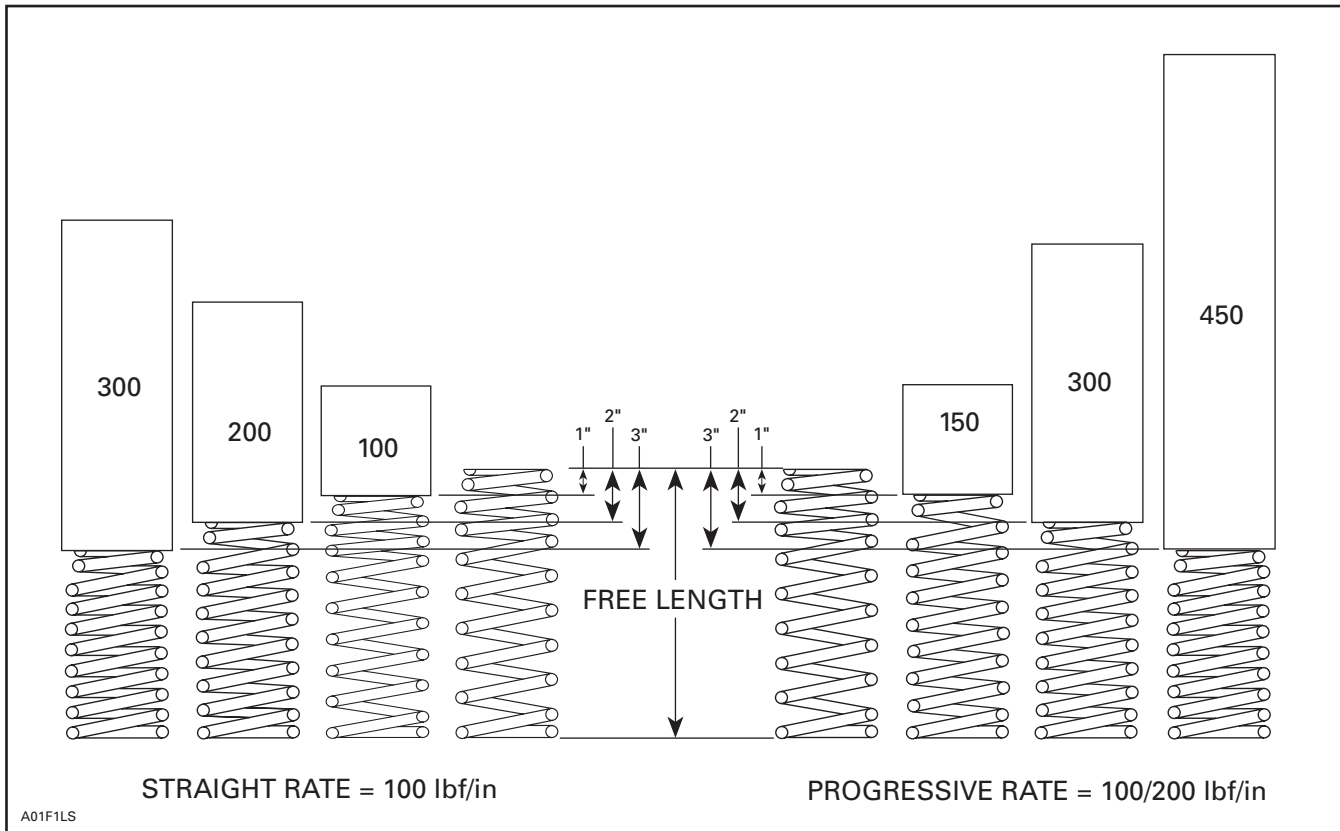


In terms of your suspension, if a bump is encountered that translates into a force at the spring of 450 pounds, the 100 lbf/in spring will want to compress 4.5 inches while the 150 lbf/in spring will only compress 3 inches. If our suspension only has 4 inches of spring travel the unit with the 100 lbf/in spring will bottom out while the 150 lbf/in unit still has 1 inch of travel remaining (see following illustration).



A spring can also be progressively wound. This means that the rate of the spring is increasing as it is compressed. A 100/200 lbf/in progressive spring will require 100 pounds to compress the first one inch but will require 200 additional pounds to compress the last one inch (see following illustration).

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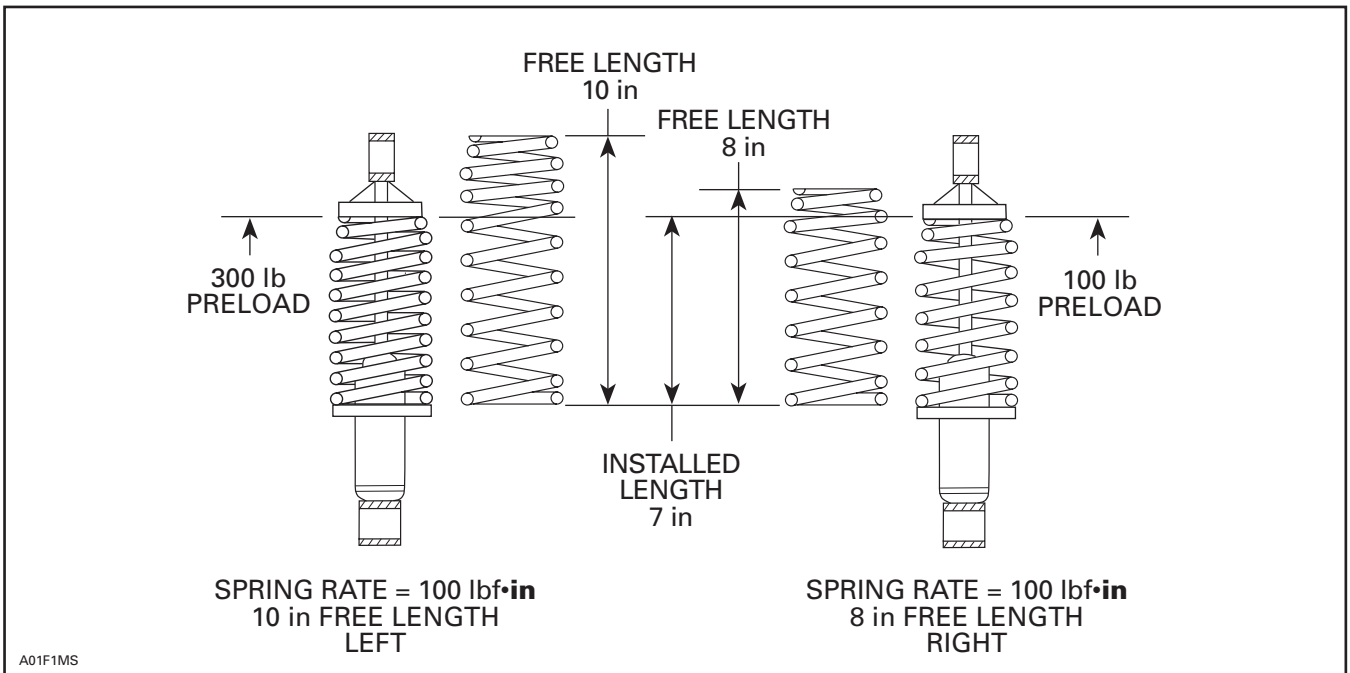


An easy way to measure coil springs is to put a bathroom scale in a press with the spring resting on the scale. Measure the free length and then apply a load until the spring compresses 1 inch. The reading on the scale will approximate the rate of the spring. Now compress the spring another 1 inch. If the spring is a straight rate, the scale reading should be doubled. If the reading is more than doubled, then you have a progressive spring. If you can compress the spring another 1 inch (3 inches total) (don't blow up your scale) the reading should be 3 times your first reading. In order to maintain a reasonable cost on springs, the manufacturing tolerances are quite large. A 100 lbf/in rated spring may test anywhere from 80 to 120 lbf/in.

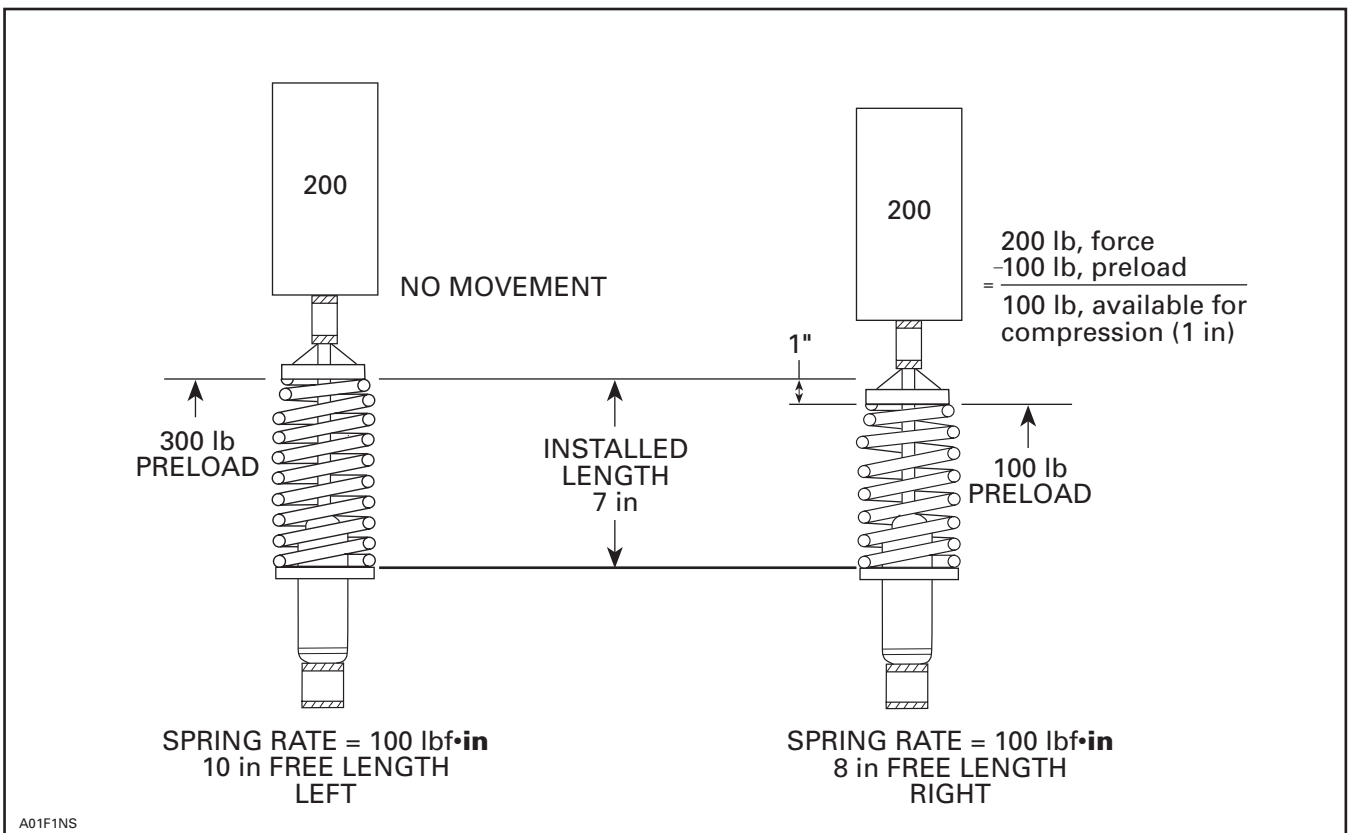
Now, so far we have assumed that the 2 springs in our examples have the same free length and that they are not preloaded at all. In the case of our suspensions, we mount the coil springs on a shock absorber. The shock will have a certain length between the spring retainers which is called the installed length of the spring. If the installed length is less than the free length (as is the case in most applications), then there will be some preloading of the spring.

Let us see what happens if we make 2 100 lbf/in springs. One with a free length of 10 inches and one at 8 inches. We will put them both onto a shock with an installed length of 7 inches. The 10 inch spring will need to be compressed 3 inches. This will give us a preload of 300 pounds. The 8 inch spring is only compressed 1 inch so it only has 100 pounds of preload.

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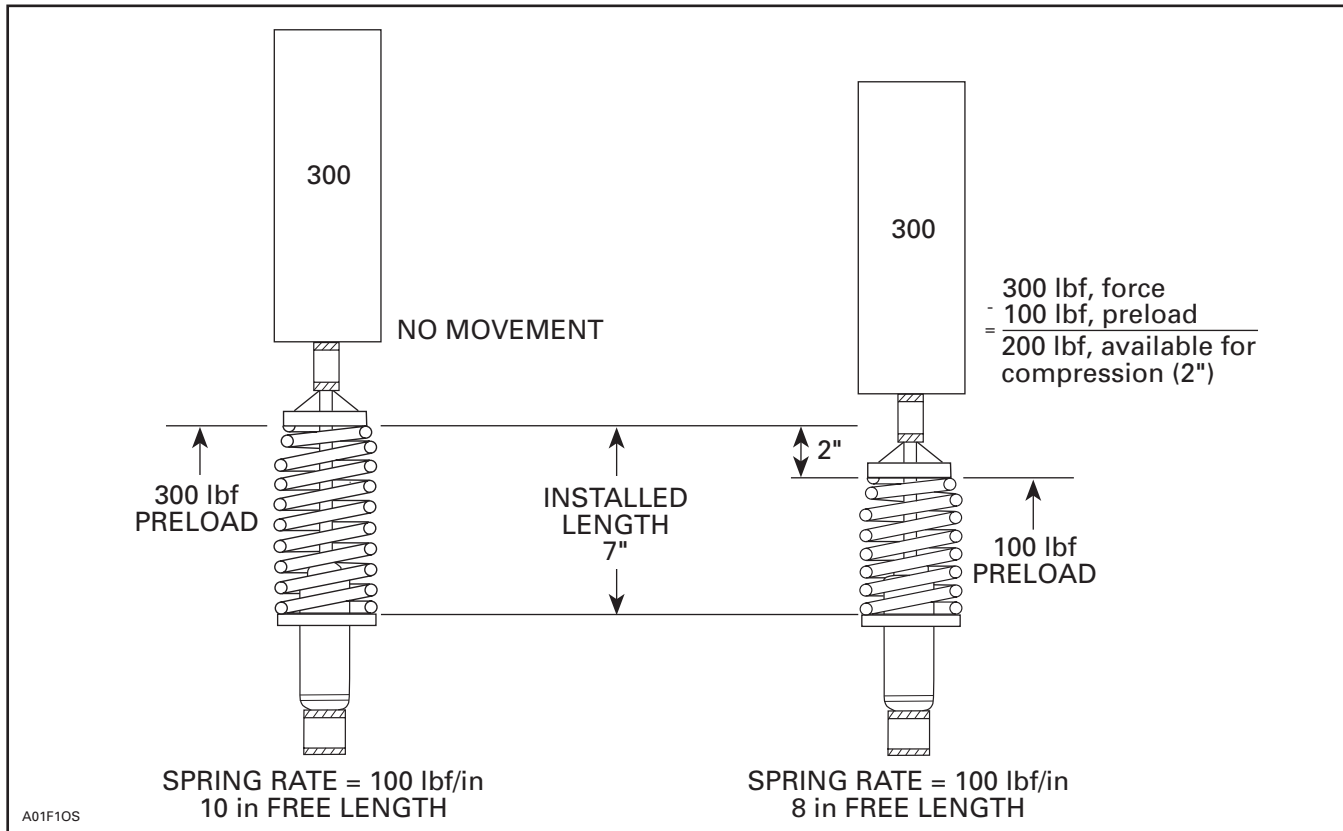


If we now apply a 200 pound load to the system, the 10 inch spring will not move because it has 300 pounds of preload. But the 8 inch spring will compress one inch (see following illustration).



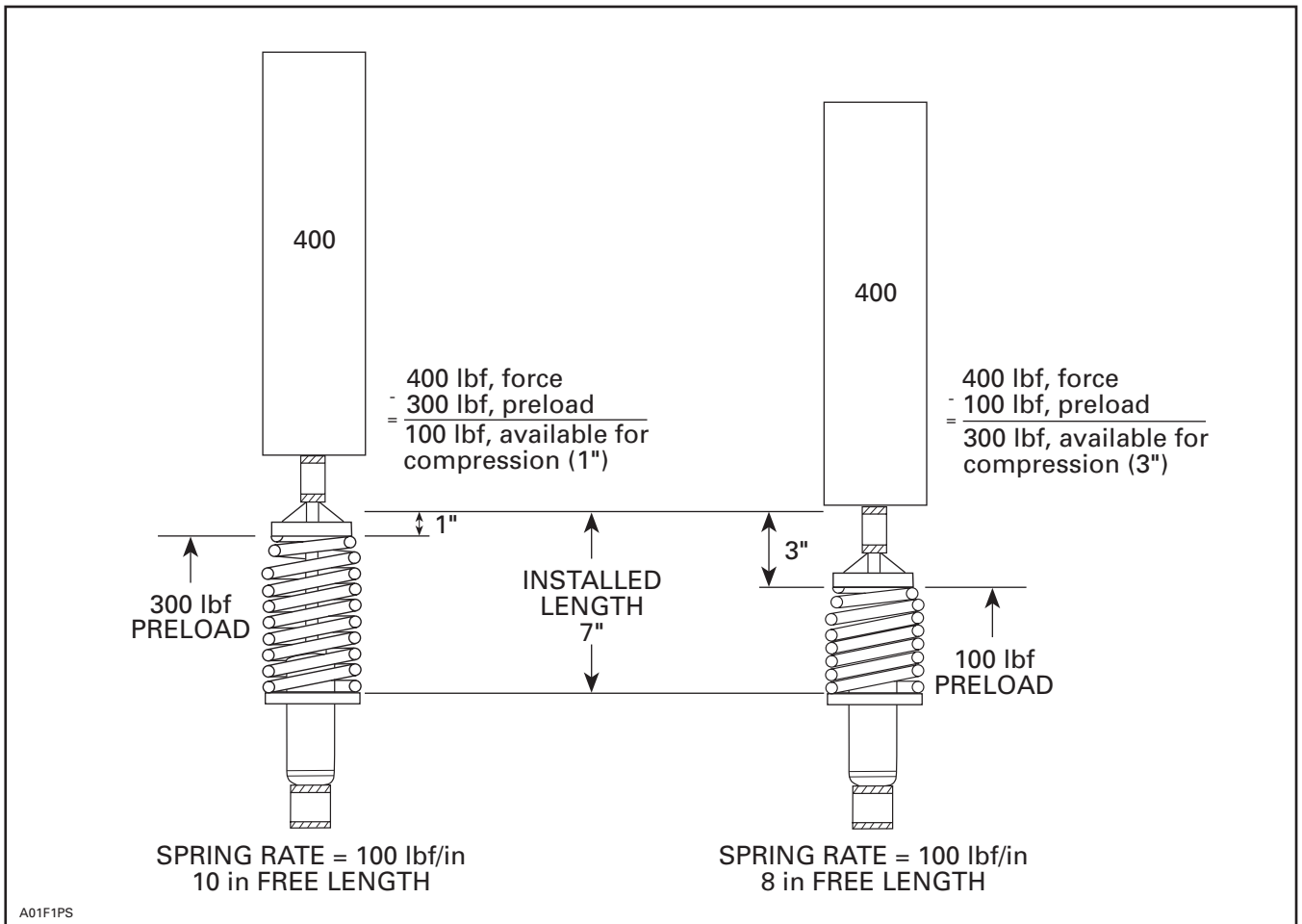
SECTION 03 - CHASSIS PREPARATION

If another 100 pounds is applied the 10 inch spring will still not move, but the 8 inch spring will compress another one inch (2 inches total).



Finally, if more than 300 pounds is applied, the 10 inch spring will start to compress. If 400 pounds were applied the 10 inch spring will compress one inch and the 8 inch spring will compress 3 inches. Notice that each additional 100 pounds added after movement begins compresses the system one inch because the spring rate is 100 lbf/in on both springs.

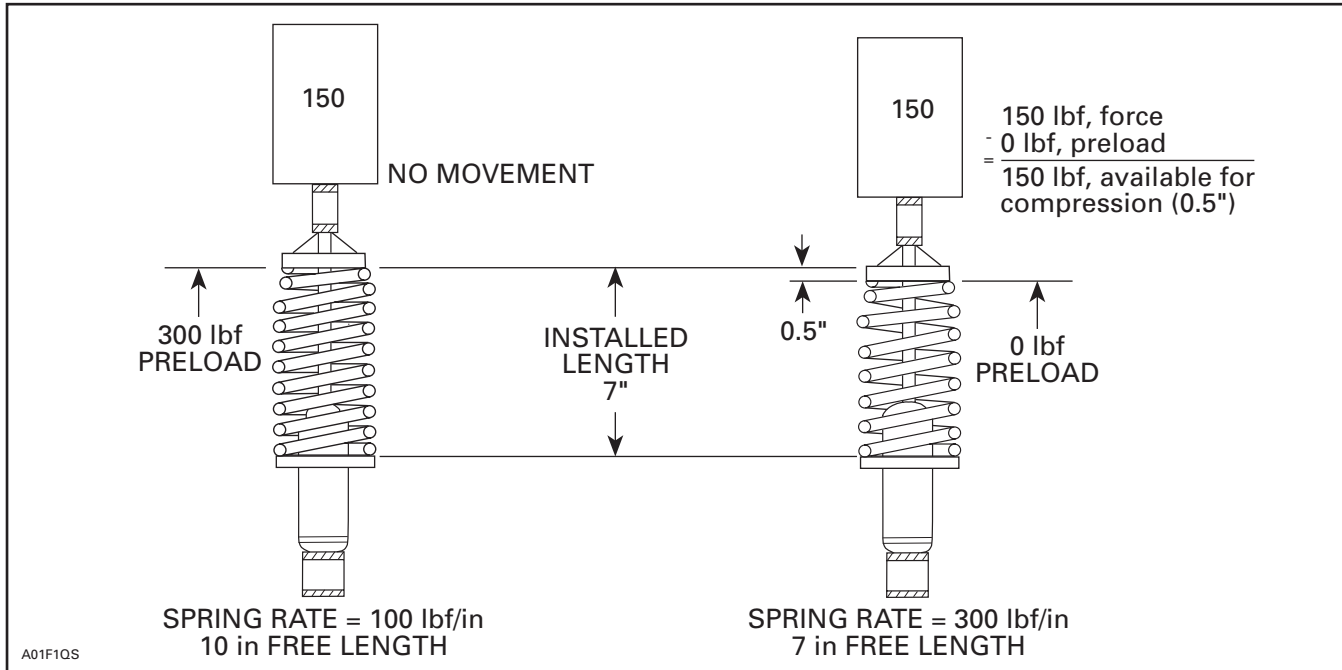
SECTION 03 - CHASSIS PREPARATION



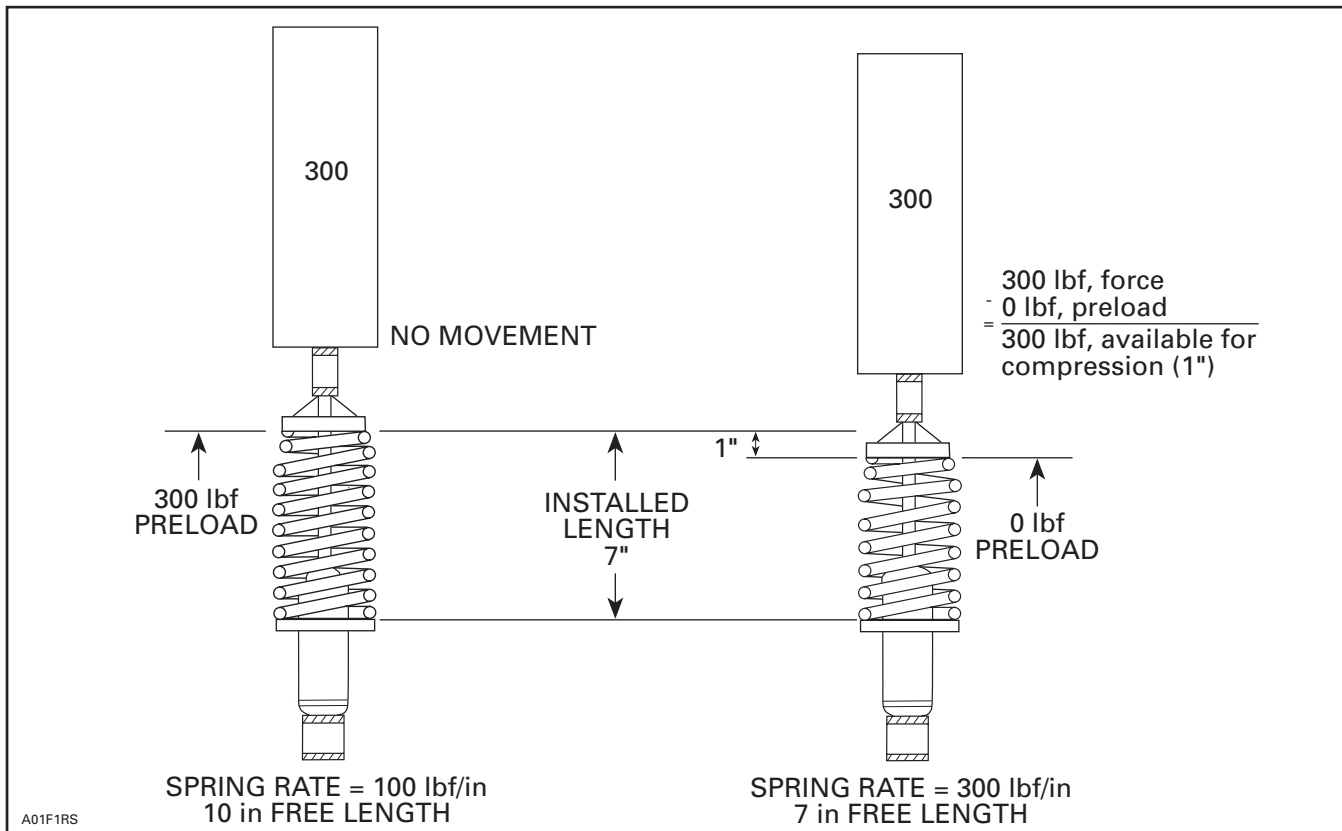
Now let's see what happens if we use a long, soft spring and a short, stiff spring. We will use a 100 lbf/in rate spring with a free length of 10 inches. Our 2nd spring will be a 300 lbf/in rate spring with a free length of 7 inches. The installed length will be 7 inches as in the previous example, thus the 100 lbf/in, 10 inch spring will react the same with 300 pounds of preload. The 300 lbf/in spring will not have any preload as its installed length is the same as the free length.

So if we apply 150 pounds of force, the 1st spring will not move, while the 2nd spring will compress 0.5 inches (see following illustration).

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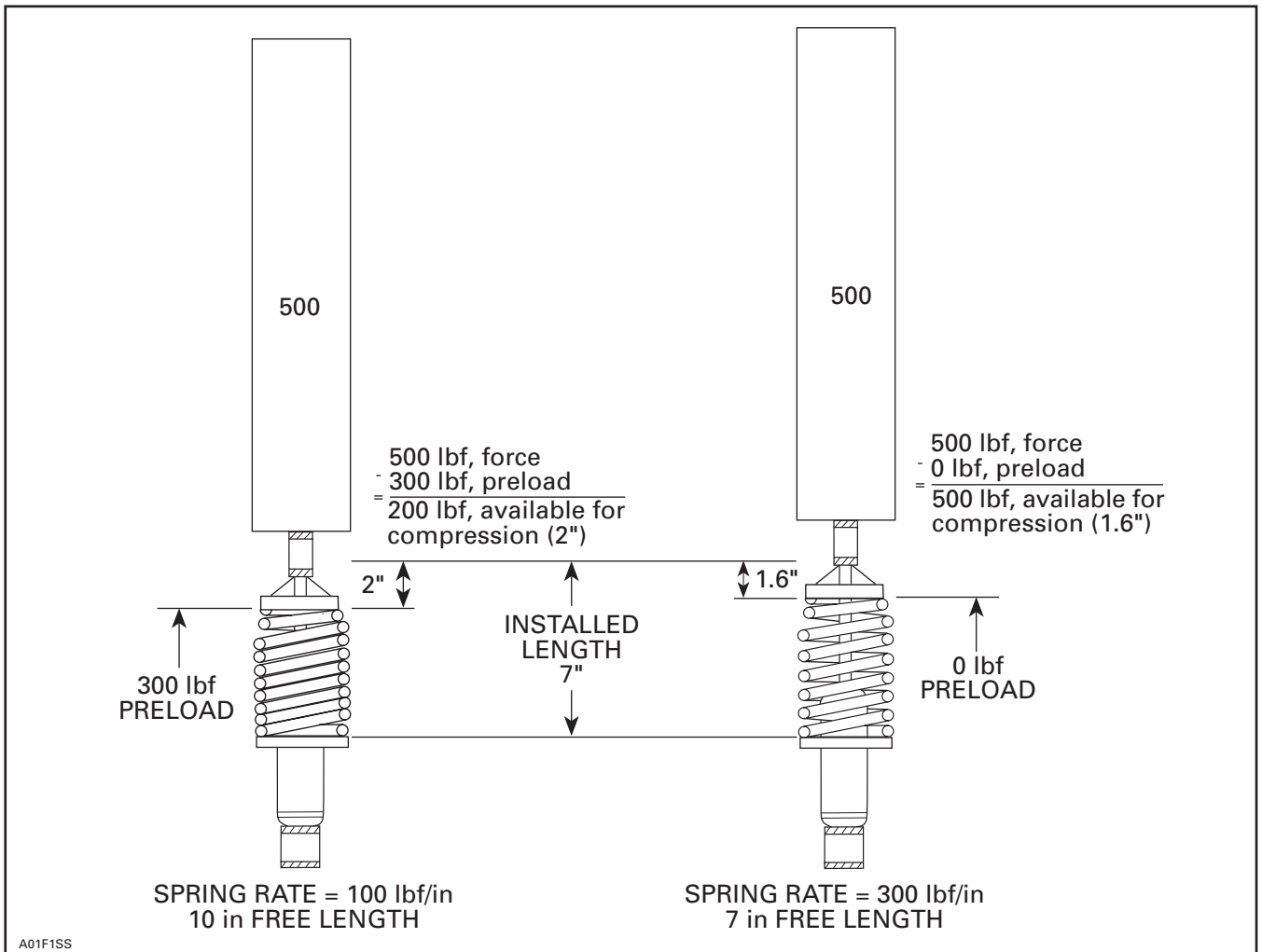


At 300 pounds applied force the 1st spring will not yet move and the 2nd spring will compress 1 inch (following illustration).



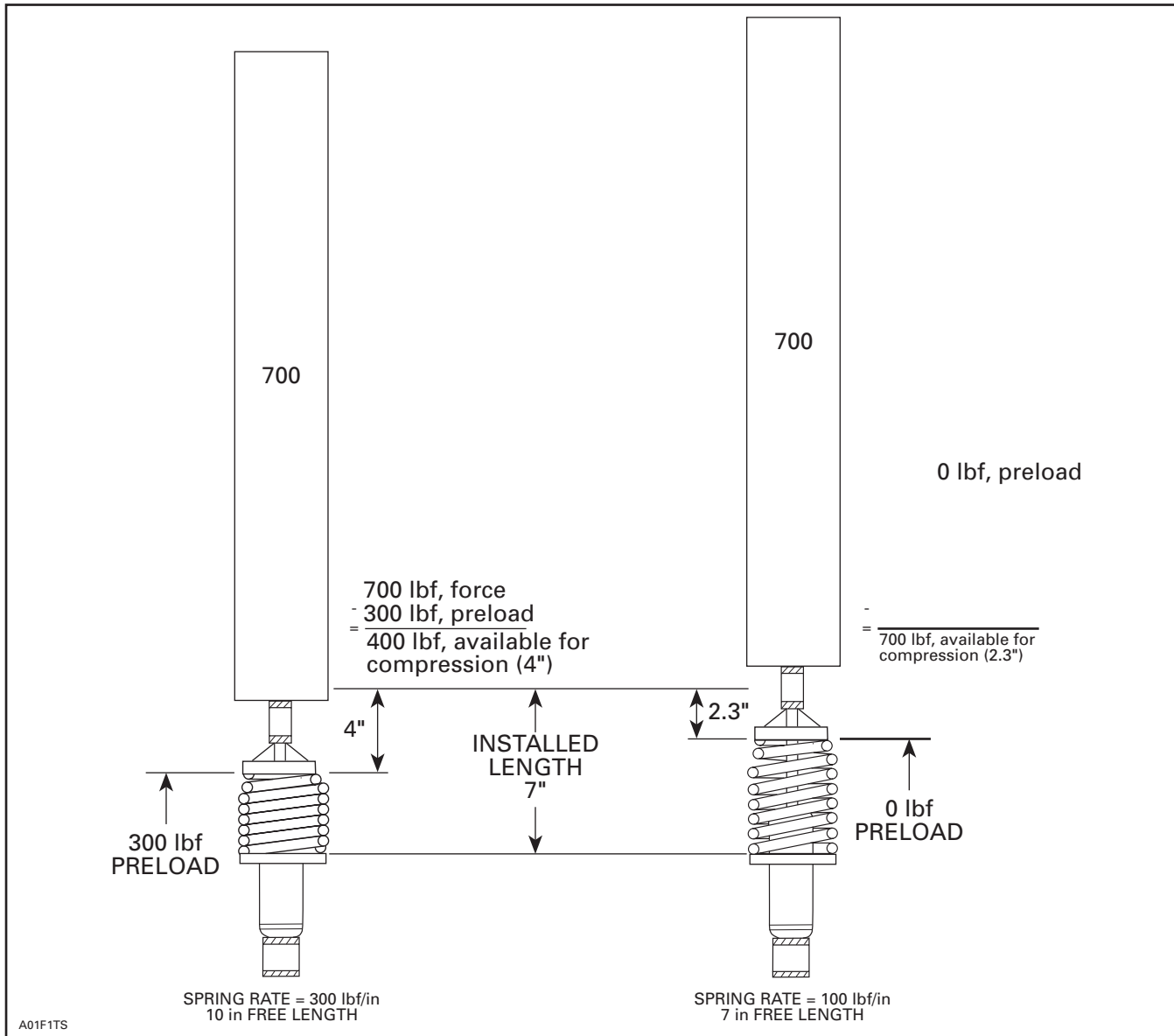
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With a force of 500 pounds applied the 1st spring will compress 2 inches and the 2nd spring will compress 1.6 inches (following illustration).



If 700 lb were now applied, the 100 lbf/in spring will now compress 4 inches while the 300 lbf/in spring will only compress 2.3 inches (following illustration).

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So while the soft spring with a lot of preload acted stiffer initially, it's rate allowed it to compress substantially with increasing loads. But the stiffer rate spring with no preload actually acted softer at small loadings but then became stiff very quickly as the load increased.

Dual Rate Spring Formula

$$\frac{\text{Spring 1} \times \text{Spring 2}}{\text{Spring 1} + \text{Spring 2}}$$

A Dual Rate Spring will assume the rate of the heavier rate spring when the lighter spring bottoms or coil binds.

Example:

Spring 1 100# Rate

Spring 2 150# Rate

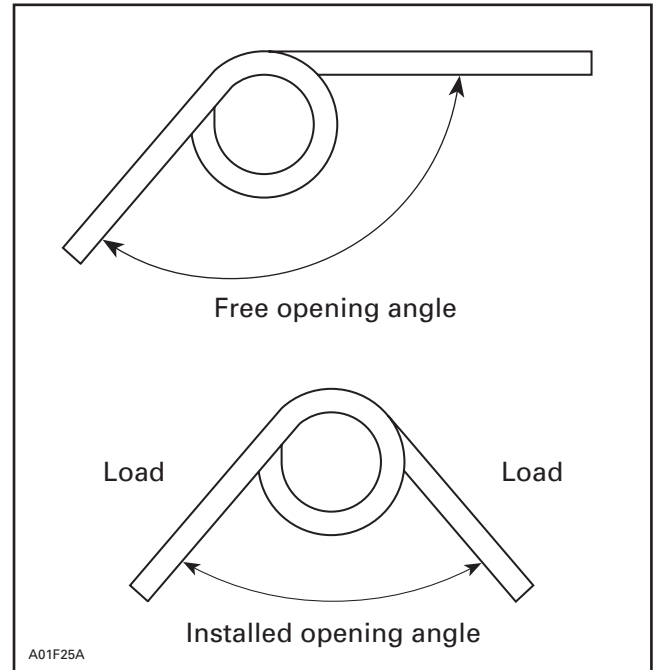
$$\frac{100 \times 150}{100 + 150} = \frac{1500}{250} = 60$$

Spring 1 was a 100# Rate separately, but when stacked on the 150# spring (spring 2), it now has a 60# rate. As the spring bottoms or coil binds, it will assume the 150# rate of spring 2.

Torsional Springs

A torsional spring acts just like a coil spring but it is shaped differently. It is much more difficult to measure the rate of a torsional spring because of the lengths of the legs and where the load will be applied. The rear torsional springs on the S chassis are rated in lb-ft/degree (pounds-feet per degree of rotation). Suffice it to say that there are stiffer and softer springs for most applications.

The preload on a torsional spring is controlled by the free opening angle and the installed opening angle. If a torsional spring must be "twisted" more to be installed, then it will have more preload (following illustration).



Spring Identification

Our springs will have one, 2 or 3 stripes of color painted on the spring. This is the color code used for identification. Refer to the applicable chart to find a cross reference between the part number, model application, color code, spring rate, free length and spring type. The spring type denotes physical characteristics of the spring like the inside diameter of the ends which will determine the type of retainer used to hold the spring. All spring types are not interchangeable.

CHECK THE SPRING TYPE AND FIT OF THE SPRING RETAINER BEFORE INSTALLING DIFFERENT SPRINGS!

Spring Preload Spacers:

- 503 1171 00 8.25 mm thick × 46.8 mm I.D.
- 503 1621 00 15.0 mm thick × 47.8 mm I.D.

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Spring Chart 1996

The following information is divided into 2 main sections.

Section 1, Spring Applications

Is a quick reference chart which provides authorized spring applications per Ski-Doo model. It contains the standard spring part number (in gray shading) as installed at the factory, as well as 1 softer spring and 1 harder spring recommendation.

Section 2, Spring Specifications

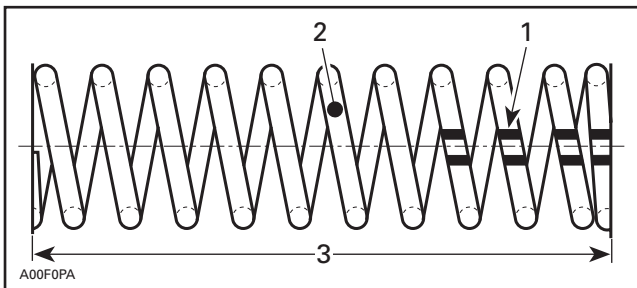
Refers to spring specifications.

The informations in this bulletin supersede all informations previously published.

Please update your *Shop Manual* by indicating the number of this bulletin in the proper section of the manual.

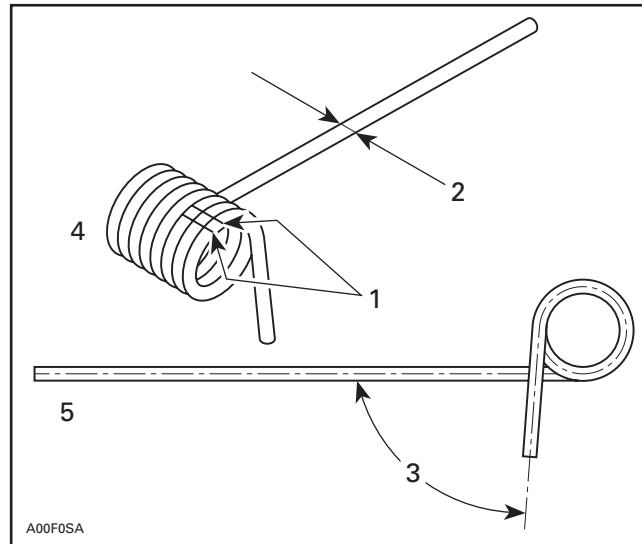
COIL SPRINGS (Compression)

Type R (Straight on Both Ends)



1. Color Code Stripes
2. Wire Diameter
3. Free Length

TORSION SPRINGS

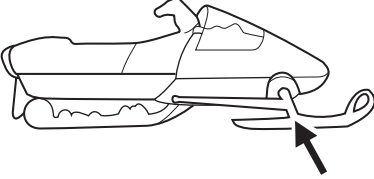


1. Color Code Stripes
2. Wire Diameter
3. Opening Angle (°)
4. Left Hand (LH)
5. Right Hand (RH)

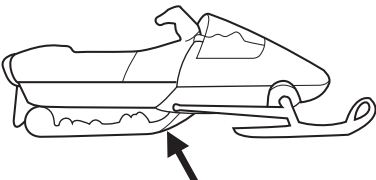
SECTION 03 - CHASSIS PREPARATION

SPRING APPLICATIONS 1996

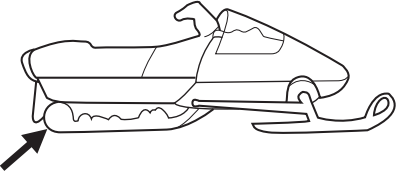
Section 1

1996	FRONT SPRINGS		1996
			
MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
MACH Z	414 9744 00	414 9565 00	414 9761 00
MACH Z LT	414 9744 00	414 9565 00	414 9761 00
MACH 1	414 9744 00	414 9565 00	414 9761 00
FORMULA III	414 9744 00	414 9564 00	414 9761 00
FORMULA III LT	414 9744 00	414 9564 00	414 9761 00
FORMULA Z	414 9281 00	414 9761 00	415 0397 00
FORMULA SS	414 9281 00	414 9761 00	415 0397 00
FORMULA STX	414 8951 00	414 9561 00	415 0397 00
FORMULA STX LT	414 8951 00	414 9561 00	415 0397 00
FORMULA SLS	414 8951 00	414 9561 00	415 0397 00
FORMULA SL	414 8951 00	414 9561 00	415 0397 00
FORMULA S	414 8951 00	414 9560 00	415 0397 00
MX-Z 670	414 9744 00	414 9563 00	414 9761 00
MX-Z 583	414 9744 00	414 9560 00	414 9761 00
MX-Z 440	414 9744 00	414 9560 00	414 9761 00
SUMMIT 670	414 9168 00	414 9686 00	415 0396 00
SUMMIT 583	414 9168 00	414 9686 00	415 0396 00
SUMMIT 500	414 9168 00	414 9686 00	415 0396 00
GRAND TOURING SE	414 9744 00	414 9568 00	414 9761 00
GRAND TOURING 580	414 8951 00	414 9559 00	415 0397 00
GRAND TOURING 500	414 8951 00	414 9559 00	415 0397 00
TOURING SLE	414 8951 00	414 9560 00	415 0397 00
TOURING LE	414 8951 00	414 9560 00	415 0397 00
TOURING ELT	414 8951 00	414 9560 00	415 0397 00
TOURING E	414 8951 00	414 9560 00	415 0397 00
SKANDIC 500	414 8593 00	414 9558 00	414 9686 00
SKANDIC 380	414 8593 00	414 9558 00	414 9686 00

SECTION 03 - CHASSIS PREPARATION

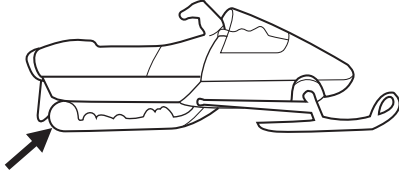
1996		CENTER SPRINGS		1996	
					
MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING		
MACH Z	414 9760 00	414 8778 00	415 0137 00		
MACH Z LT	414 8778 00	415 0137 00	415 0401 00		
MACH 1	414 9760 00	414 8778 00	415 0137 00		
FORMULA III	414 9760 00	414 8778 00	415 0137 00		
FORMULA III LT	414 8778 00	415 0137 00	415 0401 00		
FORMULA Z	414 9293 00	415 0129 00	415 0398 00		
FORMULA SS	414 9293 00	415 0129 00	415 0398 00		
FORMULA STX	414 9168 00	414 9562 00	414 9760 00		
FORMULA STX LT	414 9562 00	414 9760 00	415 0399 00		
FORMULA SLS	414 9168 00	414 9562 00	414 9760 00		
FORMULA SL	Not Applicable	414 9744 00	414 9745 00		
FORMULA S	Not Applicable	414 9744 00	414 9745 00		
MX-Z 670	Not Applicable	414 8951 00	415 0400 00		
MX-Z 583	Not Applicable	414 8951 00	415 0400 00		
MX-Z 440	Not Applicable	414 8951 00	415 0400 00		
SUMMIT 670	414 9562 00	414 9760 00	415 0399 00		
SUMMIT 583	414 9562 00	414 9760 00	415 0399 00		
SUMMIT 500	414 9562 00	414 9760 00	415 0399 00		
GRAND TOURING SE	414 8778 00	415 0137 00	415 0401 00		
GRAND TOURING 580	414 9562 00	414 9760 00	415 0399 00		
GRAND TOURING 500	414 9562 00	414 9760 00	415 0399 00		
TOURING SLE	414 9744 00	414 9745 00	414 7977 00		
TOURING LE	414 9744 00	414 9745 00	414 7977 00		
TOURING ELT	414 9744 00	414 9745 00	414 7977 00		
TOURING E	Not Applicable	414 9744 00	414 9745 00		
SKANDIC 500	414 9745 00	414 9745 00	414 7977 00		
SKANDIC 380	414 9745 00	414 9745 00	414 7977 00		

SECTION 03 - CHASSIS PREPARATION

1996	REAR SPRINGS		1996
			
MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
FORMULA Z	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH	414 9443 00 LH 414 9442 00 RH
FORMULA SS	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH	414 9443 00 LH 414 9442 00 RH
FORMULA STX	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
FORMULA STX LT	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH	414 9443 00 LH 414 9442 00 RH
FORMULA SLS	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
FORMULA SL	Not Applicable	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH
FORMULA S	Not Applicable	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH
MX-Z 670	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
MX-Z 583	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
MX-Z 440	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
SUMMIT 670	Not Applicable	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH
SUMMIT 583	Not Applicable	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH
SUMMIT 500	Not Applicable	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH
GRAND TOURING 580	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH	414 9443 00 LH 414 9442 00 RH
GRAND TOURING 500	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH	414 9443 00 LH 414 9442 00 RH
TOURING SLE	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
TOURING LE	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
TOURING ELT	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH

LH= Left Hand RH=Right Hand

SECTION 03 - CHASSIS PREPARATION

1996		REAR SPRINGS		1996	
					
MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING		
TOURING E	Not Applicable	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	414 9436 00 LH 414 9435 00 RH	
SKANDIC 500	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH	415 0106 00 LH 415 0105 00 RH	
SKANDIC 380	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH	415 0106 00 LH 415 0105 00 RH	
MACH Z	414 8091 00	415 0145 00	415 0144 00	415 0144 00	
MACH Z LT	414 8091 00	415 0145 00	415 0144 00	415 0144 00	
MACH 1	414 8091 00	415 0145 00	415 0144 00	415 0144 00	
FORMULA III	414 8715 00	415 0139 00	415 0144 00	415 0144 00	
FORMULA III LT	414 8715 00	415 0139 00	415 0144 00	415 0144 00	
GRAND TOURING SE	414 9271 00	415 0138 00	415 0144 00	415 0144 00	

LH= Left Hand RH=Right Hand

SECTION 03 - CHASSIS PREPARATION

SPRING SPECIFICATIONS 1996

Section 2 — Coil Springs Specifications

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
291 000 794	R	100	215	6.65	PI/WH	BLACK
414 7713 00	R	135	272.5	8.41	BK/BK	SAFARI RED
414 7823 00	R	225	165	8.41	BK	SAFARI RED
414 7882 00	R	150	272.5	8.41	BK/YL	SAFARI RED
414 7894 00	R	135	272.5	8.41	BK/BK	AQUA BLUE
414 7977 00	R	135	272.5	8.41	BK/BK	FLAME RED
414 7978 00	R	135	272.5	8.41	BK/BK	PEARL BLUE
414 7979 00	R	135	272.5	8.41	BK/BK	VIOLET
414 8030 00	R	65	408	6.17	BL/OR	BLACK
414 8088 00	R	120	272.5	7.77	BK/OR	SAFARI RED
414 8093 00	R	160	213.1	7.77	WH	BLACK
414 8095 00	R	150 ± 5	256.8	7.92	BK	YELLOW
414 8101 00	R	125 ± 5	256.8	7.49	WH	YELLOW
414 8593 00	R	90 ± 7	239	7.14	BK/WH	YELLOW
414 8616 00	R	135	272.5	8.41	BK/BK	BLACK
414 8690 00	R	125 ± 5	256.8	7.49	WH	SAFARI RED
414 8716 00	R	150 ± 5	256.8	7.92	WH	VIOLET
414 8778 00	R	160 ± 7	223.1	7.92	WH/WH	BLACK
414 8910 00	R	100 ± 7	260	7.14	WH/BK	SAFARI RED
414 8938 00	R	185 ± 7	213	8.41	GN/GN	YELLOW
414 8951 00	R	100	255	7.14	PI/GD	BLACK
414 9168 00	R	90 ± 7	239	7.14	RD	FIREFLY GREEN
414 9281 00	R	110	256.8	7.77	GD/BK	SAFARI RED
414 9286 00	R	100 ± 7	260	7.14	GD	RASPBERRY
414 9293 00	R	110	256.8	7.77	BK/RD	PEARL BLUE
414 9295 00	R	100 ± 7	260	7.14	RD/YL	PEARL BLUE
414 9402 00	R	140 ± 7	223	7.77	WH/GN	BLACK

SPRING COLOR CODES

BK=BLACK BL=BLUE GD=GOLD GN=GREEN OR=ORANGE PI=PINK RD=RED SI=SILVER WH=WHITE YL=YELLOW

SECTION 03 - CHASSIS PREPARATION

Section 2 — Coil Springs Specifications

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
414 9558 00	R	100	239	7.14	RD/GN/GN	BLACK
414 9559 00	R	125 ± 5	256.8	7.49	BK/RD	NEON GREEN
414 9560 00	R	125 ± 5	256.8	7.49	BL/RD	BLACK
414 9561 00	R	125 ± 5	256.8	7.49	BL/BL/BL	VIPER RED
414 9562 00	R	115	242	7.77	PI/BL	BLACK
414 9563 00	R	100	265	7.14	PI/WH/BL	YELLOW
414 9564 00	R	100 ± 7	260	7.14	RD/YL/BL	ROYAL VIOLET
414 9565 00	R	100 ± 7	260	7.14	BL/YL/GN	VIPER RED
414 9568 00	R	100 ± 7	260	7.14	RD/YL	NEON GREEN
414 9686 00	R	125	235	7.49	RD	NEON GREEN
414 9744 00	R	90	265	7.14	GN/OR	BLACK
414 9745 00	R	115	265	7.49	OR/WH	BLACK
414 9760 00	R	135	242	8.25	PI/GN	BLACK
414 9761 00	R	125	262	7.92	PI/YL	VIPER RED
415 0129 00	R	115	260	7.92	PI/YL	BLACK
415 0137 00	R	200	230	8.71	PI/OR/YL	BLACK
415 0138 00	R	150	264	7.77	BK/PI/WH	NEON GREEN
415 0139 00	R	150	264	7.77	PI/WH/YL	ROYAL VIOLET
415 0142 00	R	150	264	7.77	GN/OR/BL	PEARL BLUE
415 0145 00	R	150	264	7.77	BK/WH/OR	VIPER RED
415 0206 00	R	125	203.2	7.60	4 Green lines	BLACK
415 0207 00	R	150	203.2	7.96	4 Red lines	BLACK
415 0208 00	R	70	152	5.73	4 Blue lines	BLACK
415 0209 00	R	150	190.5	8.29	4 Pink lines	BLACK
415 0355 00	R	125	262	7.92	SI/GN	YELLOW
415 0356 00	R	125	235	7.49	OR	FRENCH BLUE
415 0357 00	R	125	262	7.92	SI/OR	JAY BLUE
415 0358 00	R	125	262	7.92	SI/PI	FIR GREEN

SPRING COLOR CODES

BK=BLACK BL=BLUE GD=GOLD GN=GREEN OR=ORANGE PI=PINK RD=RED SI=SILVER WH=WHITE YL=YELLOW

SECTION 03 - CHASSIS PREPARATION

Section 2 — Coil Springs Specifications

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
415 0359 00	R	125	262	7.92	YL	BLACK
415 0385 00	R	100	265	7.14	SI/GD	VIPER RED
415 0396 00	R	150	235	8.41	GN	BLACK
415 0397 00	R	150	258	8.71	PI	BLACK
415 0398 00	R	140	257	8.71	SI	BLACK
415 0399 00	R	150	238	8.71	SI/WH	BLACK
415 0400 00	R	130	250	8.25	SI/SI	BLACK
415 0401 00	R	215	218	9.19	OR/PI	BLACK
415 0575 00	R	160	260	8.71	RD/GD	BLACK
415 0582 00	R	115	270	7.92	N/A	BLACK
503 1007 00	R	65	290	6.35	BL/YL	BLACK

SPRING COLOR CODES

BK=BLACK BL=BLUE GD=GOLD GN=GREEN OR=ORANGE PI=PINK RD=RED SI=SILVER WH=WHITE YL=YELLOW

Section 2 — Torsion Springs Specifications

P/N	WIRE DIAMETER (mm)	OPENING ANGLE ±7°	COLOR CODE	COLOR OF SPRING
414 8663 00 LH 414 8662 00 RH	10.3	85°	YL	BLACK
414 9436 00 LH 414 9435 00 RH	10.6	90°	WH	BLACK
414 9443 00 LH 414 9442 00 RH	11.11	90°	GN	BLACK
415 0106 00 LH 415 0105 00 RH	10.6	80°	RD	BLACK

LH=Left Hand RH=Right Hand

SPRING COLOR CODES

BK=BLACK BL=BLUE GD=GOLD GN=GREEN OR=ORANGE PI=PINK RD=RED SI=SILVER WH=WHITE YL=YELLOW

SECTION 03 - CHASSIS PREPARATION

Spring Chart 1997

The following information is divided into 2 main sections.

Section 1, Spring Applications

Is a quick reference chart which provides authorized spring applications per Ski-Doo model. It contains the standard spring part number (in gray shading) as installed at the factory, as well as 1 softer spring and 1 harder spring recommendation.

Section 2, Spring Specifications

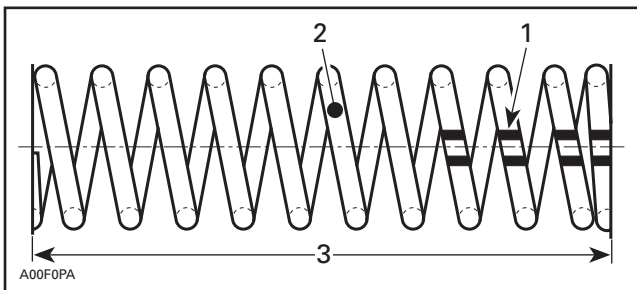
Refers to spring specifications.

The informations in this bulletin supersede all informations previously published.

Please update your *Shop Manual* by indicating the number of this bulletin in the proper section of the manual.

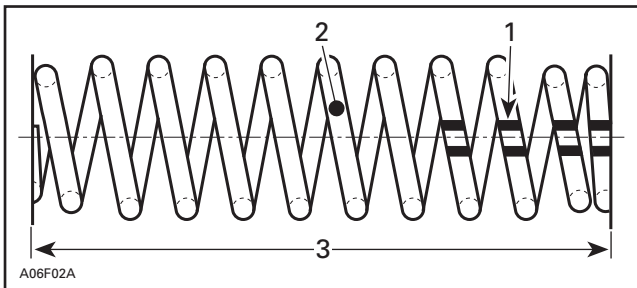
Coil Springs (Compression)

Type R (Straight on Both Ends)



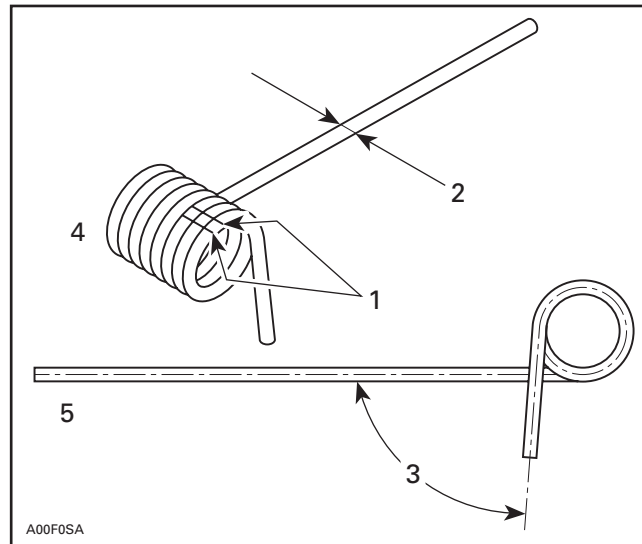
1. Color Code Stripes
2. Wire Diameter
3. Free Length

Type T (Barrel Shaped on Both Ends)



1. Color code Stripes
2. Wire Diameter
3. Free Length

Torsion Springs

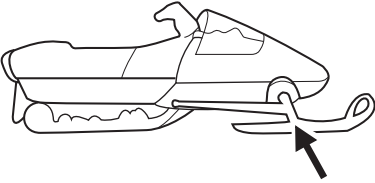


1. Color Code Stripes
2. Wire Diameter
3. Opening Angle (°)
4. Left Hand (LH)
5. Right Hand (RH)

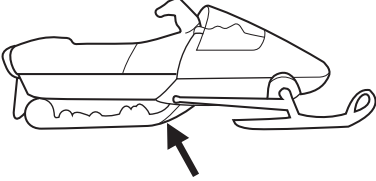
SECTION 03 - CHASSIS PREPARATION

SPRING APPLICATIONS 1997

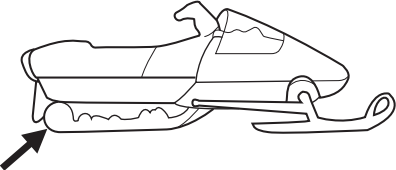
Section 1

1997	FRONT SPRINGS		1997
			
MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
MACH Z	414 9744 00	414 9563 00	414 9761 00
MACH Z LT	415 0397 00	415 0355 00	414 9563 00
MACH 1	414 9744 00	414 9563 00	414 9761 00
FORMULA III	414 9744 00	415 0385 00	414 9761 00
FORMULA III LT	414 9563 00	414 9761 00	415 0397 00
FORMULA Z	414 9563 00	414 9761 00	415 0397 00
FORMULA 583	414 9563 00	414 9761 00	415 0397 00
FORMULA 500 DE LUXE	414 9563 00	414 9761 00	415 0397 00
FORMULA 500	414 9563 00	414 9761 00	415 0397 00
FORMULA SL	414 8951 00	414 9561 00	415 0397 00
FORMULA S	414 8951 00	414 9561 00	415 0397 00
MX Z 670	414 9744 00	414 9563 00	414 9761 00
MX Z 583	414 9744 00	414 9563 00	414 9761 00
MX Z 440	414 9744 00	414 9563 00	414 9761 00
MX Z 440 F	414 9563 00	415 0355 00	415 0397 00
SUMMIT 670	414 9168 00	415 0356 00	415 0396 00
SUMMIT 583	414 9168 00	415 0356 00	415 0396 00
SUMMIT 500	414 9168 00	415 0356 00	415 0396 00
MX Zx		415 0633 00	

SECTION 03 - CHASSIS PREPARATION

1997		CENTER SPRINGS		1997	
					
MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING		
MACH Z	414 9761 00	415 0575 00	415 0576 00		
MACH Z LT	415 0706 00	415 0576 00	415 0707 00		
MACH 1	414 9761 00	415 0575 00	415 0576 00		
FORMULA III	414 9761 00	415 0575 00	415 0576 00		
FORMULA III LT	415 0706 00	415 0576 00	415 0707 00		
FORMULA Z	414 9744 00	415 0704 00	414 7713 00		
FORMULA 583	414 8593 00	415 0701 00	415 0705 00		
FORMULA 500 DE LUXE	414 8593 00	415 0701 00	415 0705 00		
FORMULA 500	414 8593 00	415 0701 00	415 0705 00		
FORMULA SL	414 9744 00	415 0699 00	414 7713 00		
FORMULA S	414 9744 00	415 0699 00	414 7713 00		
MX Z 670	414 9744 00	415 0703 00	414 9761 00		
MX Z 583	414 9744 00	415 0703 00	414 9761 00		
MX Z 440	414 9744 00	415 0703 00	414 9761 00		
MX Z 440 F	414 8593 00	415 0701 00	415 0705 00		
SUMMIT 670	415 0701 00	415 0705 00	415 0710 00		
SUMMIT 583	415 0701 00	415 0705 00	415 0710 00		
SUMMIT 500	415 0701 00	415 0705 00	415 0710 00		
MX Zx		415 0905 00			
MX Zx		415 0703 00			

SECTION 03 - CHASSIS PREPARATION

1997	REAR SPRINGS		1997
			
MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
MACH Z	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
MACH Z LT	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
MACH 1	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
FORMULA III	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
FORMULA III LT	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
FORMULA Z	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH	414 9443 00 LH 414 9442 00 RH
FORMULA 583	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
FORMULA 500 DE LUXE	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 415 9435 00 RH	415 0106 00 LH 415 0105 00 RH
FORMULA 500	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
FORMULA SL	Not Applicable	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH
FORMULA S	Not Applicable	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH
MX Z 670	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
MX Z 583	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
MX Z 440	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
MX Z 440 F	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH	415 0106 00 LH 415 0105 00 RH
SUMMIT 670	Not Applicable	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH
SUMMIT 583	Not Applicable	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH
SUMMIT 500	Not Applicable	414 8663 00 LH 414 8662 00 RH	414 9436 00 LH 414 9435 00 RH
MX Zx		415 0693 00 LH 415 0694 00 RH	

LH= Left Hand RH=Right Hand

SECTION 03 - CHASSIS PREPARATION

SPRING SPECIFICATIONS 1997

Section 2 — Coil Springs Specifications

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
291 000 794	R	100	215	6.65	PI/WH	BLACK
414 7713 00	R	135	272.5	8.41	BK/BK	SAFARI RED
414 7823 00	R	225	165	8.41	BK	SAFARI RED
414 7882 00	R	150	272.5	8.41	BK/YL	SAFARI RED
414 7894 00	R	135	272.5	8.41	BK/BK	AQUA BLUE
414 7977 00	R	135	272.5	8.41	BK/BK	FLAME RED
414 7978 00	R	135	272.5	8.41	BK/BK	PEARL BLUE
414 7979 00	R	135	272.5	8.41	BK/BK	VIOLET
414 8030 00	R	65	408	6.17	BL/OR	BLACK
414 8088 00	R	120	272.5	7.77	BK/OR	SAFARI RED
414 8093 00	R	160	213.1	7.77	WH	BLACK
414 8095 00	R	150 ± 5	256.8	7.92	BK	YELLOW
414 8101 00	R	125 ± 5	256.8	7.49	WH	YELLOW
414 8593 00	R	90 ± 7	239	7.14	BK/WH	YELLOW
414 8616 00	R	135	272.5	8.41	BK/BK	YELLOW
414 8690 00	R	125 ± 5	256.8	7.49	WH	SAFARI RED
414 8716 00	R	150 ± 5	256.8	7.92	WH	VIOLET
414 8778 00	R	160 ± 7	223.1	7.92	WH/WH	BLACK
414 8910 00	R	100 ± 7	260	7.14	WH/BK	SAFARI RED
414 8938 00	R	185 ± 7	213	8.41	GN/GN	YELLOW
414 8951 00	R	100	255	7.14	PI/GD	BLACK
414 9168 00	R	90 ± 7	239	7.14	RD	FIREFLY GREEN
414 9281 00	R	110	256.8	7.77	GD/BK	SAFARI RED
414 9286 00	R	100 ± 7	260	7.14	GD	RASPBERRY
414 9293 00	R	110	256.8	7.77	BK/RD	PEARL BLUE
414 9295 00	R	100 ± 7	260	7.14	RD/YL	PEARL BLUE
414 9402 00	R	140 ± 7	223	7.77	WH/GN	BLACK
414 9558 00	R	100	239	7.14	RD/GN/GN	BLACK
414 9559 00	R	125 ± 5	256.8	7.49	BK/RD	NEON GREEN
414 9560 00	R	125 ± 5	256.8	7.49	BL/RD	BLACK

SPRING COLOR CODES

BK=BLACK BL=BLUE GD=GOLD GN=GREEN OR=ORANGE PI=PINK RD=RED SI=SILVER WH=WHITE YL=YELLOW

SECTION 03 - CHASSIS PREPARATION

Section 2 — Coil Springs Specifications

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
414 9561 00	R	125 ± 5	256.8	7.49	BL/BL/BL	VIPER RED
414 9562 00	R	115	242	7.77	PI/BL	BLACK
414 9563 00	R	100	265	7.14	PI/WH/BL	YELLOW
414 9564 00	R	100 ± 7	260	7.14	RD/YL/BL	ROYAL VIOLET
414 9565 00	R	100 ± 7	260	7.14	BL/YL/GN	VIPER RED
414 9568 00	R	100 ± 7	260	7.14	RD/YL	NEON GREEN
414 9686 00	R	125	235	7.49	RD	NEON GREEN
414 9744 00	R	90	265	7.14	GN/OR	BLACK
414 9745 00	R	115	265	7.49	OR/WH	BLACK
414 9760 00	R	135	242	8.25	PI/GN	BLACK
414 9761 00	R	125	262	7.92	PI/YL	VIPER RED
415 0129 00	R	115	260	7.92	PI/YL	BLACK
415 0137 00	R	200	230	8.71	PI/OR/YL	BLACK
415 0138 00	R	150	264	7.77	BK/PI/WH	NEON GREEN
415 0139 00	R	150	264	7.77	PI/WH/YL	ROYAL VIOLET
415 0142 00	R	150	264	7.77	GN/OR/BL	PEARL BLUE
415 0145 00	R	150	264	7.77	BK/WH/OR	VIPER RED
415 0206 00	R	125	203.2	7.77	4 Green lines	BLACK
415 0207 00	R	150	203.2	7.92	4 Red lines	BLACK
415 0208 00	R	70	152	5.73	4 Blue lines	BLACK
415 0209 00	R	150	190.5	8.29	4 Pink lines	BLACK
415 0355 00	R	125	262	7.92	SI/GN	YELLOW
415 0356 00	R	125	235	7.49	OR	FRENCH BLUE
415 0357 00	R	125	262	7.92	SI/OR	JAY BLUE
415 0358 00	R	125	262	7.92	SI/PI	FIR GREEN
415 0359 00	R	125	262	7.92	YL	BLACK
415 0385 00	R	100	265	7.14	SI/GD	VIPER RED
415 0396 00	R	150	235	8.41	GN	BLACK
415 0397 00	R	150	258	8.71	PI	BLACK
415 0398 00	R	140	257	8.71	SI	BLACK
415 0399 00	R	150	238	8.71	SI/WH	BLACK
415 0400 00	R	130	250	8.25	SI/SI	BLACK

SPRING COLOR CODES

BK=BLACK BL=BLUE GD=GOLD GN=GREEN OR=ORANGE PI=PINK RD=RED SI=SILVER WH=WHITE YL=YELLOW

SECTION 03 - CHASSIS PREPARATION

Section 2 — Coil Springs Specifications

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
415 0401 00	R	215	218	9.19	OR/PI	BLACK
415 0575 00	R	160	260	8.71	RD/GD	BLACK
415 0582 00	R	115	270	7.92	GN/GD	BLACK
415 0696 00	R	300	170	9.50	YL/BK/YL	BLACK
503 1007 00	R	65	290	6.35	BL/YL	BLACK
414 8091 00	T	125 ± 5	274	7.92	GD	YELLOW
414 8155 00	T	135	259	7.77	BK/WH	VIOLET
414 8528 00	T	100 ± 7	279	7.92	RD	YELLOW
414 8713 00	T	125 ± 5	274	7.92	GD	SAFARI RED
414 8715 00	T	125 ± 5	274	7.92	GD	VIOLET
414 8941 00	T	112 ± 7	279.4	8.41	BK/GN	YELLOW
414 9169 00	T	100 ± 7	279	7.92	BK/WH	FIREFLY GREEN
414 9254 00	T	100 ± 7	279	7.92	WH/BK	SAFARI RED
414 9260 00	T	100 ± 7	279	7.49	BK	RASPBERRY
414 9269 00	T	110	279.4	7.77	GN/YL	SAFARI RED
414 9271 00	T	110	279.4	7.77	BK/YL	PEARL BLUE
414 9275 00	T	100 ± 7	279	7.92	RD/WH	PEARL BLUE
414 9886 00	T	100 ± 7	279	7.49	PI/PI	BLACK
414 9986 00	T	100 ± 7	279	7.49	BK/PI	SAFARI RED
415 0069 00	T	150 ± 7	272.5	8.41	BK/YL	FIREFLY GREEN
415 0070 00	T	135 ± 7	272.5	8.41	BK/BK	FIREFLY GREEN
415 0143 00	T	150	264	7.77	GN/OR/PI	CAN-AM RED
415 0575 00	T	160	264	8.71	RD/GD	BLACK
415 0576 00	T	180	260	9.52	BL/GD	BLACK
415 0699 00	T	115	265	7.49	SI/YL/YL	BLACK
415 0700 00	T	135	242	8.25	WH/YL/YL	BLACK
415 0701 00	T	115	242	7.92	GD/YL/YL	BLACK
415 0702 00	T	115	270	7.92	PI/YL/YL	BLACK
415 0703 00	T	100	264	7.49	OR/YL/YL	BLACK
415 0704 00	T	115	270	8.25	GN/YL/YL	BLACK
415 0705 00	T	135	242	8.41	BL/YL/YL	BLACK
415 0706 00	T	160	264	9.19	RD/YL/YL	BLACK

SPRING COLOR CODES

BK=BLACK BL=BLUE GD=GOLD GN=GREEN OR=ORANGE PI=PINK RD=RED SI=SILVER WH=WHITE YL=YELLOW

SECTION 03 - CHASSIS PREPARATION

Section 2 — Coil Springs Specifications

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
415 0707 00	T	200	263	9.52	YL/YL/YL	BLACK
415 0710 00	T	150	242	8.71	SI/RD/YL	BLACK
503 1272 00	T	170	258	8.71	BL/GN	BLACK
503 1354 00	T	250	300	10.31	RD/OR	BLACK

SPRING COLOR CODES

BK=BLACK BL=BLUE GD=GOLD GN=GREEN OR=ORANGE PI=PINK RD=RED SI=SILVER WH=WHITE YL=YELLOW

Section 2 — Torsion Springs Specifications

P/N	WIRE DIAMETER (mm)	OPENING ANGLE ±7°	COLOR CODE	COLOR OF SPRING
414 8663 00 LH 414 8662 00 RH	10.3	85°	YL	BLACK
414 9436 00 LH 414 9435 00 RH	10.6	90°	WH	BLACK
414 9443 00 LH 414 9442 00 RH	11.11	90°	GN	BLACK
415 0106 00 LH 415 0105 00 RH	10.6	80°	RD	BLACK
415 0608 00 LH 415 0607 00 RH	11.11	80°	BL	BLACK
415 0694 00 LH 415 0693 00 RH	11.11	100°	OR	BLACK
486 0714 00 LH 486 0713 00 RH	10.3	150°	WH/WH	BLACK
486 0785 00 486 0786 00	10.0	115°	YL/RD	BLACK

LH=Left Hand RH=Right Hand

SPRING COLOR CODES

BK=BLACK BL=BLUE GD=GOLD GN=GREEN OR=ORANGE PI=PINK RD=RED SI=SILVER WH=WHITE YL=YELLOW

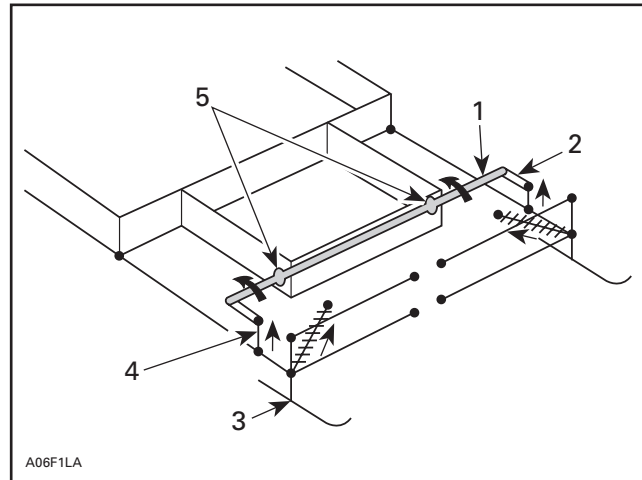
SECTION 03 - CHASSIS PREPARATION

CORNERING DYNAMICS

The ideal situation, while going through a turn, is to keep the snowmobile as flat as possible without the skis or track losing contact with the driving surface.

As you enter a corner and turn the skis, the rest of the vehicle will want to continue straight ahead. If the skis do not bite the surface, they will start slipping and the vehicle will not turn as tight as the skis are turned. This is called "understeering" or pushing. If the skis bite very well and the track starts sliding out, then the vehicle is "oversteering" or is said to be loose. If the ski and track traction is balanced, then the vehicle will maintain a good "line" though the corner. Because the center of gravity of the vehicle wants to continue straight ahead and because the center of gravity is above ground level, weight will be transferred to the outside of the vehicle. This causes the machine to roll to the outside. As the radius of the corner gets tighter and/or speeds increase, the machine rolls more, and more weight is transferred to the outside of the vehicle until the front or back loses traction or the vehicle tips over.

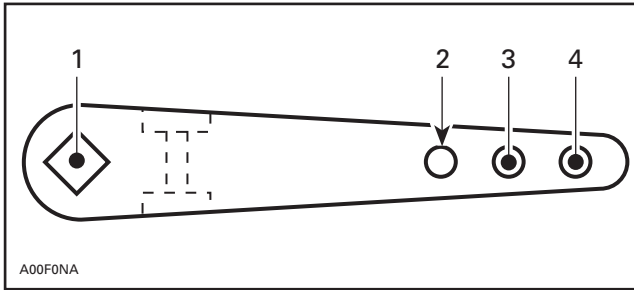
Roll can be reduced by installing stiff springs on the front suspension and / or a lot of preload, but this will cause a harsher ride than necessary. Lowering the center of gravity will also reduce roll but there are practical limits as to how low the center of gravity can go. Most vehicles are equipped with an antiroll bar or "stabilizer" bar. Common terminology will refer to it as a "sway" bar. (It is in fact an "anti-sway" bar) The bar is mounted to and pivots on the chassis. The ends of the bar have lever arms from 3" to 7" in length. The ends of the levers are connected to the front suspension. As the outside suspension is compressed during a corner, the bar is twisted and forces the inside spring to compress also. The bar is "borrowing" spring pressure from the inside spring and adding it to the outside spring. The suspension can now resist more chassis roll (see following illustration).



1. Sway bar
2. End lever
3. Cornering force
4. Connector linkage
5. Pivot bushings

By having a sway bar in the suspension, softer springs can be used to achieve a good ride because the bar will help control roll in a corner. The bar has no effect on ride when traveling straight ahead over bumps that are even from side to side. However, if only one ski encounters a bump, then the bar will transfer energy between the springs. This leads to another design decision. The diameter of the sway bar determines how much spring pressure will be "borrowed" from the opposite spring. A smaller bar will twist more and not transfer as much energy. A larger diameter bar will transfer more energy which will reduce chassis roll, but will produce a harsher ride on uneven, bumpy terrain. A smaller diameter bar will give a more compliant ride on the nasty bumps but it will allow the chassis to roll more in corners. A cross country sled will use small to medium diameter bars while oval and lemans racers will use large diameter bars.

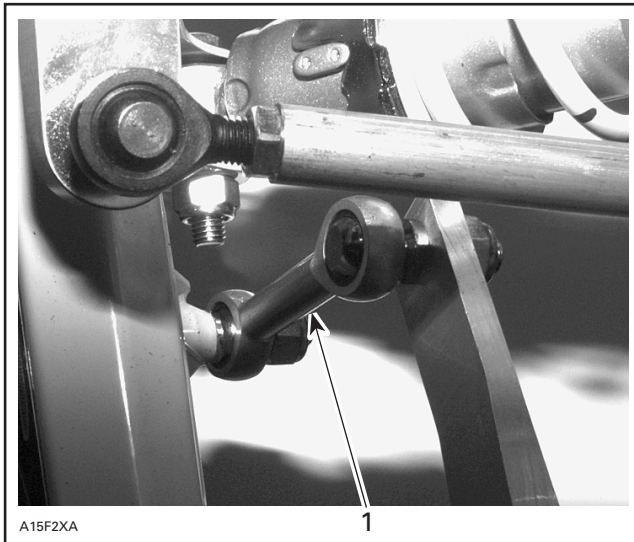
The length of the lever arm also affects the "stiffness" of the sway bar. A shorter lever will "stiffen" the bar and a longer lever will "soften" the bar. Many lever arms will have 2 holes to mount the connector linkage. The hole closest to the bar will act stiffer (see following illustration).



END LEVER

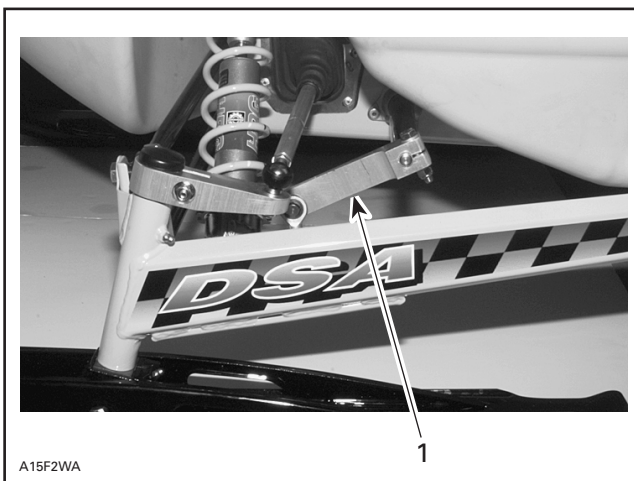
1. Sway bar
2. Stiffer
3. Softer
4. Softest

Unlike previous years, the ball joint is no longer adjustable.



1. Ball joint

The lever arm is no longer horizontal when the snowmobile is resting on the ground.



1. Lever arm

– Ensure to perform the same adjustment on each side of the snowmobile.

The sway bar should have no torsional load in it when the machine is at rest with the rider aboard. The sway bar connector linkages should be the last item adjusted after any ride height or camber adjustments are made. There should not be any preload on the bar.

Another little known fact that has a large affect on roll is the limiter strap length. As mentioned earlier, if the limiter is lengthened, the front suspension will extend during acceleration, which reduces ski pressure. If this vehicle was in a corner when power was applied, it would have quite a bit of chassis roll and the inside ski will start to lift off of the ground. Shortening the limiter in this case will have a very large affect on controlling roll. A general guideline for initially setting limiter length for good ski pressure and reducing roll is to have the front and back of the track touch the ground at the same time when you set the back of the vehicle down. If the front of the track touches much sooner than the rear, there will be quite a lot of weight transfer and chassis roll during hard cornering. If the adjuster nut is all the way tight and you would like more ski pressure, install a shorter limiter strap.

For snowcross racing some racers prefer to disconnect the sway bar. This will let the front suspension act more independently, as the suspension is no longer coupled.

NOTE: To be legal the components must remain on the sled.

SHOCK ABSORBER

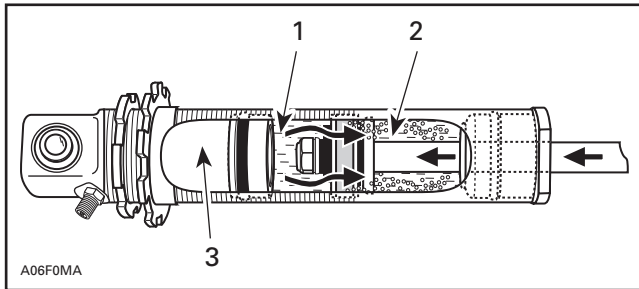
HPG (High Pressure Gas)

INTRODUCTION

A shock absorber could more accurately be called a damper as its main function is to control or dampen suspension oscillations. Without shocks, a suspension system would bounce for quite a while after hitting a bump and the vehicle would not offer as good a ride or control. A shock works by moving a valved piston through a chamber of oil. The less resistance to oil flow through the piston, the less dampening the shock provides. Conversely, more resistance to oil flow equals more dampening. Bombardier uses a variety of shock absorber types which vary on the exact application and requirements for performance.

SECTION 03 - CHASSIS PREPARATION

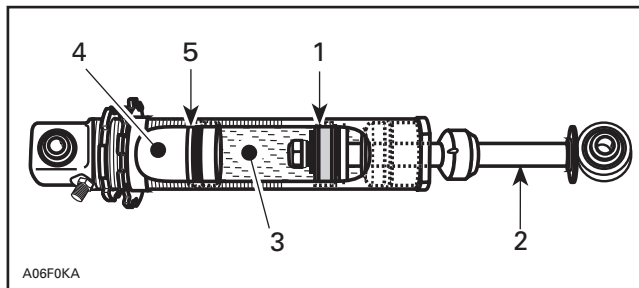
As dampers of the air/oil type are cycled rapidly, a low pressure will be generated on the oil exit side of the valved piston. If the pressure drops too much, a vaporization or aeration of the oil can occur. If this oil aeration is allowed to continue, a loss in damping performance will result. This is called shock "fading". This condition can be compensated for if the engineers know the exact application and performance requirements of the damper.



1. Oil
2. Aeration
3. Low pressure

This aeration can be eliminated by pressurizing the oil. HPG shocks use a floating piston design (except some center shocks). This design allows an oil chamber and a gas chamber in the same single damper body.

The gas chamber of the shock absorber is filled with nitrogen gas at 300 PSI (2070 kPa). This pressurizes the oil reservoir portion of the shock which prevents the oil from aerating. The gas pressure should not be changed as a way of tuning the shock. Calibration should be done with the piston and valve shims.

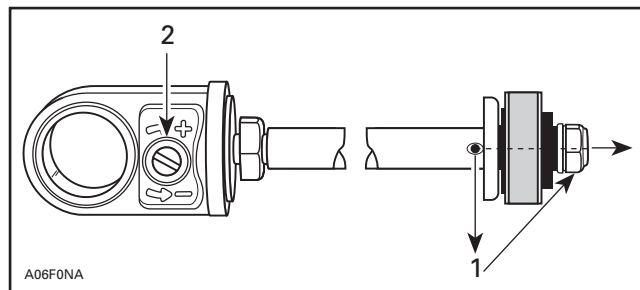


1. Valved piston
2. Damper shaft
3. Oil volume
4. High pressure gas chamber (300 PSI N_2)
5. Floating piston

HPG, MVA (Multi-Valve Adjustable)

This shock absorber is standard on the 670 SE Grand Touring models and offers the benefit of a full gas (nitrogen) shock, with the addition of an external adjustment for rebound damping. Some compression damping is also adjusted with this feature.

Although this damper is not rebuildable, the feature of offering trail-side adjustability and the benefits of a gas-filled shock will be recognized at first use. It is possible to upgrade C7 rear HPG T/A shocks with the optional MVA shaft-order P/N 486 0671 00 Qty (2) required. Note: you must change shock spring stoppers to P/N 414 7625 00 Qty (2).



1. Oil flow option with MVA screw
2. 10 detent adjustments

HPG, Emulsion Gas Shock

This calibration is used as a center shock for the front of some track suspensions. As the name implies, this damper mixes the oil and gas (nitrogen) in the same chamber.

This shock is mounted with the damper body upward. This offers a volume of oil at the damper piston at all times.

As mentioned, this calibration was used in the center shock of the 1994 MX Z (all HPG T/A shocks since 1995 use an internal floating piston), this type of shock could suffer from fading however, the gas pressure assists to prevent this from occurring. Additionally, knowing this shock type, its requirements, and mounting position, allows engineering to valve this damper accordingly.

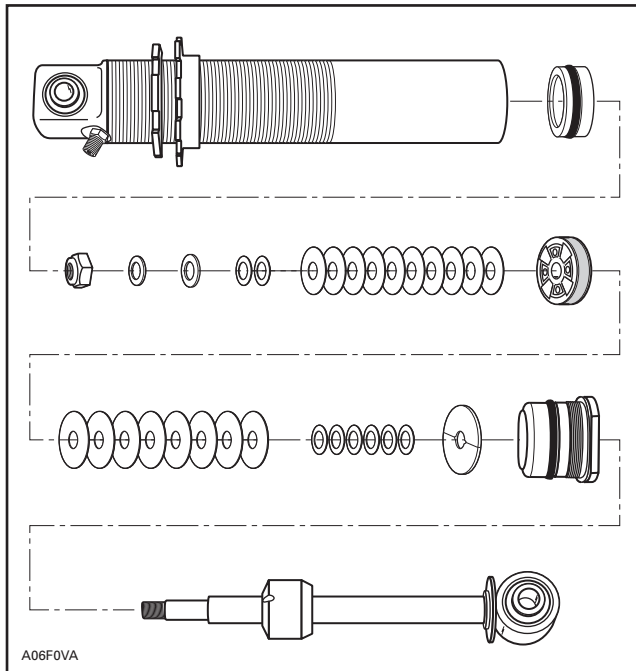
HPG, Gas Shock

This shock assembly is a floating piston design like the T/A type shock, without the take apart option. This shock uses the same quality valving mechanism and floating piston configuration, but cannot be disassembled.

HPG, T/A (Take Apart) Gas Shock

This damper is completely rebuildable and all versions use an internal floating piston (IFP). It offers the options of replacing valves or revolving and/or the option of replacing seals (should it be needed). All HPG T/A shocks since 1995 use IFP.

Although the adjustments are internal, rather than external as in the (MVA), the rider is able to select the exact damping adjustment required for his/her riding style.

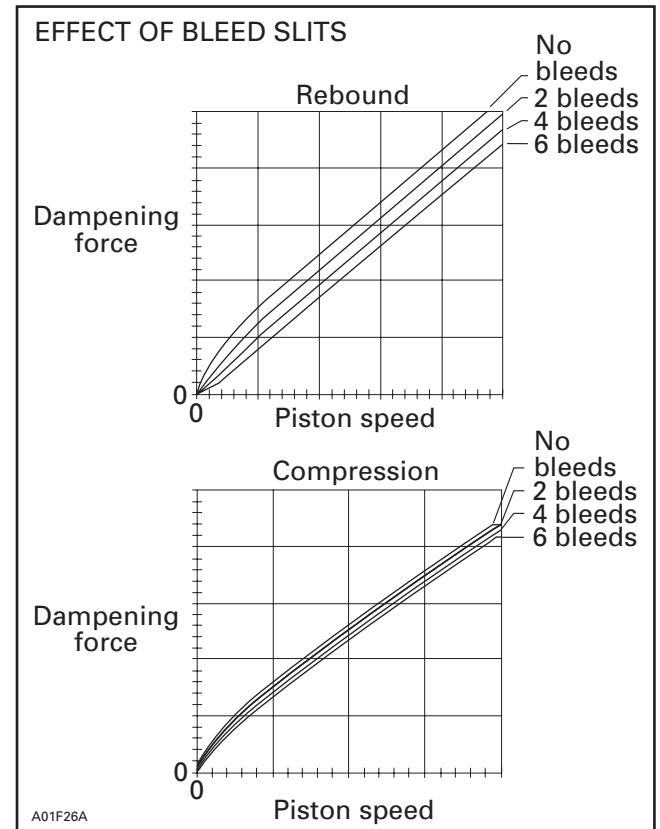


Valving and Dampening

In the HPG shock, the piston passages are covered by a stack of thin metal shims of various thicknesses and diameters. The shims provide dampening by acting as spring loaded valves offering resistance to the oil traveling through the piston. There is a stack of shims on both sides of the piston. One side controls compression dampening and the other side controls rebound dampening. By varying the number and thickness of shims the dampening characteristics can be very accurately obtained. There may also be orifices or "slits" in the piston that are not covered by the shims. These are referred to as bleed slits. The size and number of these slits will also affect dampening. The external adjustment on the MVA, HPG shocks is a variable bleed hole.

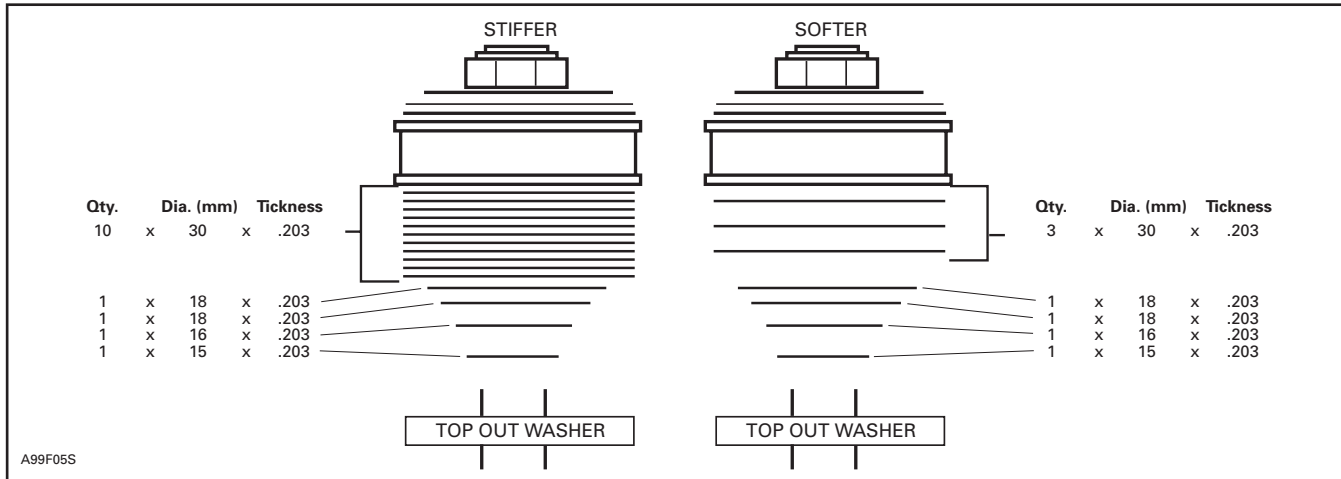
Rebound dampening will usually be much stiffer than compression dampening. This is because rebound dampening must resist the force of the spring and because piston speeds are much slower during rebound.

At low piston speeds, the number of bleed slits will have a fairly large effect on dampening, but as piston speeds increase most of the dampening is controlled by the shim stack. This is because the flow area of the slits is much smaller than the flow area under the shims. Since only a small amount of oil can flow through the bleed slits (compared to the amount that flows under the shim stack), the slits have only a very small effect on dampening at high piston speeds. Because of this characteristic, bleed slits are most effective on rebound dampening. They will have only a very slight effect on compression dampening because the typical piston speeds on compression strokes are several times faster than on rebound strokes. There really is no such thing as "high speed" rebound dampening.



SECTION 03 - CHASSIS PREPARATION

As mentioned earlier, the configuration of the shim stack will control most of the dampening of the shock. There are several methods to tuning shim stacks. The first and most commonly used is to increase or decrease the overall stiffness of the stack. This can be done by changing the number of large shims or by increasing or decreasing their thickness.



The overall stiffness of the stack has been increased by adding 7-30 mm x .203 mm shims. This will result in firmer dampening at both low and high piston speeds. Thicker shims will also result in firmer dampening but it is better to use more thin shims than fewer thick shims. More thin shims will provide better, smoother dampening than a few thick shims. There is an equivalency between thick and thin shims, though. The following chart indicates how many thin shims are required to equal the stiffness of one thick shim.

(mm)	
1 x .152	= 2.4 x .114
1 x .203	= 2.3 x .152
1 x .254	= 2.0 x .203

This means it will take 2.4 x .114 mm shims to have the same dampening as 1 x .152 mm shim. Obviously you can't use a fraction of a shim so you must find the lowest common denominator. For 2.4 it will be 5. For 2.3 it will be 10. The following chart shows the most common possibilities.

(mm)	
5 x .152	= 12 x .114
10 x .152	= 24 x .114
10 x .203	= 23 x .152
1 x .254	= 2 x .203
2 x .254	= 4 x .203
3 x .254	= 6 x .203
4 x .254	= 8 x .203
5 x .254	= 10 x .203
6 x .254	= 12 x .203
7 x .254	= 14 x .203
8 x .254	= 16 x .203
9 x .254	= 18 x .203

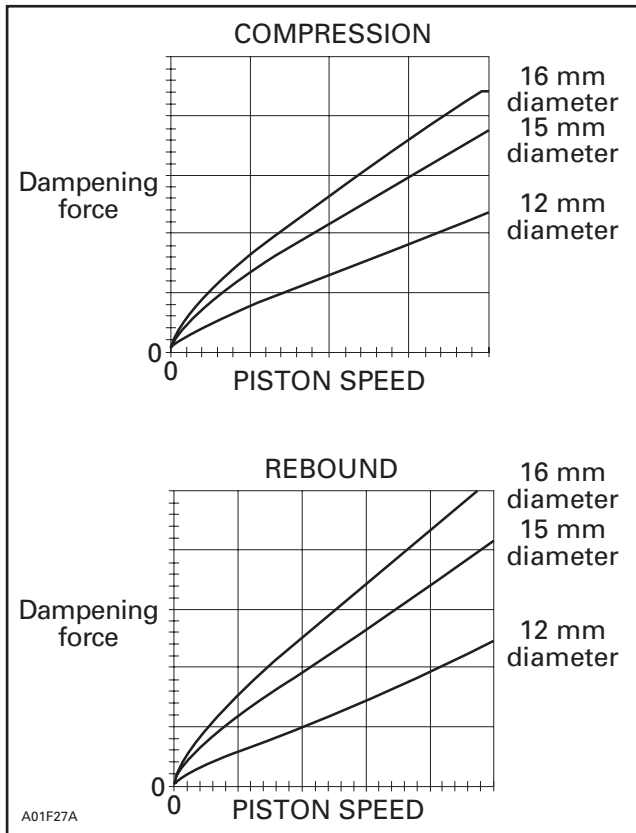
The diameter of the smaller shims that support the large shims will also affect the dampening. A larger support shim gives more support to the large shim thus making it act stiffer. Conversely, a smaller diameter support shim will allow the large shim to bend more easily thus softening the dampening. The following graph shows the effect of different diameter support washers.

SECTION 03 - CHASSIS PREPARATION

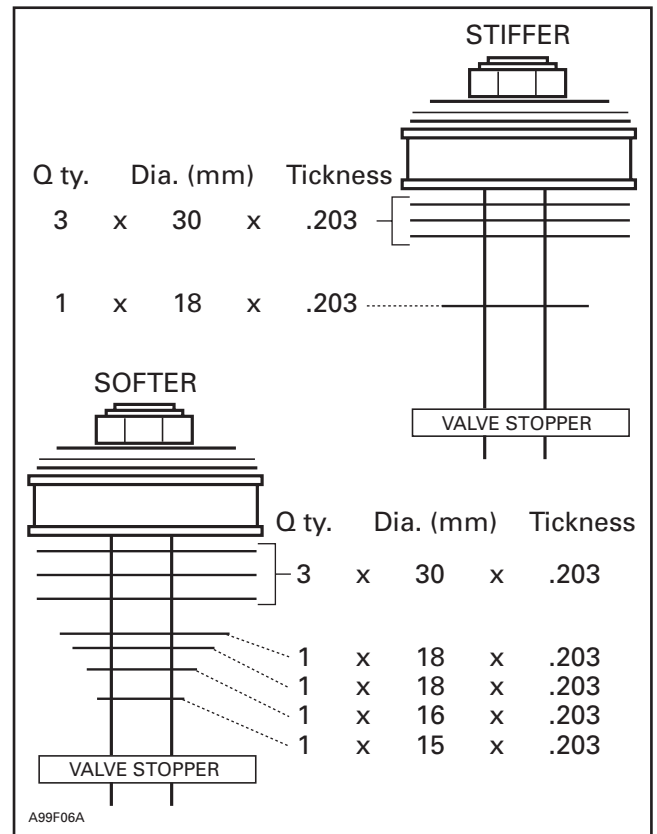
Shim Comparator Formula

Thickness³ or cubed.

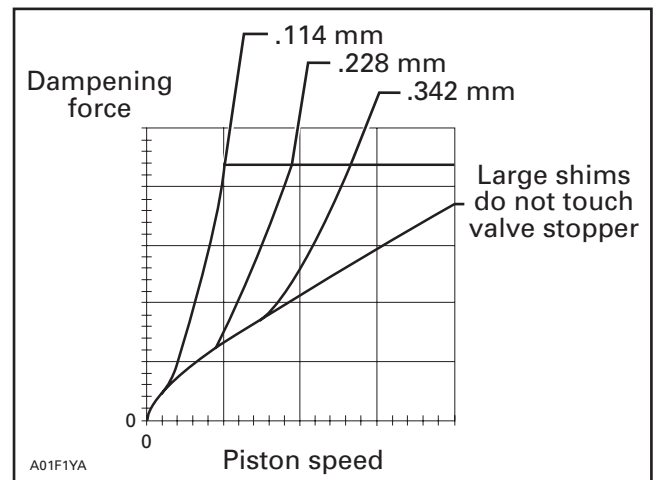
Example: .152 x .152 x .152



Another method of changing dampening is by controlling the amount of space the stack has to open. This is done by reducing the amount of smaller shims which support the larger shims. The larger shims act the same until they "bottom out" against the valve stopper.

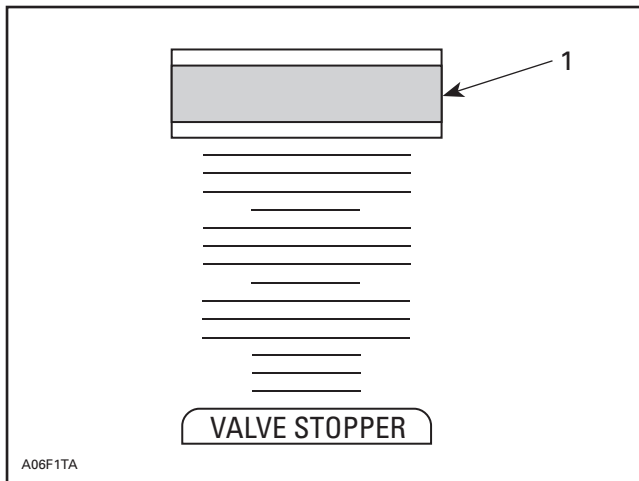


The large shims are only able to deflect .203 mm instead of .610 mm thus reducing the flow area of the piston. This will result in the same low speed dampening, but the medium and high speed dampening will be increased. The following graph represents the effect of changing the total thickness of small shims which determine the amount of large shim deflection.



SECTION 03 - CHASSIS PREPARATION

As you can see, low speed dampening remains the same until the shim stack bottoms out against the valve stopper. Then the dampening becomes significantly stiffer. This is sometimes referred to as progressive dampening. Another similar way to achieve this type of dampening is to use multiple stacks of large and small shims.



1. Piston

The first stack of large shims will deflect very easily thus giving soft low speed dampening. The number of small shims will determine when the first stack hits the second stack of large shims. Now both stacks are acting together thus stiffening the dampening. This can be repeated several times until the complete stack of large shims bottoms out against the valve stopper.

As you can see, there are an unlimited number of valving combinations and many different versions will achieve very similar results. The following general guidelines should help reduce your tuning time.

- If the dampening is close to what you want, just add or remove 1 or 2 large shims, from the appropriate side, to fine tune the overall stiffness.

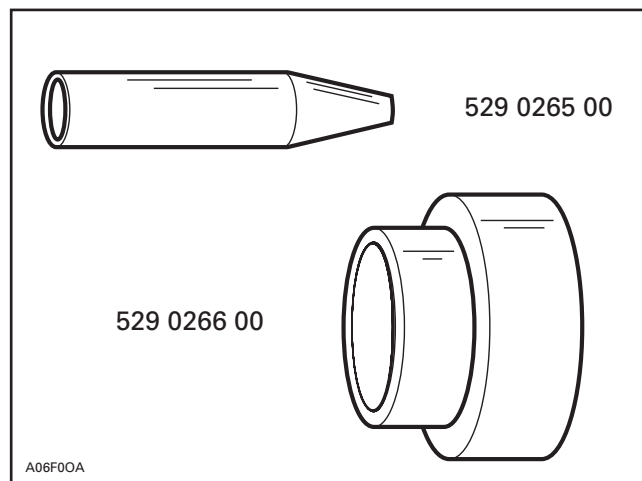
NOTE: Always use 30 mm diameter shims against the piston for compression dampening and 26 mm diameter shims against the piston for rebound dampening.

- Generally, rebound dampening should not be changed unless a large change in spring rate is made.
- Bleed slit quantity will affect low speed dampening.

- Underdampening may be due to an aerated shock due to low gas pressure and/or old, used oil. Change the oil and recharge the gas pressure to 300 PSI before altering the shock valving.
- If the vehicle bounces or “pogos” a lot, the problem may be too little compression dampening NOT too little rebound dampening. Do not use too much rebound dampening ! Excessive rebound dampening is a common error. Over-dampening will not allow the suspension to recycle to full extension after an obstacle compresses the suspension. This situation (called “packing”) will eventually bottom the suspension and not allow it to cycle properly.
- For faster weight transfer under acceleration and deceleration, use a piston with more bleed slits.

Special Tools

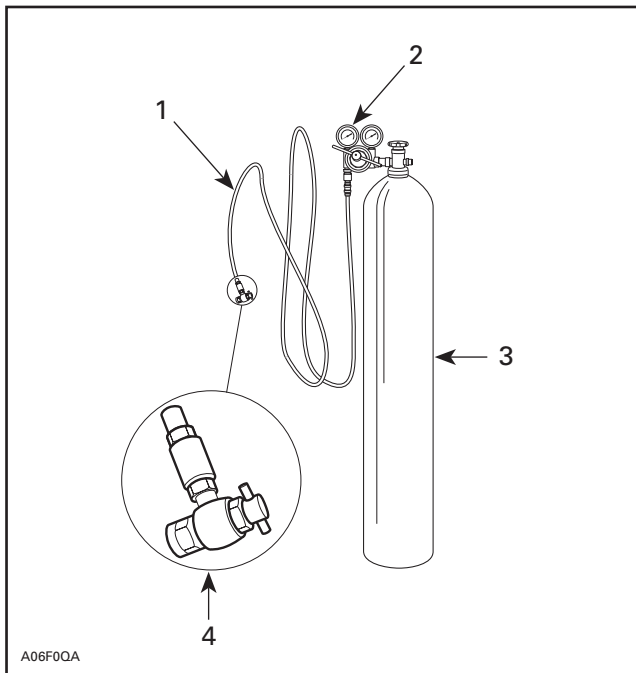
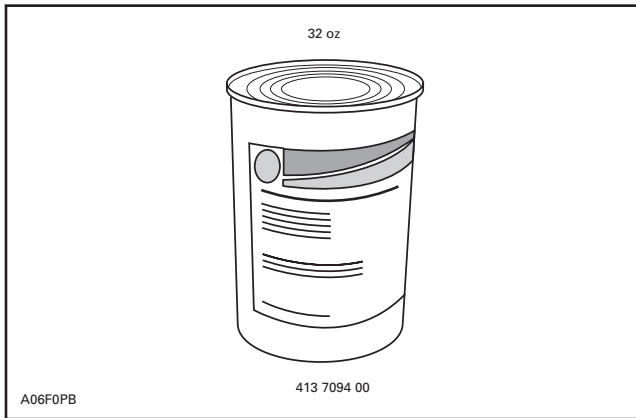
Special tools specific to the HPG T/A shock will be the seal pilot P/N 529 0265 00 and piston guide P/N 529 0266 00 from Bombardier.



NOTE: Do not attempt to rebuild the T/A damper without the benefit of these assembly tools, damage will occur without their use.

SECTION 03 - CHASSIS PREPARATION

Shock Oil and Nitrogen



1. Automotive type air pressure hose
2. 2 stage regulator, delivery pressure range 2070 KPa (300 PSI)
3. High pressure cylinder filled with industrial grade nitrogen
4. Valve tip

NOTE: Commercially available through compressed gas dealers.

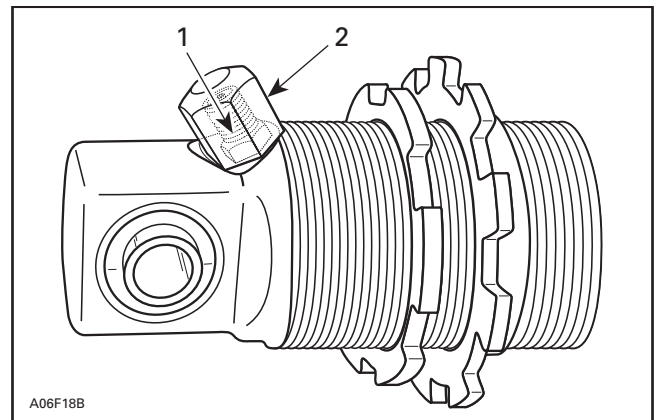
Disassembly and Assembly

Release N₂ (nitrogen) pressure from the damper Schrader valve on any HPG T/A with IFP.

NOTE: When rebuilding a gas emulsion shock, such as the center MX Z, mount the shock vertically in a vice with the schrader valve up and let it sit for 5 minutes before releasing the gas. This 5 minute period will allow most of the gas to separate from the oil and minimize oil spray.

◆ WARNING

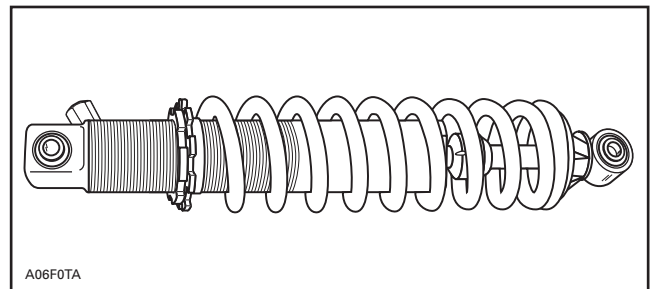
Nitrogen gas is under extreme pressure. Use caution when releasing this gas volume. Protective eye wear should be used.



1. Schrader valve 1.5-2 N•m (13-17 lbf•in)
2. Schrader cap 5-6.5 N•m (44-57 lbf•in)

NOTE: Before unscrewing pre-load rings, measure the compressed length of the installed spring and mark position for reinstallation. For factory adjustment refer to the end of this section.

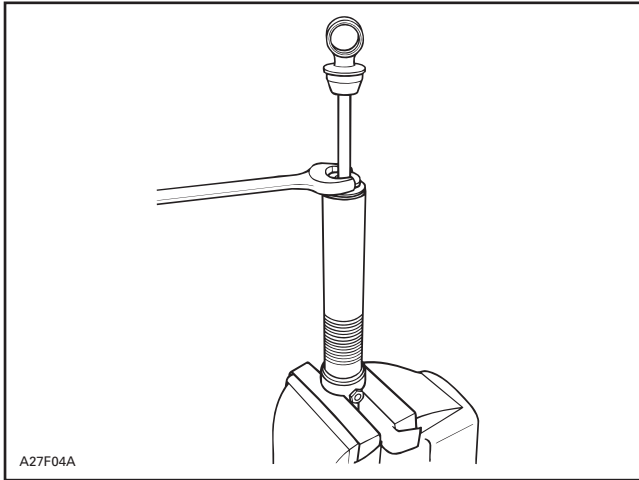
Use tools (P/N 861 7439 00) to remove damper spring by unthreading spring pre-load rings, then removing spring retainer or use the spring removal tool P/N 529 0271 00.



TYPICAL

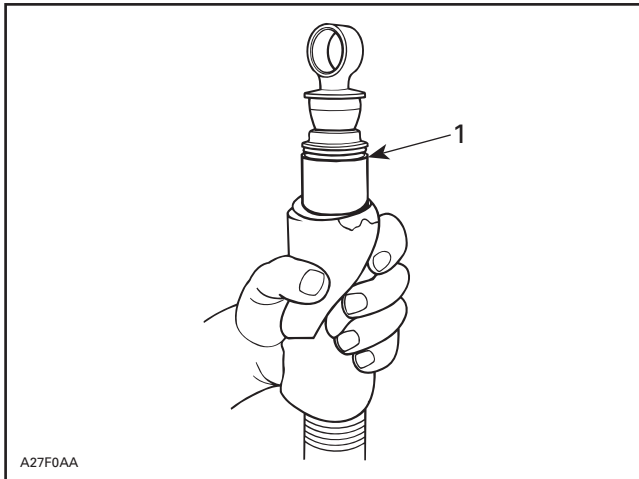
Holding damper assembly in bench vise with aluminum jaw protectors, unthread seal assembly from damper body using a 32 mm (1.25 in) spanner wrench. This assembly uses a right hand thread.

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With the seal assembly removed, slowly lift and remove damper rod assembly from the damper body.

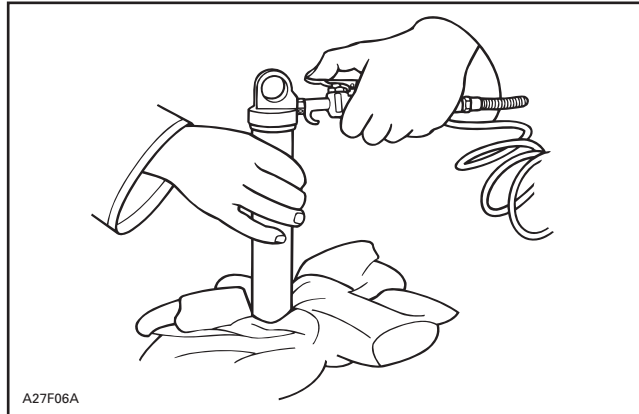
NOTE: Remove damper rod assembly slowly to reduce oil spillage and prevent piston seal damage by damper body threads. Wrap the damper body with a shop cloth to capture possible overflow oil while removing the damper piston.



1. Oil flows

Discard old oil into storage container. Never reuse damper oil during shock rebuild.

Remove Schrader valve core. Using compressed air pressure, carefully remove floating piston from damper body. Hold shop cloth over damper body opening to catch released floating piston. Allow room for floating piston to leave damper body.



TYPICAL

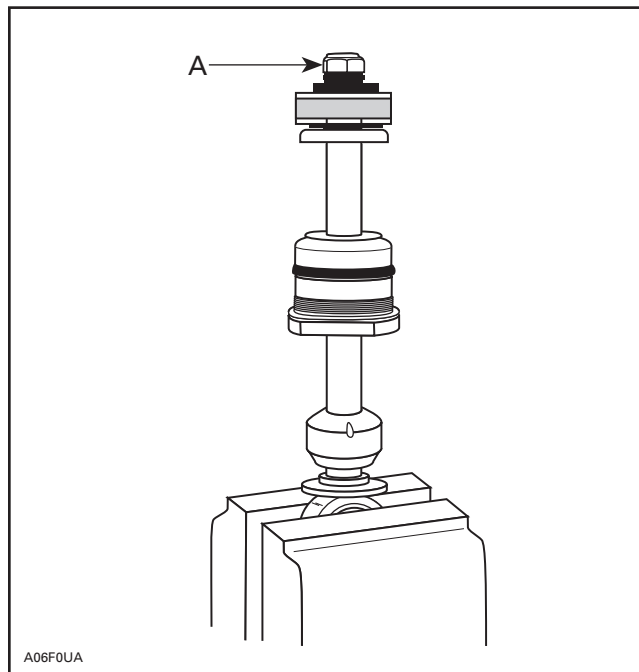
◆ WARNING

Whenever using compressed air, use an O.S.H.A. approved air gun and wear protective eye wear.

Thoroughly clean, with a typical cleaning solution, and blow dry using low pressure air. Carefully inspect the damper body for any imperfections or signs of wear in the damper bore.

Replace damper body if wear is identified.

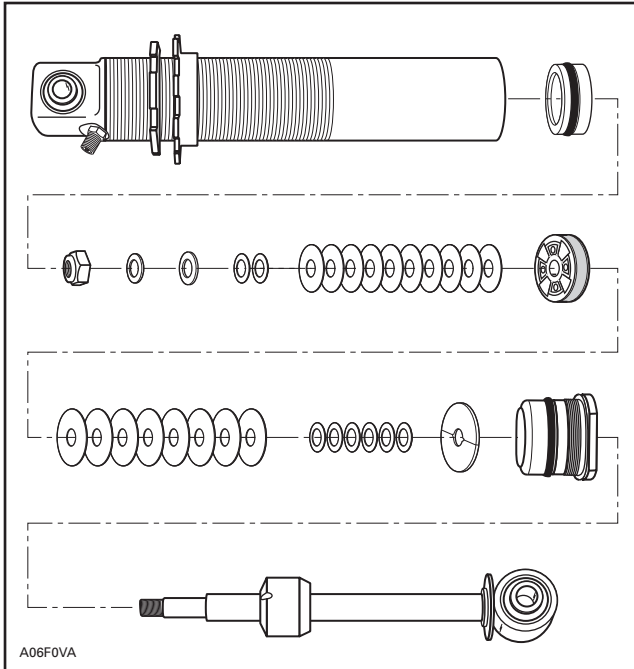
Holding the damper rod assembly in a bench vise, begin piston and valve removal.



A. Remove damper nut

SECTION 03 - CHASSIS PREPARATION

Always arrange parts removed in the sequence of disassembly.



NOTE: As a general rule we suggest replacing the damper rod lock-nut after 4 rebuilds to ensure good locking friction and use Loctite 271 each time.

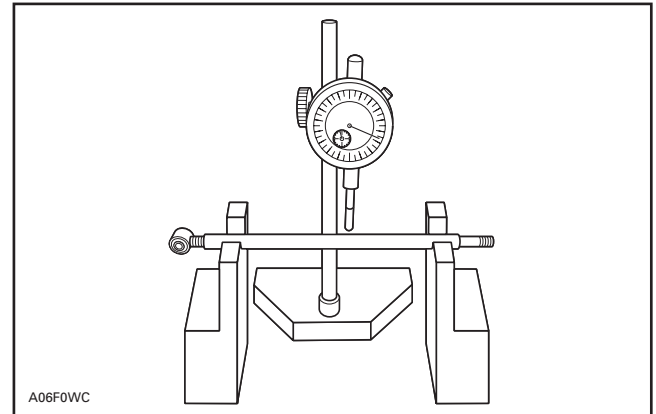
NOTE: If revalving is to be done, it is imperative that you identify the original shim pack (size and number of shims). The seal carrier need not be removed if only revalving is to be done.

Shims can be measured by using a vernier caliper or a micrometer.

NOTE: All shims should be carefully inspected and any bent or broken shims must be replaced for the shock to function properly.

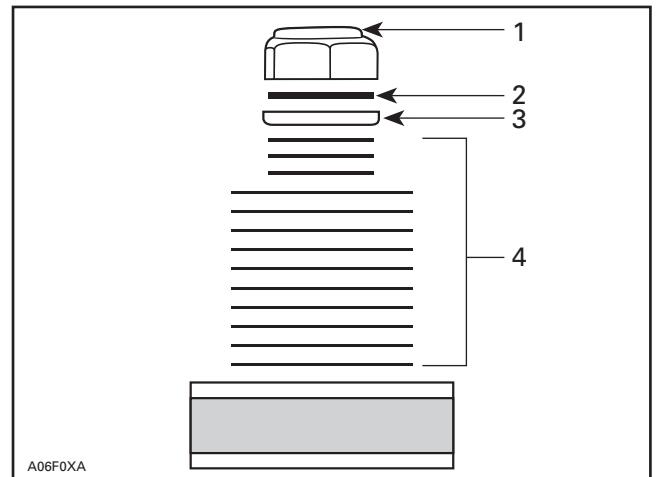
The damper rod is constructed of a plated shaft design. This damper shaft must be inspected for any visible wear on the surface of the damper rod.

Another check that must be completed if damper seal leakage has been noticed, is damper rod "run-out". This damper rod run out must not exceed .025 mm (.001 in).



MAXIMUM DEFLECTION 0.025 mm (.001 in)

After the new or replacement shim pack has been selected, reassemble in the reverse order of disassembly. Torque piston nut 11-13 N•m (96-108 lbf•in). Use 271 Loctite.



1. Damper nut
2. Spacer
3. Washer
4. Shim pack

▼ CAUTION

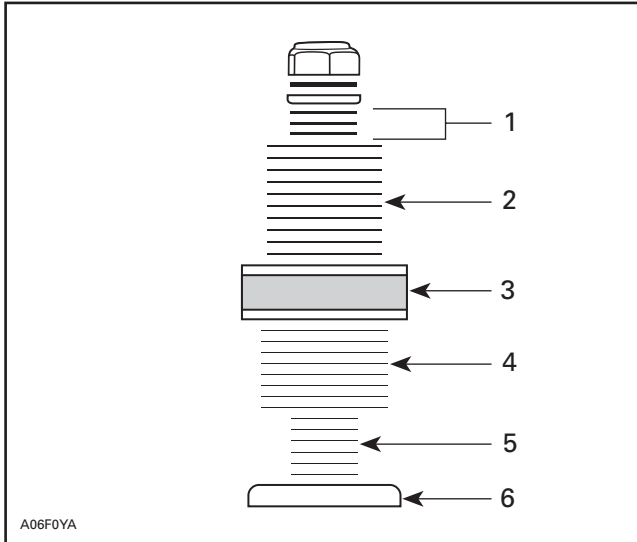
The damper rod nut can only be reused 4 times, then, must be replaced. Do not substitute this part for non – O.E.M. use Loctite 271 on nut each time.

This spacer washer(s) P/N 414 8883 09 must be used as shown to ensure damper rod nut does not bottom out or contact shaft threads.

Rebound valve stopper with round edge facing shim stack.

SECTION 03 - CHASSIS PREPARATION

NOTE: Rebound shim stack must not reach into threads of damper shaft. Washer under damper shaft nut is used to prevent damper shaft nut from bottoming on threads.



1. Rebound dampening shim pack
2. Rebound dampening shim pack
3. Piston
4. Compression dampening shim
5. Compression dampening shim pack
6. Stopper

Rebound

A minimum of 0.203 mm (.008 in) clearance must be allowed between shim stack and rebound valve stopper. Use at least one shim of 12 × .203 mm.

Whenever tuning for more rebound damping always use 26 mm (1.02 in) shims against piston to properly close piston orifice holes. More thin shims will offer more control than a few thick shims of the same overall thickness.

NOTE: When tuning for less dampening it is important to remember, never use less than 3-26 mm (1.02 in) shims against piston. This will guard against fatigue breakage.

Piston options include 4 pistons; 0, 2, 4 and 6, slits for rebound dampening bleeds.

Compression

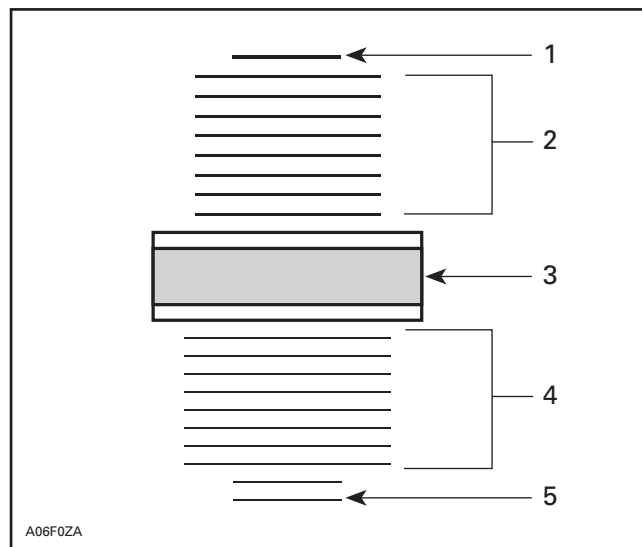
Whenever tuning for more compression dampening always use 30 mm (1.18 in) shims against piston to properly close piston orifice holes. Two thin shims will offer more control than one thick shim of the equal thickness.

NOTE: When tuning for less dampening it is important to remember, never use less than 3 shims against piston. This will guard against fatigue breakage.

Fewer spacer shims will result in more high speed dampening. A minimum of 0-114 mm (.0045 in) clearance should be allowed between shim stack and compression valve stopper. Use at least one shim of 12 × .114.

Compression valve stopper must have groove facing shim stack.

Factory HPG T/A Shock Calibrations



1. Rebound dampening shim pack
2. Rebound dampening shim pack
3. Piston
4. Compression dampening shim pack
5. Compression dampening shim pack

SECTION 03 - CHASSIS PREPARATION

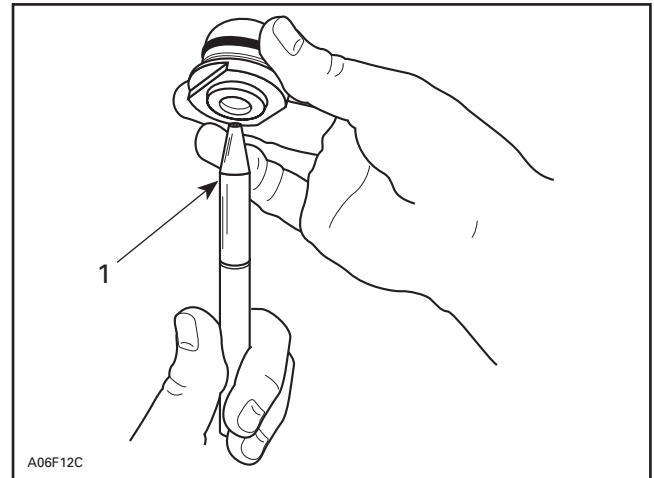
FRONT / SKI SHOCK	CENTER SHOCK	REAR SHOCK
1996/97 MX Z	1996/97 MX Z	1996/97 MX Z
Compression 1. 8 x 30 x .152 2. 2 x 15 x .114 3. 4 SLIT PISTON	Compression 1. 10 x 30 x .203 2. 3 x 16 x .203 3. 4 SLIT PISTON	Compression 1. 7 x 30 x .203 2. 3 x 15 x .203 3. 2 SLIT PISTON
Rebound 4. 1 x 12 x .203 5. 5 x 26 x .203	Rebound 4. 1 x 12 x .203 5. 8 x 26 x .152	Rebound 4. 1 x 15 x .203 5. 10 x 26 x .152
FRONT / SKI SHOCK	CENTER SHOCK	REAR SHOCK
1997 MX Zx	1997 MX Zx	1997 MX Zx
Compression 1. 3 x 30 x .203 2. 1 x 12 x .114 3. 3 x 30 x .203 4. 1 x 20 x .114 5. 1 x 16 x .114 6. 6 SLIT PISTON	Compression 1. 10 x 30 x .203 2. 3 x 16 x .203 3. 4 SLIT PISTON	Compression 1. 3 x 30 x .203 2. 1 x 15 x .114 3. 5 x 30 x .203 4. 1 x 20 x .114 5. 7 x 30 x .203 6. 2 SLIT PISTON
Rebound 7. 9 x 26 x .203 8. 1 x 15 x .203	Rebound 4. 8 x 26 x .152 5. 1 x 12 x .203	Rebound 7. 9 x 26 x .203 8. 1 x 15 x .203

If the seal carrier assembly is replaced, use seal pilot (P/N 529 0265 00) to guide seal over damper shaft. Lubricate seal carrier guide pilot before use.

▼ CAUTION

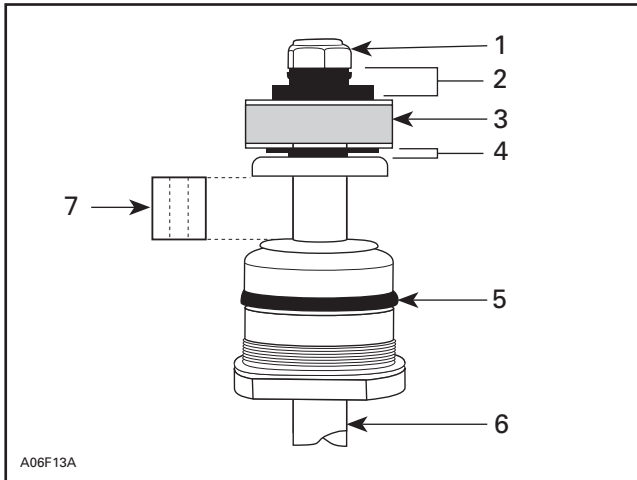
Failure to use seal pilot will result in seal damage.

Reassemble damper rod assembly, taking care to properly assemble shim packs as required for your dampening needs. Ensure that the shaft piston is installed with the slits/larger intake holes facing the rebound shim stack.



1. Pilot (P/N 529 0269 00)

SECTION 03 - CHASSIS PREPARATION



1. Damper nut torque 11-13 N•m (96-108 lbf•in) use Loctite 271
2. Rebound shim pack
3. Piston
4. Compression shim pack
5. O-ring visual inspection seal carrier assembly
6. Damper rod
7. Optional travel restriction spacer kit (P/N 861 7442 00)

Kit includes:

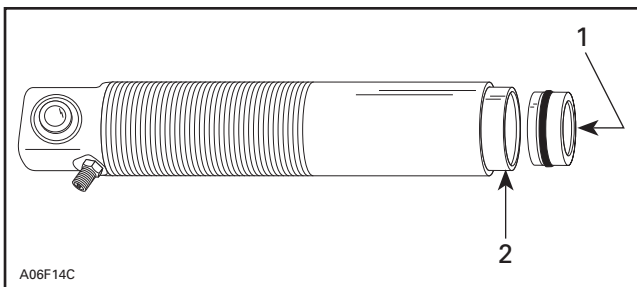
- 2 x 26 mm long spacer
- 1 x 48 mm long spacer
- 2 x 60 mm long spacer

Reinstall floating piston into damper body (ensure that Schrader valve core has been removed). Use molybdenum disulfide grease (example: molykote paste (P/N 413 7037 00) or silicone grease Dow Corning MS4 (P/N 420 8970 61) to ease O-ring past damper body threads with floating piston pilot (P/N 529 0266 00).

▼ CAUTION

Failure to install IFP correctly could result in shock damage.

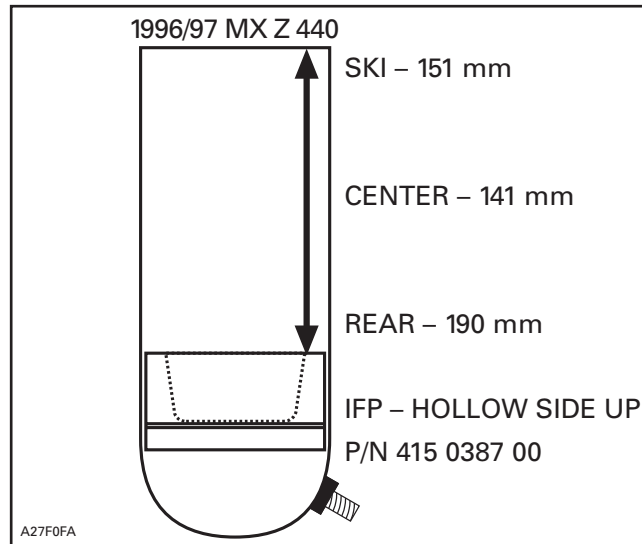
NOTE: For 1994/95 HPG's install hollow side of IFP towards Schrader valve. For 1996 HPG's hollow side should face away from Schrader valve.



1. Push (slowly) by hand
2. Floating piston guide (P/N 529 0266 00)

NOTE: Lubricate inside of piston guide with molykote GN paste (P/N 413 7037 00) or MS4 silicone grease (P/N 420 8970 61).

Install floating piston to the proper depth.



Required distance for floating piston installation

1997/MX Zx

- SKI - 40 mm*
- CENTER 141 mm
- REAR 190 mm

* Floating piston is located within the Remote Reservoir.

NOTE: If the floating piston is installed too far into the damper body, light air pressure through Schrader valve (with core removed) will move piston outward.

NOTE: Reinstall Schrader valve core after IFP has been installed at correct height and before adding oil.

◆ WARNING

Whenever using compressed air exercise extreme caution, cover damper opening with shop cloth to reduce chance of possible injury.

▼ CAUTION

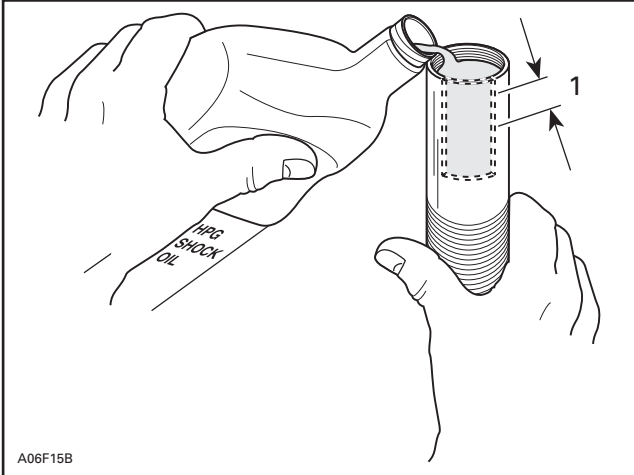
Moisture laden compressed air will contaminate the gas chamber and rust floating piston.

SECTION 03 - CHASSIS PREPARATION

◆ WARNING

Always wear protective eye wear whenever using compressed air.

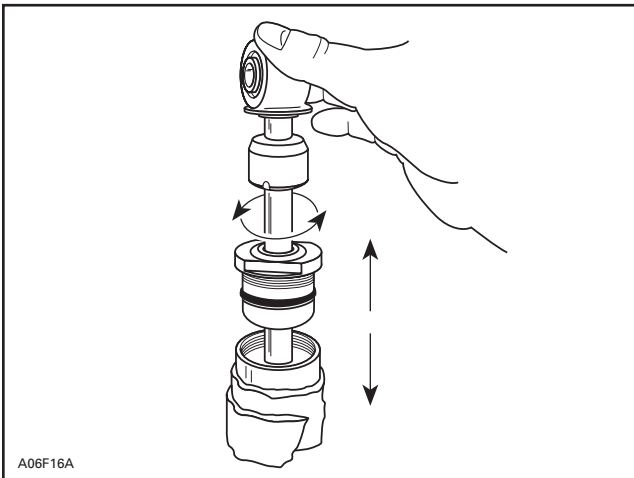
Fill the shock with Bombardier HPG shock oil (P/N 413 7094 00) to approximately 10 mm (.393 in), from the base of seal carrier threads.



1. Fill to 10 mm

NOTE: Although we do not measure the exact amount of oil added to the damper, approximately 106 mL (3.58 oz. US) will be used.

Carefully insert damper rod into the damper body. Install damper rod assembly into the damper body. Lightly oil damper piston seal ring with shock oil to ease installation.



NOTE: Some shock oil will overflow when installing damper. Wrap damper with shop cloth to catch possible overflow oil.

▼ CAUTION

Use care when passing piston into damper body at damper body threads.

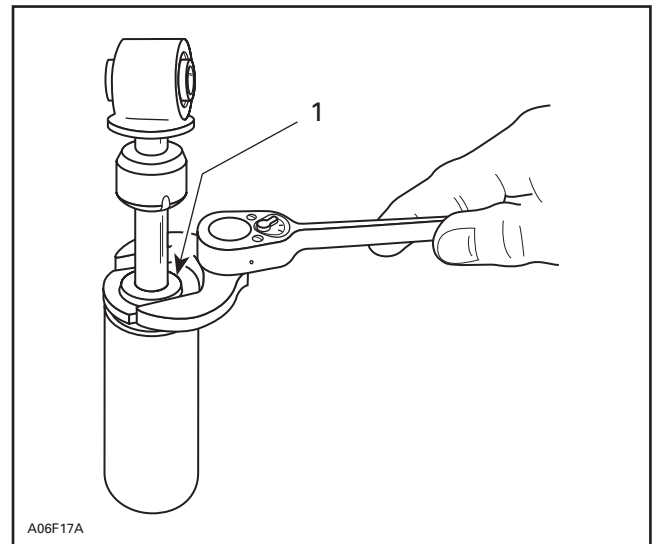
Slight oscillation of damper rod may be required to allow piston to enter damper body bore.

Slowly push piston into damper body. Slight up and down movement may be required to allow all air to pass through piston assembly. The gentle tapping of a small wrench, on the shock eye, may help dislodge air trapped in the submerged piston. Be careful not to drive the shaft any deeper into the oil than is necessary to just cover the shim stack.

NOTE: Fast installation of the damper rod may displace the floating piston from its original position. This must not occur if the damper is expected to perform as designed.

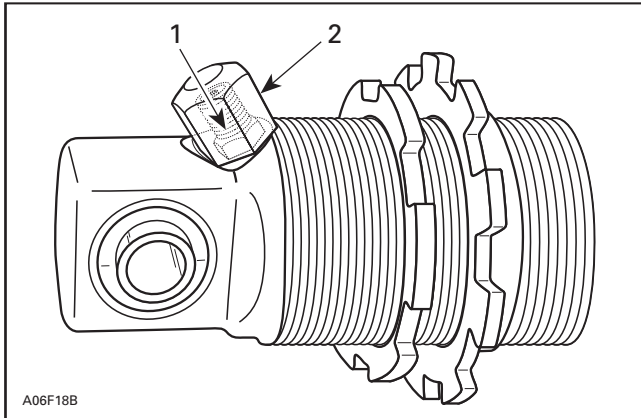
With damper rod piston into-oil, TOP OFF damper oil volume. Oil level should be to damper body thread base.

Seal carrier assembly can now be threaded into damper body. This should be done slowly to allow weepage of oil and to minimize IFP displacement. After the seal carrier is fully in place avoid pushing the shaft into the body until the nitrogen charge is added.



1. Torque seal carrier to 88-89 N•m (64-72 lbf•ft)

SECTION 03 - CHASSIS PREPARATION



1. Schrader valve 1.5-2 N•m (13-17 lbf•in)
2. Schrader cap 5-6.5 N•m (44-57 lbf•in)

Adding Gas Pressure

Nitrogen (N₂) can now be added to damper body.

NOTE: Never substitute another gas for nitrogen. Nitrogen has been selected for its inert qualities and will not contaminate the gas chamber of the shock.

Preset your pressure regulator to 2070 kPa (300 PSI) nitrogen (N₂), this gas pressure will restore the correct pressure for your damper.

▼ CAUTION

Do not exceed the recommended pressure values.

When removing and retightening the Schrader valve acorn nut use minimal torque. When the cap is over tightened and subsequently removed it may prematurely break the seal of the Schrader valve to the shock body and cause a loss of nitrogen charge without being noticed. If you suspect this has happened then recharge the shock as a precaution. Inspect the acorn cap before installation to ensure that the internal rubber gasket is in its proper position.

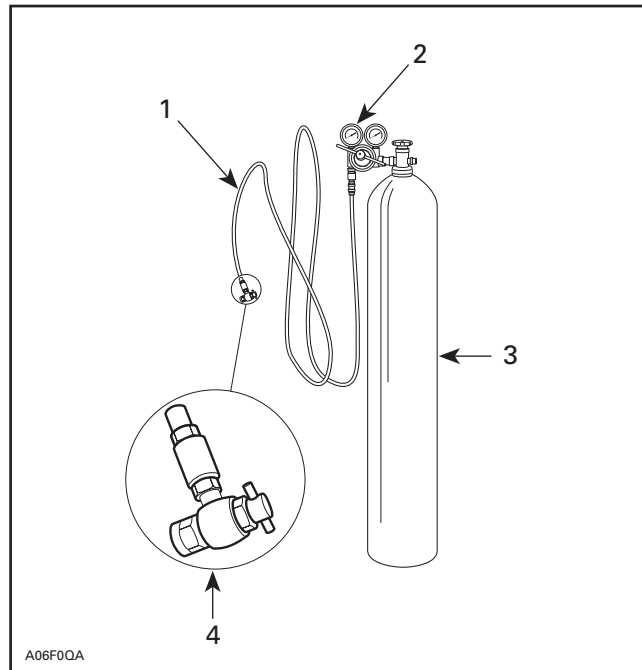
◆ WARNING

Whenever working with high pressure gas, use eye wear protection. Never direct gas pressure toward anybody.

NOTE: Carefully inspect damper for gas or oil leaks. Any leaks must be corrected before continuing.

Damper gas pressure cannot be confirmed by using a pressure gauge. The volume of gas in the shock is very small, and the amount lost during gauge installation will lower the pressure too much and require refilling.

After recharging is complete and before installing the spring the rebuilt shock should be bench-tested. Stroke the shock to ensure full travel and smooth compression and rebound action. If the shaft moves in or out erratically this could indicate too much air is trapped inside. If the shaft will not move or has partial travel then it may be hydraulically locked. In either event the shock must be rebuilt again. Pay particular attention to the placement of the IFP, quantity of oil and shim stack/piston assembly.



1. Automotive type air pressure hose
2. 2 stage regulator, delivery pressure range 2070 KPa (300 PSI)
3. High pressure cylinder filled with industrial grade nitrogen
4. Valve tip

Reinstall damper spring retainer, then your spring. Next, thread the spring pre-load rings up to the spring. Set pre-load according to recommended spring length specifications. Your damper is now ready for reinstallation to your snowmobile.

MX ZX 440 LC

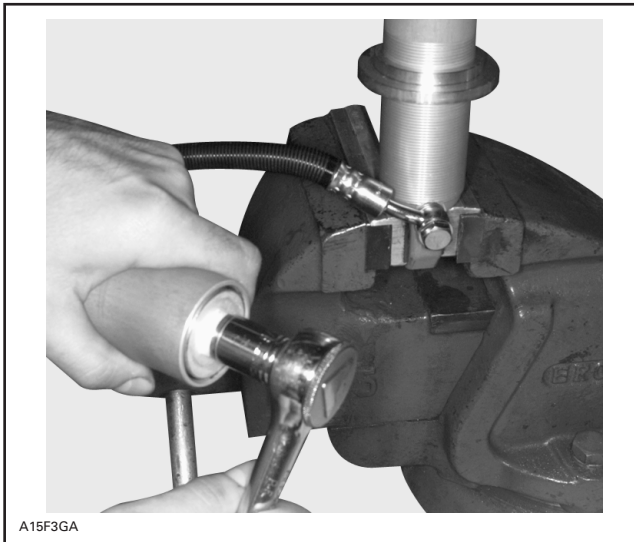
Shock Absorber Servicing

HPG Racing remote reservoir shocks with 4-positions adjustment knob. Refer to *Shop Manual* and *Racing Handbook* for damper disassembly and assembly procedures.

Reservoir Disassembly and Assembly

Gas Pressure Release

In a bench vise with shock body downward, hold reservoir in hand then remove air valve cap from air valve on reservoir.



REMOVE AIR VALVE CAP FROM RESERVOIR

Using air valve cap, release pressure from reservoir as shown on the next photo.



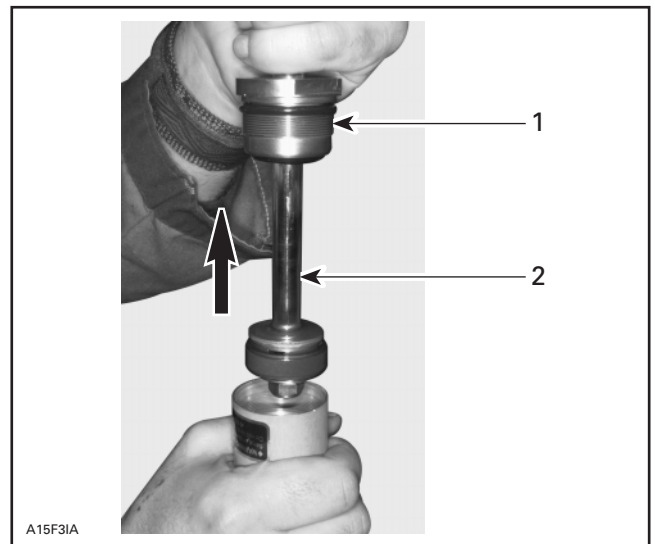
RELEASE PRESSURE FROM RESERVOIR

Damper Disassembly

◆ WARNING

Never perform any maintenance onto damper and reservoir assemblies until pressure is completely released from reservoir.

Remove seal carrier assembly from damper body. Slide out the damper rod assembly. Refer to *Shop Manual* or *Racing Handbook* to change damper valving.



- 1. Seal carrier assembly
- 2. Damper rod assembly

Discard old oil into storage container. Never reuse old oil during damper rebuild.

Reservoir Disassembly

Remove air valve from reservoir cap assembly on the remote reservoir.

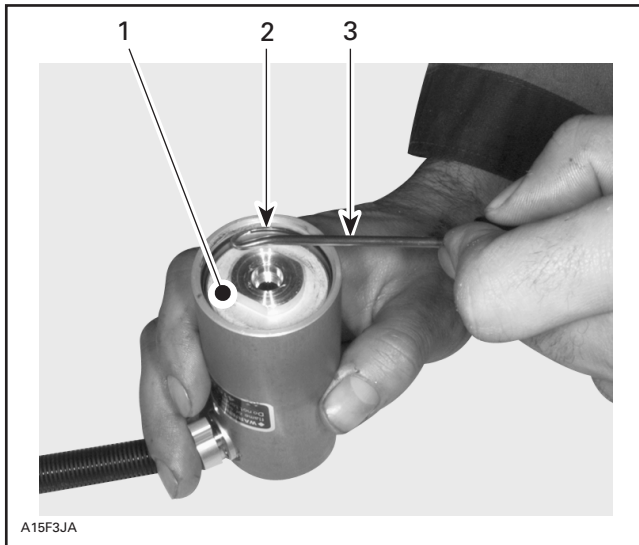
Using both thumbs, press on the reservoir cap assembly.

Remove circlip with special tool Snap-on 3ASH.

▼ CAUTION

Ensure not to scratch any inner parts of the cylinder.

SECTION 03 - CHASSIS PREPARATION



1. Reservoir cap assembly
2. Circlip
3. Special tool Snap-on 3ASH

Using a M8 (pitch 1.0mm) bolt, pull out reservoir cap assembly.

Disconnect oil hose from reservoir.

NOTE: Note oil hose positioning for proper reassembling, as shown on the next photo.



HOSE POSITIONING

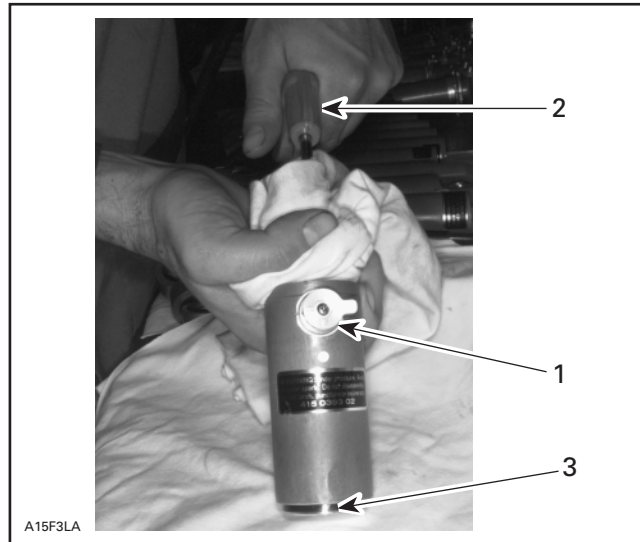
Set reservoir adjustment knob to position 4.

Hold reservoir in hand, 1 inch above table then use compressed air pressure and carefully remove floating piston from reservoir body.

NOTE: Shock oil will leak from reservoir. Use shop cloth to catch excess oil.

◆ WARNING

Use extreme caution when removing piston with compressed air. Protective eye wear should be used.



1. Adjustment knob set to position 4
2. Compressed air
3. Floating piston

Reservoir Assembly

Reinstall oil hose on both reservoir and damper. Torque bolts to 30 N•m (22 lbf•ft). Refer to the HOSE POSITIONING photo of the reservoir disassembly section for proper hose positioning.

NOTE: When reinstalling oil hose always use new washers (P/N 415 0387 00).

Fill reservoir with 50 mL of Bombardier HPG shock oil (P/N 413 7094 00).

Reinstall floating piston into reservoir body. Concave side of piston must be facing upward. Use oil to ease O-ring pass reservoir body groove.

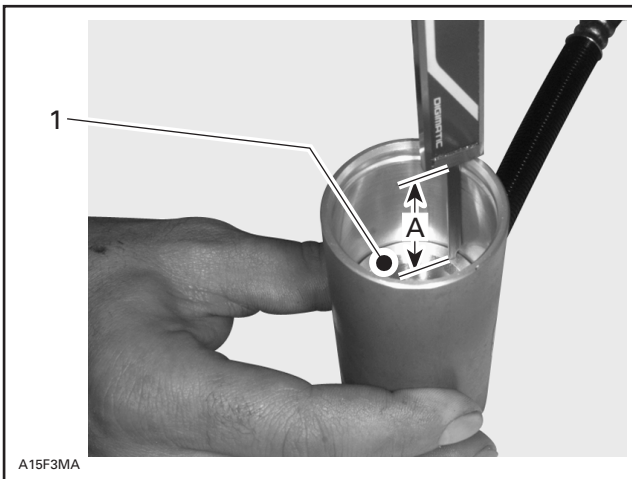
SECTION 03 - CHASSIS PREPARATION

Invert reservoir (hose connector upward). Using the two thumbs apply pressure on floating piston to position floating piston to depth of 43 ± 2 mm ($1-11/16 \pm 5/64$ in). Measure from the top edge of reservoir body.

▼ CAUTION

When positioning floating piston ensure that reservoir is in vertical position (hose connector facing upward). This will allow air to exit from reservoir. Oil transferring from reservoir to damper body indicates that no more air remains in reservoir.

NOTE: If the floating piston is installed too far into reservoir body, wait for damper rod assembly installation to adjust floating piston position.

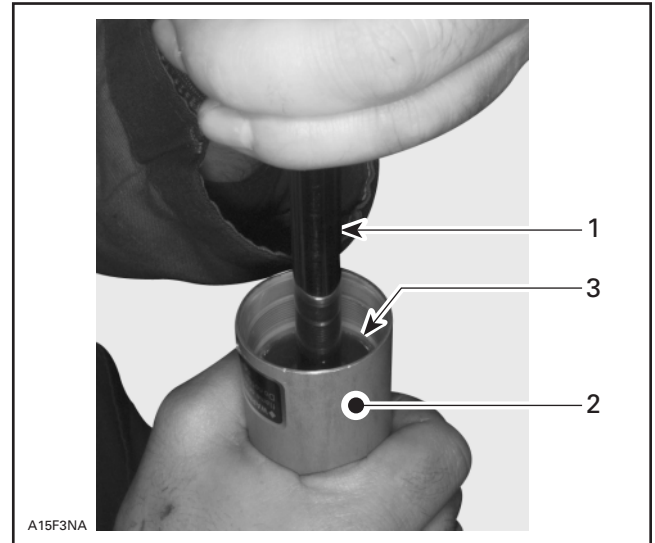


RESERVOIR HAS BEEN REVERSE TO SHOW HOW TO MEASURE

1. Concave side of piston facing upward
- A. 43 ± 2 mm ($1-11/16 \pm 5/64$ in)

Damper Assembly

Replace damper oil with Bombardier HPG shock oil (P/N 413 7094 00) to the base of damper seal carrier threads.



1. Damper rod assembly
2. Damper body
3. Oil level

Install damper rod assembly into the damper body. Lightly oil damper piston seal ring with shock oil to ease installation.

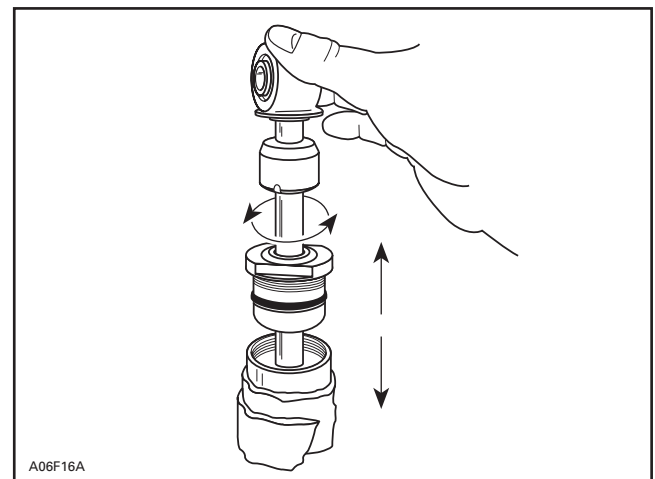
NOTE: Some shock oil may overflow when installing damper rod assembly. Wrap damper with shop cloth to catch possible oil overflow.

▼ CAUTION

Use care when passing piston into damper body at damper body threads.

Slight oscillation of damper rod may be required to allow piston to enter damper body bore.

Slowly push piston into damper body. Slight up and down movement may be required to allow all air to pass through piston assembly.



SECTION 03 - CHASSIS PREPARATION

NOTE: Fast installation of the damper rod may displace the floating piston from its original position. Do not allow this to occur.

Reservoir Floating Piston Final Check (before damper seal carrier installation)

Perform a final check of the floating piston position (43 ± 2 mm ($1-11/16 \pm 5/64$ in)):

- If floating piston is positioned 41 mm and less. Apply pressure on floating piston to position floating piston to a depth of 43 mm ($1-11/16$ in).
- If floating piston is too far (45 mm and more). Move damper rod with fast movement to allow oil to transfer from damper body to reservoir. Floating piston will move back.

Damper Final Assembly

With damper rod piston into oil volume, re-top damper oil volume. Oil level should be to damper body thread base.

Seal carrier assembly can now be threaded into damper body. This should be done slowly to allow weepage of shock oil from body while installing.

NOTE: When reinstalling seal carrier, oil must overflow. This overflow indicates that damper is full of oil.

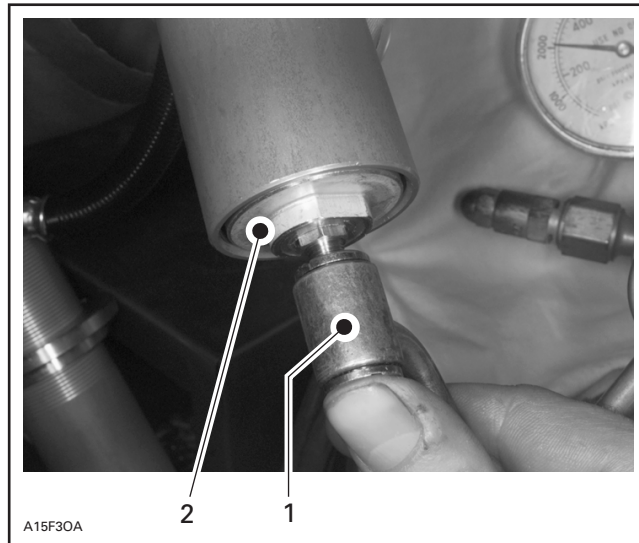
Reservoir Final Assembly

NOTE: If all previous procedures have been properly performed, **final floating piston position must be 40 ± 2 mm ($1-9/16 \pm 5/64$ in).** Final floating piston position must be measured after damper seal carrier assembly has been completely threaded.

Reinstall reservoir cap assembly with circlip then install air valve.

Gas Pressure Adjustment

Nitrogen (N_2) can now be added to reservoir body. Preset pressure regulator to 2070 kPa (300 PSI) nitrogen (N_2), this gas pressure will restore the correct pressure for the damper.



1. Valve tip (Nitrogen)
2. Reservoir cap assembly

▼ CAUTION

Do not exceed the recommended pressure value.

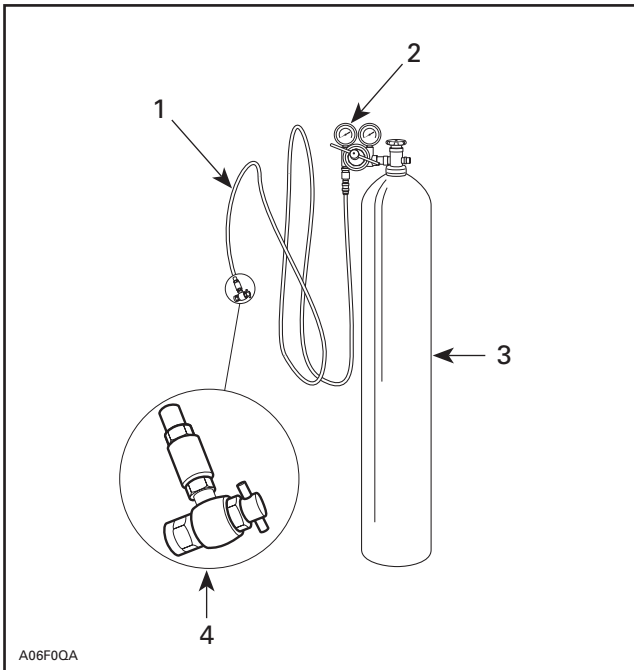
◆ WARNING

Whenever working with high pressure gas, use eyewear protection. Never direct gas pressure toward anybody.

NOTE: Carefully inspect damper for gas or oil leaks. Any leaks must be corrected before continuing.

Damper gas pressure can be confirmed by using a pressure gauge available through your local industrial gas supplier.

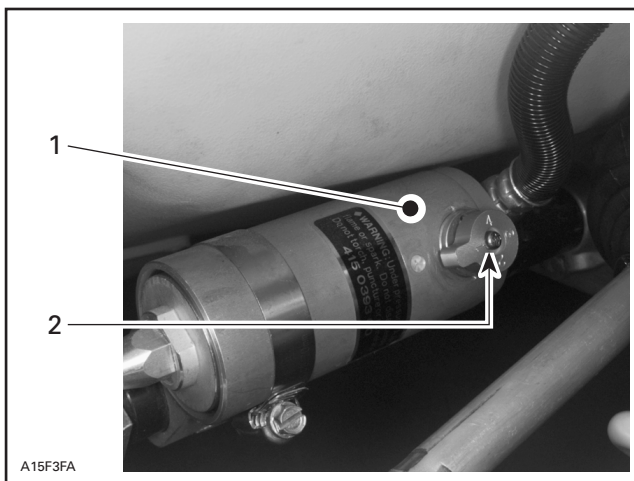
SECTION 03 - CHASSIS PREPARATION



1. Automotive type air pressure hose
2. Two stage regulator, delivery pressure range 2070 KPa (300 PSI)
3. High pressure cylinder filled with industrial grade nitrogen
4. Valve tip

4-Positions Quick Adjustment

Perform front suspension adjustment with adjusting knob located on remote reservoir.



1. Remote reservoir
2. Adjusting knob ("1" softer — "4" stiffer)

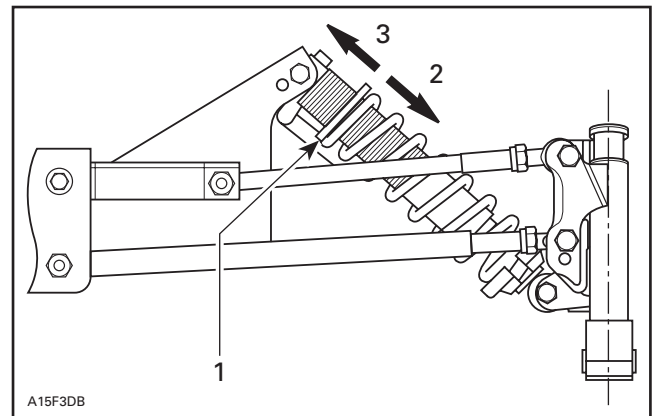
Preload Adjustment

Lift snowmobile to remove tension from shock absorber.

Perform preload adjustment on HPG shock absorbers by setting adjusting nut upward (remove preload) or downward (add preload).

CAUTION

Ensure that shock absorber is extended when adjusting preload and make sure that tension remains on spring when removing preload.



TYPICAL — FRONT HPG SHOCK ABSORBER

1. Adjusting nut
2. Add preload
3. Remove preload

SECTION 03 - CHASSIS PREPARATION

ASSEMBLY AND TEAR DOWN PROCEDURE FOR HPG SHOCK ABSORBERS

MODEL NAME	YEAR	APPLICATION
MX Z 583	1998	Front/Center/Rear
MXZ 670	1998	Front/Center/Rear
SUMMIT X 670	1998	Rear only

Part numbers

PART NUMBERS	MODEL NAME
415 0822 00	MX Z - Front
415 0823 00	MX Z - Center
415 0824 00	MX Z - Rear
415 0864 00	Summit X 670

Tear Down Procedure

1. Remove valve cap.
2. Remove gas pressure by depressing the center pin in the valve.

▼ CAUTION

There is 300 lb of nitrogen gas pressure.

3. Using a straight edge chisel, separate the shock body cover from the shock body.
4. Press down on the inside cover (about 2 mm) in order to gain access to the snap-ring.
5. Using a scratch awl or a pick, remove the snap-ring.

▼ CAUTION

Use care with the scratch awl or pick to avoid scratching the inner surface of the shock body.

6. Remove the inside cover as follows:
 - a. Place a clean rag over the top of the shock body.
 - b. Press downward on the piston rod approximately 50 mm.

c. Pull upward on the piston rod quickly, this will create a pressure that will force the inside cover to come out.

7. The piston rod should come out of the shock body.

You may now change the oil and/or calibration.

Assembly procedure

1. Ensure that the nut holding the calibration spacers is tight.
2. Check the position of the floating piston inside the shock body. The following measure is taken from the top of the piston to the edge of the shock body.

PART NUMBERS	MODEL	APPLICATION
415 0822 00	MX Z	145.5 mm (Front)
415 0823 00	MX Z	133.5 mm (Center)
415 0824 00	MX Z	174.5 mm (Rear)
415 0864 00	Summit X 670	201.5 mm (Rear)

3. Fill the shock body with oil.

NOTE: Fill up to 5 mm below the groove.
4. Slowly insert the rod assembly.
5. Install the snap-ring.
6. To check if the snap-ring is properly seated, pull on the rod slowly to full extension. the snap-ring should stop the movement.
7. Install the shock body cover using a hammer.

▼ CAUTION

Do not hit the shock rod with the hammer.

8. Using proper equipment, fill shock with 300 lb of nitrogen.
9. Install valve cap.
10. To check shock press down on shock rod, it should return to its original position by itself.

SECTION 03 - CHASSIS PREPARATION

SHOCK CALIBRATION WORK SHEET

MODEL: _____ DATE: _____

RIDING CONDITIONS: _____

	FRONT	CENTER	REAR	OPTION
PISTON SLITS				
IFP HEIGHT				
COMPRESSION				
REBOUND				
SPRING				
PRELOAD				

NOTES: _____

SECTION 03 - CHASSIS PREPARATION

HPG T/A Shock Spare Parts

SHIMS

P/N	SIZE (mm)	MOQ (minimum order quantity)
415 0391 00	30 × .254	5
414 8883 18	30 × .203	15
414 8883 19	30 × .152	1
414 8883 20	28 × .203	5
414 8883 21	28 × .152	5
415 0390 00	26 × .254	5
414 8883 22	26 × .203	5
414 8883 23	26 × .152	50
414 8883 24	22 × .203	5
414 8883 25	22 × .152	5
414 8883 26	20 × .203	5
414 8883 27	20 × .152	5
414 8883 28	20 × .144	5
414 8883 29	18 × .203	5
414 8883 30	18 × .152	5
414 8883 31	16 × .254	10
414 8883 32	16 × .203	10
414 8883 33	16 × .152	10
415 0389 00	16 × .114	10
414 8883 34	15 × .254	10
414 8883 35	15 × .203	10
414 8883 36	15 × .152	10
414 8883 37	15 × .114	10
414 8883 38	12 × .203	10
414 8883 39	12 × .152	10
415 0388 00	12 × .114	10
414 8883 40	21 × .114	10
414 8883 41	24 × .114	10

PISTONS

P/N	SIZE	MOQ (minimum order quantity)
414 8883 04	0 slit	1
414 8883 05	2 slits	2
414 8883 06	4 slits	1
414 8883 07	6 slits	1

SECTION 03 - CHASSIS PREPARATION

Miscellaneous

P/N	DESCRIPTION
414 8621 02	Cylinder body without bearing front
414 8619 02	Cylinder rod without bearing front
414 8615 02	Cylinder rod without bearing center
414 8621 03	Cylinder rod without bearing rear
414 9257 02	Cylinder body without bearing center
414 8615 03	Cylinder body without bearing rear
414 5629 00	Spherical bearing
371 9050 00	Circlip
414 8883 00	Seal carrier assembly with O-ring
414 8883 01	O-ring for seal carrier
414 8883 02	Rubber cushion
414 8883 03	Compression valve stopper D33 x T4
414 8883 08	Rebound valve stopper D17 x T2
414 8883 09	Washer
414 8883 10	Piston nut with spring lock
414 8883 1	Floating piston with O-ring for 1994/95 HPG
415 0387 00	Floating piston with O-ring for 1996 HPG
414 8883 12	O-ring for floating piston for all 1994/95/96 models
414 8883 13	Gas valve cap ass'y with rubber
414 8883 14	Gas valve ass'y with O-ring
414 8883 15	O-ring for gas valve
414 8883 16	Threaded spring collar
414 7625 00	Threaded jam collar
414 9566 00	Optional MVA shaft for C7 rear shocks
414 8883 17	Spring stopper for MVA use
414 9566 00	96 MX Z T/A Front damper unit
414 9539 00	96/97 MX Z T/A Center damper unit
414 9540 00	96/97 MX Z T/A Rear damper unit
415 0393 00	97 MX Zx T/A Front damper unit RH
415 0393 02	97 MX Zx T/A Front damper unit LH
415 9539 00	97 MX Zx T/A Center damper unit
414 9540 00	97 MX Zx T/A Rear damper unit

SECTION 03 - CHASSIS PREPARATION

Shock Calibration Work Sheet

MODEL: MX Zx 1997				
RIDING CONDITIONS: Sno Cross				
	FRONT	CENTER	REAR	OPTION
PISTON SLITS	6	4	2	
IFP HEIGHT	40.5 mm	141 mm	190 mm	
COMPRESSION	3 x 30 x .203	3 x 30 x .203	4 x 30 x .203	2 x 30 x .254
	1 x 12 x .114	1 x 15 x .114	1 x 21 x .114	
	5 x 30 x .254	3 x 30 x .254	5 x 30 x .203	2 x 30 x .254 1 x 30 x .203
	1 x 24 x .114	1 x 28 x .203	1 x 21 x .114	
	1 x 20 x .114	1 x 26 x .203	6 x 30 x .203	3 x 30 x .254
	1 x 16 x .114	1 x 24 x .114	1 x 28 x .152	
		1 x 22 x .152	1 x 26 x .152	
		1 x 18 x .152	1 x 24 x .114	
		1 x 16 x .152	1 x 22 x .152	
			1 x 20 x .152	
REBOUND	6 x 26 x .254	6 x 26 x .254	1 x 26 x .203	
	1 x 15 x .203	1 x 20 x .203	2 x 26 x .254	
		1 x 15 x .152	1 x 16 x .114	
			6 x 26 x .254	
			1 x 22 x .203	
			1 x 18 x .203	
			1 x 15 x .203	
SPRING	Stock 125# BL/BL/BL	Stock	Stock	
PRELOAD	1/2" – 9-3/4" spring length	*Installed on sled	Cam pos. 2	
	300 PSI	300 PSI	300 PSI	

*NOTES: Sway Bar Installed, ACM Tight.

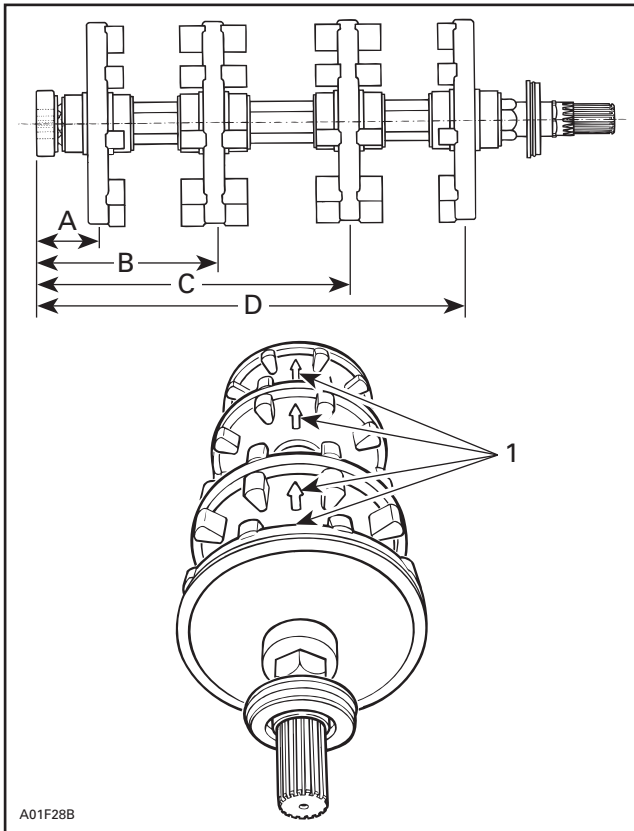
CHASSIS SET-UP

General

Reducing rolling resistance of a snowmobile is also an important area to explore when you are searching for the ultimate top speed. The horsepower required to overcome rolling resistance or drag increases approximately with the square of velocity so small reductions here can provide measurable improvements in top speed.

Good chassis set up starts with accurate alignment of the drive axle, countershaft, suspension system, and chassis. Use the following procedure to check your vehicle:

Remove the rear suspension, driven clutch, tuned pipe and muffler, track and drive axle. Check to see that the spacing of the drive sprockets is correct on the drive axle. The sprockets should be centered in the space between the rows of internal drive lugs on the track.



- 1. Indexing marks aligned
- A. 65.8 mm (2-18/32 in) 1995/1998 All S-Series DSA
- B. 159.3 mm (6-17/64 in) 1993/1998 All F-Series DSA
- C. 282.3 mm (11-7/64 in)
- D. 375.8 mm (14-51/64 in)

Use a press or special tool P/N 861 7257 00 for shifting the sprockets. The sprocket indexing should also be checked. The maximum desynchronization is 1/16 inch (1.5 mm). The drive axle can be chucked in a lathe and spun to observe the sprocket "wobble" and run out. Wobble should not exceed 2 mm (.080 in). While this amount of wobble may look excessive, it does not affect performance. If wobble is more than allowed, the sprockets should be replaced.

Maximum run out should not exceed 0.5 mm (.020 in). A maximum of 1 mm (.040 in) can be removed from the sprockets to true the diameter.

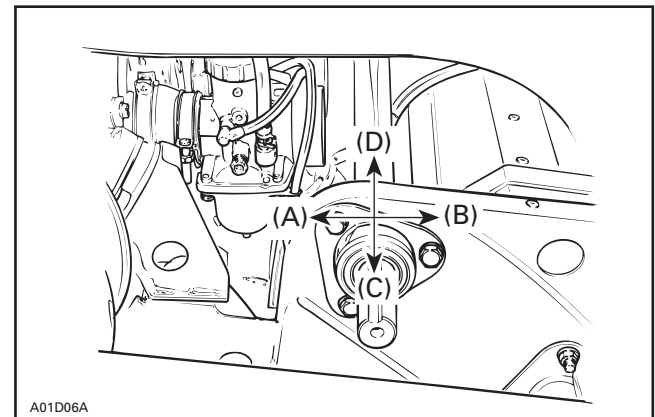
▼ CAUTION

Do not remove more than 1 mm (.040 in) of material or the sprockets will start to go out of pitch with the track.

Reinstall the drive axle leaving the left end bearing housing off.

Loosen the left side countershaft eccentric bearing collar and slide the bearing retainer out so that the shaft end is free to locate itself in the support opening.

With both left shaft ends free, you can see if the shafts are centered in their bearing mount holes.

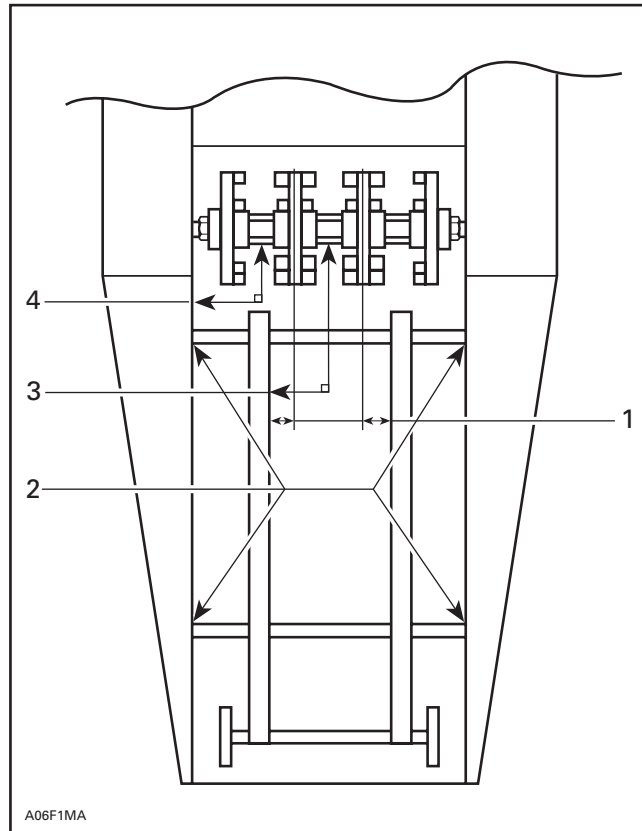


TYPICAL

SECTION 03 - CHASSIS PREPARATION

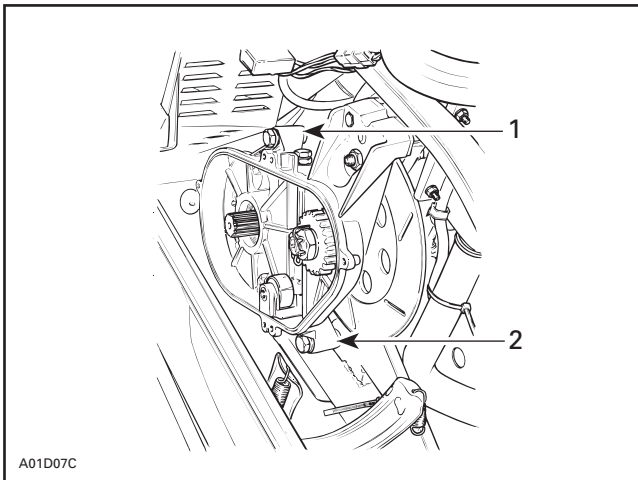
NOTE: Shafts will have a tolerance in the bearing housings and the bearings them-selves. These tolerances can be felt by hand. The shafts should be mid-point in these tolerances when centered in the bearing mount holes. If not perfectly centered, the two upper chaincase bolts should be loosened and shims should be added between the chassis and chaincase as necessary to align the countershaft and drive axle in their bearing mount holes. Depending on the amount of shims added, it may be necessary to use longer chaincase bolts. Make certain the bolt is fully engaged in the nut when properly torqued.

Now, reinstall the left end bearing housing. Using a large carpenters square, check to see that the drive axle is square (90°) with the tunnel. If not, slot the left end bearing housing holes and reshim the chaincase to square up the drive axle and the countershaft.



1. Align runners with drive sprockets. Equal distance both sides. Shim drive axle to reduce end play. Maximum end play = .060" (ideal = less than .030")
2. Cut ends of tubes and shim as required to align suspension and remove freeplay
3. Suspension square with drive axle
4. Drive axle square with tunnel

Now check the axial play (side-to-side clearance) of the drive axle. The axle must not move more than 1.5 mm (.060 in) from side to side. Ideally, the axle has 0.25 – 0.50 mm (.010 – .020 in).

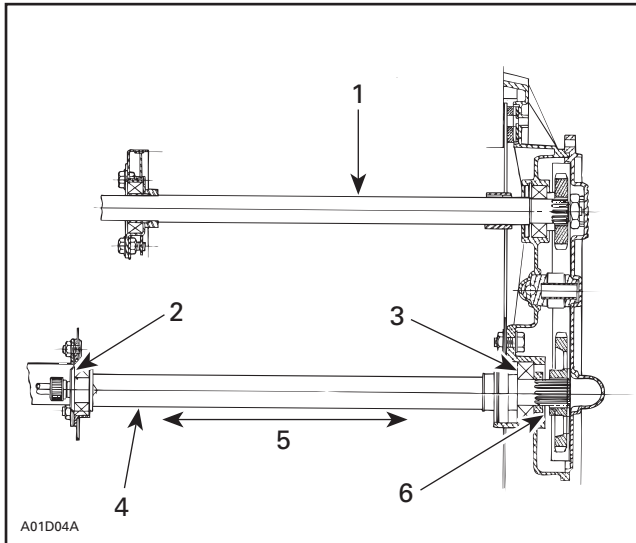


TYPICAL

1. Shim location
2. Shim location

Reinstall the rear suspension and using a square check to see that the runners are square (90°) with the drive axle. If not, cut and shim the ends of the suspension cross tubes to perfectly align the runners and also remove any side-to-side movement. If the suspension must be shimmed, correlate the adjustment with the next step.

SECTION 03 - CHASSIS PREPARATION



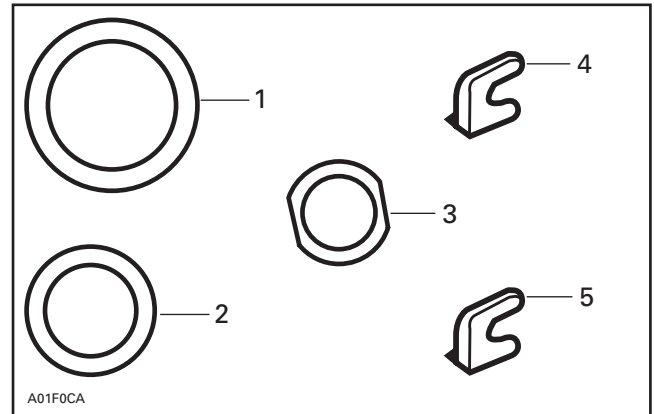
TOP VIEW

1. Countershaft
2. Shim position on end bearing housing side
3. Shim position on chaincase side
4. Drive axle
5. Axial play
6. Shim between sprocket and spacer

If the axle must be shifted left or right, note the direction and distance, and shim the axle as necessary.

Shims can be placed between the left side bearing and the end bearing housing to move the axle to the right or between the right side bearing and the chaincase to move the axle to the left.

NOTE: If shims are placed between the chaincase and the right side bearing, an equal thickness shim must be placed between the drive chain sprocket and the spacer on the axle.



1. 501 0205 00
Shim, Drive Axle End Bearing Housing 1.6 mm (.063 in) Thick
2. 414 6053 00
Shim, Drive Axle Chaincase Side 1.6 mm (.063 in) Thick
3. 506 0414 00
Shim, Drive Axle Chaincase Side 1.6 mm (.063 in) Thick
4. 504 0307 00
Shim, Chaincase Perpendicularity 1 mm (.040 in) Thick
5. 504 0398 00
Shim, Chaincase Perpendicularity 0.5 mm (.020 in) Thick

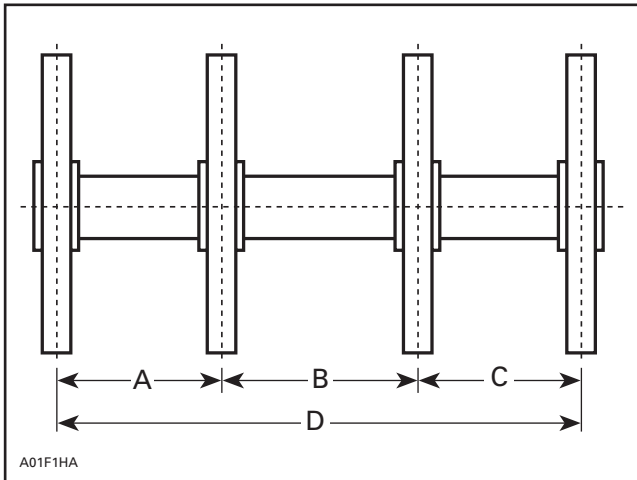
Rear Axle Modification

Heavily studded tracks combined with hard cornering put enormous loads on the track. To reduce the chance of derailing the track and to help spread the tensile loads of the track, a fourth idler wheel should be installed.

Modify your rear axle and fabricate sleeves as necessary for your Formula model year to allow the mounting of additional inner idler wheels. The two inner idlers should be placed so that they run between the left and right double rows of drive lugs. This will help maintain alignment of the track and lessen the chance of derailing.

Use the spacing shown in the drawing noting that the outer two idler wheels are in their original position.

SECTION 03 - CHASSIS PREPARATION

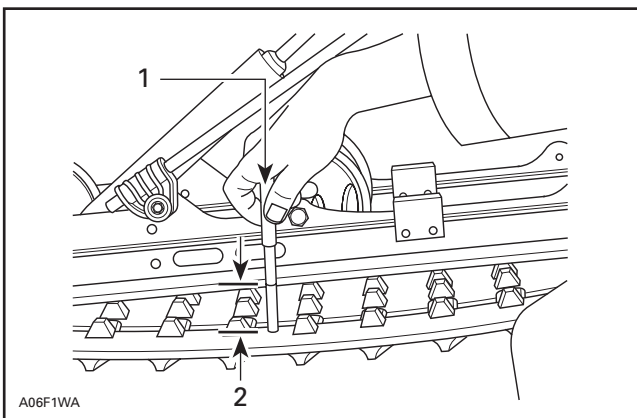


- A01F1HA
- A. 101.5 mm (3-63/64 in)
 - B. 123 mm (4-27/32 in)
 - C. 101.5 mm (3-63/64 in)
 - D. 326 mm (12.83 in)

When you have reinstalled the track and suspension, make certain that all bolts attaching the suspension to the chassis are installed with high strength threadlocker (Loctite 271), and that bolts are properly torqued.

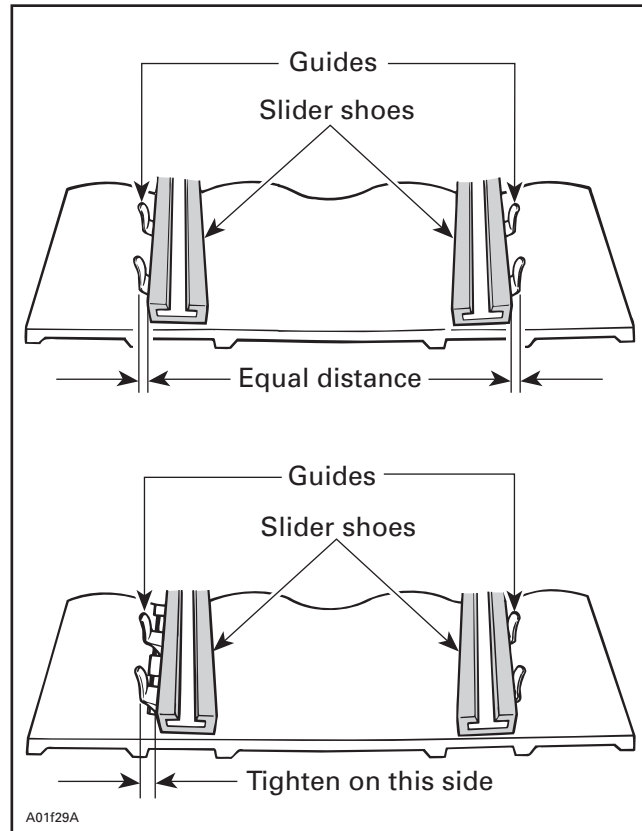
There are grease fittings on all moving parts of the suspension and they should be greased on a weekly basis with a quality, low temperature grease (P/N 413 7061 00).

Finally, adjust the track tension and alignment. Track tension and alignment are most critical to top speed. Make certain the track is aligned so that you have equal clearance between the slider shoe and the track guides on each side of the snowmobile.



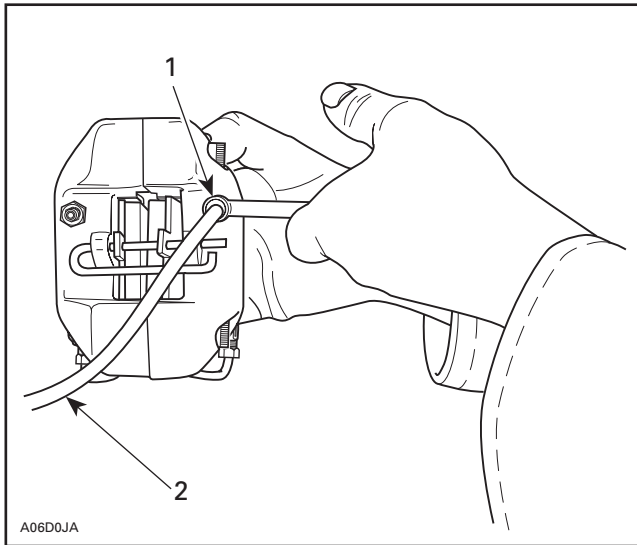
TYPICAL

- 1. 7.3 kg (16 lb)
- 2. Deflection



For straight line racing, top speed can sometimes be increased by running the track a bit looser. "Ratcheting" of the drive sprockets during hard acceleration can occur if the track is too loose. Conversely, heavily studded tracks may need to be tighter to achieve top speed because the extra weight of the studs may cause the track to "balloon out" at high speeds.

NOTE: Track tension should be checked whenever major changes are made to the limiter strap length and/or ride height changes.



1. Hold bleeder adaptor while opening bleeder
2. Clear hose to catch used brake fluid

Pump a few times brake lever and while holding brake lever depressed, open bleeder and check for air to escape.

Repeat with the same bleeder until no air appears in hose.

Proceed the same way with the right side bleeder.

BRAKES

To achieve maximum top speed and proper brake functioning, it is important to make sure the brake disc is loose on the countershaft to allow the disc to float and remain centered between the brake pads. The shaft should be lubed to maintain the floating disc.

If extreme brake use is anticipated, use 3 inch diameter dryer hose (or equivalent) to route outside air directly from the hood vents to the brake area.

Both the Wilwood and Brembo hydraulic brake systems use DOT 4 brake fluid. For conditions where extreme brake heat is generated, DOT 5 fluid can be used. DOT 5 has a higher boiling point but it is more susceptible to moisture intrusion and should be changed on a regular basis. DOT 5 should not be used for long, multi-day cross country racing where maintenance is minimal.

If the brakes become "spongy", the system should be bled to remove any air bubbles. If the brake fluid is dark and/or cloudy, flush the complete system and refill with fresh brake fluid.

When refilling the injection oil container be careful not to overfill as excess oil can drop onto the brake disc and impregnate the brake pads. If this happens the brake pads should be replaced to ensure maximum braking performance.

AERODYNAMIC CONSIDERATIONS

Yes, aerodynamics are an important consideration in snowmobile design. The horsepower required to overcome aerodynamic drag increases according to the cube of the velocity. At speeds under 64 km/h (40 MPH), the aerodynamic considerations are not great, but when you approach the 160 km/h (100 MPH) mark, simply how you sit on the snowmobile can mean 6.4 km/h (4 MPH) in top speed.

Bombardier has spent many hours in the wind tunnel on the hood design, and has optimized the shape to fit the function. You cannot improve the shape of your snowmobile but you can reduce the frontal area of the snowmobile by lowering the ride height and by using the lowest windshield available.

The high windshield offers the rider good wind protection. That protection, however, translates into increased frontal area and more aerodynamic drag. If you are running at a local radar run with the high windshield on, you should sit upright behind the windshield. Crouching behind the windshield increases drag because of interruption of the air flow from the top of the windshield to the rider's back.

When the low windshield is fitted, the opposite is true, you should crouch behind the low windshield for best top speeds. When crouched behind the low windshield, there is an improvement in the aerodynamics compared to sitting upright behind the high windshield. That translates into an increase at top speed in a laboratory setting.

Because of the purity of the air flow in the wind tunnel, you should not expect this increase in normal running, but you can always expect a 3.2 – 4.8 km/h (2-3 MPH) improvement and even more when winds are still.

Lowering the vehicle a couple of inches can also improve top speed by 1-3 MPH.

SECTION 03 - CHASSIS PREPARATION

ADJUSTING RIDE HEIGHT

A cross-country racer will want all the suspension travel you can come up with for a rough and tumble, snowcross-type event. But when racing a high speed event on a relatively smooth lake, giving up some of the suspension travel to lower the machine is advantageous. Lowering the machine, reducing the ride height, does 3 things for you :

1. lowers the center of gravity of the machine; which improves cornering.
2. reduces the frontal area of the sled; which improves aerodynamics.
3. reduces the approach angle of the track; which reduces drag.

A person wanting to lower the machine for a short event like a radar run may simply chain or strap the machine down. Provided the course is quite smooth, this can work, but realize that strapping down the suspension preloads the springs highly and the ride will be very stiff. This technique is not recommended for most forms of racing.

The most common technique for lowering the machine is to use shorter springs or to shorten the existing springs by heating and collapsing a coil or 2 of the spring as needed. Realize that shortened springs will have very little preload when the suspension is in its "topped out" position, and it may be necessary to safety wire the spring collars into position, and use additional limiter devices like straps, chains or on HPG /A shocks, a spacer can be added internally to limit the extension of the shock.

NOTE: Some race organizations do not allow shortening springs so a proper optional short spring would be used.

Lowering the Front Suspension

Option 1: Make limiter straps from standard rubber limiter strap material or link chain and go from shock bolt to shock bolt (longer shock bolts will be required). The length of the strap should be adjusted to obtain the desired ride height. Most rules require you to maintain 2 inches of suspension travel. This equates to a shock eye center to center distance of about 11.5 inches on the DSA (F-series and S-series) chassis.

Shorter springs should be used to avoid excessive preload.

Option 2: On vehicles with rebuildable shocks (HPG T/A), a spacer can be installed internally on the shock shaft to limit the shock extension. A kit (P/N 861 7442 00) is available that includes 60 mm long spacers. This will give a full extension shock eye center to center distance of about 11.1 inches. (Refer to the shock rebuilding section for proper installation procedures).

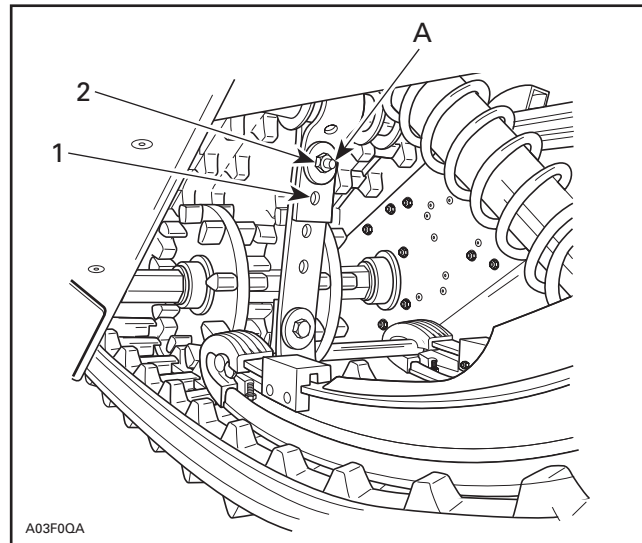
The threaded adjusters can be loosened to provide the desired amount of spring preload.

Lowering the Rear Suspension

Rear SC-10

Option 1: The SC-10 Rear Suspension can be lowered by compressing the rear scissors to the desired ride height and installing a strap to maintain this height. Compressing the rear scissors adds a great deal of preload to the rear torsion springs. Use Racing Springs P/N 486 0785 00 and P/N 486 0786 00. Install bushings P/N 572 0861 00.

Option 2: It is also possible to lower the rear suspension on vehicles equipped with HPG T/A shocks, by using a spacer to limit shock extension. Use Racing springs P/N 486 0785 00 and P/N 486 0786 00. Install bushings P/N 572 0861 00.



- A03F0QA
1. 1st hole.
 2. 2nd hole
 - A. 11 N•m (97 lbf•in)

Center

Shorten the limiter strap(s) to match the ride height of the front and rear and obtain the desired amount of weight transfer. New holes can be punched in rubber limiter straps. A shorter nylon limiter strap (P/N 414 9553 00) is available for the vehicles with the strap and bolt style.

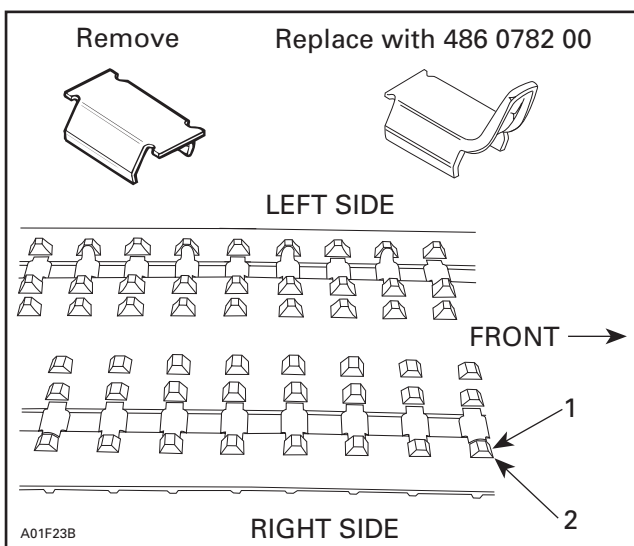
Quick Adjust Limiters may also be used. The P/N 861 7602 00 is for the 1997 MX Zx and 1997/98 MX Z 440/500/583/670. Use P/N 486 0781 00 for the 1997 MX Z 440F and P/N 861 7655 00 for the 1998 MX Zx. The Quick Adjust Limiter will allow you to shorten or lengthen the length of the limiter straps just by turning an adjuster knob.

On vehicles with HPG T/A shocks the threaded adjusters can be loosened to reduce the amount of spring preload. If less preload is desired or on vehicles with cam adjusters, shorter springs may be used to reduce excessive spring preload.

TRACK GUIDES

Additional taller track guides (P/N 486 0782 00) should be installed when oval racing with a heavily studded track. These taller guides help prevent derailing without having to overly tighten the track. When in a turn, the side loads on the guides are extremely high and it is advantageous to reduce the load per guide by adding more of the guides.

All of the flat cleats should be removed from the right side of the track and replaced with guide cleats. (See drawing.)



1. Standard
2. P/N 486 0782 00

NOTE: When installing taller track guides or studs part P/N 572 0861 00, bushings should be installed inside the rear torsion springs on SC-10 rear suspensions. Track guide clearance should also be checked on top of the rear suspension A.C.M.

For ice lemans type racing where left and right hand corners are encountered, extra guides should also be installed on the left side of the track.

There are two special tools which greatly enhance the removal and addition of guide clips.

- 529 0287 00 Guide clip remover
- 529 0085 00 Guide clip crimper

TRACK STUDDING

◆ WARNING

Installation of track studs is not a safe practice recommended by Bombardier, and we strongly suggest not to alter the track configuration or design. The actual installation of studs involves many factors, including rider weight, suspension set-up, terrain type and conditions as well as driver's experience and preference. One must also consider the adequacy of stud retention, short- and long-term, accidental body or vehicle contact and under certain conditions, greater stopping distances. One should also consider greater strain on the drive components and reduction track strength to name a few. This information relates to the preparation and use of snowmobiles in competitive events and has been utilized safely and effectively by Bombardier Inc. professional racing team. However, Bombardier Inc. disclaims liability for all damages and/or injuries resulting from improper use of the contents. We strongly recommend that these modifications be carried out and/or verified by a highly-skilled professional racing mechanic. It is understood that racing or modifications of any Bombardier-made snowmobile voids the vehicle warranty and that such modifications may render use of the vehicle illegal in other than sanctioned racing events under existing federal, provincial and state regulations.

SECTION 03 - CHASSIS PREPARATION

Traction control requires the installation of studs to the track so that you may improve the acceleration, direction and braking of the snowmobile on certain surfaces. Selection of the proper traction components is very important. It is also important to have the proper number of studs and to keep them sharp or replaced at all times.

For racing on hard ice, the single point stud is the most popular. If the ice gets a little softer, racers will add a variety of stamped studs. Always use Loctite when installing your studs.

Stud sharpness counts more than the number of studs. Fewer sharp, fresh studs work much better than a great many dull studs with a few new ones thrown in. Too many studs will keep the points from digging in and the sled will float, instead of hooking up.

If the studs do not prick your finger when you touch the tip they are not sharp enough. A small die grinder can be used to sharpen worn studs.

Place studs where pressure is concentrated on the edge of the track for turns, in the center of the track for acceleration and braking.

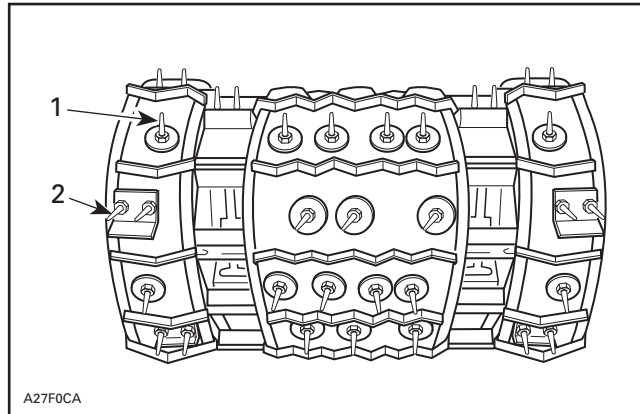
Hooker plates are welded to the track cleats and place the studs directly beneath the slider shoes for maximum pressure. The hooker setup is very hard on tracks, particularly the fiberglass reinforcing rods.

The other thing that must be kept in mind if hooker plates are used is that the studs will be directly in line with the heat exchanger protectors. The protectors must be removed and another system employed to protect the heat exchangers.

Depending upon machine setup, driver weight and driving characteristics, 250 to 300 penetrator studs will be required. The 121 inch track has 48 pitches. The most studs that can effectively be placed on each pitch is 7 — which means the maximum number of studs the track can hold is 336.

The drawing below shows a pattern of 6 studs alternating with 7 studs for a total of 312 studs. Try to keep studs from following the same line for 3 pitches.

NOTE: Refer to the appropriate section of this book for specific stud patterns for various types of racing.



TYPICAL

1. 6 stud row
2. 7 stud row

Most race associations sanctioning oval, snow cross and cross-country events limit the length of the studs to 3/8 inch above the high point of the track, while most drag and speed run associations allow a 3/4 inch limit. Rules do vary, however, and it is your responsibility to make certain your studs are legal. It is also necessary to protect the heat exchangers from damage from the studs.

Another item to keep in mind is the length of the threaded shank of the stud. Some stud patterns require that the stud pass under an idler wheel. If this is the case, you must be absolutely certain that the shank of the stud does not project beyond the flat face of the "T" nut. If necessary, grind the studs off.

Studs that are 20.8 mm to 21.5 mm (.850 to .875 inch) long mounted with square back plates are generally used. 24.5 mm (1 in) picks may be used for maximum penetration, but their use will require the addition of taller heat exchanger protectors (P/N 414 8382 00) 2 req'd.

▼ CAUTION

Check condition of heat exchanger after every race.

The best way to determine suitable studding patterns is to stud up and test. Compare several patterns for acceleration and cornering. Remember, the best way around the corner is to drive around it — not slide.

Take the time and care to lay out your stud pattern carefully. And, make sure you write down what works best for you at certain tracks and various conditions.

NOTE: The track must be run in for ten (10) hours before holes are drilled to receive the studs. This must be done to stretch out all the elements of the track before any of the track cords are cut by the studding operation.

SLIDER SHOE LUBRICATION

When running a vehicle on surfaces that do not provide adequate lubrication for the slider shoes, the plastic will start to melt and stick to the track guide clips. This not only reduces the life of the slider shoes but it also acts like a big brake that substantially reduces vehicle speed. If rules allow, the most effective means to reduce slider shoe sticking is to apply a lubricant via a slide lubrication system.

The lube system should have a tank of approximately 1 to 1.5 gallons, a control valve, pump and a series of hoses and tees. A standard fuel pump can be used. The pump is operated by primary crankcase compression and can be connected to the fuel pump impulse line with a tee. Because the pump will operate whenever the engine is running, a control valve is used to conserve lubricant for the race.

When plumbing your system, run the supply line from the tank to the shutoff valve first. Make sure the valve is in a convenient location but protected from flailing arms and legs. Be certain to tie wrap the lines away from any rotating, vibrating or heated surfaces. The outputs from the pump should be routed through the tunnel just in front of and beneath the footrest.

The 2 front nozzles should be located on each runner where the track just begins to touch the slider shoe. Drill a 1/4 inch diameter hole on the inner side of each runner down through the runner and slider shoe. Using red or green Loctite, insert a 1/4 inch diameter by 1-1/2 inch long roll pin in each location. Install the roll pin flush with the bottom of the aluminum runner. Do not let the pin protrude into the slider shoe. Prepare the slider shoes by grinding a "V" groove approximately 1/8 inch deep and 1/4 inch wide on the bottom side of the slider at each nozzle location. The grooves should run almost to the sides of the slider but not protrude on the sides. This will allow a better distribution of lubricant and make sure the lube supply does not become obstructed.

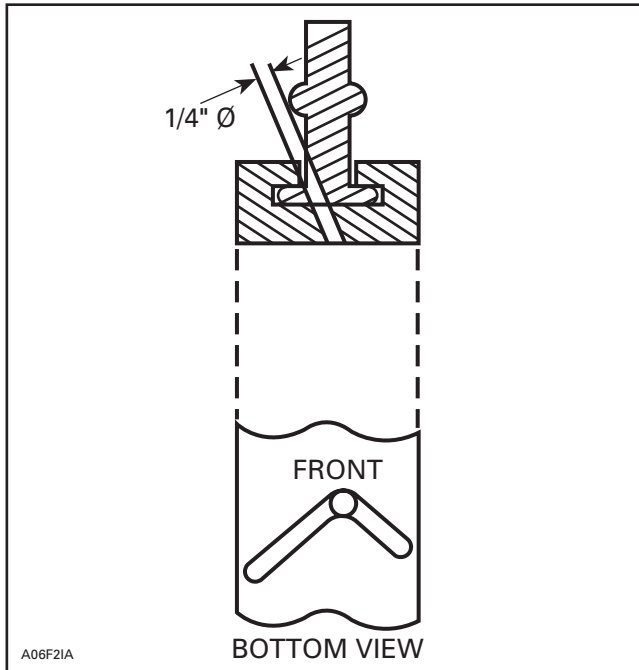
The 2 rear nozzles should be placed approximately half the remaining distance to the rear. For straight line racing, install the roll pins using the same procedure as above. For oval racing, mount the roll pins on the right side of both runners so the lubricant runs down the side of the slider shoe. This lubricates the sliders and the guiding portion of the track clips where side loading is highest during cornering. Be sure to clamp the side nozzles in place and secure all lines with locking ties.

Lubricant flow can be restricted at each nozzle by placing a Mikuni hex main jet inside each hose (about a no. 500). You cannot apply too much lube but you must last the race. Vary the restriction depending on your tank size and the length of the race.

PARTS LIST	QTY	P/N
Fuel pump	1	403 8004 00
Impulse hose	1	414 2867 00 (10 ft)
Hose clamp (1/4 D)	4	408 8011 00
Fuel line (1/4" D)	1	414 8340 00 (25 ft roll)
Tee (1/4 × 1/4 × 1/4)	3	414 1553 00
Spring clamp (for fuel line)	@	414 5548 00
Shutoff valve	1	414 5390 00
Lube tank (1 to 1 1/2 gallon)	1	N/A
Roll pin (1/4" dia. × 1-1/2")	4	N/A
Locking tie	@	414 1152 00 (package of 25)

If slide lubrication is not allowed, install a larger diameter idler wheel. This reduces the load on the slider shoes.

SECTION 03 - CHASSIS PREPARATION



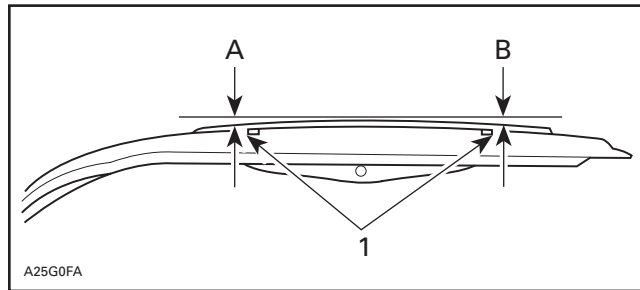
NOTE: Before installing a lubrication system check with your sanctioning body or race organization. In some cases, use of this system and/or certain lubricants is not allowed.

Also, a used or "seasoned" set of slider shoes will be faster than a brand new pair. The high spots and areas between the idler wheels will be worn down. If brand new sliders must be raced with stock wheels, remove about 1/8 inch of material from the bottom of the slider shoes.

SKIS AND RUNNERS

The skis on your Ski-Doo are not flat on their bottoms, they are slightly convex. This is done to improve stability at high speed on straightaways.

The plastic ski on the 1998 MX Zx incorporates more of its use ("rocker" effect). This plastic ski will work very well on snowy surfaces as it increases flotation and reduces drag. For oval and Ice Lemans, the new profile is superior to the steel ski.



1. The above illustration is an example of what is called "rocker"

Check your skis from time to time to confirm the 2 mm (3/32 in) (measured at the ski runner studs) bow. If the skis have flattened, use a hydraulic press as necessary to restore the original shape. This is most important for oval racers.

For the racer who encounters deep snow conditions, flotation can be increased and drag decreased by installing plastic ski liners onto steel skis, or use the plastic ski assembly (P/N 860 6002 00).

Plastic skis or liners are good for a 2 MPH increase in speed in most snow conditions, more in sticky snow conditions.

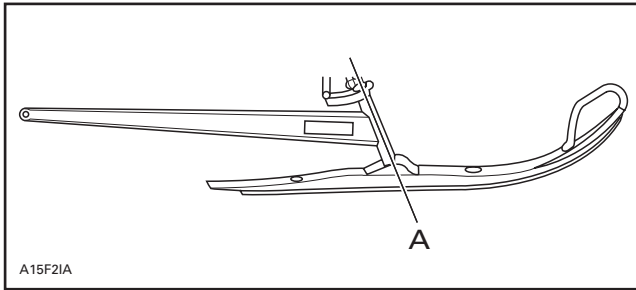
Carbide inserted ski runners are necessary for all forms of racing except drag racing and radar runs. The type of racing you are involved in and the condition of the track will determine what style of carbide and how much carbide you will be using.

For the ice race track, special flat-backed race runners with 60° carbide inserts are a must. The flat back of the runner helps to keep the runner from being rolled over by cornering forces. The best racing runners are heat-treated to prevent them from bending under high side loads.

When installing carbide inserts, start with 100 mm (4 in) of carbide in front of a line projected from the center line of the ski leg and 125 mm (5 in) behind the line. Always keep the amount of carbide behind the line longer than in front.

The MX Zx ski design displays three holes in the ski bridge. This allows for the ski to be moved forward or rearward in relationship to the spindle center line. Moving the ski to the forward hole will make steering more aggressive. Moving the ski to the rear mounting, hole will make the sled react slower.

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A. 122 mm (5")	98 mm (4")
147 mm (6")	122 mm (5")
171 mm (7")	147 mm (6")

The amount of carbide allowed on each runner may be limited by your race association. Check your rule book.

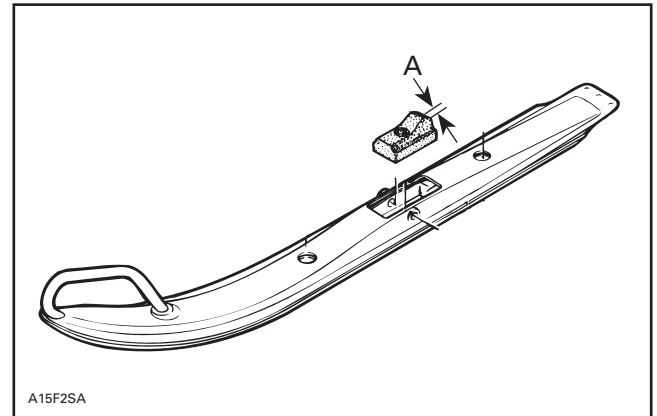
Once you have determined how much carbide you will be using, make up at least one more set. Sharp carbides dig! They must be sharp enough that when you drag your thumb nail over them, they will scrape off some of the nail. To keep your carbide runners in this condition, you must sharpen them every 5 or 6 laps. This is why you should have an extra set ready to go on in a hurry.

The condition of the skis and runners, as well as their alignment, has an effect on top speed. The ski toe out must be correct; any irregularities in the skis should be removed, and bent or badly worn runners must be replaced.

Ski runners used for cross-country racing must be selected for the type of conditions you will be running in. When exposed earth or plowed roads are to be encountered in an event, full length carbide runners should be used. The concern here is to make the runner and the ski last through the event. These runners are usually set up with 245 mm (10 in) of 60° carbide in the center of the bar with the front and rear portions of the bar filled in with 120° carbide inserts.

When the event is held on a lake or surface conditions consist only of snow and ice, a flat-backer runner with 150 to 200 mm (6 to 10 in) of carbide will do the job. Remember, the more carbide you install, the more positively the front end steers, but more steering effort is also required. Cross-country events run for many hours not just a few minutes like an oval event. Match your carbide to the strength and endurance of your arms.

A cross-country carbide does not need to be razor sharp. In fact, testing should be done with a slightly dulled edge, that way your set-up will be right for the majority of the race. If you test with sharp carbides, your chassis set-up will be off when the runners lose their edge after 5-10 miles.



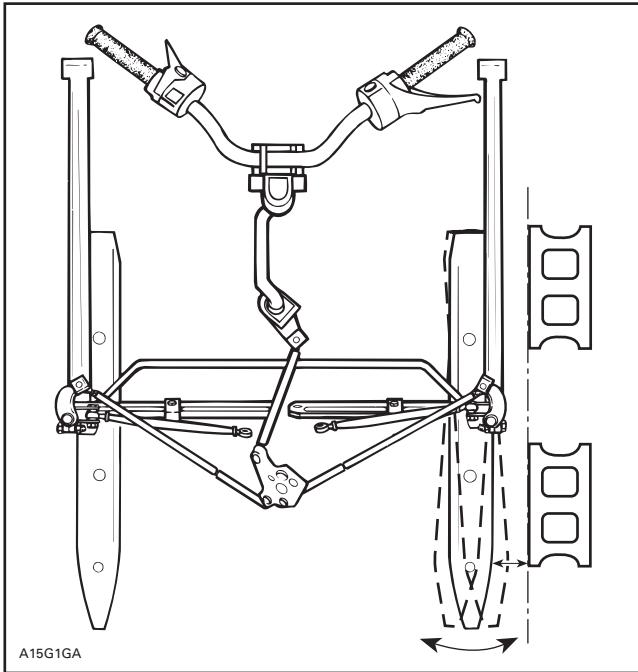
A. 3 mm (1/8 in)

BUMP STEER

Bump steer refers to the amount of change in the toe out of the skis as the suspension moves through its total vertical travel. Block up the machine so that the skis are just off the ground and remove the springs from the shocks. This will allow you to cycle the suspension and measure the bump steer on your vehicle.

You will need a reference point to measure to as you cycle the suspension through its travel. Because you will be lifting the ski and suspension assemblies as you are measuring, you should use a reference point that is not easily bumped out of position. A pair of concrete blocks set on a line about 50 mm (2 inches) away from the edge of the ski and parallel to the ski works nicely.

SECTION 03 - CHASSIS PREPARATION



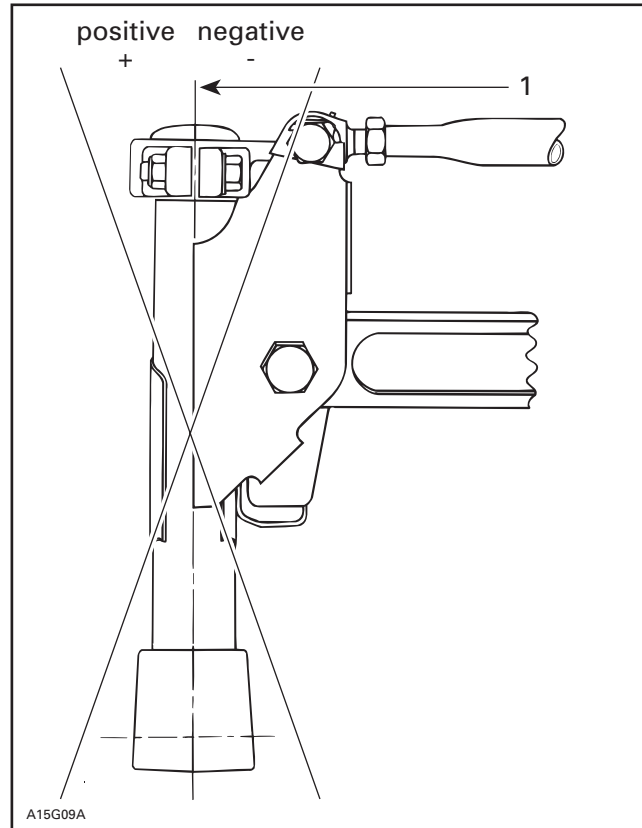
Lift the ski up to its upper travel limit. Using a measuring tape, measure the distances from the front and rear edges of the ski to the concrete block reference. The front and rear measurements must be equal or no more than 1.6 mm (1/16 in) difference if the bump steer adjustment is correct.

SKI LEG CAMBER

The camber angle of the ski legs changes how aggressively the ski runners hook up with the driving surface. Adding negative camber will have the most effect on handling. This is because the "weight shift" in a turn is always to the outside of the turn and the negative camber of the ski leg causes the wear bar to be presented to the driving surface in a more aggressive position. Positive camber will tuck the wear bar in toward the sled, thereby reducing its traction in a turn.

Camber adjustments do have an effect on the width of the machine. Make certain your camber adjustments do not push you beyond the overall width limit imposed in most forms of racing.

Camber is the tilting of the ski leg from the vertical. To obtain a negative camber angle, the ski leg must be tilted inward so that the ski legs are closer together at the top than at the bottom. Positive camber would tilt the top of the ski leg away from the machine. Camber angle is measured in degrees from the vertical and must be noted as positive or negative.



1. Ski leg vertical = 0° camber

Most oval racers set the left ski leg at 0° camber and the right at -3° to -5° camber. Trail riders and drag racers should set both ski legs at 0° camber while cross-country and snocross riders most often set up both ski legs with -1° to -3° camber.

Camber angle is measured using an angle finder available from most tool supply stores.

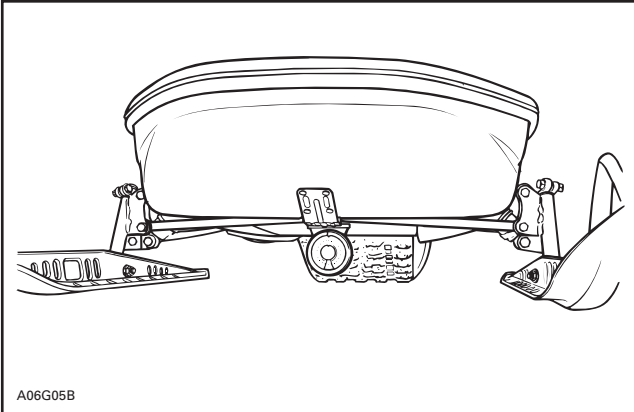
Adjustment is performed by adjusting the length of the upper control arm.

SECTION 03 - CHASSIS PREPARATION

Procedure

NOTE: Any chassis lowering should be performed before adjusting camber.

- Make sure the vehicle is leveled by placing the angle finder on the main horizontal frame member. "Settle" the suspension so the vehicle is sitting at the normal ride height.



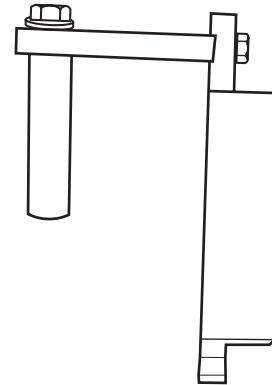
- Remove the black plastic cap from the spindle.
- Insert camber angle tool P/N 529 0216 00 into the spindle.
- Place an Angle Finder squarely on the Camber angle tool.
- Loosen the lock nuts on the upper radius rods.

Unbolt the upper radius rod at the ski leg housing. Turn the radius rod in or out to achieve the desired camber angle.

Camber angle tool
(P/N 529 0216 00)

NOTE: Angle finder with a magnetic base must be used.

Suggestion: K-D tool no. 2968

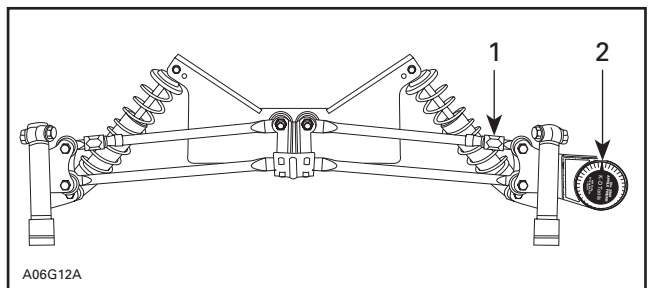


APPLICATION

All DSA front suspensions.

▼ CAUTION

The bushing fits into the ski leg housing in only one direction, therefore adjustments must be made in one full revolution increments.



TYPICAL

1. Adjustment
2. Camber reading

- Retorque all nuts and bolts to the proper torque.
- Ski toe out must be checked after any camber adjustments.

SECTION 03 - CHASSIS PREPARATION

SKI TOE OUT

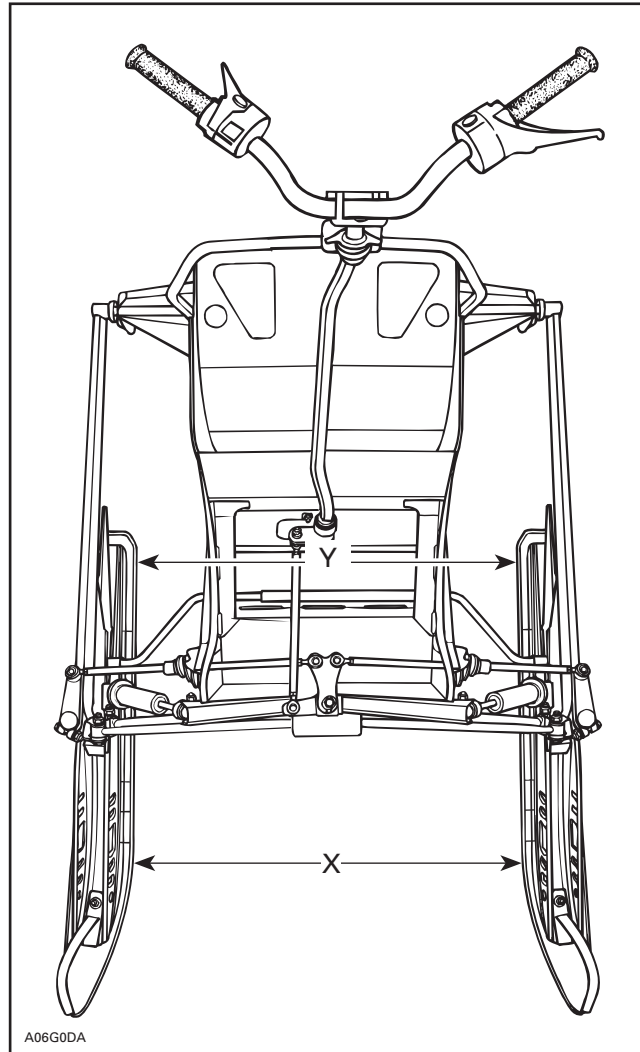
Most oval racers use modified handlebars with loops or angles on the left end. Often a driver prefers a handlebar position that is not horizontal when the skis are in their straight ahead position. This allows a more comfortable driving position when in a corner. Whatever handlebar you prefer should be positioned as you prefer it when going down a straightaway before you begin your toe out adjustment.

Use a rubber cord stretched between the ski tips to keep constant pressure on the steering system while measuring toe out. Measure the distance between the inner edges of the skis as far back and as far forward on the skis as possible. Avoid measuring at a point at the top or heel of the ski where the ski is tapered. With aggressive race carbide, the measurements should be taken at the front and back of the runners on the cutting edge for the most precise measurement.

Skis must have a toe out of 3 to 6 mm (1/8 to 1/4 in) when they are in the straight ahead position.

Adjustment is performed by loosening the lock nuts on the ball joints at the ends of the left and right tie rods. Rotate tie rods as necessary to achieve the proper toe out and handlebar position. Do not use the short tie rod that runs beneath the engine to adjust ski toe out.

Never lengthen a tie rod so that the threaded portion of the ball joint extends over 17 mm (11/16 in) beyond the tie rod. To avoid this, distribute the adjustment requirements equally to both left and right tie rods.



$$X = Y \pm 3 \text{ mm (1/8 in)}$$

Retorque ball joint lock nuts to 29 N•m (21 lbf•ft) when toe out is correct.

With the aggressive setup of the front end necessary for competitive oval racing, it is important to keep all the steering system components tight and free of play. Worn ball joints and bushings should be replaced, bolts holding the skis to the ski leg must be tight and wear bars must be straight and bolted securely to the skis. Any play in the steering will result in severe chattering in the corners and darting on the straightaways.

CHASSIS TUNING GUIDELINES

How to Deal with Handling Problems

There is usually never one adjustment that will correct a certain handling quirk. You will usually end up with several changes in setup to achieve the same goal. There are certain basics to keep in mind, however, when you are working with your sled:

- Handling problems encountered when entering a corner are usually corrected by working with front end adjustments.
- Handling problems encountered when exiting a corner are usually corrected by working with rear suspension adjustments.
- Basic handling problems are often traced to improper suspension adjustments.

Guide to Handling Problems

NOTE: "PUSHING" refers to the front of a vehicle not steering as much as the driver wants. The skis are not grabbing the surface with sufficient force. "LOOSE" refers to the rear of a vehicle sliding outward in a turn. The track is not grabbing the surface with sufficient force.

NOTE: Center spring/shock refers to the front arm of the rear suspension.

1. Problems encountered when entering a corner.
 - a. Front end pushes coming into a corner. (Steering is not precise).
 - Sharpen carbide runners.
 - Add more carbide.
 - Shorten limiter strap on center arm.
 - Increase negative camber of ski legs.
 - Increase ski spring preload.
 - Decrease center spring preload.
 - b. Rear of machine starts to come around or is loose when entering a corner.
 - Lengthen limiter strap on center arm.
 - Decrease ski spring preload.
 - Decrease negative camber of ski legs.
 - Increase center spring preload.
 - Sharpen/add track studs.

- c. Inside ski lifts.
 - Reduce the amount of negative camber on the ski legs.
 - Check for free operation of stabilizer bar.
 - Decrease preload of ski springs.
 - Shorten limiter strap on center arm.
2. Problems encountered while going around or exiting a corner.
 - a. Front end pushes coming out of corner (steering is not precise).
 - Shorten limiter strap on center arm.
 - Decrease center spring preload.
 - Check condition of carbides.
 - Add more carbide.
 - Increase negative camber of ski legs.
 - Increase ski spring preload.
 - Increase rear spring preload.
 - Tighten A.C.M.
 - b. Rear of machine starts to come around or is loose when exiting a corner.
 - Lengthen limiter strap on center arm.
 - Decrease ski spring preload.
 - Increase center spring preload.
 - Decrease negative camber of ski legs.
 - Decrease rear spring preload.
 - Loosen A.C.M.
 - c. Left ski lifts.
 - Shorten limiter strap on center arm.
 - Decrease center spring preload.
 - Check for free operation of stabilizer bar.
 - Increase stabilizer bar diameter or shorten end levers.

SECTION 03 - CHASSIS PREPARATION

3. General handling problems.

a. Machine darts from side to side on straight-away.

- Check ski toe-out.
- Check for loose ball joints in steering.
- Too much negative ski leg camber.

b. Excess effort required to turn handle bars.

- Check steering linkages for binding and/or corrosion.
- Rubber blocks between skis and ski legs have too much preload at the rear (causing rear of skis to be pushed down too much).
- Lengthen limiter strap on center arm.
- Increase center spring preload.
- Decrease ski spring preload.
- Too much carbide on ski runners.

4. Adjusting the suspension for ride and comfort.

a. The rear springs of the rear suspension should be adjusted as follows :

- Fully extend the rear suspension.
- Measure from the floor to the bottom of the rear grab handle (remember this dimension).
- Load the vehicle as it will be used (1 or 2 people, saddlebags full of equipment, etc.).

- Again, measure from the floor to the bottom of the rear grab handle. This dimension should be 1" to 2" (25 mm to 50 mm) less than the fully extended dimension.

- If the vehicle settles more than 2" (50 mm), increase the rear spring preload.

- If the vehicle settles less than 1" (25 mm), decrease the rear spring preload.

- This is a preliminary setting only ! Increase and decrease the preload adjustments to fine tune for your preference.

- The center spring and ski springs will have the most affect on handling, but if the pre-load is too stiff, it will produce a harsh ride.

General Tips

If the spring and preload combination you are using exerts the right amount of pressure at full compression but has too much force at initial compression, try a shorter, stiffer spring. The shorter spring will not be preloaded as much and will "act" softer during initial compression, but will get stiffer as the suspension compresses. Conversely, if a setup is good at initial compression but too stiff at full compression, then a softer spring would be used. The following chart can be used to determine how much force a spring and preload combination will exert during compression.

L _F SPRING FREE LENGTH	L _I SPRING INSTALLED LENGTH	K SPRING RATE (LB/IN)	FORCE (LB) AT VARIOUS COMPRESSION LENGTH						
			INSTALLED LENGTH	1/2" COMP.	1" COMP.	1.5" COMP.	2.0" COMP.	2.5" COMP.	3.0" COMP.
10"	7"	100	300	350	400	450	500	550	500
7"	7"	200	0	100	200	300	400	500	600
8"	7"	200	200	300	400	500	600	700	800
7"	7"	100	0	50	100	150	200	250	300
7"	7"	150	0	75	150	225	300	375	450
8"	7"	150	150	225	300	375	450	525	600

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SECTION 04 - ENGINE PREPARATION

EQUIVALENT WEIGHTS AND MEASURES CHART

LINEAR MEASURE	
1 inch = 25.4 millimeters (mm)	1 millimeter = .03937 inch
1 inch = 2.54 centimeters (cm)	1 centimeter = .3937 inch
1 foot = .3048 meter (m)	1 meter = 3.2808 feet
1 yard = .914 meter (m)	1 meter = 1.093 yards
1 statute mile = 1.609 kilometers (km)	1 kilometer = .6214 statute mile

AREA	
1 Sq. Foot = 144 Sq. Inches = 929.03 Sq. Centimeters (cm ²)	
1 Sq. Inch = 6.4516 cm ²	1 cm ² = .155 Sq. Inch
1 Sq. Foot = .092 Sq Meter (m ²)	1 m ² = 10.8 Sq. Feet
1 Sq. Yard = 9 Sq. Meter = .836 m ²	1 Sq. Mile = 2.590 km ²
1 Acre = 4.047 m ²	

WEIGHT	
1 Ounce = 28.35 Grams (g)	1 Gram = .03527 Ounce
1 Pound = .4536 Kilogram (kg)	1 Kilogram = 2.2046 Pounds
1 Ton = .907 Metric Ton (t)	1 Metric Ton = 1.102 Tons

VOLUME	
1 Fl. U.S. Ounce = 29.574 Milliliters = .2957 Deciliter = .0296 Liter	
1 Fl. U.S. Pint = 473.18 Milliliters = 4.7316 Deciliters = .4732 Liter	
1 Fl. U.S. Quart = 946.35 Milliliters = 9.4633 Deciliters = .9463 Liter	
1 U.S. Gallon = 3.785 Liters	
1 Cu. Inch = 16.387 Cu. cm	
1 Cu. Centimeter = .061 Cu. Inch	
1 Cu. Foot = 2.831.16 Cu. Cm.	
1 Cu. Decimeter = .0353 Cu. Foot	
1 Cu. Yard = .7646 Cu. Meter	
1 Dry Quart = 1.101 Liters	

TEMPERATURE	
32° Fahrenheit = 0° Celsius	°F = 9/5 °C + 32
0° Fahrenheit = -17.8° Celsius	°C = (°F - 32) = 5/9

SECTION 04 - ENGINE PREPARATION

SPEED
1 MPH = 1.61 KPH

POWER
1 HP = 746 WATTS

TORQUE
1 lbf•ft = 1.356 N•m (Newton-Meters)

METRIC WEIGHTS AND MEASURE CHART

LINEAR MEASURE	AREA MEASURE
10 Millimeters (mm) = 1 Centimeter	100 Sq. mm = 1 Sq. Centimeter
10 Centimeters (cm) = 1 Decimeter	10 000 Sq. Centimeters = 1 m ²
10 Decimeters (dm) = 1 Meter	100 Sq. Meters = 1 Acre
10 Meters (m) = 1 Decameter (dcm)	100 Acres = 1 Hectare (h)
10 Decameter = 1 Hectometer (hm)	100 Hectares = 1 Sq. Kilometer
10 Hectometers = 1 Kilometer (km)	

WEIGHT	VOLUME/CAPACITY
10 Milligrams (mg) = 1 Centigram	10 Milliliters (mL) = 1 Centiliter
10 Centigrams (cg) = 1 Decigram	10 Centiliters (cL) = 1 Deciliter
10 Decigrams (dg) = 1 Gram (g)	10 Deciliters (dL) = 1 Liter
10 Grams = 1 Decagram (dag)	10 Liters (L) = 1 Decaliter
10 Decagrams = 1 Hectogram (hg)	10 Decaliters(daL) = 1 Hectoliter
10 Hectograms = 1 Kilogram (kg)	10 Hectoliters (hL) = 1 Kiloliter
1000 Kilograms = 1 Metric Ton (t)	1000 Cu. Millimeters = 1 Cu. cm
	1000 Cu. Centimeters = 1 Cu. dm
	1000 Cu Decimeters = 1 Cu. Meter

SECTION 04 - ENGINE PREPARATION

ENGINE TUNING CAUTIONS

Here are a few items to keep in mind when working with your engine.

If you are in stock classes, know what adjustments are legal.

Modifications to the power curve of an engine will require recalibration of the transmission.

The lower the RPM at which you can generate the torque you need, the higher the percentage of that power that will reach the track.

Sloppy engine modification usually results in less power than you had stock.

Follow the assembly and disassembly procedures outlined in the appropriate *Shop Manual*:

YEAR	P/N
1988	484 0550 00
1989	484 0557 00
1990	484 0560 00
1991	484 0572 00
1993	484 0587 00
1994	484 0609 00
1995	484 0618 00
1996	
Vol. 1	484 0628 00 Élan, Tundra II LT, Touring E/E LT/LE/SLE Formula S/SL, Skandic 380/500
Vol. 2	484 0628 01 Grand Touring 500/580/SE Formula SLS/STX/STX LT(2) Summit 500, Mach 1
Vol. 3	484 0628 02 MX Z 440/583 Formula Z/SS/III/III LT Summit 583/670 Mach Z/Z LT Skandic WT
1997	
Vol. 1	484 0647 00 Tundra II LT, Touring E/E LT/LE/SLE Formula S/SL, Skandic 380/500
Vol. 2	484 0647 01 Grand Touring 500/583 Formula 500/500 DL/Z/583 Summit 500/583/670 MX Z 440/440 F/583/670 Skandic WT/S WT/WT LC
Vol. 3	484 0647 02 Formula III/III LT Mach 1, Mach Z/Z LT

YEAR	P/N
1998	
Vol. 1	484 0680 00 Tundra II LT, Touring E/E, Formula S/S Electric/SL, Skandic 380/500
Vol. 2	484 0682 00 MX Z 440/500/583/670, Summit 500/583/670, Grand Touring 500/583, Skandic WT/SWT/WT LC, Formula 500/500 DL/583 DL/ Z 583/Z 670
Vol. 3	484 0684 00 Grand Touring 700/SE, Mach 1/1 R/Z/Z R/ZLT/Z LTR Formula III 600/600 R/600 LT/ 700/700 R

Use the proper octane gasoline for your engine (Modification may require higher octane.).

Correct your carburetor jetting for the atmospheric conditions which exist at the time as close as possible to the time you will be competing.

BASIC ENGINE THEORY

Terminology

Cycle	In a combustion engine, a cycle is accomplished when the four (4) phases; intake, compression, ignition and exhaust are complete.
T.D.C.	Top Dead Center: The position of the piston when it reaches the upper limit of its travel inside the cylinder. B.T.D.C.: Before Top Dead Center A.T.D.C.: After Top Dead Center.
B.D.C.	Bottom Dead Center: The position of the piston when it reaches the lower limit of its travel inside the cylinder. B.B.D.C.: Before Bottom Dead Center A.B.D.C.: After Bottom Dead Center.
Bore	Diameter of the cylinder.
Stroke	The maximum movement of the piston from B.D.C. to T.D.C. It is characterized by 180° of crankshaft rotation.
Combustion Chamber	Space between cylinder head and piston dome at T.D.C.
Displacement	The volume of the cylinder displaced by the piston as it travels from T.D.C. to B.D.C. The formula is: $\frac{\text{Bore}^2 \times \text{Stroke} \times \pi}{4} \times 20$ = ($\pi = 3.1416$) expressed in cc (cubic centimeters)
NOTE: To transfer cc to cubic inches, divide cc by 16.387	
Compression	Reduction in volume or squeezing of a gas.

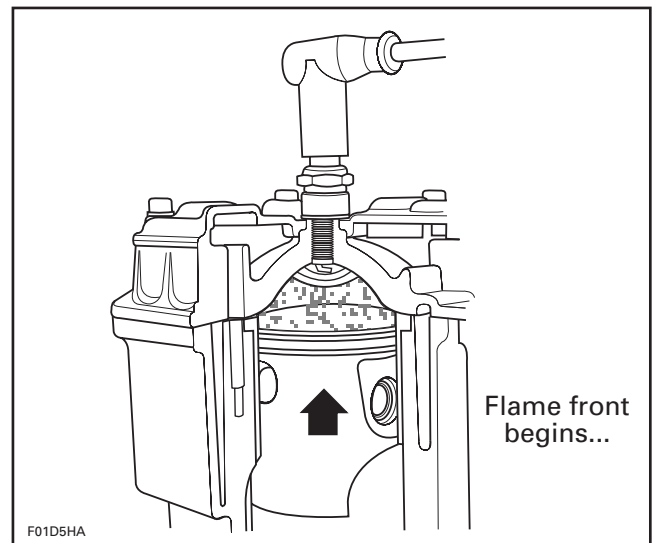
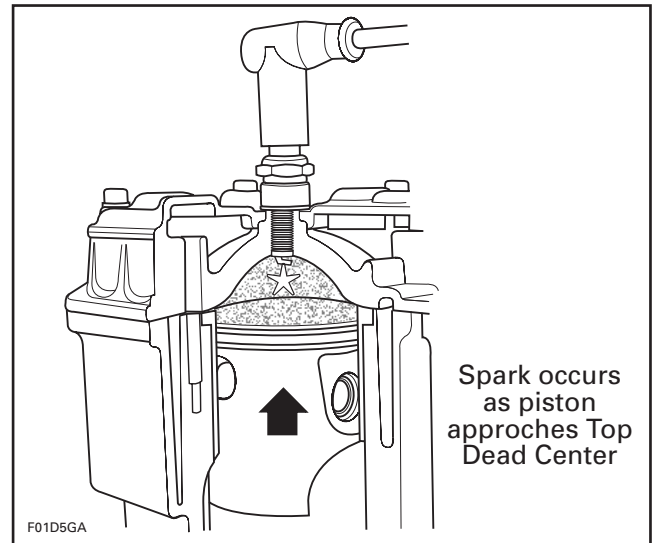
Combustion Process

NORMAL COMBUSTION

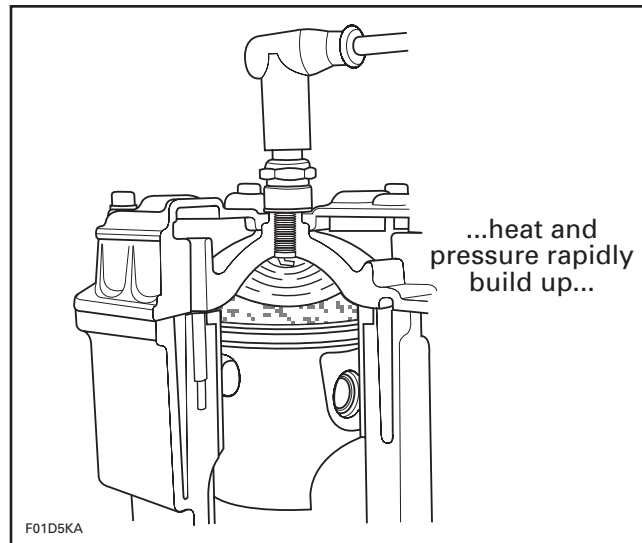
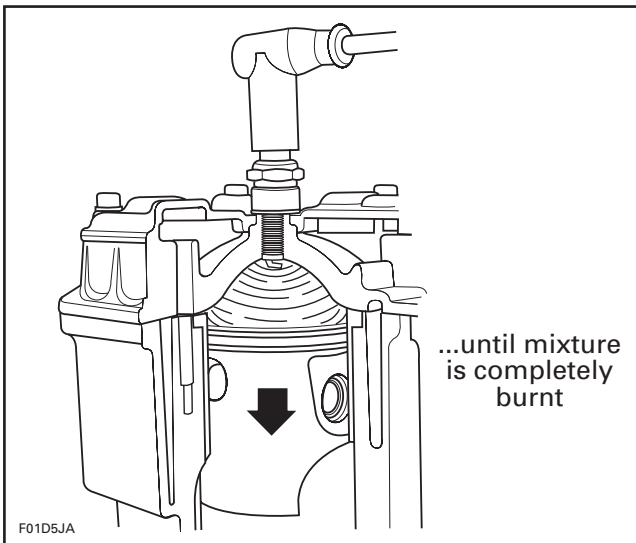
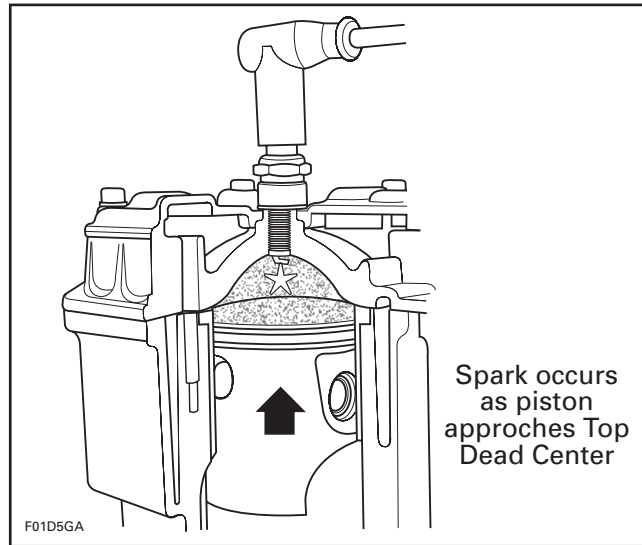
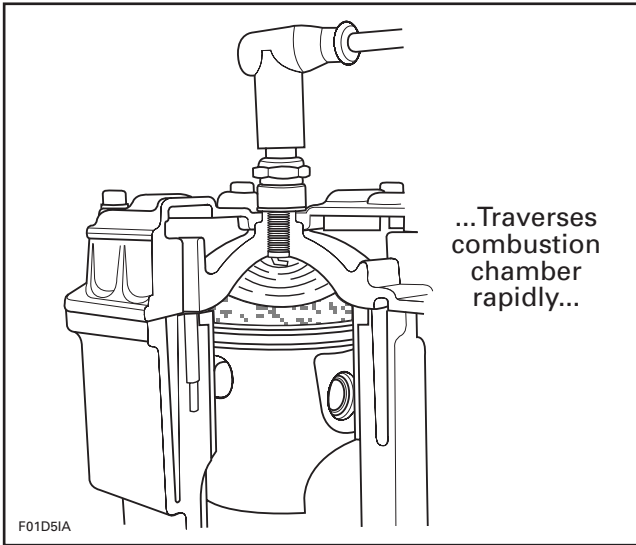
Since the beginning of this study we have spoken of air/fuel mixture combustion rather than explosion. This combustion is a slow then accelerated burning of the mixture within the combustion chamber. Ignition occurs with the firing of the spark plug.

This initial process generates heat and pressure which in turn, is transmitted by conduction to the contiguous portion of the unburned mixture. When this portion has reached the point of self-ignition it starts to burn releasing more pressure and heat.

This burning action, called a flame front, travels at a speed of approximately 30.3 m.(100 feet) per second until all mixture is burned, thus providing maximum piston thrust.



SECTION 04 - ENGINE PREPARATION

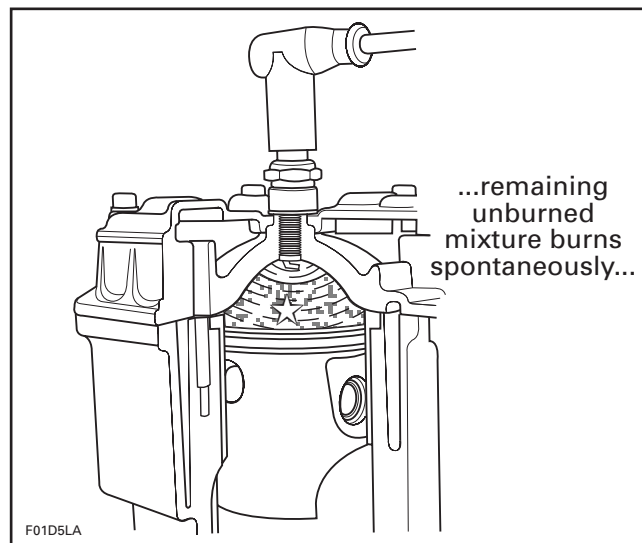


With all operating parameters correct, normal combustion will take place. However, if for some reason the temperature inside the cylinder is increased during combustion, abnormal combustion will occur and lead to serious engine damage.

DETONATION

In detonation, the spark plug initiates burning and the air/fuel mixture starts to burn in the usual manner but as combustion continues, the heat generated affects the large portion of the yet unburnt air/fuel mixture.

This unburnt mixture temperature becomes so high that it burns spontaneously creating high-velocity pressure waves within the combustion chamber.

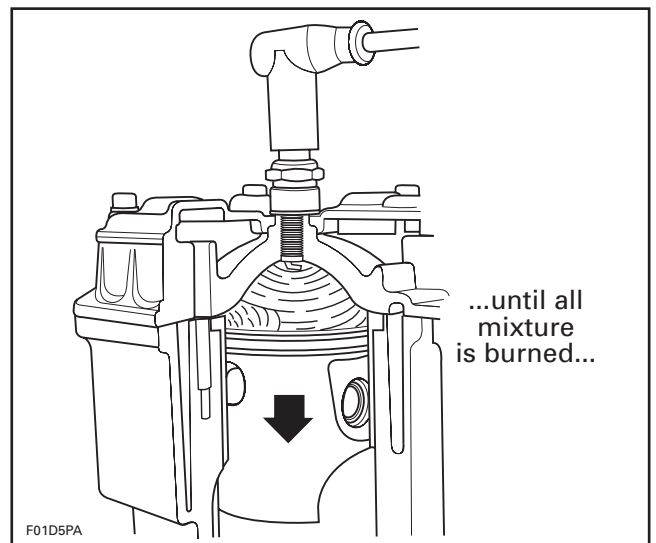
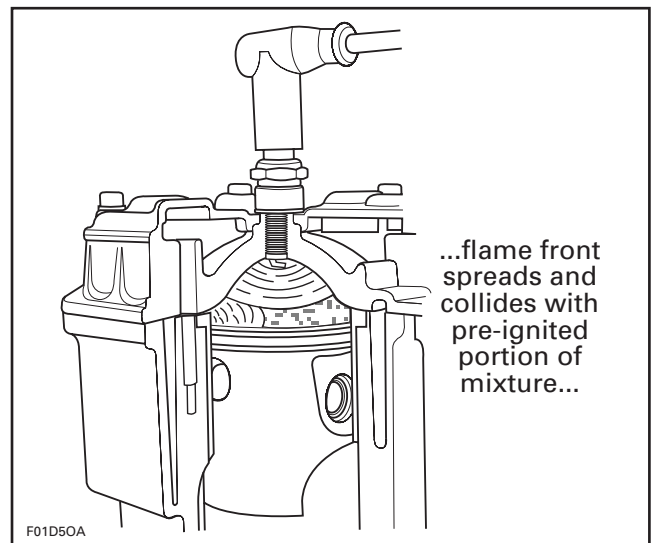
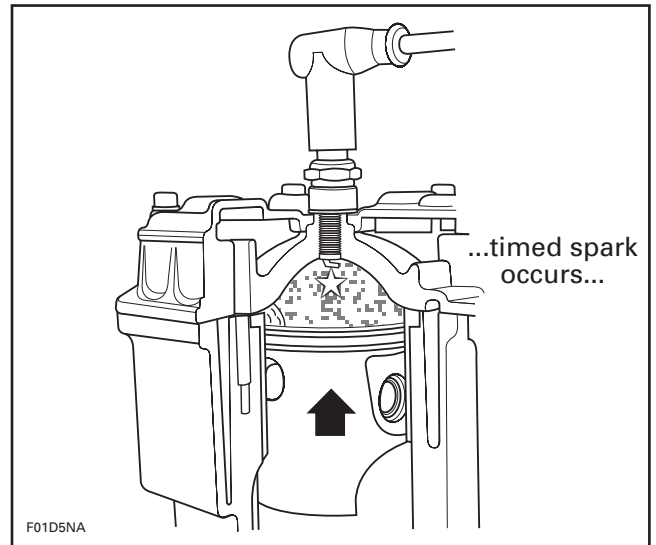
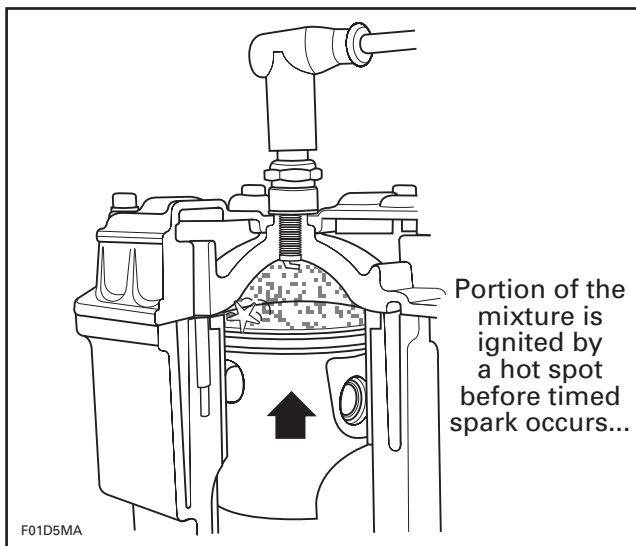


SECTION 04 - ENGINE PREPARATION

These shock waves can sometimes be heard as "pinging." While these shock waves can be detrimental to the mechanical integrity of the engine, it is the excessive heat that causes most problems in 2-strokes. The piston may expand excessively causing a seizure or the piston may melt. The melting will occur at the hottest points, which will be right below the spark plug and around the edge of the piston — often at a ring locating pin. If allowed to continue, a hole may melt completely through the top of the piston.

PRE-IGNITION

Pre-ignition is the ignition of the mixture inside the combustion chamber before the timed spark. Pre-ignition sources are generally an overheated spark plug tip or a glowing carbon deposit on the piston head. Since ignition occurs earlier than the timed spark, the hot gases stay longer in the combustion chamber, thus increasing cylinder head and piston temperatures to a dangerous level.



SECTION 04 - ENGINE PREPARATION

Usually the piston is subject to damage. It may seize or the aluminum on the exhaust side of the piston dome may melt. Pre-ignition is always preceded by detonation.

CAUSES OF DETONATION:

Octane of the fuel is too low.

Air/fuel mixture is too lean.

- a. Incorrect jetting
- b. Air leaks
- c. Varnish deposits in carburetor
- d. Malfunction anywhere in fuel system

Spark plug heat range too high.

Ignition timing too far advanced

- a. Initial timing incorrect
- b. Ignition component failure

Compression ratio too high.

- a. Improperly modified engine
- b. Deposit accumulation on piston dome or head

Exhaust system restrictions.

- a. Muffler plugged/restricted
- b. Tail pipe diameter too small
- c. Incorrect design of expansion chamber

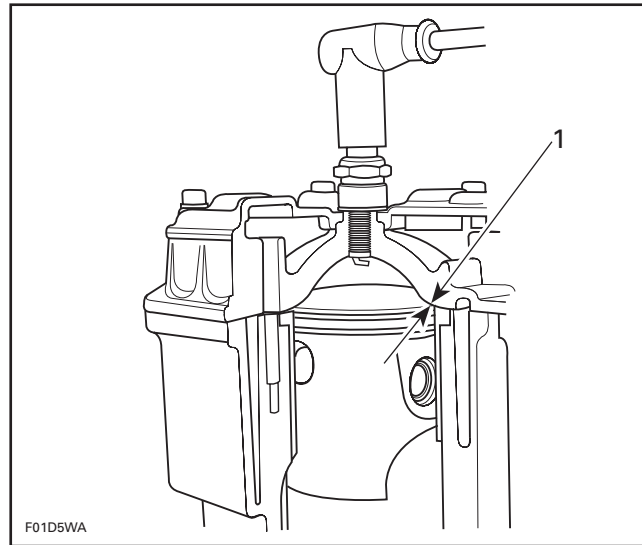
General overheating

- a. Broken fan belt
- b. Loss of coolant
- c. Lack of snow on heat exchangers

Coolant or water entering combustion chamber

SQUISH AREA

Rotax cylinder heads incorporate a squish area. This area is basically a "ledge" projecting beyond the combustion chamber area. In operation, as the piston ascends and approaches the ledge, a rapid squeezing action is applied to the air/fuel mixture contained in the area immediately between the piston dome and the ledge. This squashing action forces the entrapped mixture rapidly into the combustion chamber area, creating a greater mixture turbulence. Additionally, the small volume and large surface area of the squish band allow a better cooling of the end gases to help prevent detonation.

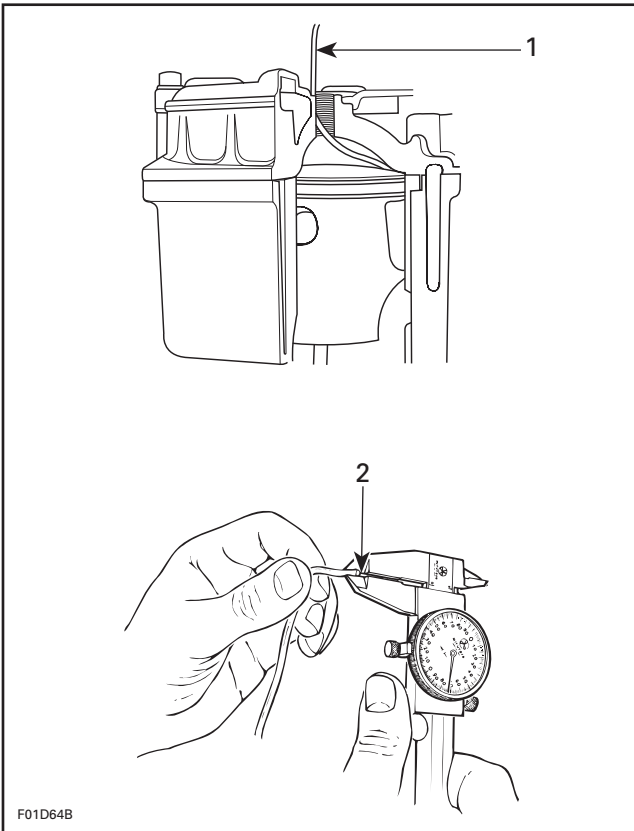


1. Squish area 1.27 – 1.78 (.050 – .070 in)

If the squish clearance is increased, a loss in power will occur while too small a squish clearance will lead to detonation.

The squish clearance can be measured by inserting a piece of rosin core solder into the combustion chamber, rotating the engine through T.D.C., removing the solder and measuring the thickness of the compressed solder.

The solder should be inserted above and in line with the wrist pin. Measure the squish on both sides of piston as it may vary from side to side.



- 1. Solder
- 2. Flattened area

▼ CAUTION

Do not use acid core solder; the acid can damage the piston and cylinder.

COMPRESSION RATIO

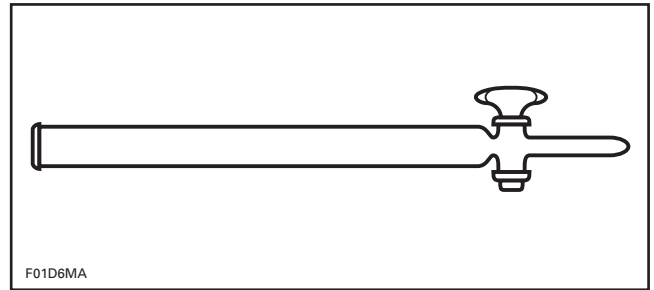
Measuring a Compression Ratio

The minimum combustion chamber volume is the region in the head above the piston at T.D.C. It is measured with the head installed on the engine.

Remove one spark plug and place piston at T.D.C.

Obtain a C.C. graduated burette, capacity 0-50 cc and fill with automatic transmission fluid.

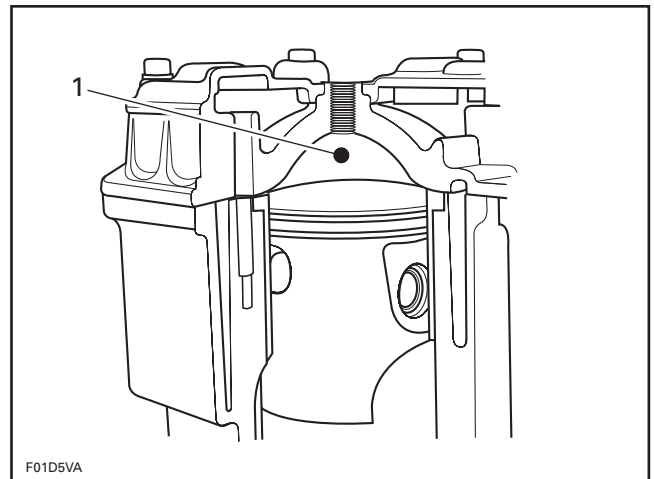
NOTE: Suggested burette, "Canlab no. 8-000/T, or equivalent.



Inject the burette content through the spark plug hole until mixture touches the two bottom threads of the spark plug hole.

Read the burette scale and obtain the number of cc injected into cylinder. (example: 21.5 cc)

Record the volume which we will note as V_2 .



1. Combustion chamber (V_2)

NOTE: When the combustion chamber is filled to top of spark plug hole, subtract 2.25 cc (19 mm reach head; i.e. BR9ES spark plug). Check if fluid level decreases, in that case there is a leak between piston/cylinder. The recorded volume would be false.

Removing the head and measuring the head volume by laying a flat plate across the head will not give an accurate measurement of combustion chamber volume because the dome of the piston protrudes into the head on an assembled engine.

The uncorrected compression ratio of an engine is the volume of the cylinder plus the minimum volume of the combustion chamber divided by the minimum volume of the combustion chamber.

$$C.R. = \frac{V_1 + V_2}{V_2}$$

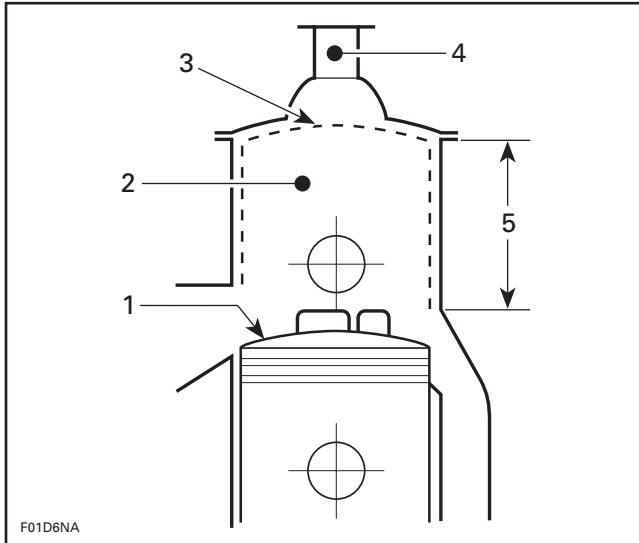
SECTION 04 - ENGINE PREPARATION

Where:

C.R. = compression ratio: 1

$$V_1 = \text{volume of a cylinder} = \frac{B^2 \times S \times \pi}{4}$$

V_2 = minimum combustion chamber volume



1. B.D.C.
2. V_1
3. T.D.C.
4. V_2
5. Stroke

EXAMPLE:

$$\pi = 3.14$$

$$B = \text{Bore diameter (cm)} = 7.2 (= 72 \text{ mm})$$

$$S = \text{Stroke (cm)} = 6.1 (= 61 \text{ mm})$$

$$V_2 = 21.5 \text{ cc}$$

$$\text{C.R.} = \frac{248.4 \text{ cc} + 21.5 \text{ cc}}{21.5 \text{ cc}}$$

$$\text{C.R.} = 12.6:1$$

In a 2-stroke engine, this is referred to as the "uncorrected compression ratio." Because of the exhaust port midway up the cylinder, some designers believe that actual compression does not begin until the piston just closes the exhaust port. This is termed "corrected compression ratio".

Measuring Corrected Compression Ratio

$$\text{C.C.R.} = \frac{V_3 + V_2}{V_2}$$

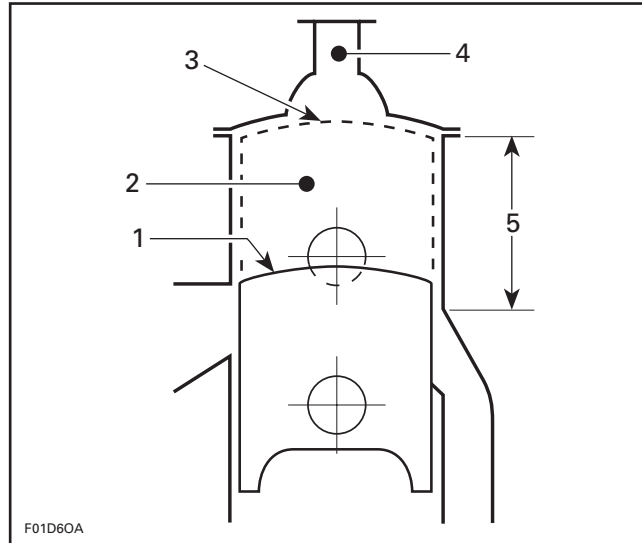
Where:

C.C.R. = corrected compression ratio: 1

V_3 = volume of a cylinder with piston just

$$\text{closing the exhaust port} = \frac{B^2 \times S_1 \times \pi}{4}$$

V_2 = minimum combustion chamber volume



1. Exhaust port just closed
2. V_3
3. T.D.C.
4. V_2
5. Portion of stroke

EXAMPLE:

$$\pi = 3.14$$

$$B = \text{Bore diameter (cm)} = 7.2 (= 72 \text{ mm})$$

$$S_1 = \text{Portion of stroke (cm)} = 3.1 (= 31 \text{ mm})$$

$$V_2 = 21.5 \text{ cc}$$

$$\text{C.C.R.} = \frac{126.2 + 21.5}{21.5}$$

$$\text{C.C.R.} = 6.9:1$$

How to Calculate Machining Cylinder Head Height Versus Combustion Chamber Volume

$$H = \frac{V_M - V_D}{\pi \times \left(\frac{B}{2}\right)^2}$$

Where:

H = material to be machined from face of cylinder head (cm)

V_M = measured combustion chamber volume (cc)

V_D = desired combustion chamber volume (cc)

$$= \frac{V_1}{CR_D - 1}$$

V_1 = Volume of cylinder

CR_D = Desired compression ratio

$\pi = 3.1416$

B = bore of cylinder (cm)

EXAMPLE:

Desired compression ratio (CR_D) = 14.0: 1

$$V_D = \frac{V_1}{CR_D - 1} = \frac{248.4 \text{ cc}}{14.0 - 1} = 19.1 \text{ cc}$$

$$H = \frac{V_M - V_D}{\pi \times \left(\frac{B}{2}\right)^2} = \frac{21.5 \text{ cc} - 19.1 \text{ cc}}{3.14 \times \left(\frac{7.2}{2}\right)^2}$$

= .059 cm = .59 mm = (.023")

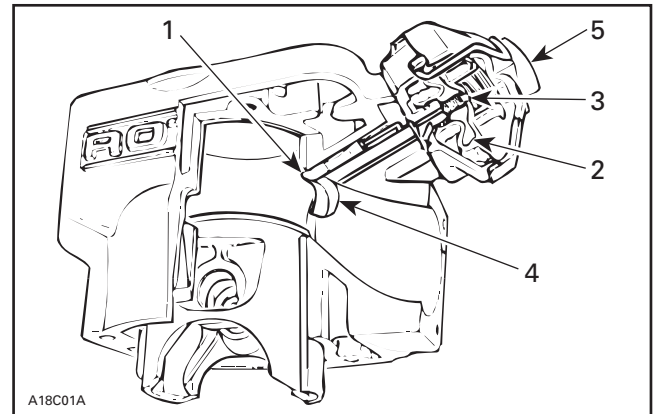
OPERATION OF THE RAVE VALVE (RAVE = ROTAX ADJUSTABLE VARIABLE EXHAUST)

Theory

For a two-stroke-cycle engine to have high power capacity at high crankshaft speeds, a high volumetric or breathing efficiency is required and the fresh charge losses must be minimized. The result is achieved by opening the exhaust port early (94.5° BBDC) and utilizing the resonant effects of the tuned exhaust system to control fresh charge losses.

When an engine of this design is run at a medium speed, efficiency falls off quickly. The relatively high exhaust port effectively shortens the useful power stroke and because the exhaust system is tuned for maximum power, there is a large increase of fresh charge losses. As a result, the torque decreases along with a dramatic increase of the specific fuel consumption. Higher torque along with lower fuel consumption can be obtained at lower engine speeds if the time the exhaust port is open is shortened.

Bombardier-Rotax has patented a remarkably simple system to automatically change the exhaust port height based on pressure in the exhaust system.



1. Guillotine
2. Diaphragm
3. Return spring
4. Exhaust port
5. Red plastic adjustment knob

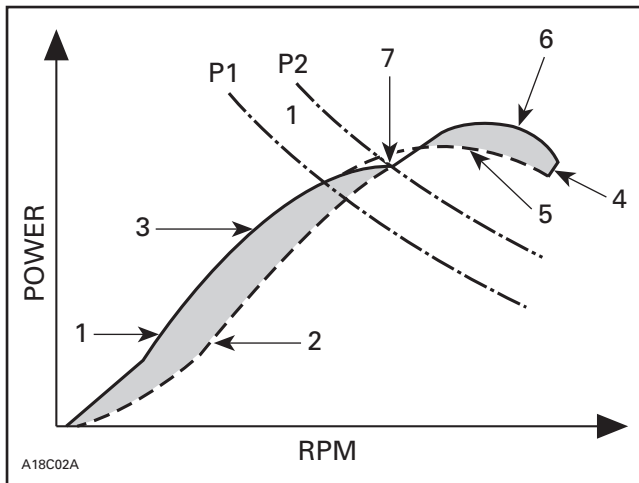
Located above the exhaust port is a guillotine-type slide valve (item 1). This rectangular valve is connected by a shaft to a diaphragm (item 2) which is working against the return spring (item 3). Two small passages in the cylinder just outside the exhaust port (item 4) allow exhaust gas pressure to reach the diaphragm. As the throttle is opened and the engine begins producing more power, the pressure against the diaphragm will overcome the pressure of the return spring and the RAVE valve will open.

To the outside of the return spring is a red plastic adjustment knob (item 5). Turning the adjustment in or out changes the preload on the return spring which, in turn, will change the RPM at which the RAVE valve opens and closes. The exhaust port height changes a total of 4 mm to 6 mm (depending on engine type) from the RAVE valve fully closed to fully open.

Operation

The RAVE valve does not allow an engine to make higher peak horsepower than an engine not so equipped, it can make moving the peak higher practical because of its effect on the rest of the power curve. Item 2 in following illustration is the power curve of an engine with the RAVE valve held fully open through its entire RPM range. Item 6 notes the peak power produced. That peak will not change if the exhaust port time of a similar engine without a RAVE valve was the same (with all other features equal).

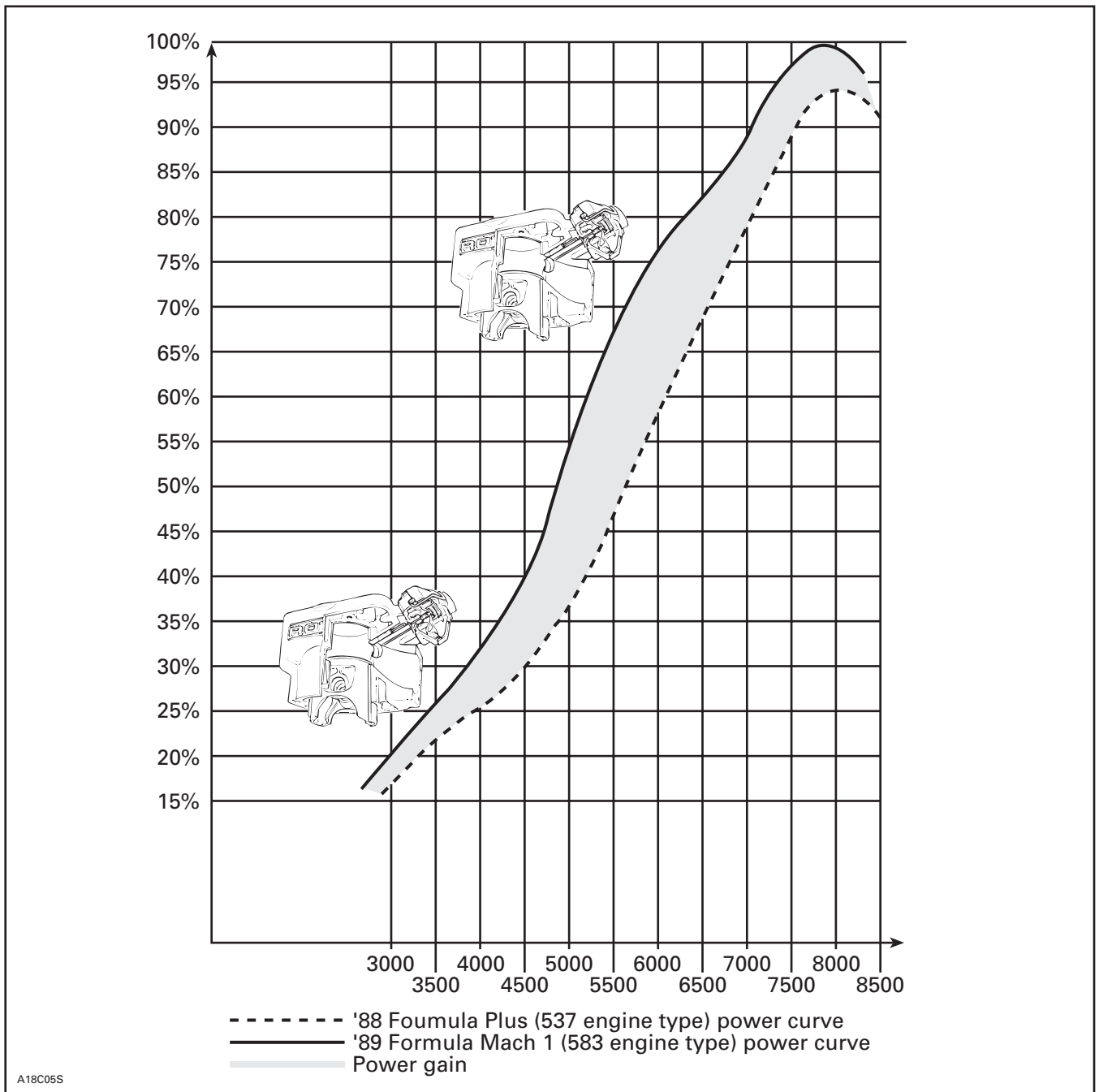
SECTION 04 - ENGINE PREPARATION



Item 1 is the power curve of the engine with the RAVE closed through its entire RPM range. The shaded area (item 3) is the improvement in power at lower engine speeds that is gained because of the lower exhaust port. If the port remains at this height, however, the power would peak as noted in item 5. Raising the exhaust port at the proper RPM (item 7) will allow the engines peak power to continue to rise to item 6.

Item P1 in the illustration is the pressure of the return spring against the diaphragm. The exhaust pressure must be high enough to overcome this pressure before the valve begins opening. Item P2 is the pressure required to completely open the RAVE valve. Between P1 and P2, the usable power curve of the engine is moving from power curve 1 to power curve 2. This transition takes place very rapidly at full throttle and from a practical standpoint can be considered to be instantaneous at item 7 which for the type 583 engine is at 6300-6400 RPM. Gradual application of the throttle, however, will result in the RAVE valve opening much later, i.e. 7300 — 7500 RPM.

If the RAVE valve opens too late, the engine will bog or hesitate momentarily as the RPM increases. Full peak performance (item 6) is still available. From a functional point of view, it is better to have the valve open a bit early than a bit late. This fact is due to certain dynamic conditions that exist on the snowmobile, i.e., the clutch and torque converter.



The 583 RAVE has, in effect, two ports. Let's compare them separately. With the RAVE valve open, the exhaust port timing of the 583 and 537 are identical with a total open duration of 202°. The exhaust port of the 583, however, is 1 mm (.039 in) wider than on the 537. When the RAVE valve closes, the exhaust port timing of the 583 matches that of the 467 with a total open duration of 189°.

Adjustment

The red cap on the RAVE valve cover should be turned all the way in and bottomed in normal use. Backing the red adjuster out will reduce the spring preload and allow the RAVE valve to open at a lower RPM.

SECTION 04 - ENGINE PREPARATION

At high altitudes, exhaust gas pressures will drop and the spring preload may have to be decreased. It is doubtful that any adjustment will be required up to an altitude of 2400 m (8000 ft.). Above that, however, the spring preload can be reduced by turning the red adjustment screw out up to a maximum of four turns.

The only other time adjustment of the spring preload should be considered is if the engine has been modified in any way.

AVAILABLE RAVE SPRINGS:

YEAR	ROTAX	P/N	FREE LENGHT
1996	779	420 2399 41	52.5 mm x D.8
	670 (1 pipe)	420 2399 46	42.0 mm x D1.0
	583	420 2399 48	38.0 mm x D1.0
	599	420 2399 40	48.5 mm x D.8
	454	420 2399 45	48.5 mm x D1.0
1997	809	420 2399 44	48.5 mm x D.9
	699	420 2399 44	48.5 mm x D.9
	670	420 2399 48	38.0 mm x D1.0
	599	420 2399 44	48.5 mm x D.9
	583	420 2399 48	38.5 mm x D1.0
	454	420 2399 45	48.5 mm x D1.0
	454 MX Zx	420 2399 45	48.5 mm x D1.0
Optional		420 2399 42	42.5 mm x D.8
		420 2399 44	48.5 mm x D.9
1998	809	420 2399 44	48.5 mm x D.9
	699	420 2399 44	48.5 mm x D.9
	670	420 2399 48	38.0 mm x D1.0
	599	420 2399 40	48.5 mm x D.8
	583	420 2399 48	38.0 mm x D1.0
	494	420 2399 46	42.0 mm x D1.0
	454	420 2299 45	48.5 mm x D1.0
	699 S.P.	420 2399 45	48.5 mm x D1.0

Maintenance

There are no wear parts anywhere in the system and there are no adjustments to be periodically checked. The only possible maintenance required would be cleaning of carbon deposits from the guillotine slide. Cleaning intervals would depend upon the user's riding style and the quality of the oil used. Using Ski-Doo or Blizzard oil, we would suggest annual cleaning of the valve. If a customer uses a lower quality, high ash oil, more frequent cleaning may be required.

No special solvents or cleaners are required when cleaning the valve.

Boring Precaution

In its stock configuration the RAVE valve guillotine has a minimum of 0.5 mm (.020 in) clearance to the cylinder bore measured at the center line of the cylinder. This is the minimum production clearance.

There is only a first oversize piston available for the 583 and 643 engines. That piston is 0.25 mm (.010 in) larger in diameter than the stock piston. When the oversize is installed, the guillotine will have a minimum clearance of 0.375 mm (.015 in) with the cylinder bore. This is the minimum operating clearance the guillotine should be used with. Clearance less than 0.375 mm (.015 in) will require reworking of the guillotine to achieve the proper clearance and radius.

Bench Test for Checking RAVE Valve Operation

The operation of the valve can be checked by pressurizing the engine as one would when checking for crankcase leaks.

The engine must be sealed at all exhaust flanges, all carburetor inlets, and at the fuel pump impulse fitting. Depending on the design of your pressure test kit, you may be pressurizing the engine through the crankcase or right at the exhaust flange cover plate. If you are pressurizing through the crankcase, make certain the piston uncovers the exhaust port on the side you are checking.

Install the RAVE valve movement indicator (P/N 861 7258 00) in place of the red plastic adjuster on the diaphragm cover so that you can observe the diaphragm movement.

The movement indicator must be turned all the way in to provide maximum spring pre-load. As you begin pressurizing the engine using engine leak tester kit (P/N 861 7256 00), you will find the RAVE valve beginning to move at 5 kPa (0.7 psi or 20 inches of water) and the valve will be fully displaced when you reach 10 kPa (1.4 psi or 40 inches of water).

NOTE: Due to the low pressure conditions when using the leak tester kit (P/N 861 7256 00) to check the RAVE valve operation, install a gauge with a range of 0-200 inches of water (P/N 529 0104 00) on leak tester. As reference 6.89 KPa 1 (PSI) = 27.71 inches of water.

Troubleshooting

SYMPTOM	CAUSE	REMEDY
Engine revs 500 to 1000 RPM lower than its maximum operational RPM; Rave valve is not opening.	1. Bent valve rod	Replace
	2. Stuck valve	Clean
	3. Wrong spring tension (too high)	Replace
	4. Clogged passages	Clean
	5. Damaged bellows or clamp(s)	Replace
Engine hesitation in mid RPM range and full peak performance is available only after a while. Rave valve opens too early.	1. Broken or weak spring	Replace
	2. Adjustment screw too far out	Turn until it bottoms
	3. Valve stuck open	Clean

OPERATION OF THE ROTARY VALVE

Controlling the opening and closing of the intake port is also a critical factor in the volumetric efficiency of an engine. Best V.E.'s are obtained by asymmetrical intake timing (opening the intake port at about 140° B.T.D.C. and closing the port at about 60° A.T.D.C.) while also allowing for an unobstructed intake tract to provide maximum air flow into the engine.

The rotary valve engine is one of the more innovative concepts to be applied to two-stroke snowmobile engines.

Simply stated, the design produces more horsepower out of the same size engine displacement at the same RPM. Because **the aperture size and degree of opening exceed that of a piston port engine, and because the disc permits asymmetric timing of the intake to close earlier after TDC than a piston port engine**, a greater air / fuel mixture supply can enter the engine and remain in the engine without spitback.

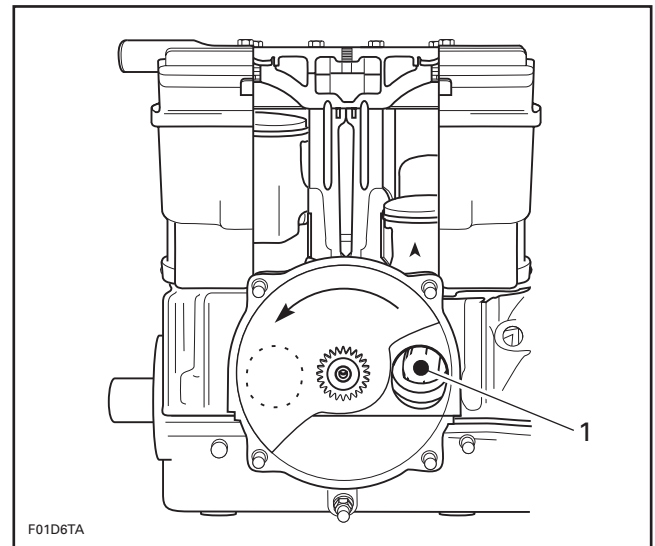
Basically, the rotary valve engine performs the same operation as the ordinary two-stroke engine. The only difference being the location and operation of intake.

The intake port is positioned directly in the crankcase.

The opening and closing of the intake port is controlled by a rotary valve instead of the piston.

The rotary valve is driven by the crankshaft in a counterclockwise direction.

Intake and Secondary Compression



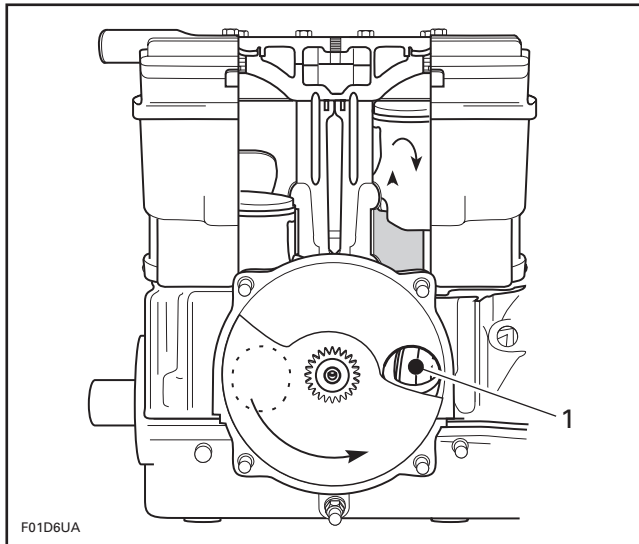
1. Fresh charge from carburetor

As the piston starts its upward stroke, the air/fuel mixture is sucked into the crankcase from the carburetor via the intake port (the rotary valve uncovers the intake port).

As the piston continues upwards, it blocks the exhaust and transfer ports, and compresses the air/fuel mixture in the combustion chamber (secondary compression).

SECTION 04 - ENGINE PREPARATION

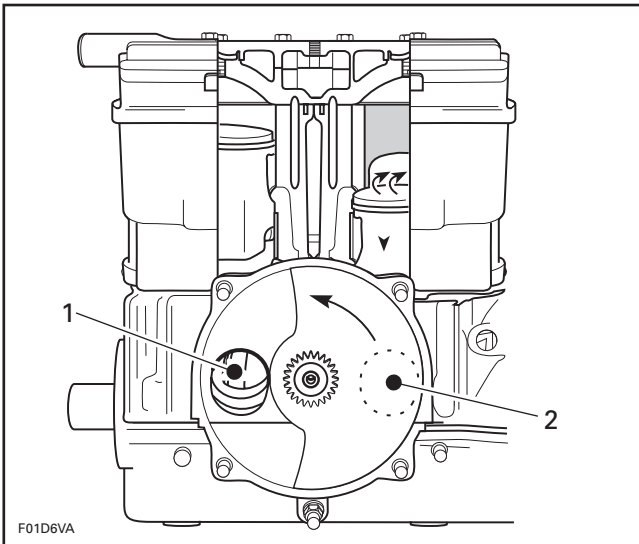
Ignition and Combustion



1. Fresh charge

As the piston nears the top of the cylinder (top dead center) the compressed air/fuel mixture in the combustion chamber is ignited by the spark plug. The burning gases expand and push the piston downward, thus causing a power stroke.

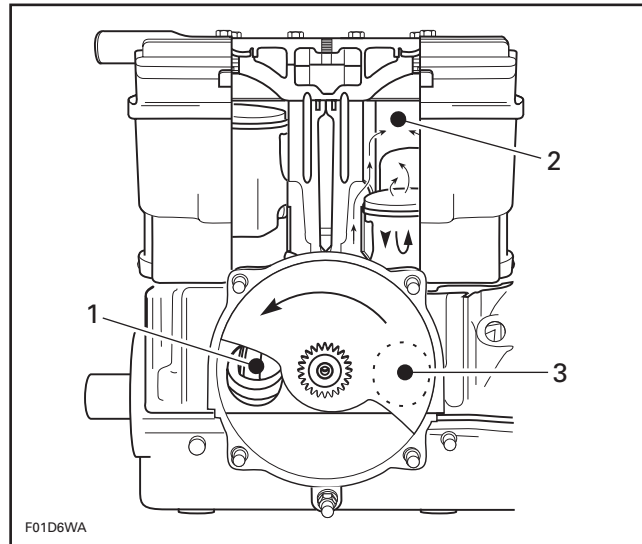
Exhaust and Primary Compression



1. Fresh charge for the other cylinder
2. Intake port covered

As the piston descends, the intake port is blocked by the rotary valve and pressure begins to build inside the crankcase (primary compression). The exhaust port is uncovered as the piston continues its course downward, and burnt gases are allowed to escape.

Transfer

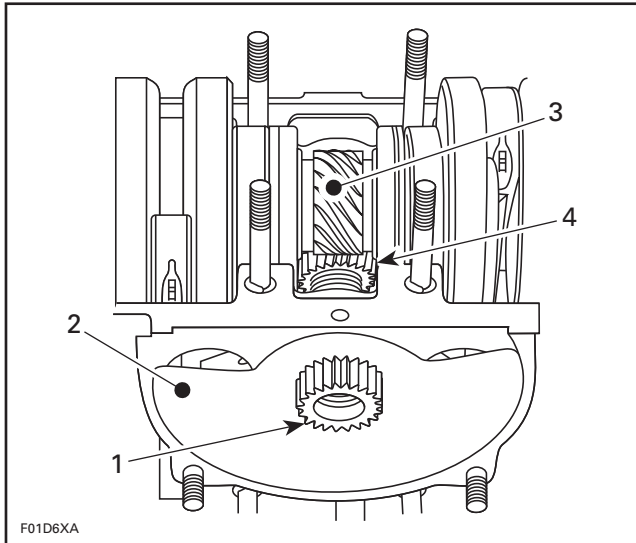


1. Fresh charge for the other cylinder
2. Fresh charge
3. Intake port covered

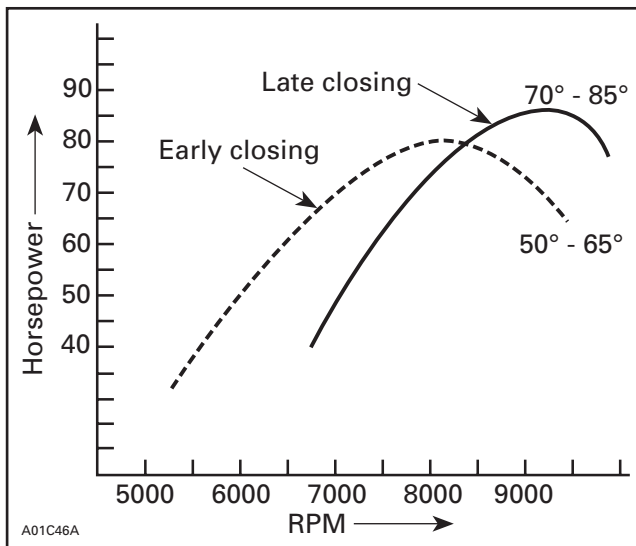
Near the bottom of the downward stroke, the transfer ports are uncovered by the piston, and the compressed air/fuel mixture in the crankcase rushes into the combustion chamber. Piston dome and combustion chamber configuration and muffler back pressures prevent fresh charge (air/fuel mixture) from escaping through the exhaust port. This also assists in clearing the combustion chamber of all burnt gases.

A worm gear is located in the crankcase halves between the two (2) cylinder bases. It transmits crankshaft rotation to the 90° angled rotary valve shaft.

The helical gear mounted on the rotary valve shaft uses the crankshaft as a power source. To prevent overheating, the gears rest in an oil bath.



1. Pinion (on rotary valve shaft)
2. Rotary valve
3. Gear (crankshaft)
4. Gear (on rotary valve shaft)



Effect on power curve of changing rotary valve closing angle.

Advantages of the Rotary Valve Engine over a Piston Port Engine

The major differences between a piston port engine and a rotary valve engine are:

Intake port directly positioned in the crankcase.

The opening and closing of the intake port is controlled by a rotary valve disc instead of the piston.

The use of a rotary valve enables a very short inlet track. The design introduces the mixture in a very suitable position without obstruction to the gas flow that would impair the volumetric efficiency. This intake position also enhances the lubrication of the lower connecting rod bearings. With rotary valves, the opening duration of the intake port is specifically controlled by the disc. Therefore, it is possible to determine the maximum possible intake with benefit to crankcase filling. (The following chart indicates the intake phase differences between a piston port engine and a rotary valve engine.)

Intake	Piston port engine	Rotary valve engine
Total Duration	150°	195°
Opening	75° B.T.D.C.	140° B.T.D.C.
Closing	75° A.T.D.C.	55° A.T.D.C.

As shown for the rotary valve engine, the total duration of the intake is greater and the opening starts earlier. This results in better filling of the crankcase.

In the rotary valve engine, the intake closes earlier to avoid fresh charge spitback.

Some engines use reed valves to increase overall performance. However, reed valve engines do have some disadvantages over the rotary disc engine. These disadvantages are:

Fluid dynamic problems with the use of the induction pipe.

The reeds tend to separate air from fuel.

Since the crankcase "vacuum" must first open the reed to permit intake, this initial force is not fully applied to the intake operation. Consequently, there is a partial loss of intake potential.

At high speeds, the delay in closing the reed affects the reopening of the reed. Again, potential volumetric efficiency is affected.

However, reed valves do offer substantial improvements in torque over piston port designs. Rotax three cylinder engines use reed valves as opposed to a double rotary valve configuration in order to make a lighter, more compact design that is also more cost effective.

SECTION 04 - ENGINE PREPARATION

Conclusion

With the central rotary valve, duration of the intake is asymmetrical. In piston port engines, intake duration is symmetrical. With the central rotary valve, complete control of intake timing means greater torque at lower rpm's, more peak power, and easier starting.

Rotary Valve Adjustment

The rotary valve controls the opening and the closing of the inlet ports. Therefore efficiency will depend on the precision of installation.

ENGINE TYPES		VALVE P/N	TIMING	
			opening	closing
1975	245	420 9242 05	140°	56°
	345	420 9242 05	140°	56°
1976	245,345	420 9242 05	140°	56°
	245, 345 (competition)	420 9242 20	140°	70°
1977	345	420 9242 00	127°	48°
	354	420 9242 20	132°	50°
	444	420 9242 05	140°	50°
	454	420 9242 07	130°	80°
1978	345	420 9242 00	127°	48°
	345 (cross country)	420 9242 02	128°	37°
	354	420 9242 00	132°	50°
	444	420 9242 05	140°	50°
	254 (super stock)	420 9242 07	137°	60°
	354 (super stock)	420 9242 07	129°	73°
	454 (super stock)	420 9242 07	135°	75°
1979	354	420 9242 00	132°	52°
	444	420 9242 05	140°	50°
	254 (super stock)	420 9242 07	137°	65°
	354 (super stock)	420 9242 07	132°	70°
	454 (super stock)	420 9242 07	140°	70°
1980	354	420 9242 00	132°	52°
	454	420 9242 07	137°	65°
	464	420 9242 05	150°	49°

ENGINE TYPES		VALVE P/N	TIMING	
			opening	closing
1981	354	420 9242 00	132°	52°
	454	420 9242 07	137°	65°
	464 (Everest LC)	420 9242 05	150°	49°
	464 (Elite)	420 9242 00	125°	60°
1982	454	420 9242 07	130°	50°
	464 (Everest LC)	420 9242 05	150°	49°
	464 (Elite)	420 9242 00	125°	60°
1983	464 (Everest LC)	420 9242 05	150°	49°
	534	420 9242 07	140°	61°
1984	354 (Competition)	420 9242 07	130°	73°
	462	420 9242 05	140°	51°
	465 (Competition)	420 9242 05	150°	49°
	534	420 9242 07	140°	61°
1985	354 (Competition)	420 9242 07	130°	73°
	462	420 9242 00	132°	52°
	537	420 9242 00	132°	52°
1986	467	420 9242 00	132°	52°
	532	420 9242 00	132°	52°
	537	420 9242 00	132°	52°
1987	354 (Competition)	420 9242 07	130°	73°
	467	420 9242 00	132°	52°
	537	420 9242	132°	52°
1988	354 (Competition)	420 9242 07	140°	69°
	467	420 9242 00	132°	52°
	537	420 9242 00	132°	52°
1989	354 (Competition)	420 9242 07	140°	69°
	467	420 9242 00	132°	52°
	536	420 9242 02	117°	52°
	583	420 9242 09	140°	68°
1990	354 (Competition)	420 9242 07	140	69°
	467	420 9242 00	132°	52°
	536	420 9242 02	117°	52°
	536 (Formula PLUS 500)	420 9242 07	134°	69°
	583	420 9242 09	140°	68°

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ENGINE TYPES		VALVE P/N	TIMING	
			opening	closing
1991	354 (Competition)	420 9242 07	140°	69°
	467	420 9242 00	132°	52°
	467 (Formula MX X)	420 9242 09	143°	66°
	536	420 9245 08	137°	61°
	536 (Formula PLUS X)	420 9242 07	134°	69°
	643	420 9245 00	144°	72°
	643 (Formula MACH 1 X)	420 9245 01	146°	75°
1992	354 (Competition)	420 9242 07	140°	69°
	467	420 9245 04	132°	52°
	582	420 9245 08	129.5°	69.5°
	583 (Formula PLUS X)	420 9245 02	141.5°	69.5°
	643	420 9245 00	144°	72°
	670 (Mach 1 X)	420 9245 01	146°	75°
1993	354 (Competition)	420 9242 07	140°	69°
	467	420 9245 04	132°	52°
	582	420 9245 08	129.5°	69.5°
	583 (Plus X)	420 9245 02	141.5°	69.5°
	670	420 9245 00	144°	72°
1994	354 (Competition)	420 9242 07	140°	69°
	467	420 9245 04	132°	52°
	467 (MX Z X)	420 9245 02	145°	65°
	582	420 9245 09	134°	65°
	583	420 9245 09	134°	65°
	670	420 9245 00	144°	72°
	670 (Summit, SS)	420 9245 00	144°	72°
1995	454	420 9245 02	146.8°	65.3°
	467	420 9245 04	132°	52°
	582	420 9245 09	129.5°	69.5°
	583 (Summit)	420 9245 09	134°	65°
	583 (STX, FZ)	420 9245 02	140°	71°
	670 (Summit, SS)	420 9245 00	144°	72°
	670 (Mach 1)	420 9245 01	145°	76°

ENGINE TYPES		VALVE P/N	TIMING		
			opening	closing	
1996	MX Z 440	420 9245 02	145°	64°	
	Summit 500 Formula SLS Touring 500 Summit 580	420 9245 09	134°	63°	
	Formula Z Formula STX Formula STX LT	420 9245 02	140°	71°	
	MX Z 583	420 9245 02	139°	70°	
	Formula SS GT 670 SE	420 9245 00	145°	71°	
	Mach 1	420 9245 01	145°	76°	
	Summit 670	420 9245 00	140°	71°	
	1997	454 MX Z	420 9245 02	146°	65°
		494	420 9245 09	135°	64°
Formula 583		420 9245 02	140°	71°	
MX Z 583		420 9245 02	140°	71°	
Formula Z		420 9245 02	140°	71°	
Summit 583		420 9245 09	135°	64°	
MX Z 670		420 9245 00	145°	71°	
Summit 670		420 9245 00	145°	71°	
454 MX Z X		420 9245 02	146°	65°	
1998	454 MX Zx	420 9245 02	146°	65°	
	494 MX Z 500	420 9245 02	146°	65°	
	494 (Formula 500)	420 9245 09	135°	64°	
	583 MX Z	420 9245 02	140°	71°	
	583 (Formula Z)	420 9245 02	140°	71°	
	494 Summit	420 9245 09	135°	64°	
	583 Summit	420 9245 09	135°	64°	
	670 Summit	420 9245 00	145°	71°	
	670 Summit X	420 9245 00	145°	71°	
	670 (Formula Z)	420 9245 00	145°	71°	
	670 MX Z	420 9245 00	145°	71°	

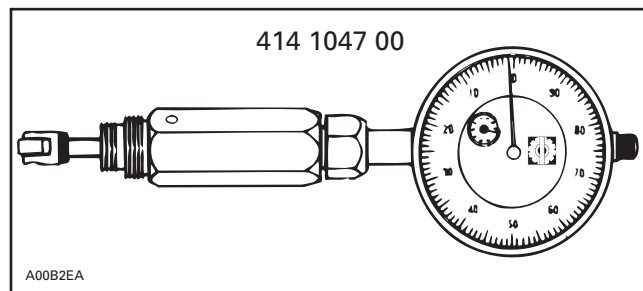
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ROTARY VALVE DURATION VS. PART NUMBER

DEGREES OF DURATION	P/N
117°	924 202
132°	924 200
	924 504
147°	924 205
	924 508
	924 509
151°	924 207
159°	924 209
	924 502
162°	924 220
164°	924 500
169°	924 501

(EACH 1/2 TOOTH OF ADJUSTMENT EQUALS 7.8°)

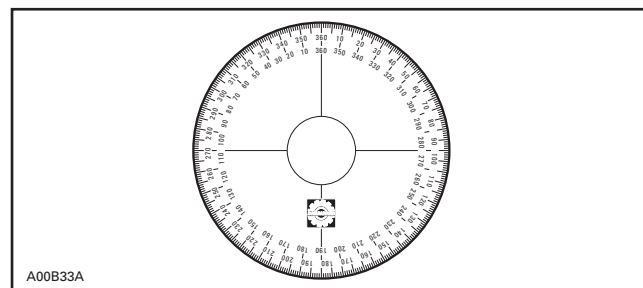
On all engines, use TDC gauge (P/N 414 1047 00).



Dial indicator (P/N 414 1047 00)

NOTE: Do not use crankshaft locking tool to find out MAGneto side top dead center. It will not give the right position on some engines.

A degree wheel (P/N 414 3529 00) is required to measure rotary valve opening and closing angles in relation with MAGneto side piston. Degree wheel will be installed on rotary valve shaft for measurements.



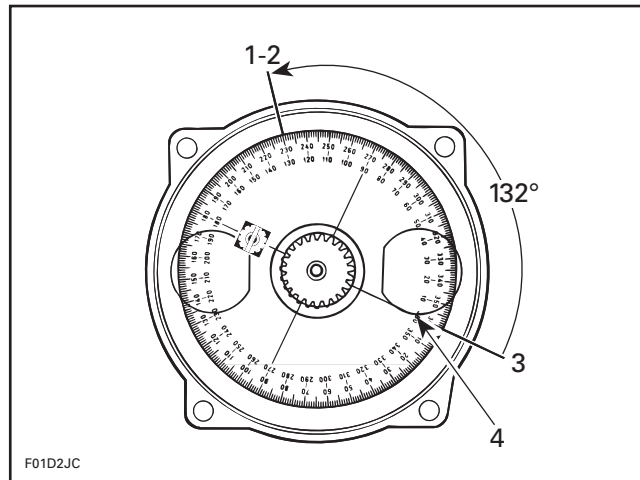
For the following instructions, let's use these specifications as an example:

OPENING: 132° BTDC

CLOSING: 52° BTDC

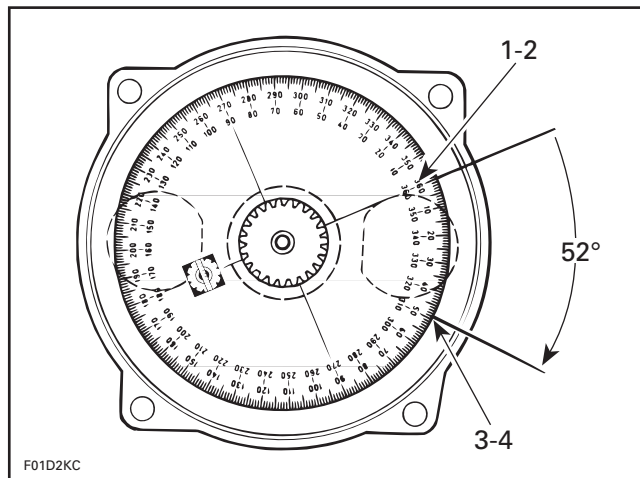
Proceed as follows:

- For opening mark, first align 360° line of degree wheel with BOTTOM of MAGneto side inlet port. Then find 132° line on degree wheel and mark crankcase at this point.



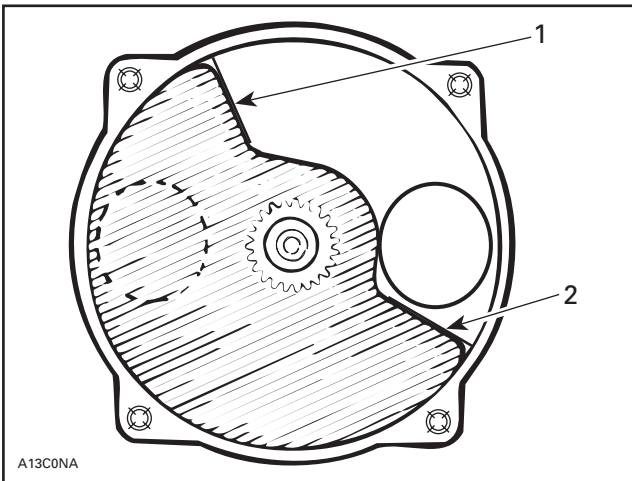
1. Find 132° on degree wheel and mark here
2. Opening mark
3. Bottom of MAGneto inlet port
4. Align 360° line of degree wheel here

- For closing mark, first align 360° line of degree wheel with TOP of MAGneto side inlet port. Then find 52° line degree wheel and mark crankcase at this point.



1. Top of MAGneto inlet port
2. Align 360° line of degree wheel here
3. Closing mark
4. Find 52° on degree wheel and mark here

- Bring MAGneto side piston to top Dead Center using a TDC gauge.
- Rotate rotary valve gear clockwise to remove any backlash.
- Position the rotary valve on gear to have edges as close as possible to the marks.



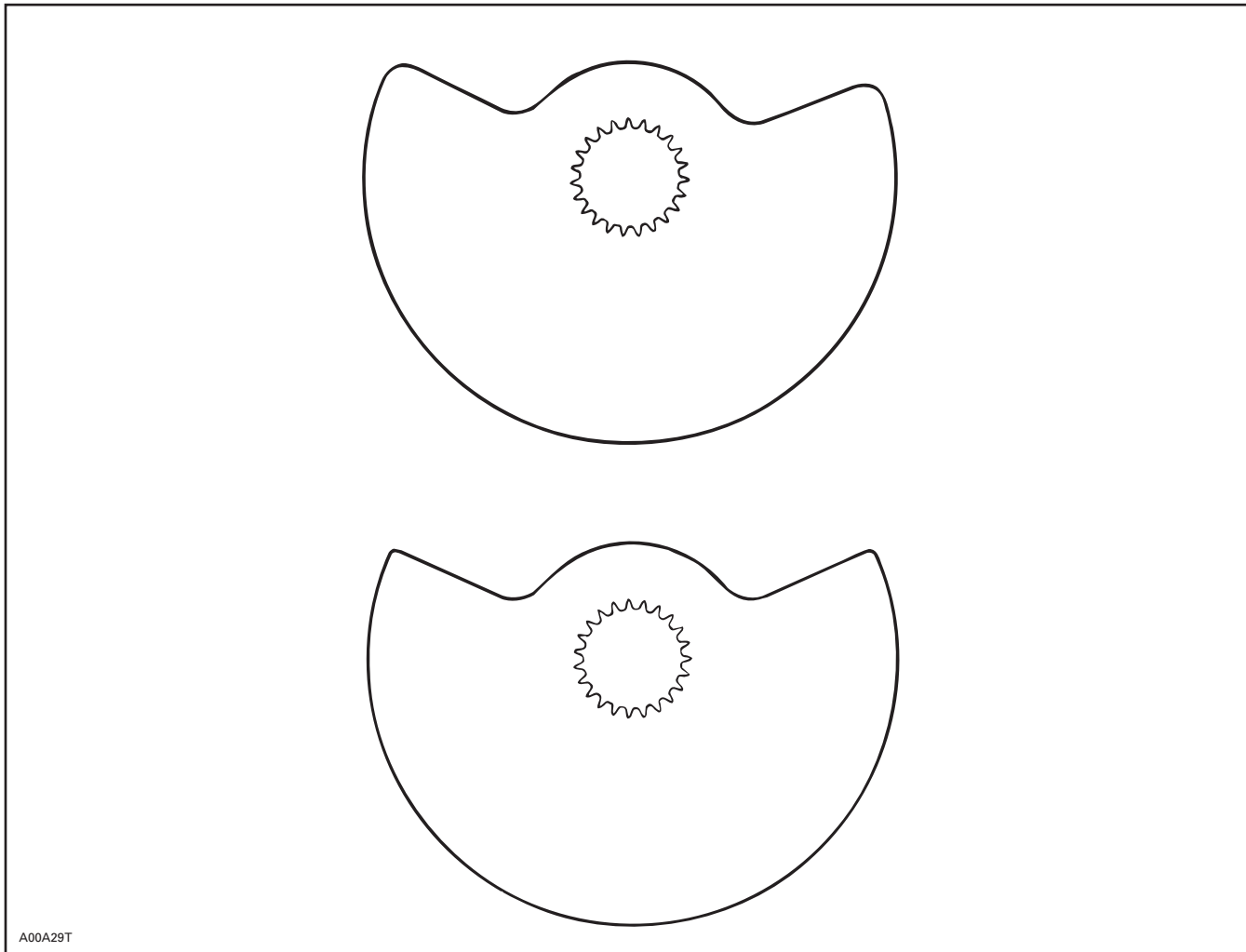
MAGNETO SIDE PISTON MUST BE A TDC

1. Timing mark
2. Timing mark

NOTE: Rotary valve is asymmetrical. Therefore, try turning it inside out then reinstall on splines to determine best installation position.

Apply injection oil on rotary valve before closing rotary valve cover.

SECTION 04 - ENGINE PREPARATION



NOTE: Bombardier Inc./Bombardier Corporation of America has running changes on rotary valves used in our snowmobile product line. The shape of the leading or trailing edge may not conform to drawing shown in some technical material (example follows).

This change is for reliability and does not affect performance in any fashion. The valves are interchangeable, but do carry different part numbers.

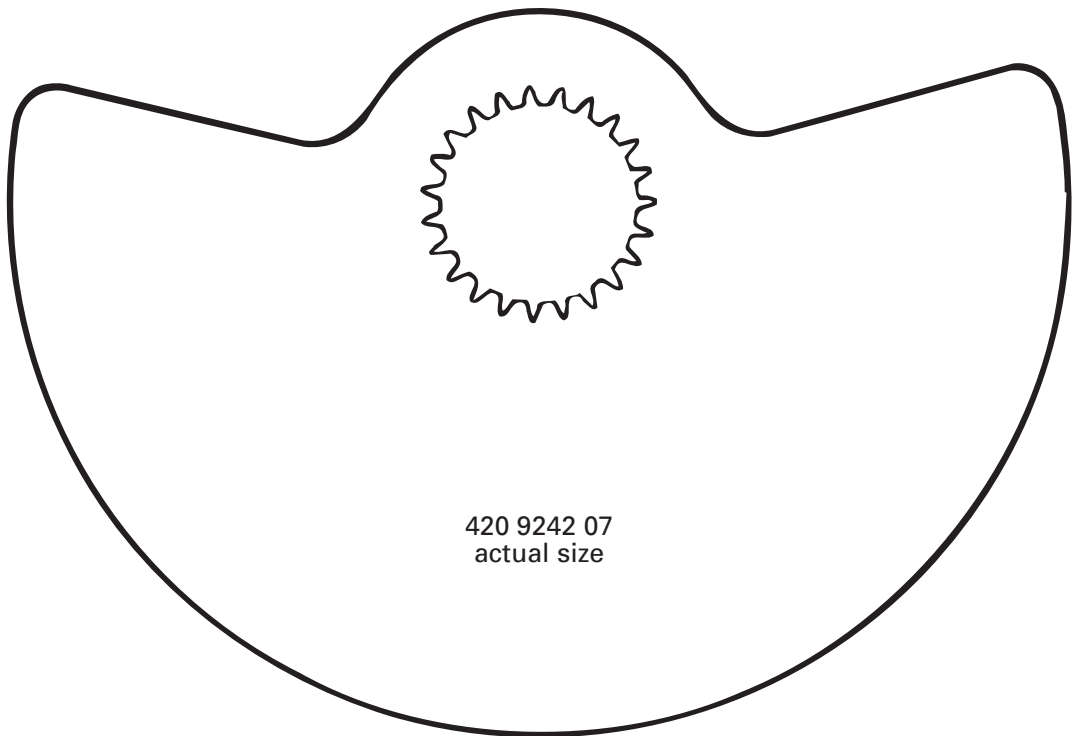
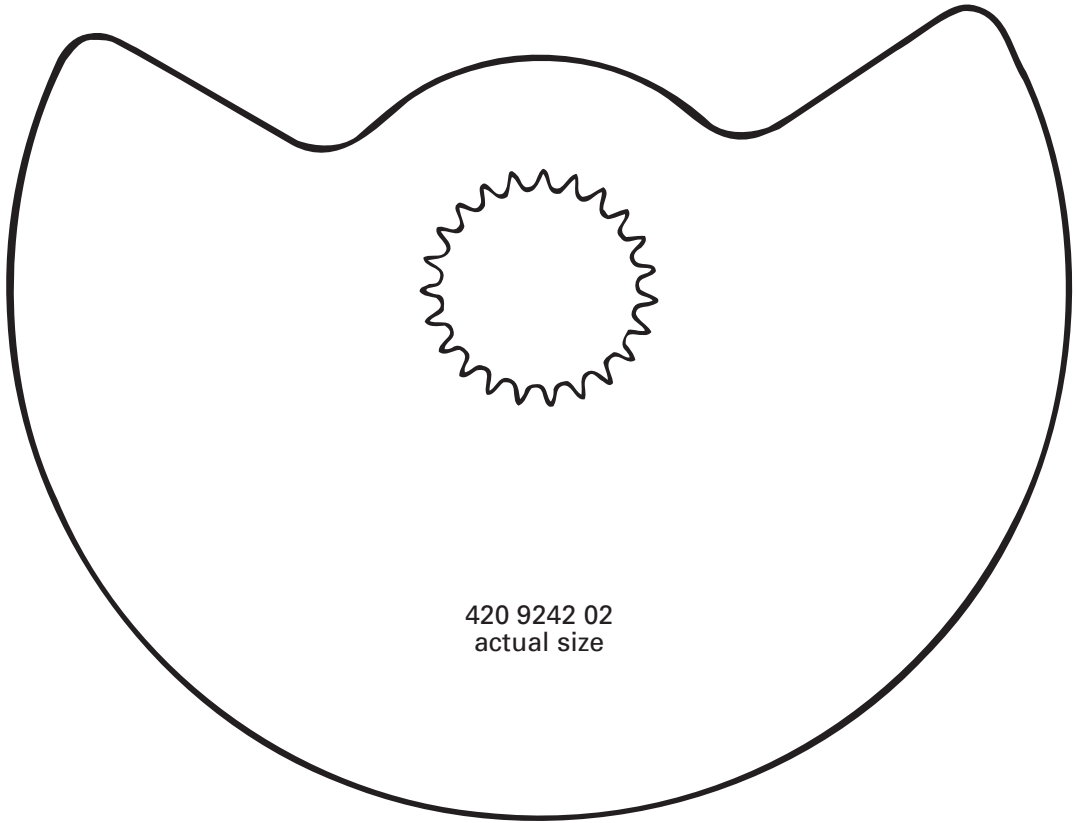
420 9242 00 subs to 420 9245 04

420 9242 05 subs to 420 9245 08

420 9242 09 subs to 420 9245 02

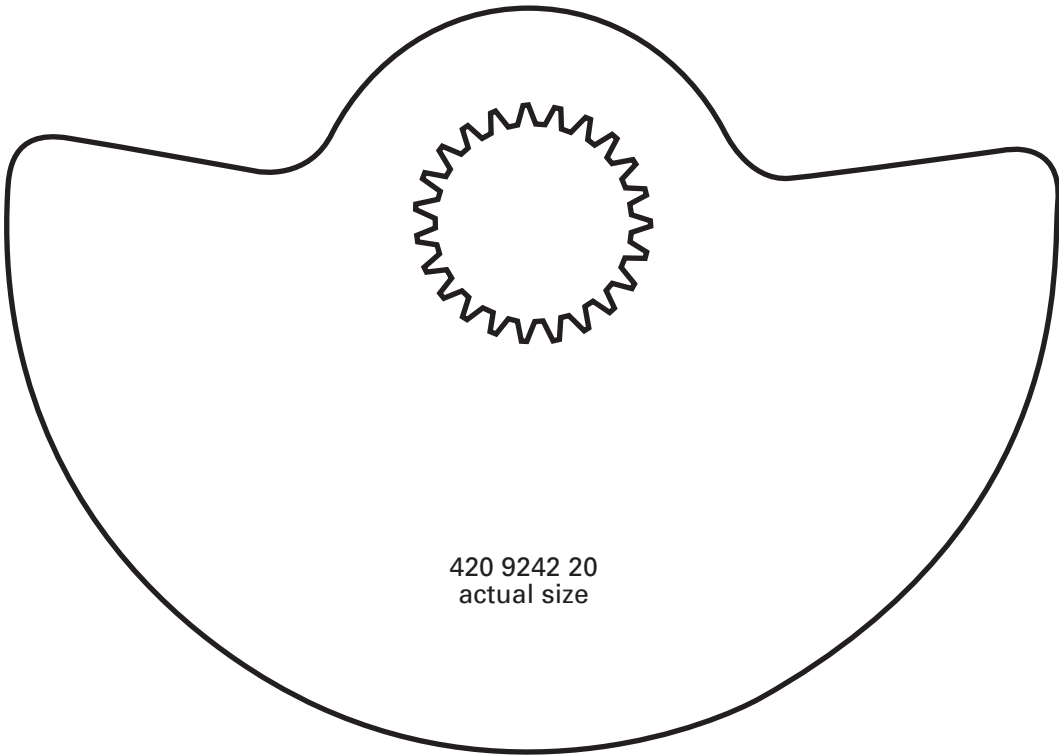
Refer to next page.

SECTION 04 - ENGINE PREPARATION

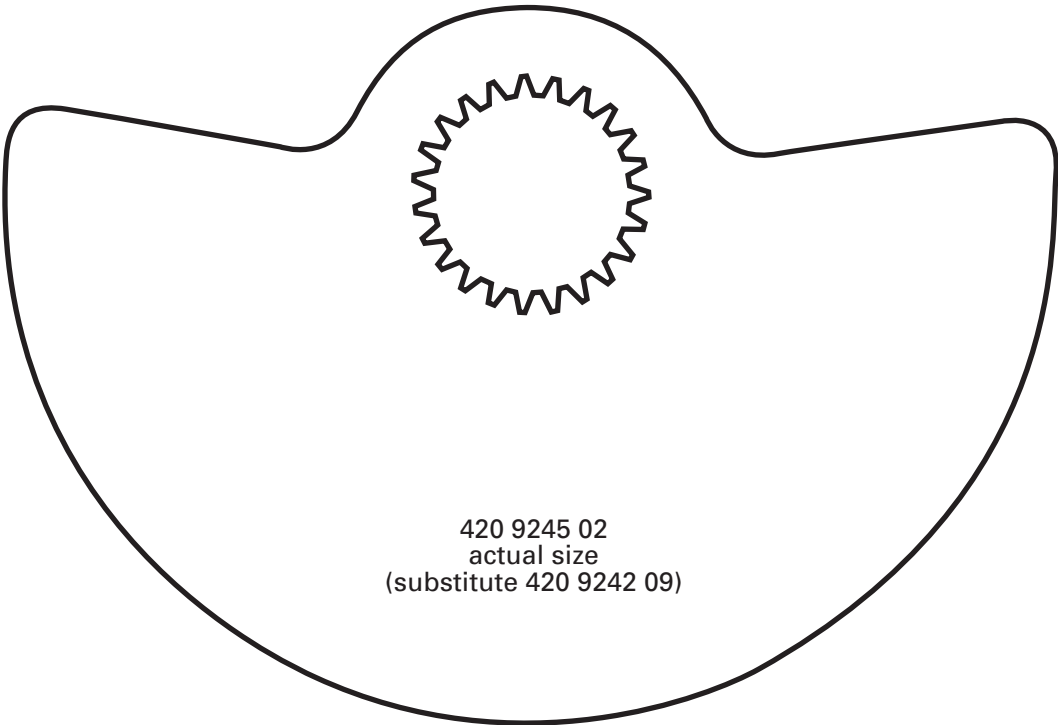


A00A2AS

SECTION 04 - ENGINE PREPARATION



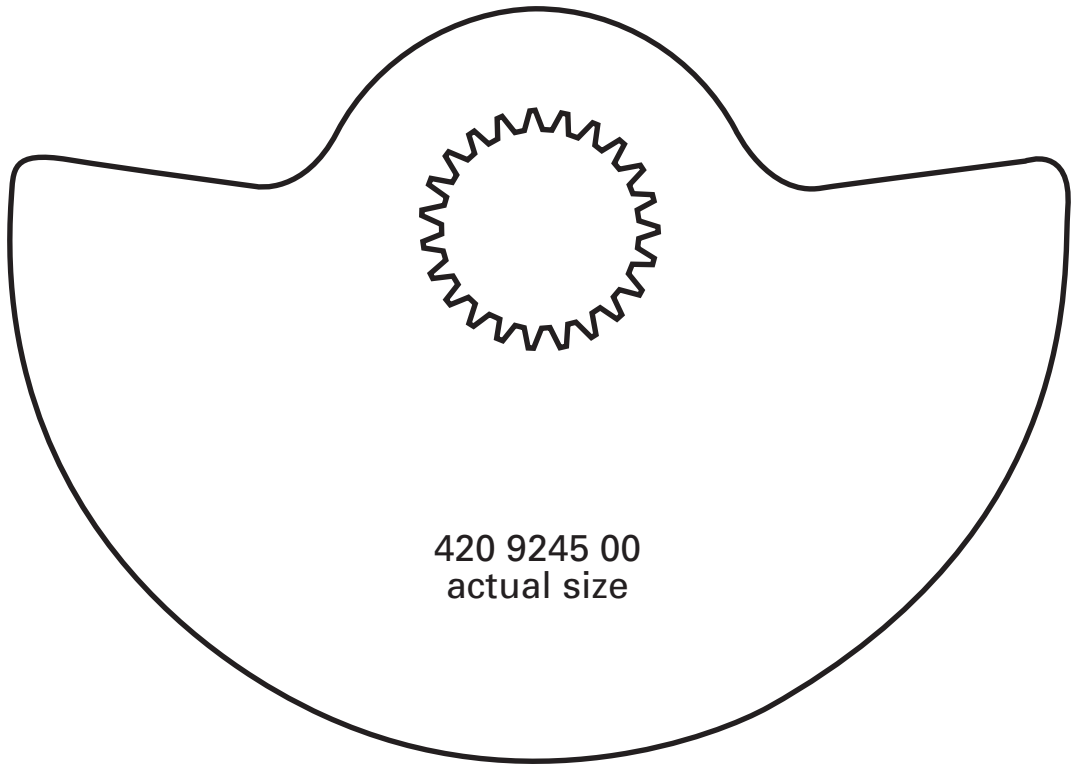
420 9242 20
actual size



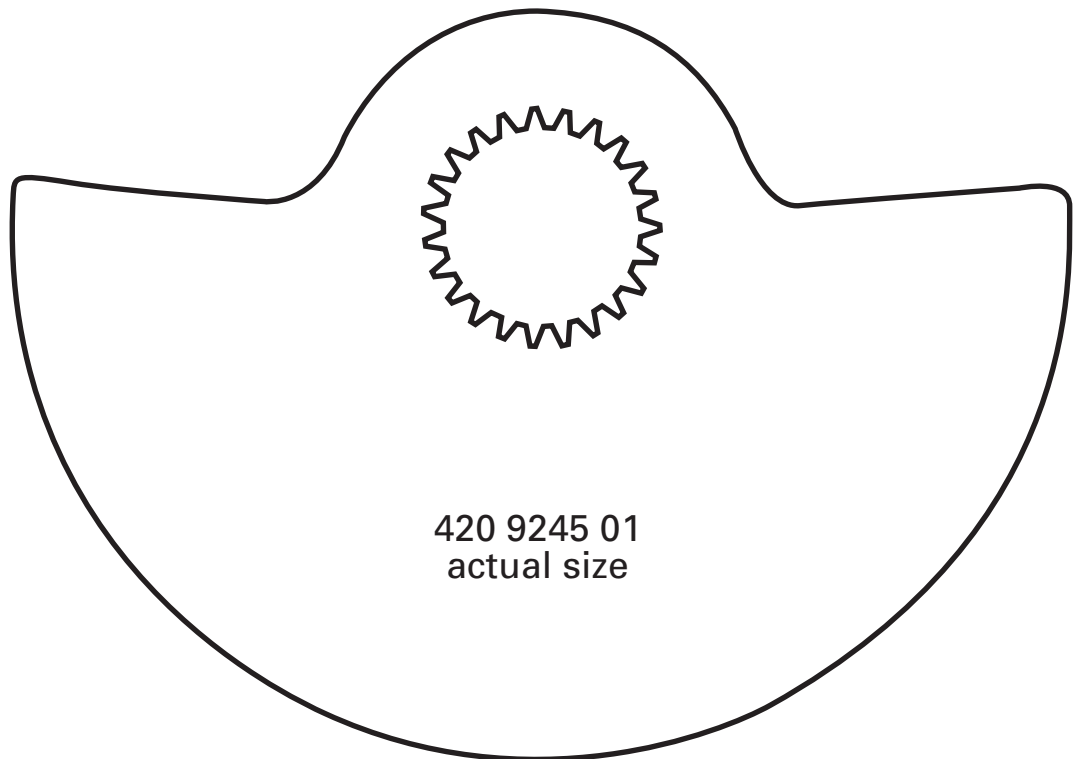
420 9245 02
actual size
(substitute 420 9242 09)

A00A2BS

SECTION 04 - ENGINE PREPARATION

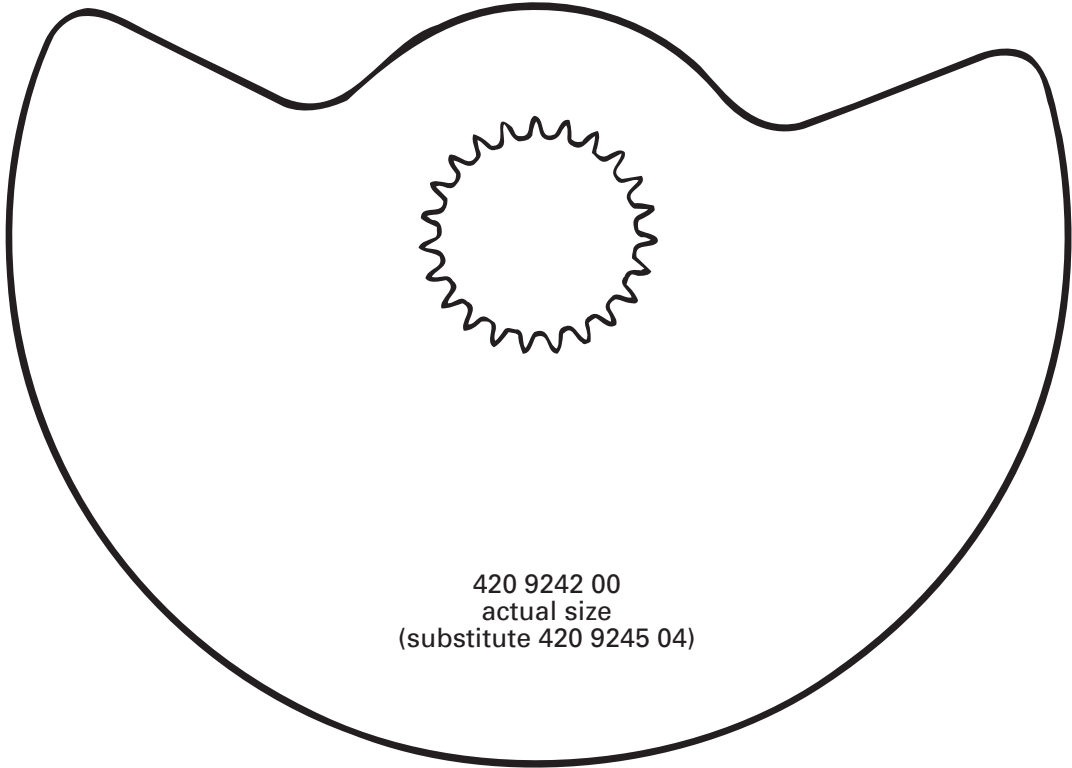


420 9245 00
actual size

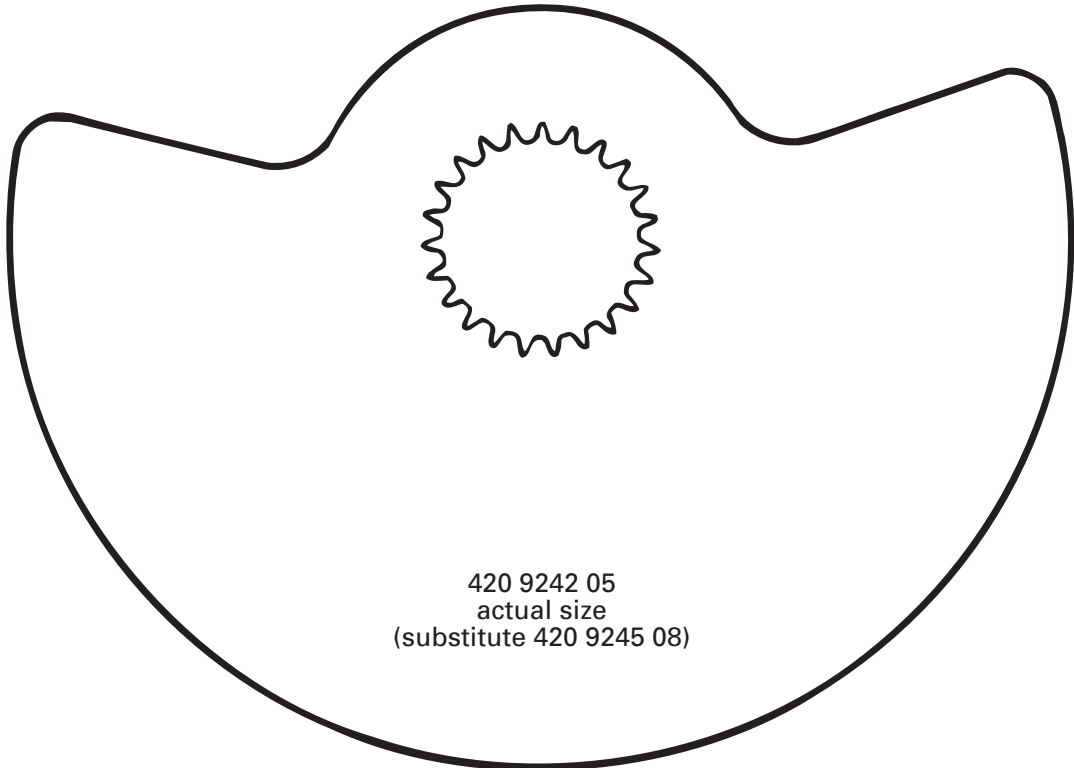


420 9245 01
actual size

SECTION 04 - ENGINE PREPARATION



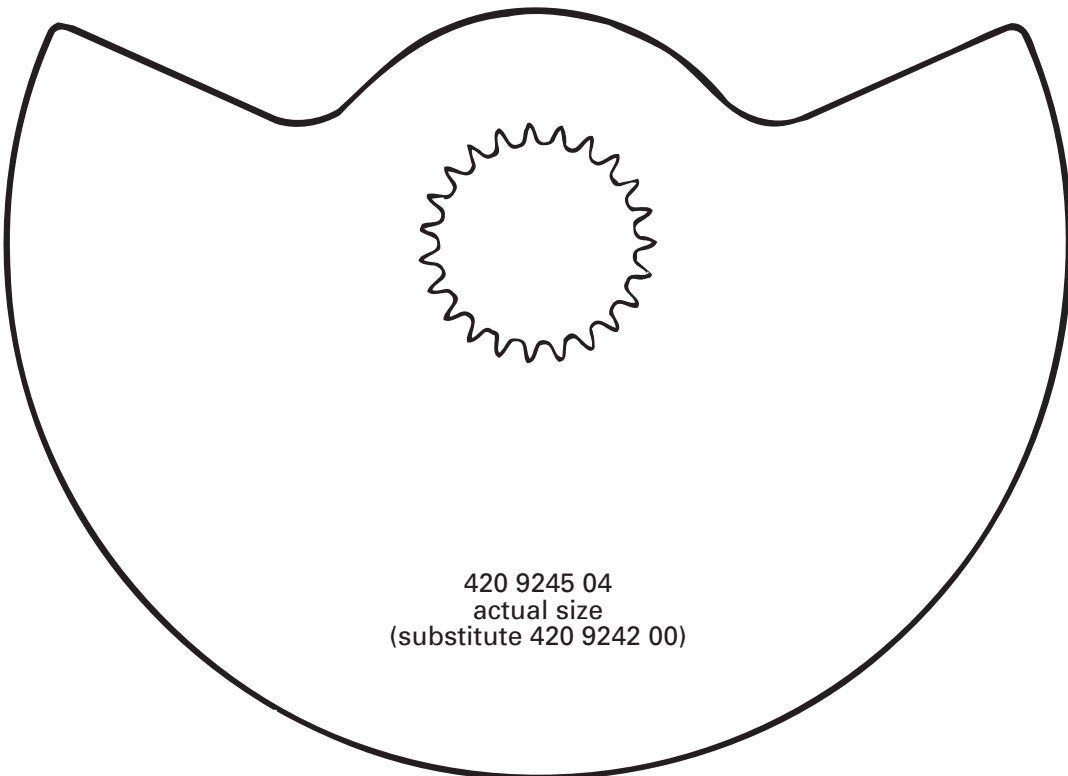
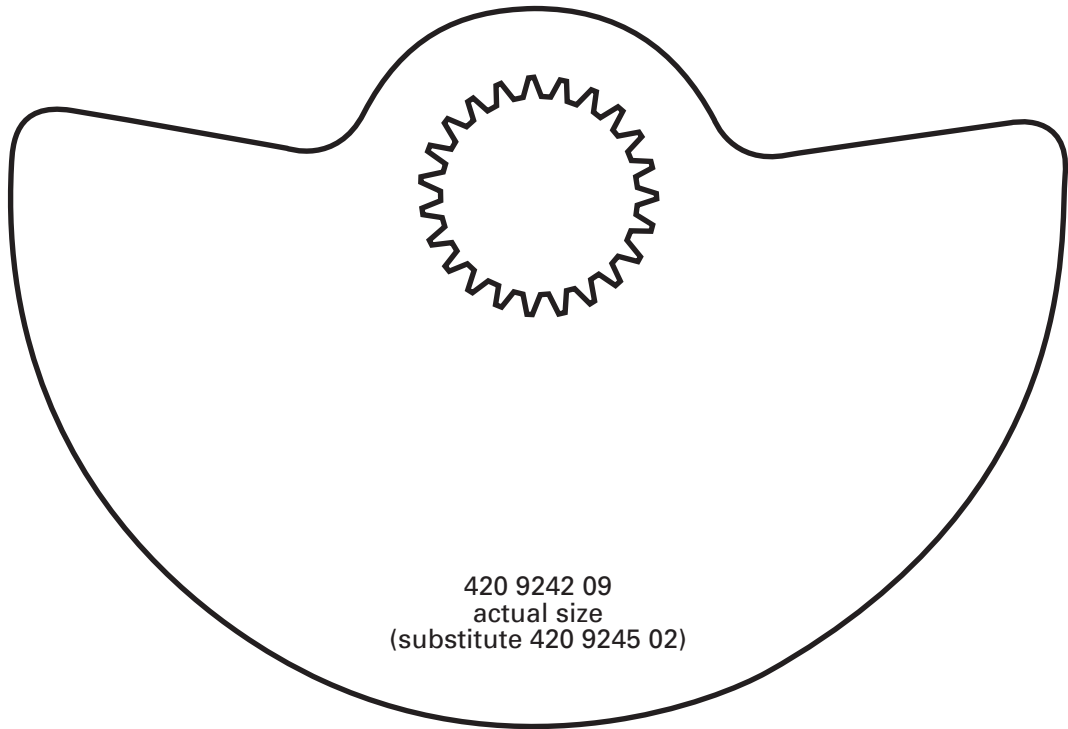
420 9242 00
actual size
(substitute 420 9245 04)



420 9242 05
actual size
(substitute 420 9245 08)

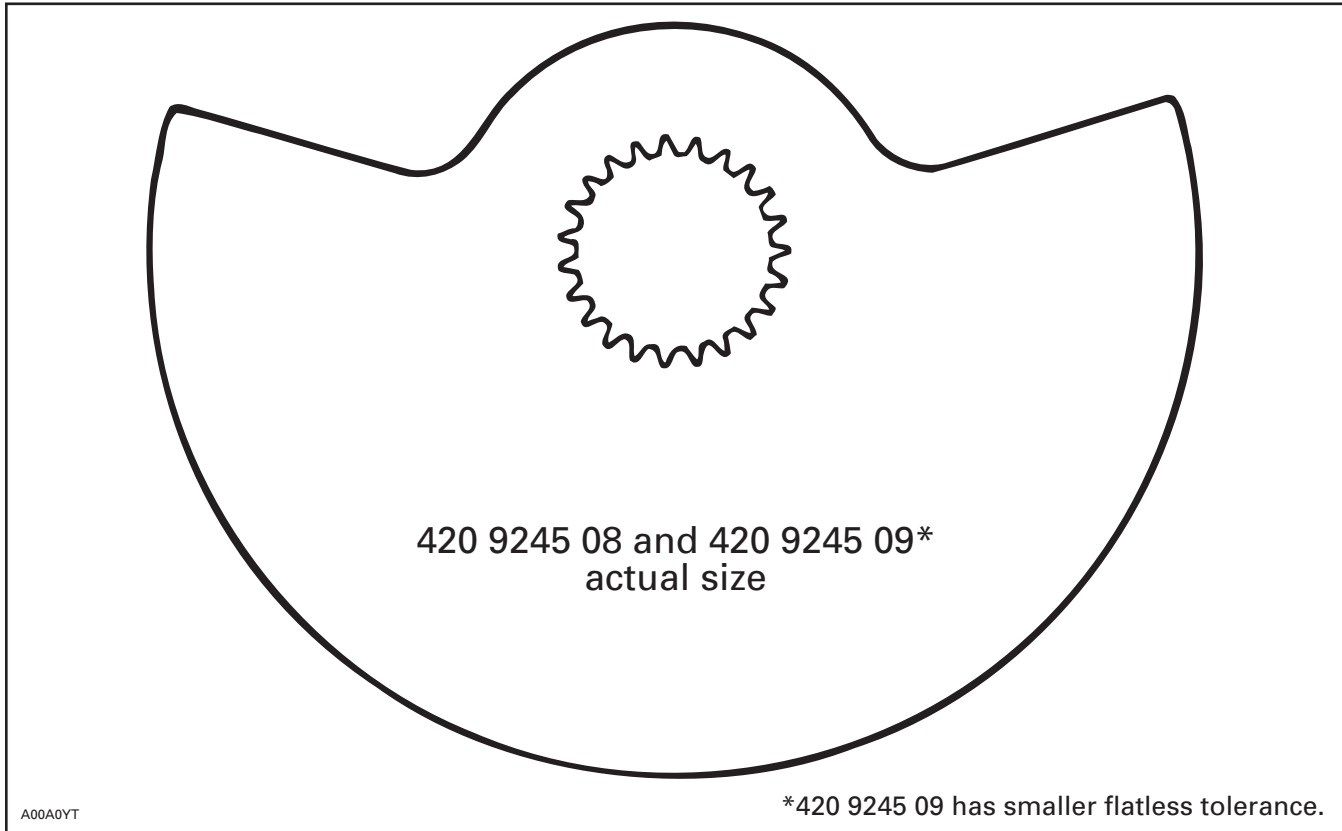
A00A2DS

SECTION 04 - ENGINE PREPARATION



A00A2ES

SECTION 04 - ENGINE PREPARATION



1996 BASE GASKETS	
454 MX Z	
B494 Formula SLS, Grang Touring 500, Summit 500	
P/N 931-360 (0,3)	yellow con rod dot
P/N 931-361 (0,4)	red con rod dot
P/N 931-362 (0,6)	green con rod dot
582 GRAND TOURING 580	
583 MX Z 583 SUMMIT	
599 FORMULA III/FORMULA III LT (1995/1996)	
P/N 931-310 (0,4)	red con rod dot (middle rod)
P/N 931-311 (0,6)	green con rod dot (long rod)
670 FORMULA SS, SUMMIT 670, GRAND TOURING SE AND MACH 1	
P/N 931-230 (0,3)	P/N 931-232 (0,6)
P/N 931-231 (0,4)	P/N 931-234 (0,8)
P/N 931-233 (0,5)	
779 MACH Z/MACH Z LT	
P/N 950-271 (0,4)	red con rod dot (middle rod)
P/N 950-272 (0,6)	green con rod dot (long rod)
P/N 950-273 (0,3)	yellow con rod dot (short rod)


SECTION 04 - ENGINE PREPARATION

1997 AND 1998 BASE GASKETS		
809		
Base gasket set P/N 420 9316 25		
Includes:	P/N 420 9316 20	0.3 mm
	P/N 420 9316 21	0.4 mm
	P/N 420 9316 22	0.6 mm
699		
Base gasket set P/N 420 9315 75		
Includes:	P/N 420 9315 70	0.3 mm
	P/N 420 9315 71	0.4 mm
	P/N 420 9315 72	0.6 mm
670		
Base gasket set P/N 420 9312 35		
Includes:	P/N 420 9312 30	0.3 mm
	P/N 420 9312 31	0.4 mm
	P/N 420 9312 33	0.5 mm
	P/N 420 9312 32	0.6 mm
	P/N 420 9312 34	0.8 mm
599		
Base gasket set P/N 420 9313 15		
Includes:	P/N 420 9313 10	0.4 mm
	P/N 420 9313 11	0.6 mm
	P/N 420 9313 12	0.3 mm
583		
Includes:	P/N 420 9311 85	0.3 mm
503		
Includes:	P/N 420 8318 58	0.5 mm
494		
Includes:	P/N 420 9313 61	0.4 mm
454		
Base gasket set P/N 420 9313 66		
Includes:	P/N 420 9313 60	0.3 mm
	P/N 420 9313 61	0.4 mm
	P/N 420 9313 62	0.6 mm
	P/N 420 9313 63	0.5 mm
	P/N 420 9313 64	0.8 mm
443		
Includes:	P/N 420 8501 05	0.4 mm
377		
Includes:	P/N 420 8501 05	0.4 mm

SECTION 04 - ENGINE PREPARATION

CARBURETION

Carburetor Main Jet Correction Chart

CARBURETOR MAIN JET CORRECTION CHART								
								
FT/METER	°F/°C							
	-60/ -50	-40/ -40	-20/ -30	-0/ -20	+20/ -5	+40/ -5	+60/ -15	+80/ -25
0	111.10	107.40	103.70	% 100.00	96.30	92.60	88.90	85.20
2000/ 600	105.77	102.07	98.37	94.67	90.97	87.27	83.57	79.87
4000/ 1200	100.43	96.73	93.03	89.33	85.63	81.93	78.23	74.53
6000/ 1800	95.10	91.40	87.70	84.00	80.30	76.60	72.90	69.20
8000/ 2400	89.7	86.07	82.37	78.67	74.97	71.27	67.57	63.27
1000/ 3000	84.44	80.74	77.04	73.34	69.64	65.94	62.24	58.54

A01C47S

NOTE: When the answer gives an unavailable jet size, select the next highest (richer) jet.

Example:

With a 250 stock main jet, at an altitude of a 600 m (2000 ft) and a temperature of -5°C (20°F):

$$250 \times \frac{90.97}{100} = 227; \text{ use } 230 \text{ jet.}$$

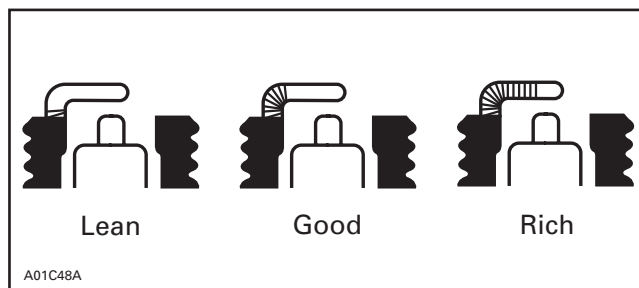
▼ CAUTION

These values are guidelines only. Specific values/adjustments vary with temperature, altitude and snow conditions. Always observe spark plug condition for proper jetting.

This table is more than adequate for stock engines. Two-stroke engines with high specific outputs that are heavily modified (twin pipes, high compression, large carburetors, etc.) and performing at high RPM are very sensitive to air density changes. The following is a very accurate formula for correcting jetting.

First, a baseline for jetting must be established.

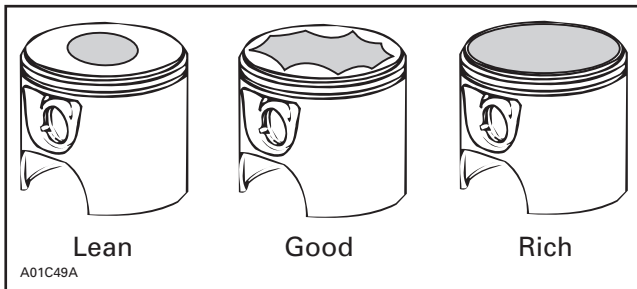
Jetting, horsepower, and B.S.F.C. data can be obtained with dyno testing but also confirmed with field testing. The tried and true method of determining mixture ratio is to inspect the parts of the engine that are directly exposed to the combustion process. The two best indicators are the spark plug and the piston dome. The color and where it is located are the two things to look for. Chocolate brown on the insulator, ground electrode, and piston dome indicate a proper mixture. The ground electrode should show a difference in color just at the radius of the electrode.



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SECTION 04 - ENGINE PREPARATION

The amount and color of carbon on the piston dome also indicate mixture ratio.



Black and sooty indicate a rich mixture. Light tan and gray indicate too lean a mixture.

The engine must be operated under load for at least one minute to obtain accurate readings.

Establish the C.R.A.D by using the following formula:

$$\text{C.R.A.D.} = \frac{1737.97 \times \text{C.A.P.}}{460 + T}$$

C.A.P. = Corrected air pressure

C.A.P. = B - E

B = Barometric pressure readings (in - Hg)

E = Vapor pressure = $\left(\text{SP} \times \frac{\text{RH}}{100} \right)$

See saturation pressure (chart 1)

S.P. = Saturation pressure (in - Hg)

R.H. = Relative humidity (%)

Record the C.R.A.D. when correct jetting has been established. This is your base line for future use.

Example: Testing established a 400 main jet at C.R.A.D. of 100%. One week later, the C.R.A.D. at the track is 110%. Use the following formula to establish the new main jet.

$$\text{New main jet} = \frac{\text{New C.R.A.D.} \times \text{Baseline main jet}}{\text{Base line C.R.A.D.}}$$

$$\text{Example: } \frac{110 \times 400}{100}$$

New main jet = 440

Record the C.R.A.D. when correct jetting has been established. This is the baseline for future use. Jetting corrections for a different C.R.A.D. can be obtained with the following ratio:

$$\text{New main jet} = \frac{\text{New C.R.A.D.} \times \text{Base line M.J.}}{\text{Base line C.R.A.D.}}$$

Example:

Testing results in a 570 M.J. at a C.R.A.D. of 105.4 %. Two weeks later at the race track, the C.R.A.D. is 110.9%.

$$\text{The new M.J.} = \frac{100.9 \times 570}{105.4}$$

New M.J. = 600

Useful Equations

$$\text{C.F.} = \frac{29.92}{B - E} \times \frac{460 + T}{520}$$

C.A.P. = B - E

$$\text{C.R.A.D.} = \frac{1737.97 \times \text{C.A.P.}}{460 + T}$$

Where:

B = barometer reading (in-Hg)

E = vapor pressure (in - Hg) = $\text{S.P.} \times \frac{\text{R.H.}}{100}$
or use wet bulb/dry bulb temperature and psychrometric chart.

T = carb inlet air temp (°F)

S.P. = saturation pressure (in-Hg)

R.H. = relative humidity (%)

C.A.P. corrected air pressure (in-Hg)

C.HP = Corrected brake horsepower

B.S.F.C. = Brake specific fuel consumption

C.R.A.D. = Corrected relative air density (%)

E.G.T. = Exhaust gas temperature

W.O.T. = Wide Open Throttle

SECTION 04 - ENGINE PREPARATION

SATURATION PRESSURE (CHART 1)	
T = Temp. (°F)	S.P. = Saturation Pressure (in-Hg)
-40	.004
-30	.008
-20	.012
-10	.020
0	.040
5	.055
10	.070
15	.090
20	.110
25	.140
30	.170
35	.208
40	.247
45	.314
50	.380
55	.450
60	.521
65	.630
70	.739
75	.884
80	1.030
85	1.225
90	1.420
95	1.675
100	1.930

Example: $300 \times 115 = 345$

Round off to next highest jet size.

New main jet = 350

Air density can change rapidly during the course of the day. Check your gauge frequently. Always use the same gauge for a different gauge may read differently.

Most racers use an air density gauge. This gauge is fairly inexpensive. It basically establishes C.R.A.D. for you by combining the variables on any given day.

First, establish a base line main jet by testing.

After you have determined the correct main jet, record the jet number and the air density gauge reading.

Example: Base line

Gauge reading 90

Main jet 300

The next day at the track, your air density gauge now reads 105. This means you have gained 15% air density.

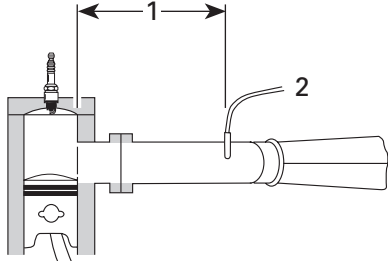
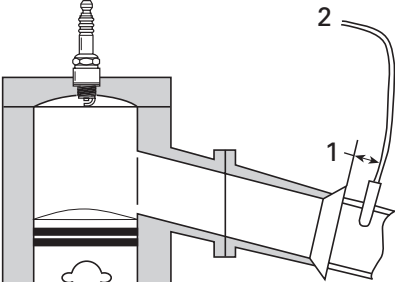
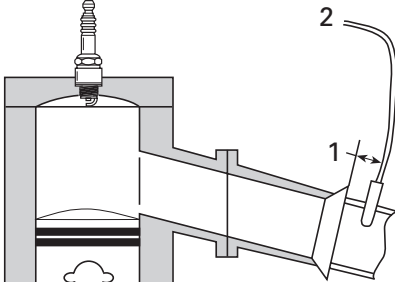
New density 105

Base line 90

$105 - 90 = 15$

Multiply your base line main jet by 115.

Exhaust Gas Temperature Probe Location

TWO CYLINDERS SINGLE PIPE	THREE CYLINDERS TRHREE PIPES	TWO CYLINDERS TWO PIPES
 <p>A00C3WY</p>	 <p>A00C3XY</p>	 <p>A00C3XY</p>
<p>DETONATION = 720°C (1330°F)</p>	<p>DETONATION = 700°C (1290°F)</p>	<p>DETONATION = 700°C (1290°F)</p>
	<p>NORMAL = 650 TO 675°C (1200 TO 1250°F)</p>	

1. 100 mm from piston
2. Probe

1. 80 mm
2. Probe

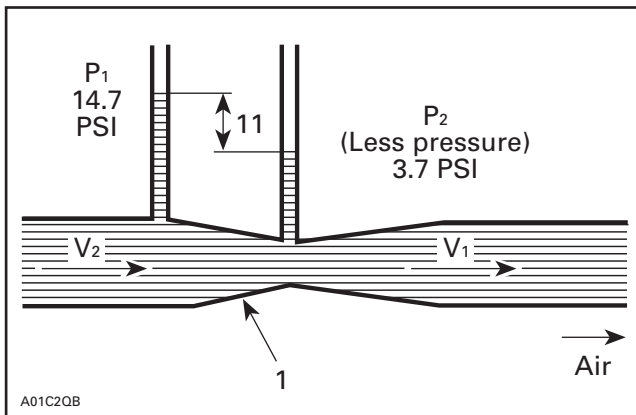
1. 35 mm
2. Probe

NOTE: Temperature at wide open throttle at maximum HP RPM.

Exhaust gas temperatures (E.G.T.'s) can also give an indication of mixture ratio. At wide open throttle (W.O.T.) at maximum HP RPM, a leaner mixture will produce higher E.G.T.'s and a richer mixture will result in lower E.G.T.'s. (E.G.T.'s are not absolute. Engines have seized with E.G.T.'s in the allowable range.)

Carburetor Operation

The operation of the carburetor is based on the physical principle that fluids (air is a fluid) under pressure gain speed but lose pressure when passing through a converging pipe (venturi).



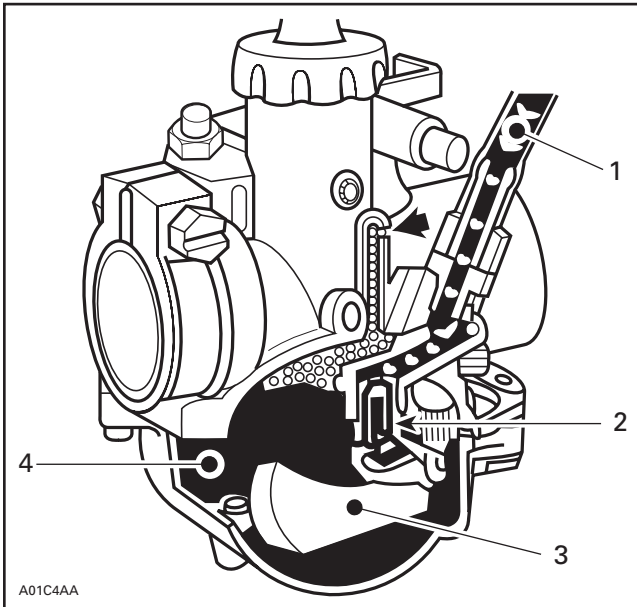
1. Venturi

Air entering the bell of the carburetor has a speed of V1 and pressure of P1. As the air is forced into the smaller diameter of the venturi, speed increases (V2) but pressure drops (P2).

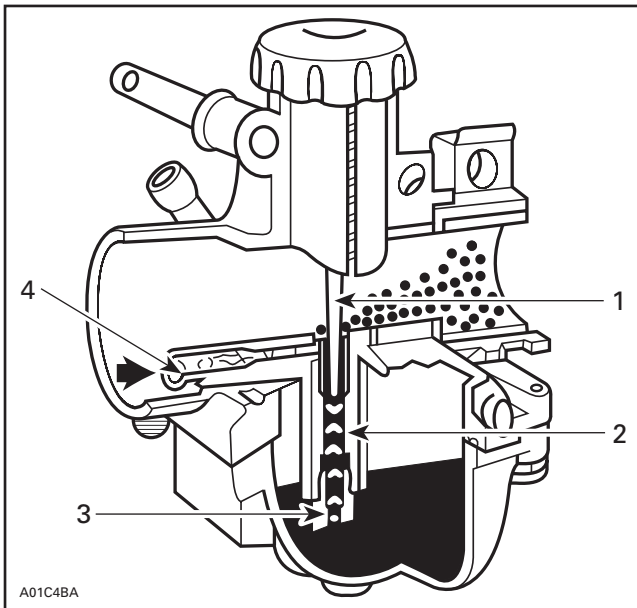
Passages in the carburetor connect the venturi to a reservoir of fuel (float bowl). The float bowl is vented to the atmosphere (P1). P1 is greater than P2 so fuel is pushed from the bowl to the venturi via the jets and passages. Varying the size of jets varies the amount of fuel the engine receives. Engine speed is controlled by varying the amount of air/fuel mixture that the engine receives.

Liquid gasoline does not burn, so for the engine to run efficiently, the fuel must be broken down into small droplets, and mixed with the oxygen molecules in the incoming air. This is referred to as atomization. The shape of the venturi and the shape and location of the jets and fuel delivery passages will determine how well the fuel and air are mixed.

SECTION 04 - ENGINE PREPARATION



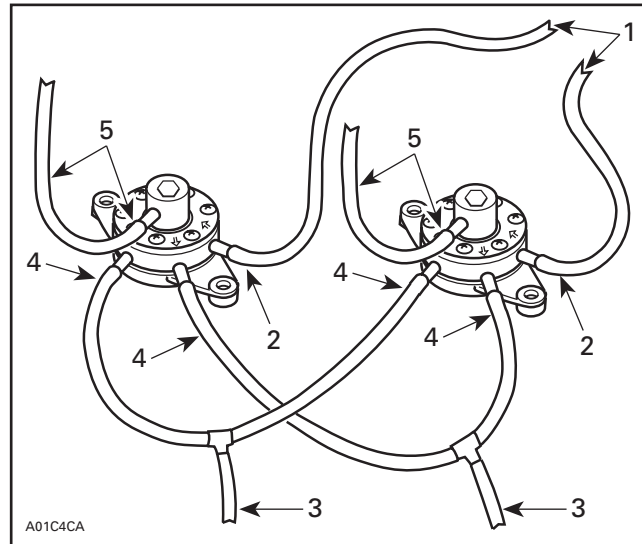
1. Float bowl
2. Needle valve
3. Float
4. Fuel inlet



1. Jet needle
2. Needle Jet
3. Main Jet
4. Air Jet

Dual Fuel Pump Installation

With a heavily modified engine, especially when using large bore carburetors, the need for 580 or larger main jets may arise. The capacity of the fuel pump may be exceeded when using these large jets. To eliminate any possibility of starvation, install two fuel pumps as shown below. Be sure to use a separate impulse line to each pump.



1. From fuel tank
2. Fuel inlet line
3. To car
4. Fuel outlet line
5. Impulse line

Dual outlet, round Mikuni fuel pump equals about 35 liters/hour.

Dual outlet, square Mikuni fuel pump equals about 30 liters/hour.

583 and larger 1995 vehicles use a single large capacity 70 liters/hour fuel pump. The following parts list includes the pieces necessary to install the 70 L/hr pump.

LARGE FUEL PUMP PARTS

70 Liter/hour fuel pump	P/N 403 9012 00
Filter, in-tank	P/N 414 8721 00
Fuel line, in-tank	P/N 414 9437 00
Grommet, tank	P/N 570 2739 00
Connector, tank	P/N 141 8727 00
Fuel line, tank to shut off valve	P/N 414 9399 00
Shut off valve	P/N 414 8722 00
Fuel line, valve to pump	P/N 414 9314 00 (roll)
Clamp, fuel line	P/N 414 6557 00

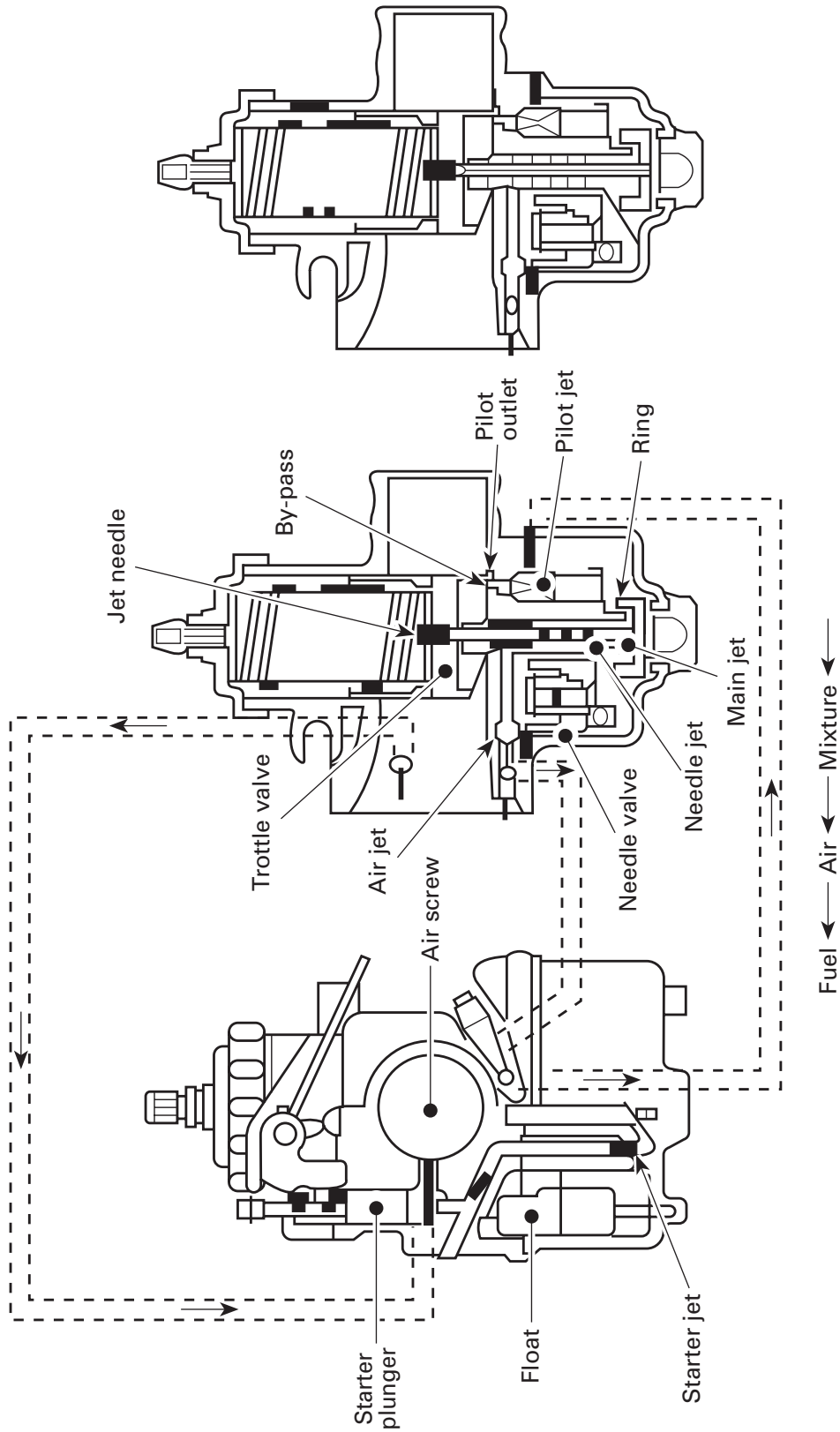
MIKUNI CARBURETORS

Snowmobile engines are operated under a wide range of conditions, from idling with the throttle valve remaining almost closed to the full load (the maximum output) with the throttle valve fully opened. In order to meet the requirements for the proper mixture ratio under these varying conditions, a low-speed fuel system (the pilot system) and a main fuel system (the main system) are provided in Mikuni VM and TM type carburetors.

While this text covers the VM-type carb., the TM flat slide carb. functions the same. The circuits function the same and tuning a TM would be done in the same manner as the VM.

SECTION 04 - ENGINE PREPARATION

MIKUNI CARBURETOR (VM)



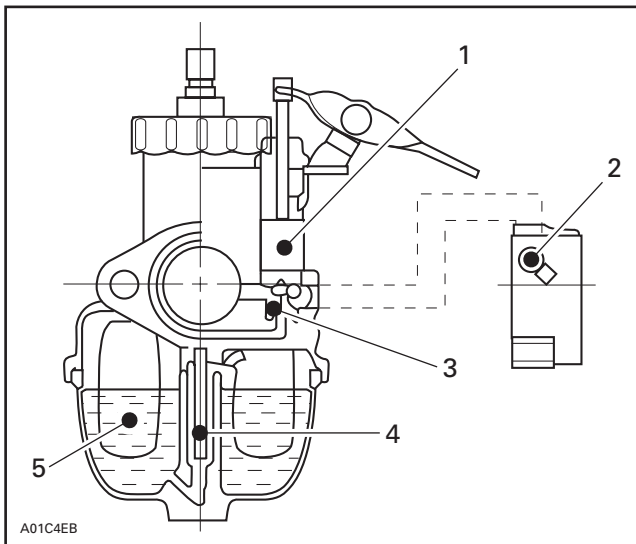
BLEED TYPE TYPE

PRIMARY TYPE

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Starting Device (Enrichener)

Instead of a choke, the enrichener system is used on some Mikuni carburetors. In the starter type, fuel and air for starting the engine are metered with entirely independent jets. The fuel metered in the starter jet is mixed with air and is broken into tiny particles inside the emulsion tube. The mixture then flows into the plunger area, mixes again with air coming from the air intake port for starting and is delivered to the engine in the optimum air/fuel ratio through the fuel discharge nozzle. The starter is opened and closed by means of the starter plunger. Since the starter type is constructed so as to utilize the negative pressure of the inlet pipe, it is important that the throttle valve be closed when starting the engine.

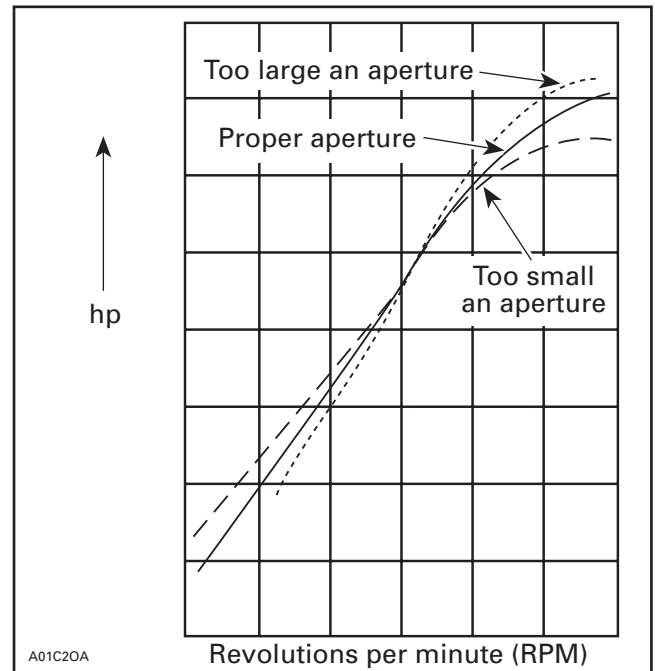


1. Plunger area
2. Emulsion tube
3. Inlet pipe
4. Needle jet
5. Float

Selection of the Aperture of Carburetor

One of the prerequisites for improving the output is to use a carburetor with as large an aperture as possible. However, a large aperture alone does not necessarily improve the output. As shown in the following illustration, it is true that a large aperture improves the power output in the high speed range. In the slow speed range, on the other hand, the output drops. The aperture of a carburetor is determined by various factors. These factors include (1) whether the vehicle is intended for racing, (2) the design of the engine, (3) driving

technique of the driver, (4) the driver's preference, etc. In addition, the maximum output, the maximum torque and the minimum number of revolutions for stable engine operation must also be taken into account.



Size of Mikuni Carburetors

Mikuni VM-type carburetors come in various sizes, with the main bore ranging from 10 (.39 in) to 44 (1.73 in) (in even numbers for the most part.) The carburetor body is made of aluminum or zinc.

Carburetor Test

Once the aperture of the carburetor is determined, a test to select the proper jet should be made. The size of the jet is determined by measuring the output in a bench or in a chassis dynamo test. For racing, it is best to determine the proper size of the jet on the racing track, because the following points must be taken into account:

- a. The altitude (atmospheric pressure), temperature and humidity of the race track.
- b. The operation of the engine based on the topography of the race track.

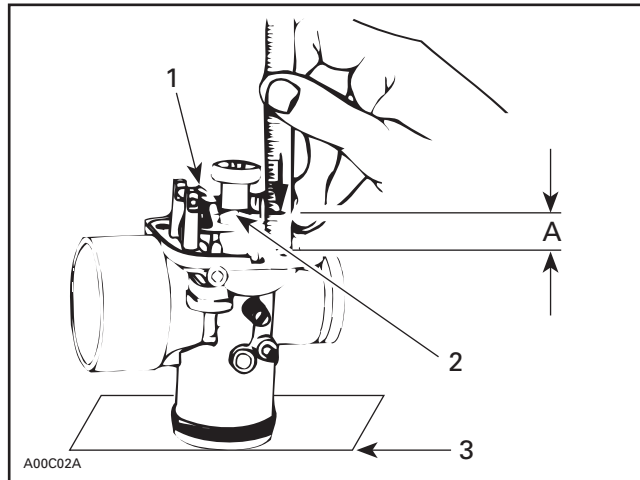
SECTION 04 - ENGINE PREPARATION

Checking and adjusting float system

1. Invert the carburetor and check the alignment between the float arm and the base of the carburetor. The float arm should be parallel to the base.
2. Bend the actuating tab as required to make the float arm parallel to the base. Be careful not to bend the float arm.

NOTE: Incorrect float adjustment can prevent proper tuning of a carburetor. Always make sure the float is properly adjusted before attempting adjustment of the other fuel metering system.

NOTE: Mikuni carburetors used on snowmobiles with fuel pumps require a smaller inlet needle valve (usually 1.5 or 2.0) than carburetors used in gravity feed applications (3.0).



TYPICAL

1. Contact tab
2. Float arm
3. Level surface
- A. Height (refer to table below)

On TM 38, do not turn carburetor up side down. Measure float arm height when it just touches needle valve without moving it.

Float arm height dimensions:

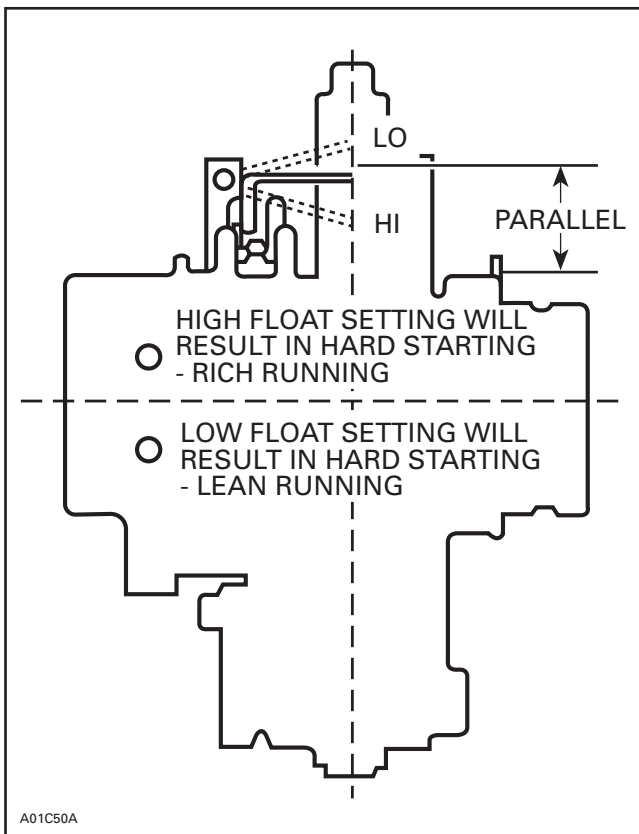
CARBURETOR MODEL	FLOAT HEIGHT A	
	± 1 mm	(± .040 in)
VM 28	17.3	(.681)
VM 30 VM 34	23.9	(.941)
VM 38 VM 40 VM 44	18.1	(.713)
VM 38 (Summit) VM 40 (Summit)	19.6	(.772)
TM 38	22.0	(.866)

NOTE: To adjust height A — bend the contact tab of float arm until the specified height is reached.

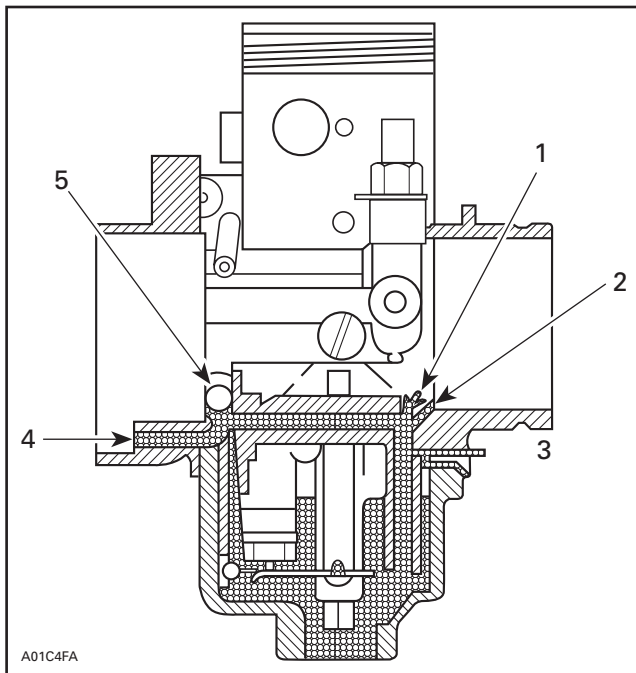
Pilot/Air System

PRINCIPLES OF OPERATION

The pilot/air system controls the fuel mixture between idle and approximately the 1/4 throttle position. As the throttle is opened wider for low speed operation, the pilot outlet cannot supply adequate fuel, and fuel then enters the carburetor bore from the bypass as well as the pilot outlet. The pilot/air system is tuned by first adjusting the air screw; then, if necessary, by replacing the pilot jet.



Adjusting Air Screw



1. Pilot bypass
2. Pilot outlet
3. Pilot jet
4. Air intake
5. Air screw

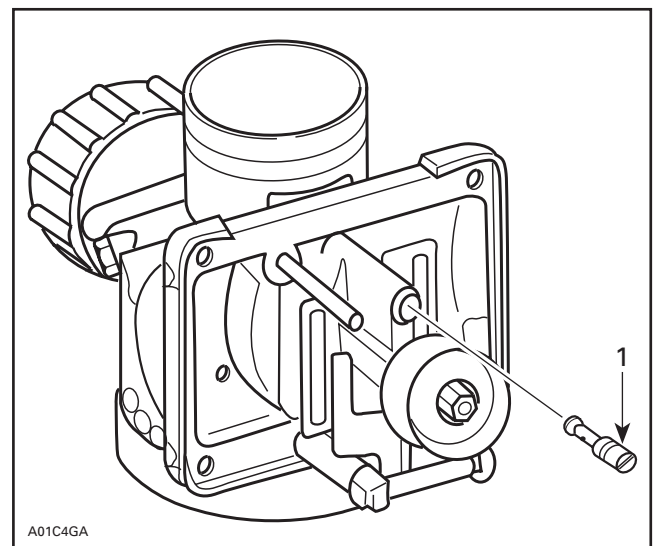
NOTE: This procedure may be performed for single and dual carburetors. Never adjust screws more than 1/4 turn at a time.

1. Turn idle stop screw in until screw contacts throttle valve. Then turn idle stop screw in 2 additional turns.
2. Start and warm up engine. Adjust idle stop screw to 500 RPM above normal idle speed. See *low-speed fuel system*.
3. Turn air screw in or out using 1/4-turn increments until engine rpm peaks or reaches its maximum RPM.
4. Readjust idle stop screw to return engine to normal idle speed. See pages *low speed fuel system*.
5. Repeat Steps 3 and 4 until engine operates at normal idle speed and air screw is peaked.
6. When air screw is adjusted stop engine. Note the setting of air screw and turn it all the way in. If it takes less than 1 turn, the pilot jet is too small and a larger one must be installed. If it takes more than 2-1/2 turns to set air screw, the pilot jet is too large and must be replaced by a smaller one.

7. Turn the air screw left and right (between 1/4 and 1/2 turn) and select the position where the engine revolution reaches the maximum. Adjust the throttle stop screw to bring down the engine revolution to your target speed for idling. After this adjustment of the throttle stop screw is made, select once more the position where the engine revolution reaches the maximum, by turning the air screw left and right (between 1/4 and 1/2 alternately). At this point, attention should be paid to the following points.

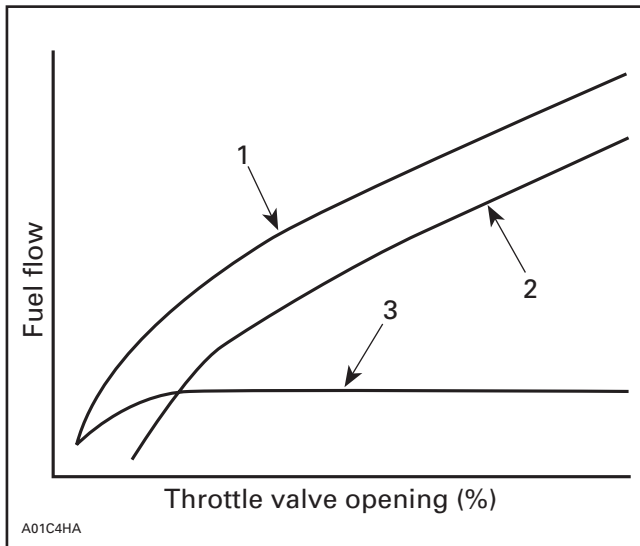
1. If there is a certain range in the opening of the air screw where the fast engine revolution can be obtained (for instance, the number of revolutions does not change in the range of 1-1/2 to 2.0 turns), it would be better for acceleration to 1-1/2 turns.
2. To determinate the "fully closed" position of the air screw, turn the air screw slightly. Excessive tightening of the air screw would damage the seat. The position where the air screw comes to a stop should be considered the "fully closed" position. The maximum number of turns in the opening of the air screw must be limited to 3.0. If the air screw is opened over 3.0 turns, the spring will not work and the air screw can come off during operation of the vehicle.

Replacing Pilot Jet



1. Pilot jet

SECTION 04 - ENGINE PREPARATION



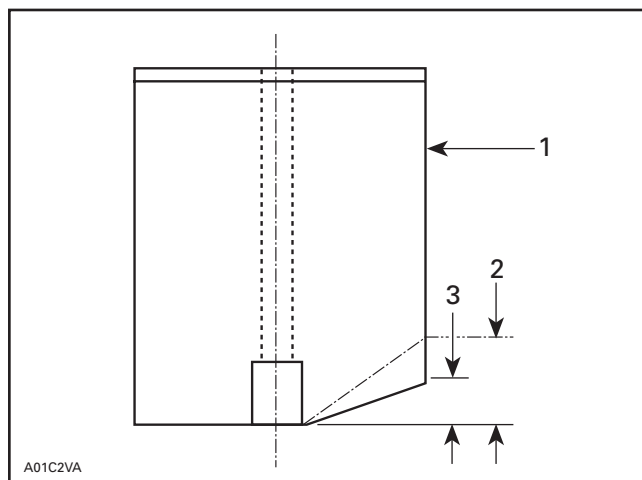
1. Total amount of fuel flow
2. Main fuel system
3. Pilot fuel system

Pilot jets are numbered from no. 15 (the smallest) to no. 80 (the largest). The number corresponds to fuel flow and not necessarily to drill size or through-hole diameter. After changing the pilot jet, check and adjust air screw as described above.

NOTE: Since the pilot/air system provides some fuel up to wide open throttle, changes in this system will affect the throttle valve, jet needle/needle jet, and main jet metering systems.

Throttle Valve

PRINCIPLES OF OPERATION



1. Throttle Valve
2. 3.0
3. 2.0

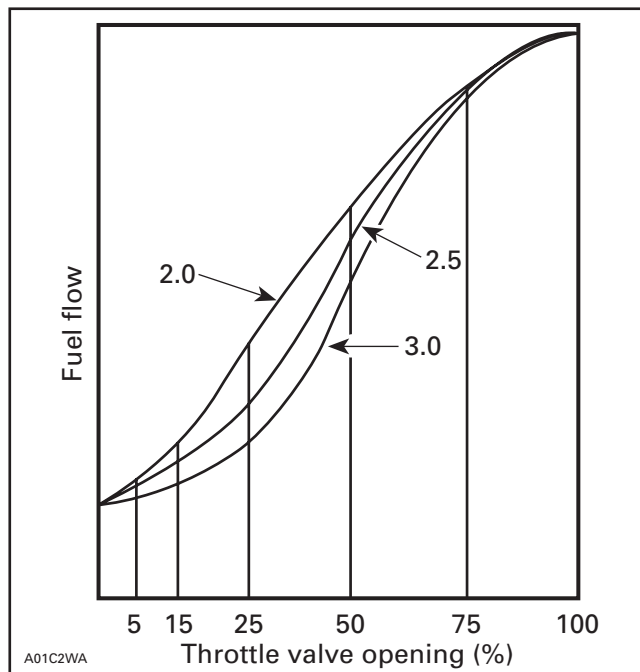
The throttle valve is cut away on the air inlet side to help control the fuel/air mixture at low and intermediate throttle settings. The size of cutaway also affects acceleration.

Throttle valves are numbered from 0.5 to 4.5 in 0.5 increments based on the size of the cutaway. The most commonly used configurations are 1.5 to 3.5. The higher the number, the greater the cutaway and the larger the air flow.

The throttle valve functions in about the same range as the pilot/air system. After the air screw is adjusted, it can be used to check the throttle valve selection.

NOTE: Too lean of a slide cut-away can cause piston seizures during sudden throttle closures from large throttle settings.

CHECKING AND SELECTING THROTTLE VALVE



1. Operate engine at low throttle settings, accelerating from idle to 1/4 throttle.
2. If engine bogs during acceleration, there is probably insufficient fuel. Turn in air screw about 1/4 turn at a time. If engine acceleration is improved, after adjusting air screw, the throttle valve cutaway needs to be decreased.

3. If engine runs rough or smokes excessively during acceleration, there is probably too much fuel. Turn out air screw 1/4 turn at a time. If engine operation is improved, the throttle valve cutaway needs to be increased.

NOTE: Illustration above indicates fuel flow according to throttle valve size and the amount throttle valve is opened.

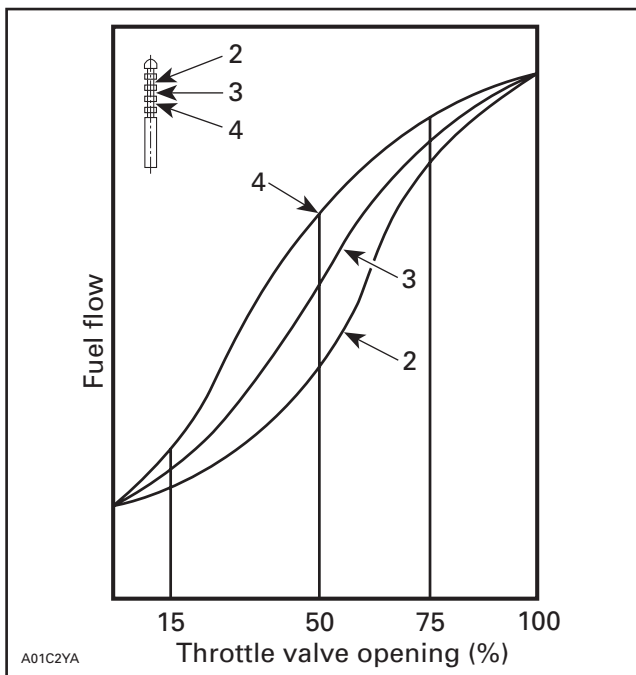
4. Increase or decrease throttle valve cutaway size in 0.5 steps.

5. Return air screw to its original setting and operate engine at low throttle settings. Accelerate engine from idle to 1/4 throttle; engine should accelerate smoothly.

6. As a final check, change the position of the air screw. If this does not significantly affect engine performance (as in steps 2 and 3), the throttle valve is correct.

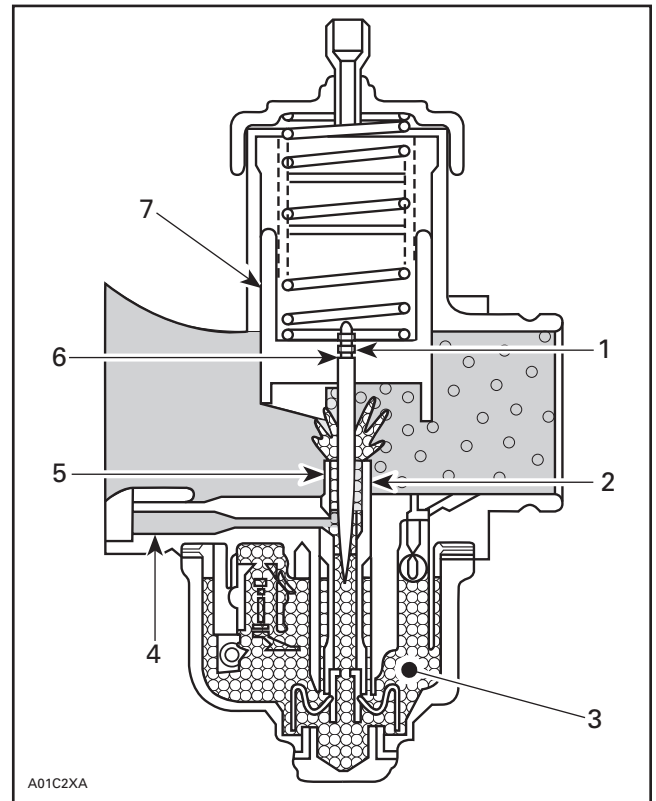
Jet Needle

PRINCIPLES OF OPERATION



The jet needle works with the needle jet to increase the amount of fuel as the throttle valve is raised.

Although the jet needle and needle jet function in the 1/4 to 3/4 throttle range, they also affect the amount of fuel present at wide open throttle. When tuning the jet needle, also check main jet system operation.

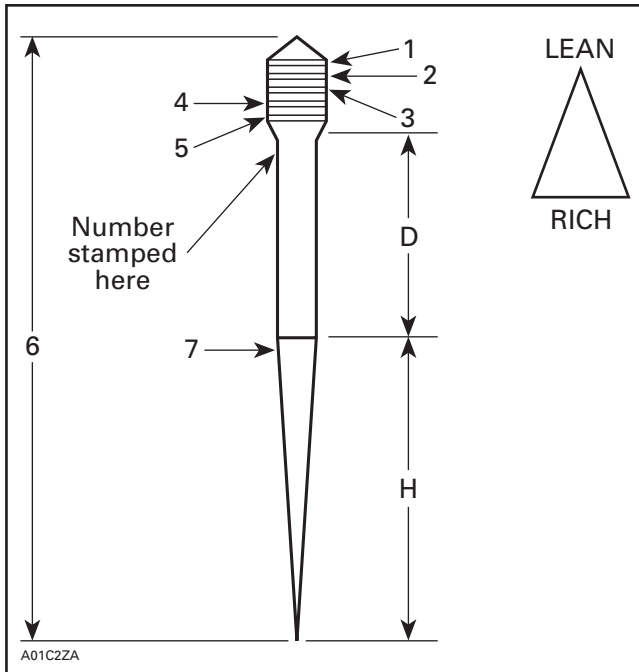


- 1. E-ring
- 2. Needle jet
- 3. Fuel
- 4. Air
- 5. Metered here
- 6. Jet needle
- 7. Throttle valve

The jet needle raises and lowers with the throttle valve which changes jet needle position in the needle jet. Because the jet needle is tapered from top to bottom, an increasing amount of fuel is delivered through the needle jet whenever the throttle valve is raised. Increased or decreased air flow, by the throttle valve position, regulates the amount of fuel through the needle jet and around the jet needle.

The jet needle works on combination of length, taper, and E-ring position. Each jet needle has a number and letter series stamped on the body.

SECTION 04 - ENGINE PREPARATION



Example: 6DH7

6 - Basic length of needle.

DH - A single letter would indicate a single taper of the needle, double letter a double taper, and three letters mean there is a triple taper.

D - Amount of taper at top of needle.

H - Amount of taper at bottom of needle.

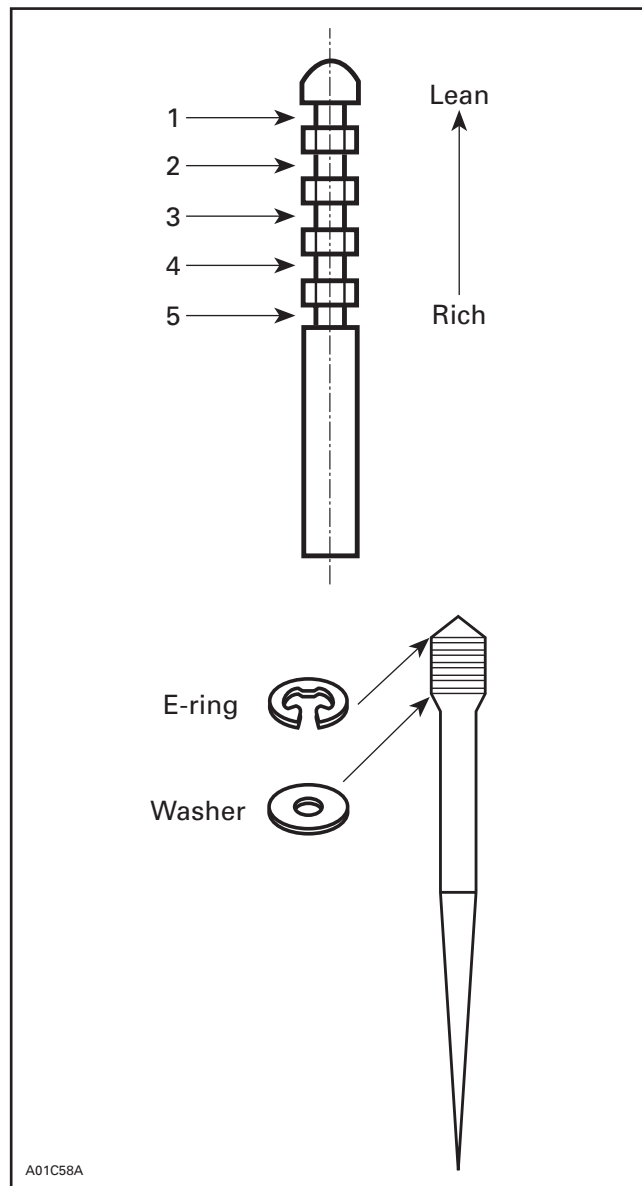
7 - Material, type of coating and start of second taper on needle.

NOTE: Letter designation of the jet needle indicates the angle of taper. Each letter (starting with A is 0.25° greater than preceding letter. Example: D = 1°, E = 1-1/4°, F = 1-1/2°, G = 1-3/4°, and H = 2°. This applies to both single and double taper needles.

At the top of the jet needle are five grooves numbered 1 through 5 from top to bottom. The number 3 or middle groove being the starting point for the E-ring. The E-ring position on any jet needle determines the rich or lean part throttle or mid-range carburetor operation.

Moving E-ring to position 1 or 2 lowers jet needle into needle jet and leans out the fuel/air mixture. Similarly, moving E-ring to position 4 or 5 raises jet needle in needle jet and enriches the fuel/air mixture.

POSITIONING THE E-RING



1 to 5 = E-ring position

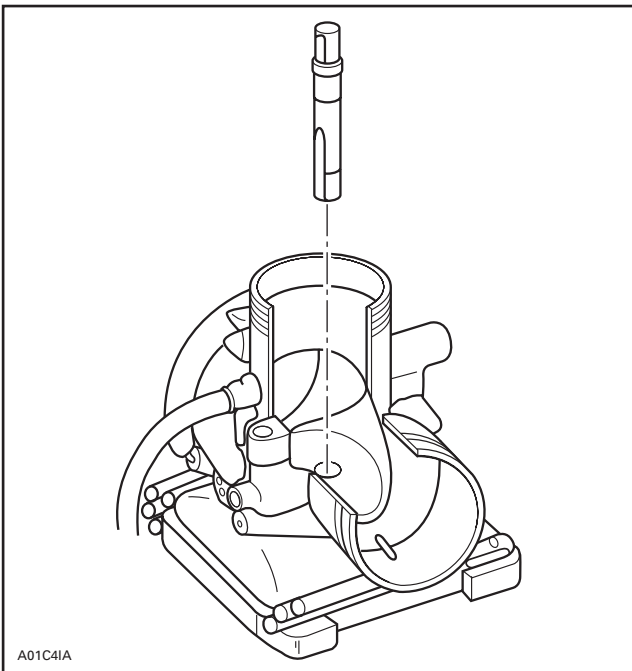
1. Check for a rich or lean setting by examining exhaust manifold. A very light brown or white color indicates a lean mixture. A very dark brown or black color indicates a rich mixture. The proper color is tan.
2. Move E-ring one groove at a time to correct the fuel/air mixture.
3. If proper operation is obtained at all but the 3/4 throttle setting after the main jet has been tuned, operation may be improved by changing the jet needle taper. Do not, however, change the jet needle until main jet and E-ring position have been thoroughly checked.

4. If the E-ring is in the number 5 position and operation is still lean, a needle jet with a larger orifice may be installed. This may be done only after thoroughly checking the main jet, jet needle, and E-ring positions.

NOTE: Make sure washer is installed under E-ring on vehicles so equipped.

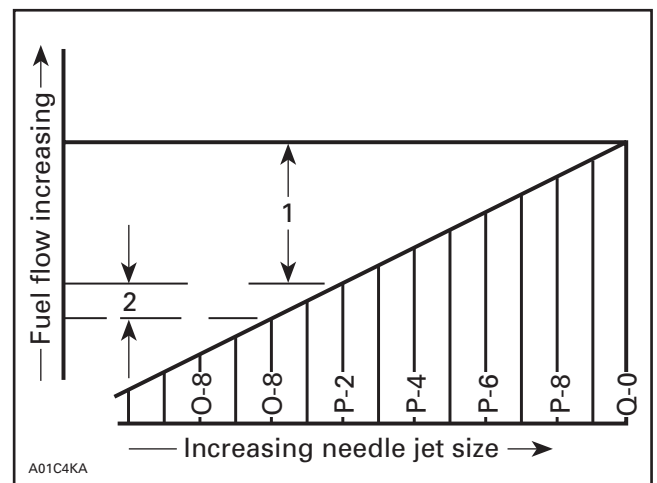
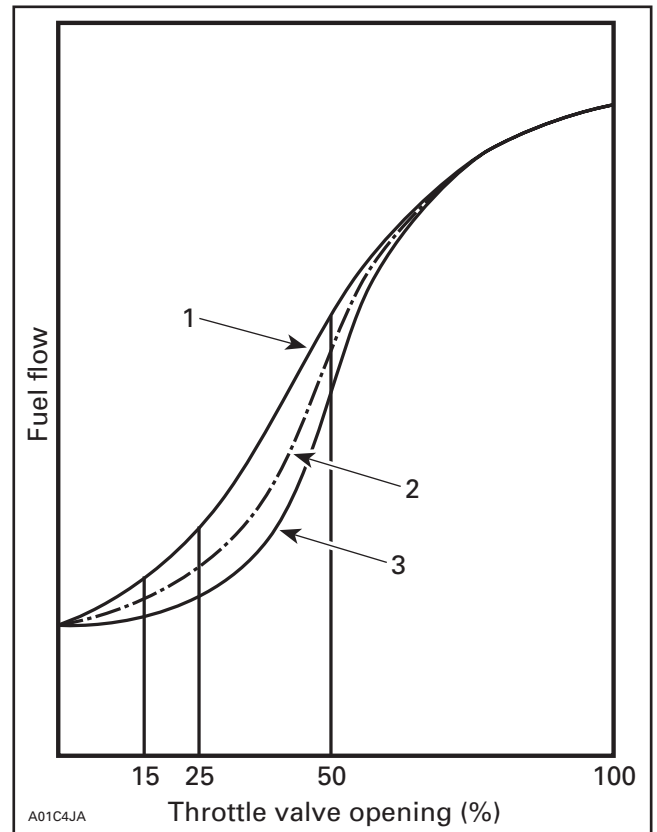
Needle Jet

PRINCIPLES OF OPERATION



The needle jet works in combination with the jet needle to meter the fuel flow in the mid range.

Changes to the needle jet should be made only if the results of changing the jet needle position are unsatisfactory. In stock applications, except for specific calibration changes necessary at high altitudes, the needle jet should not be changed. Selection of the proper needle jet requires much care and experience. Decreasing the needle jet size can prevent the main jet from metering the proper amount of fuel at wide open throttle.



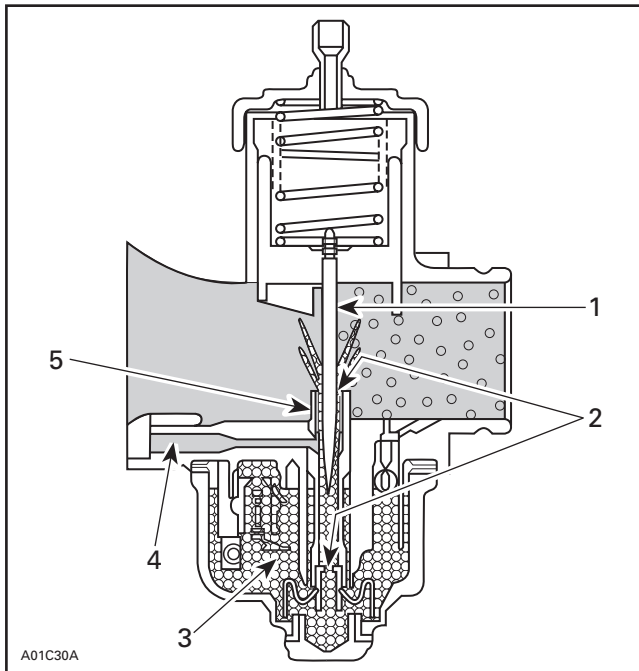
Needle jets are stamped with an alphanumeric code. The letter indicates a major change in fuel flow. P-2, for example, indicates low flow; P-4, greater flow, and so on. The number indicates minor adjustments in fuel flow. The first diagram shows the relationship between the alphanumeric needle jet size number and fuel flow.

SECTION 04 - ENGINE PREPARATION

NOTE: Needle jets carrying the numbers 166, 159 or 169 in addition to the P-2 or P-4 and are not interchangeable. Be sure correct needles are used as specified for your snowmobile.

Main Jet System

PRINCIPLES OF OPERATION



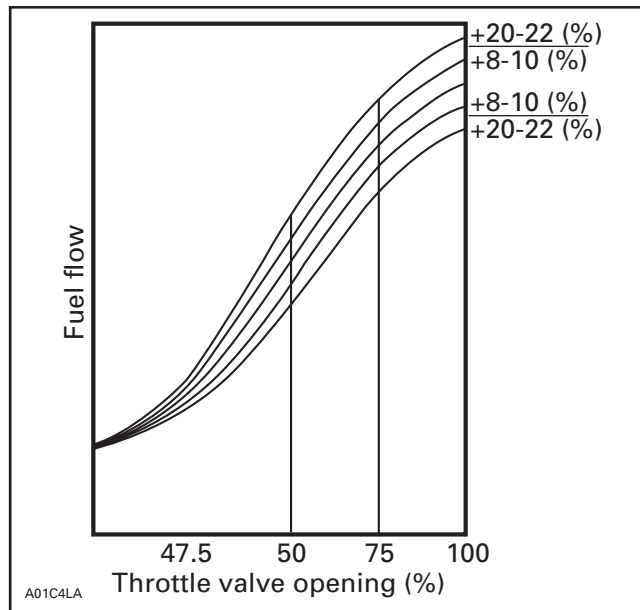
1. Jet needle
2. Metered here
3. Fuel
4. Air
5. Needle jet

The main jet system starts to function when the throttle is approximately 1/4 open. The mid range fuel is supplied by the main jet and regulated by the needle jet/jet needle combination. The main jet meters the fuel when the throttle is in the wide open position.

The main jets are available in sizes from number 50 to number 840. The size number corresponds to flow and not necessarily to hole size.

When experiencing erratic operation or overheating, check the main jet for dirt which can plug the orifice.

TUNING THE MAIN JET SYSTEM



Before operating the snowmobile, make sure all parts, including clutch and drive belt, are in good operating condition.

1. Operate snowmobile at wide open throttle for several minutes on a flat, well packed surface. Change main jet if snowmobile fails to achieve maximum RPM or labors at high RPM.
2. Continue to operate at wide open throttle and shut off ignition before releasing throttle. Examine exhaust manifold and spark plugs to determine if fuel/air mixture is too lean.

NOTE: Do not change jet sizes by more than one increment (step) at a time.

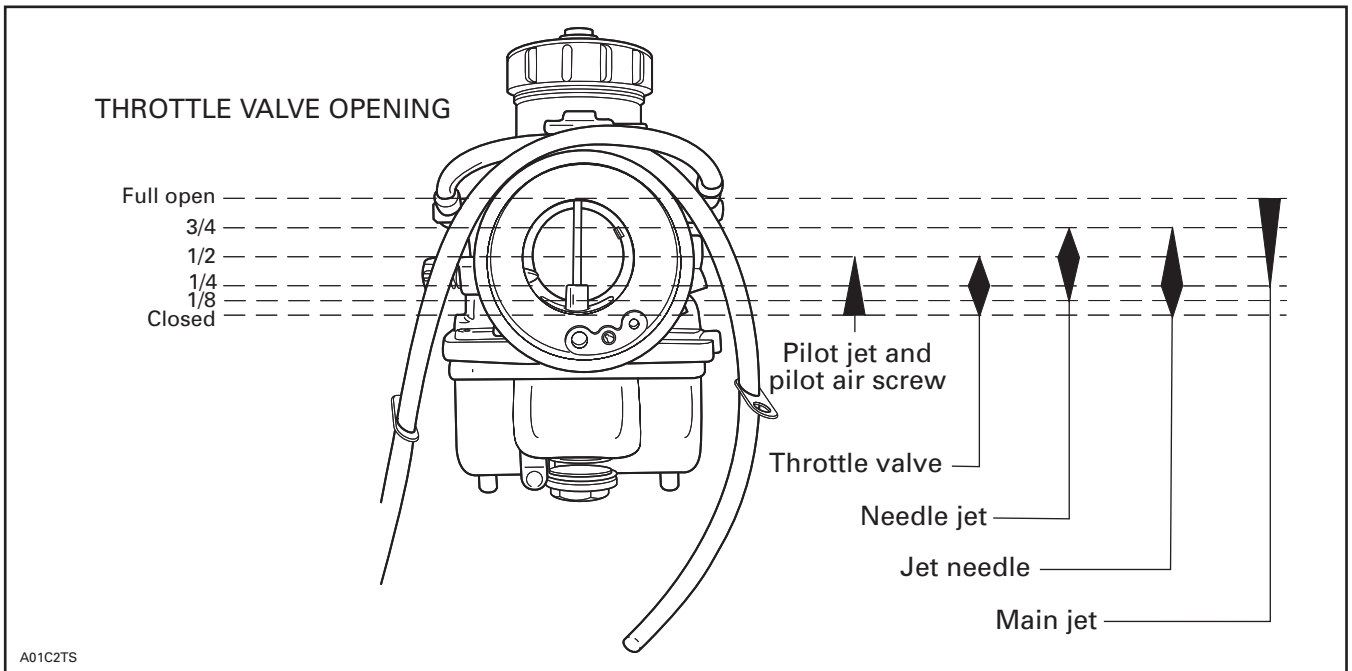
3. If the exhaust manifold or spark plug insulator is dark brown or black, the fuel/air mixture is too rich. Decrease jet size.
4. If the exhaust manifold or spark plug insulator is very light in color, the fuel/air mixture is too lean. Increase jet size.
5. If you cannot determine the color, proceed as if fuel/air mixture were too lean and increase jet size. If operation improves, continue to increase jet size to obtain peak performance. If operation becomes worse, decrease jet size to obtain peak performance.
6. After proper main jet is selected, recheck jet needle and needle jet.

Troubleshooting

When the carburetor setting is not correct for the engine, various irregularities are noticed. These can be traced to two causes as a whole:

1. When the air/fuel mixture is too rich:
 - a. The engine noise is full and intermittent. ("four stroking")
 - b. The condition grows worse when the enrichener is opened.
 - c. The condition grows worse when the engine gets hot.
 - d. Removal of the air cleaner will somewhat improve the condition.
 - e. Exhaust gases are heavy.
 - f. Spark plug is fouled.
2. When the air/fuel mixture is too lean:
 - a. The engine overheats.
 - b. The condition improves when the enrichener is opened.
 - c. Acceleration is poor.
 - d. Spark plug electrodes are melted.
 - e. The revolution of the engine fluctuates and a lack of power is noticed.
 - f. Piston seizure or scuffing occurs.

Functional Range Effectiveness in Relation to Throttle Opening



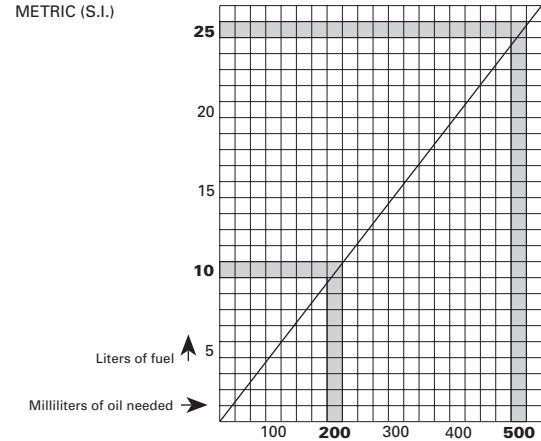
SECTION 04 - ENGINE PREPARATION

FUEL/OIL RATIO CHARTS

50/1

METRIC (S.I.)

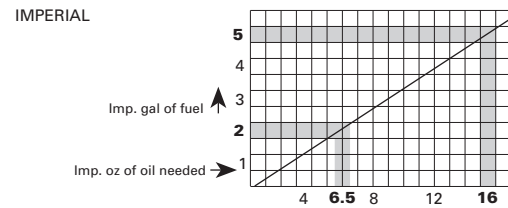
500 mL of oil + 25 L of fuel = 50/1



IMPERIAL

16 oz of oil + 5 Imp. gal of fuel = 50/1

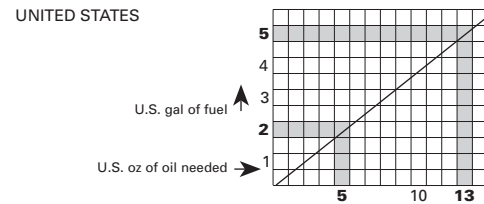
500 mL of oil + 5.5 Imp. gal of fuel = 50/1



UNITED STATES

13 oz of oil + 5 U.S. gal of fuel = 50/1

500 mL of oil + 6.6 U.S. of fuel = 50/1



A00A1WJ

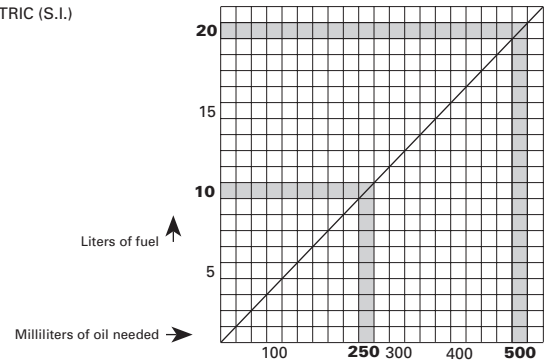
SECTION 04 - ENGINE PREPARATION

40/1

METRIC (S.I.)

500 mL of oil + 20 L of fuel = 40/1

METRIC (S.I.)

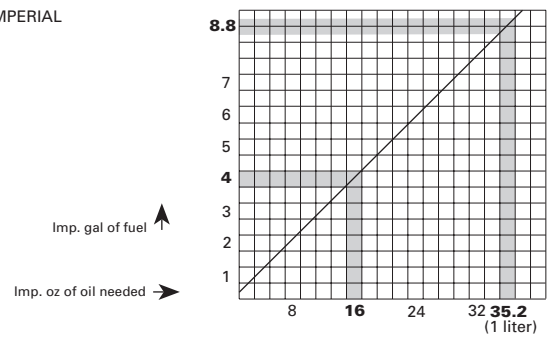


IMPERIAL

16 oz of oil + 4.0 Imp. gal of fuel = 40/1

500 mL of oil + 4.8 Imp. gal of fuel = 40/1

IMPERIAL

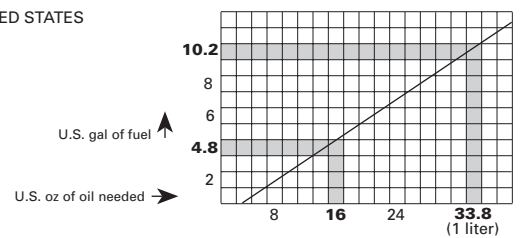


UNITED STATES

16 oz of oil + 5.1 U.S. gal of fuel = 40/1

500 mL of oil + 5.3 U.S. of fuel = 40/1

UNITED STATES



A00A2WJ

SECTION 04 - ENGINE PREPARATION

30/1

METRIC (S.I.)

500 mL of oil + 15 L of fuel = 30/1

IMPERIAL

16 oz of oil + 3 Imp. gal of fuel = 30/1

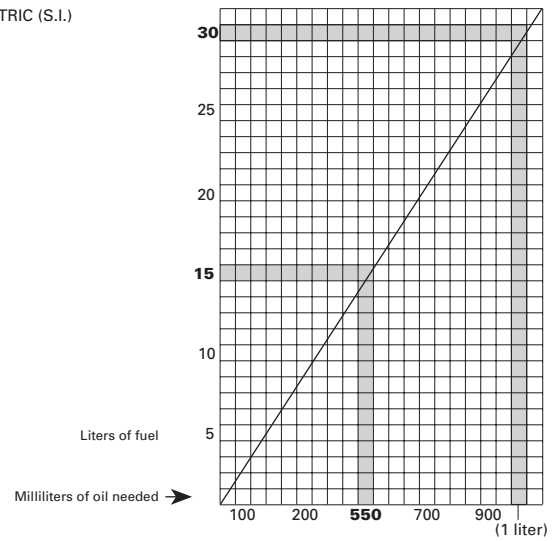
500 mL of oil + 3.3 Imp. gal of fuel = 30/1

UNITED STATES

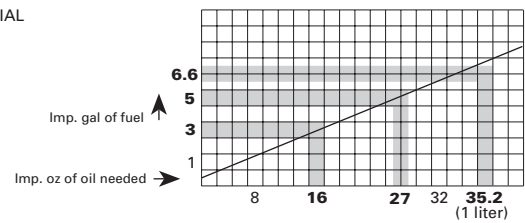
13 oz of oil + 3 U.S. gal of fuel = 30/1

500 mL of oil + 4 U.S. of fuel = 30/1

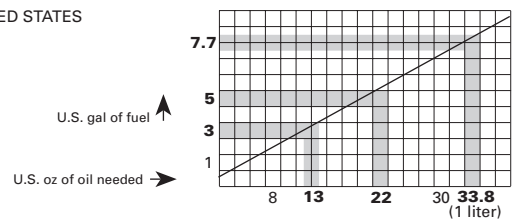
METRIC (S.I.)



IMPERIAL



UNITED STATES



A00A2XJ

SECTION 04 - ENGINE PREPARATION

25/1

METRIC (S.I.)

500 mL of oil + 12.5 L of fuel = 25/1

IMPERIAL

16 oz of oil + 2.5 Imp. gal of fuel = 25/1

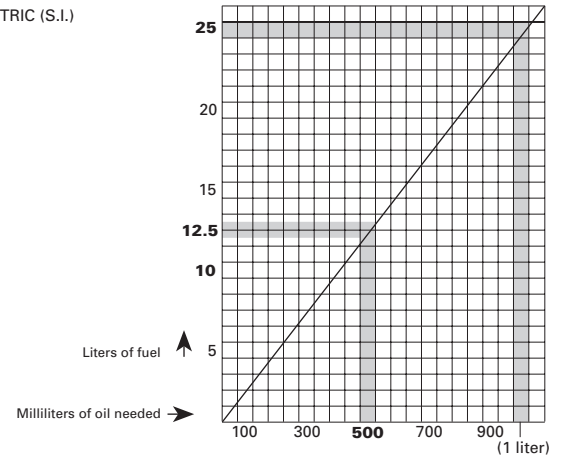
500 mL of oil + 2.7 Imp. gal of fuel = 25/1

UNITED STATES

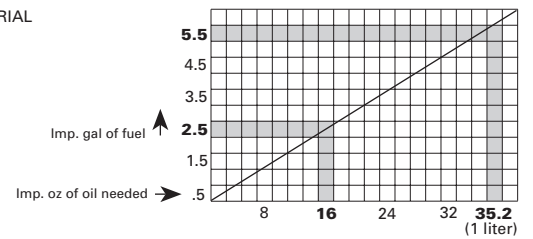
15 oz of oil + 2.8 U.S. gal of fuel = 25/1

500 mL of oil + 3.2 U.S. of fuel = 25/1

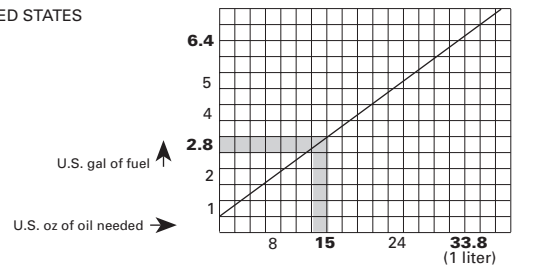
METRIC (S.I.)



IMPERIAL



UNITED STATES



A00A2YJ

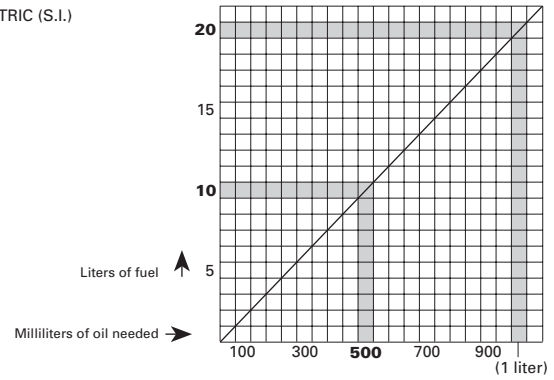
SECTION 04 - ENGINE PREPARATION

20/1

METRIC (S.I.)

500 mL of oil + 10 L of fuel = 20/1

METRIC (S.I.)

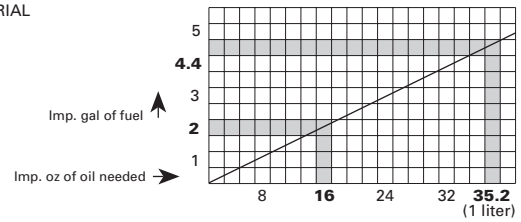


IMPERIAL

16 oz of oil + 2 Imp. gal of fuel = 20/1

500 mL of oil + 2.2 Imp. gal of fuel = 20/1

IMPERIAL

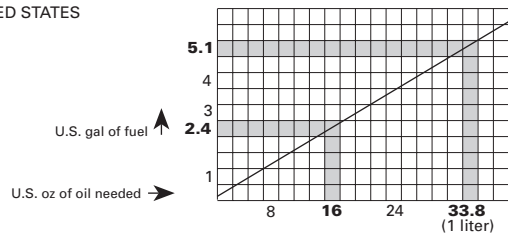


UNITED STATES

16 oz of oil + 2.4 U.S. gal of fuel = 20/1

500 mL of oil + 3.2 U.S. of fuel = 20/1

UNITED STATES



A00A2YJ

H.A.C. HIGH ALTITUDE COMPENSATOR

Theory

The high altitude compensator is a mechanical device designed to vary the pressure in the float bowl chamber relative to air density. Air density is affected by variations in elevation and air temperature. As the elevation goes up from sea level, the air density decreases and as temperatures increase air density also decreases. When going down in elevation, air density increases and as temperatures get lower, air density also increases. The H.A.C. increases or decreases the amount of air pressure in the float bowl, thus changing the fuel flow into the carburetor venturi. The unit is connected to the carburetor via several passages, which control the atmospheric pressure in the float bowl chamber. As a snowmobile goes up in altitude without a H.A.C., the air density decreases, but the same amount of fuel is delivered to the engine. The amount of oxygen available to the engine is lower, so we have a vehicle that runs rich. The H.A.C. is designed to lower the pressure in the float bowl chamber at higher altitudes and increase the pressure at lower elevations. The unit is lightweight and requires no battery or separate control device.

The fuel delivery rate of the carburetor depends on the jet sizes and on the pressure acting on the fuel. This pressure results from the pressure difference between float chamber and fuel exit in the carburetor venturi (needle jet). Pressure increase in the float chamber leads to richer mixture, pressure decrease to leaner mixture. This effect is utilized in the Automatic High Altitude Compensator (H.A.C.).

The necessary pressure reduction in the float chamber for mixture leaning is taken from the venturi depression. This low pressure is guided via connection 1 into a pressure attenuator consisting of the variable jets D1 and D2. By the air flow through the jets D1 and D2 the pressure is reduced to a certain ratio and fed into the float chamber via connection 2. The connection 3 leads to the atmosphere via a vent tube.

The air in the sealed diaphragm chamber 6 expands more or less, depending on the air density and displaces via a diaphragm 7 the profiled corrector needle 8 in the jet bores D1 and D2.

With decreasing air density the jet passage area of D2 increases and the jet passage area of D1 decreases. In consequence the pressure in the carburetor float chamber decreases and the fuel / air mixture gets leaner.

The sealed chamber 6 is filled with dry air. Moisture in the chamber can cause freezing which would lead to an incorrect mixture. For this reason, no adjustments to the H.A.C. are recommended. The screw 5 is sealed and should not be tampered with. If the H.A.C. is out of adjustment, damaged or tampered with, a new H.A.C. unit should be installed.

Application

The carburetors must be adapted for use with the H.A.C. There must be a connection to provide venturi pressure and the air jet main opening is plugged. A small hole is drilled into the top of the air jet passageway. 1996 models use much richer carburetor jets because the H.A.C. is providing reduced float bowl pressures (thus leaner mixtures) at all temperatures and altitudes.

Example

	583 H.A.C. SUMMIT	583 MX Z
Main jet	330/340	280/260
Needle jet	480 Q-6	224 AA-2
Pilot jet	75	60

The vent tube on connection 3 is routed to the atmosphere below the carburetors. This is to help prevent snowdust ingestion, and provides a drain for any excess fuel in the system from a machine tip over.

The system is very sensitive to air screw adjustments. 1/8 turn will have a large effect on low speed tuning. The system responds to other tuning changes (main jet) similar to a non H.A.C. carburetor. The only adjustments required on the Summit may be an idle speed reduction for lower elevations.

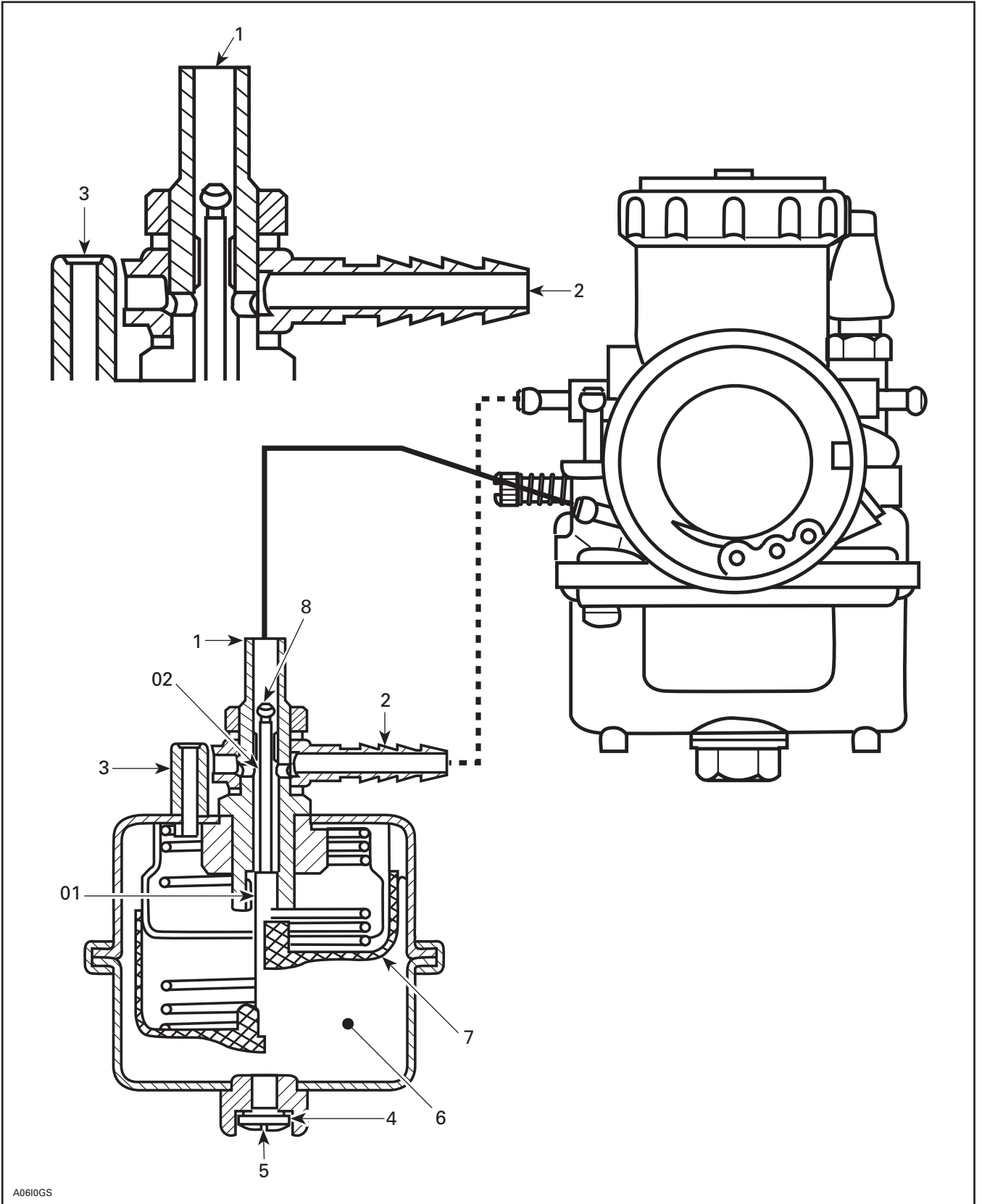
Hose lengths from the carburetor to H.A.C. should not be altered. Shorter hoses will not affect the calibration significantly, but care must be used to avoid kinking of the hoses. Too long of a hose will cause a rich condition, because of reduced signal strength.

SECTION 04 - ENGINE PREPARATION

Troubleshooting

SYMPTOM	POSSIBLE CAUSE
Lean Mixture	<ol style="list-style-type: none">1. Plugged hole in air jet inlet2. H.A.C. frozen
Rich Mixture	<ol style="list-style-type: none">1. H.A.C. connection to atmosphere is plugged2. Leakage in H.A.C. to carburetor tube3. Leak in H.A.C. sealed chamber4. H.A.C. frozen

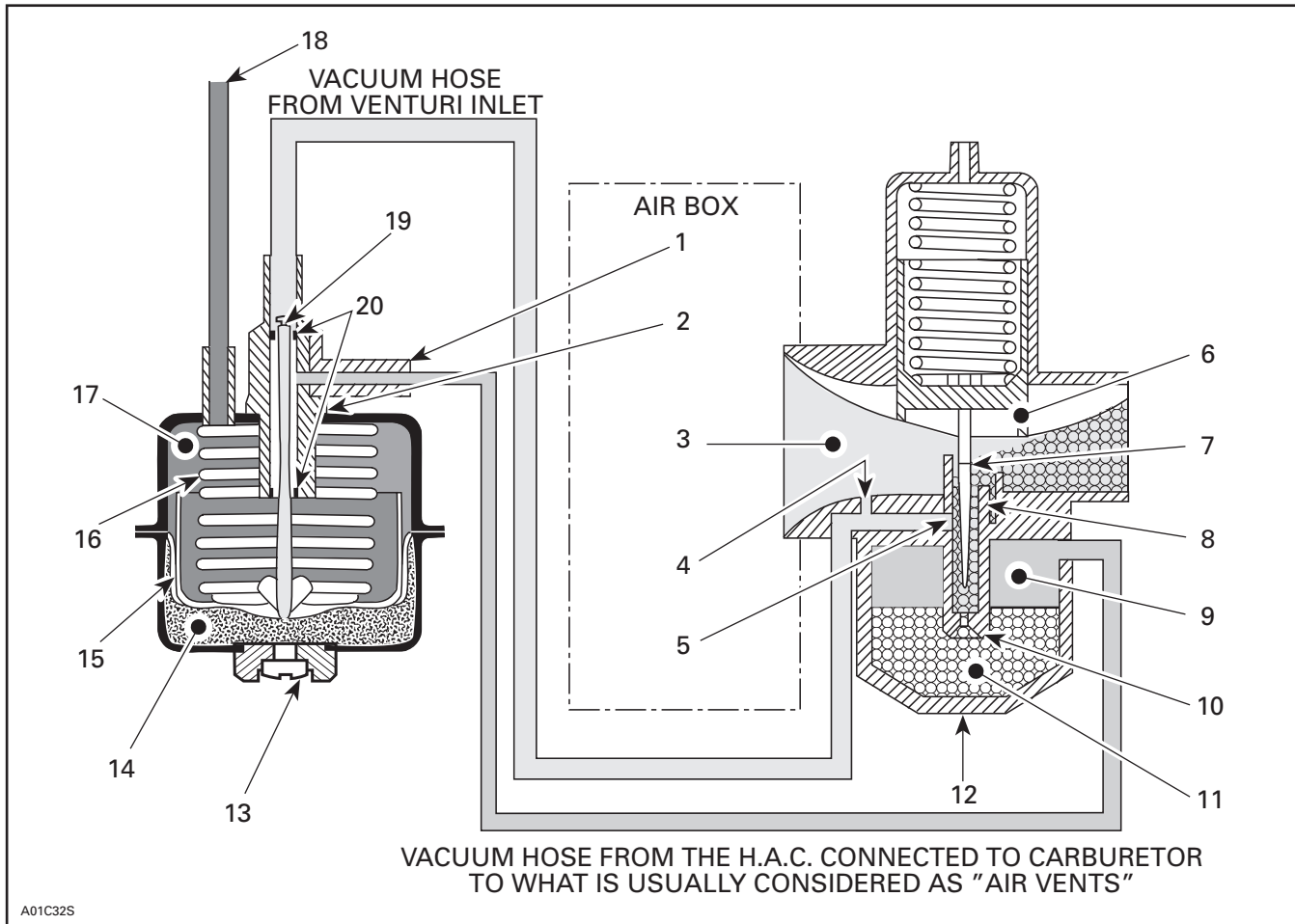
SECTION 04 - ENGINE PREPARATION



A0610GS

SECTION 04 - ENGINE PREPARATION

HAC Operation Circuit



1. Carburetor vacuum hoses manifold
2. Choke jets manifold
3. Vacuum generated by the engine induction
4. Idle air by-pass (very small hole)
5. Hac venturi vacuum inlet from needle jet diffuser
6. Throttle slide
7. Jet needle
8. Needle jet
9. Pressured room controlled by hac
10. Main jet

11. Float bowl fuel
12. Carburetor float bowl
13. Sealed room plug
14. Sealed room
15. Diaphragm
16. Diaphragm return spring
17. Atmospheric pressured room
18. Atmospheric pressure
19. Vacuum jet needle (attached to diaphragm base)
20. Vacuum choke jet

IGNITION SYSTEMS, SPARK PLUGS

Two-stroke engines in snowmobiles rely on an electric spark to initiate combustion of the fuel/air charge which has been inducted into the cylinder. For the engine to operate efficiently, the spark must be delivered at precisely the right moment in relation to the position of the piston in the cylinder and the rotational speed of the crankshaft.

Additionally, the spark must be of sufficient intensity to fire the fuel mixture, even at high compression pressure and high RPM.

It is the function of the ignition system to generate this voltage and provide it to the spark plug at the correct time.

The Nippondenso capacitor discharge ignition (CDI) system has magnets located on the crankshaft flywheel. AC voltage is induced in the generating coil(s) as the poles of the magnets rotate past the poles of the coils. Timing is controlled by a trigger coil or the position of the coil poles relative to the magnet poles, which are directly related to piston position. The CD (or amplifier) box contains the electronic circuitry to store and control the initial voltage and deliver it to the ignition coil (and then the spark plug) at the correct moment. The ignition coil is a transformer that steps up the relatively low voltage, 150-300 V, of the generating coil to the 20,400 – 40,000 volts necessary to jump the spark plug gap and initiate the burning of the fuel/air mixture in the combustion chamber.

Maximum power from a given engine configuration is produced when peak combustion chamber pressure (about 750 P.S.I.) takes place at about 15° of crankshaft rotation A.T.D.C. Normal combustion is the controlled burning of the air/fuel mixture in the cylinder. The flame is initiated at the spark plug and spreads to the unburned mixture at the edges of the cylinder.

This flame front travels through the cylinder at about 100 feet per second. In order to achieve maximum pressure at about 15° A.T.D.C., the spark must occur about 15° before T.D.C. Complete combustion will finish at about 35° A.T.D.C. The actual amount of spark advance B.T.D.C. is dependent upon bore size, combustion chamber shape, operating RPM, mixture turbulence and the actual flame speed.

Flame speed is directly proportional to piston speed in an almost linear fashion. Though it is not completely understood why this relationship exists, it is thought to be related to intake speed and mixture turbulence. Hence, flame speed increases as RPM increases. It also increases as the air/fuel ratio becomes leaner.

Because the flame speed is slower at lower RPM's, more advance at low RPM is necessary for maximum performance. Advancing the spark too much B.T.D.C. for the needs of the engine will cause the engine to go into detonation.

The optimum ignition would then have timing significantly advanced at lower RPM, but would retard the timing at higher RPM to keep the engine out of detonation. Generally, as the ignition timing is advanced, the low end mid range power will be improved and the peak power will be moved to a lower RPM. Retarding the timing will generally reduce low and mid range power but may allow jetting to be leaner and increase peak power. Peak power will be moved to a higher RPM. These are generalizations and ignition timing must be optimized depending on engine design, RPM range and operating conditions.

Ignition advance on Rotax engines is measured by a linear distance of piston travel B.T.D.C. A dimension taken through a straight spark plug hole in the center of the head is a direct measurement. A dimension through an angled plug hole on one side of the head is an indirect measurement. A direct measurement can be converted to degrees of crankshaft rotation by the appropriate formulas. Initial ignition timing procedures can be found in the *Shop Manual* for the particular model being worked on.

Starting with most 1990 Ski-Doo models, a Nippondenso CDI system with only one generating coil was introduced. This system is identified by having only two wires running from the stator plate to the CD box.

Ignition Timing

Direct Measurements v.s. Crankshaft Angle

$$\cos A = - \frac{P^2 + P^2 - L^2}{2PR}$$

$$T = L + R(1 - \cos A) - \sqrt{L^2 - (R \sin A)^2}$$

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where:

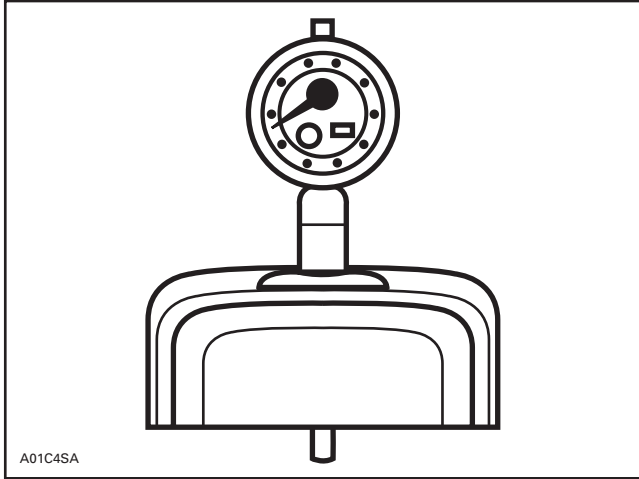
A = ignition advance in degrees of crankshaft rotation

T = ignition advance in millimeters B.T.D.C.

R = engine stroke divided by 2 (mm)

L = connecting rod length (mm)

$P = R + L - T$



DIRECT MEASUREMENT B.T.D.C.

Starting with most 1993 Ski-Doo models, a different version of Nippondenso CDI system is being used. This system has 12 magnets on the flywheel and 12 poles or ends on the stator plate. This is referred to as a 6 pole system. Power for spark ignition is produced by generating coils and power for the lighting system is produced by the lighting coils.

Ignition timing is controlled by the position of a trigger coil which is mounted on the outside of the flywheel. A trigger coil is a small pick-up coil that sends a signal to the CD box when a protrusion on the flywheel passes by the trigger coil. Moving the trigger coil opposite to the direction of crankshaft rotation will advance the ignition timing. This ignition system has quite a bit of advance built into the timing curve. See the accompanying graph to see the exact curve. All engines using this ignition have the same timing curve but the initial setting will vary depending on engine type.

The three cylinder uses a slightly different version of this ignition. The generating coils are wired to produce a high speed and a low speed generating coil circuit.

Tachometer Selection

A different tachometer type is needed for different ignition types. The number of poles on the stator and flywheel determine the number of pulses generated per revolution. The tach must be matched to the ignition type. Two types of tachometers are used on Ski-doo models. Tachometers with no labeling are usually 4 pulse tachometers. 6 pulse tachometers are usually labeled as such on the dial face.

4 PULSE TACHOMETERS

Bosch breaker points
Bosch CDI polar fire, '72-'78
Bosch CDI racing, '79-'82
ND dual and single generating coil, 4 pole, '81-'95
ND 4 pole racing
(ND = Nippondenso)

6 PULSE TACHOMETERS

Bosch 6 pole CDI, 77-80 Blizzard
Ducati CDI 170 and 240 watt, '92 and newer
ND 12 pole CDI 220 watt, '93 and newer

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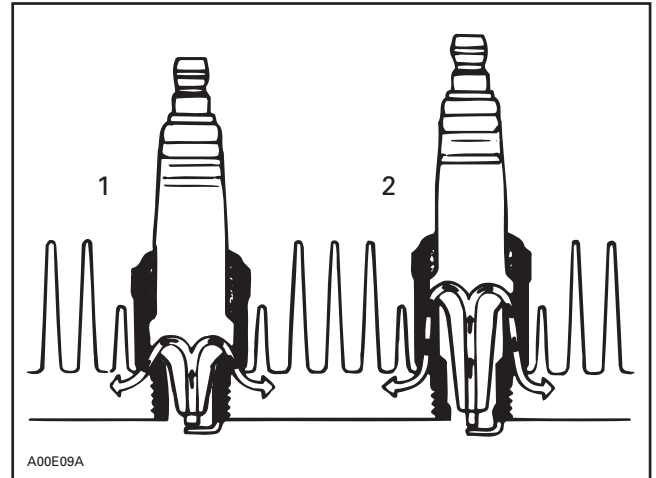
ENGINE TYPE	STROKE mm (in)	LENGTH mm (in)
253	61 (2.402)	115 (4.527)
377	61 (2.402)	115 (4.527)
447	61 (2.402)	115 (4.527)
247 (fan cooled)	66 (2.598)	132 (5.196)
640 (fan cooled)	70 (2.756)	132 (5.196)
670	70 (2.756)	132 (5.196)
277	66 (2.598)	120 (4.724)
354	61 (2.402)	120 (4.724)
454	61 (2.402)	120 (4.724)
462	61 (2.402)	120 (4.724)
464	61 (2.402)	120 (4.724)
467	61 (2.402)	120 (4.724)
494	66 (2.598)	125 (4.921)
503 (fan cooled)	61 (2.402)	120 (4.724)
532	64 (2.520)	125 (4.921)
534	64 (2.520)	125 (4.921)
536	64 (2.520)	125 (4.921)
537	64 (2.520)	125 (4.921)
582	64 (2.520)	125 (4.921)
467	61 (2.402)	120 (4.724)
599	61 (2.402)	120 (4.724)
643	68 (2.677)	125 (4.921)
779	68 (2.677)	125 (4.921)
699	61 (2.402)	120 (4.724)
809	68 (2.677)	125 (4.921)

Spark Plug Heat Range

Spark plug heat ranges are selected by measuring actual combustion chamber temperatures. A colder spark plug, one that dissipates heat more rapidly, is often required when engines are modified to produce more horsepower.

The proper operating temperature or heat range of the spark plugs is determined by the spark plug's ability to dissipate the heat generated by combustion.

The longer the heat path between the electrode tip to the plug shell, the higher the spark plug operating temperature will be — and inversely, the shorter the heat path, the lower the operating temperature will be.



1. Cold
2. Hot

A “cold” type plug has a relatively short insulator nose and transfers heat very rapidly into the cylinder head.

Such a plug is used in heavy duty or continuous high speed operation to avoid overheating.

The “hot” type plug has a longer insulator nose and transfers heat more slowly away from its firing end. It runs hotter and burns off combustion deposits which might tend to foul the plug during prolonged idle or low speed operation.

Generally speaking, if you have increased horsepower by 10-15%, you will have to change to the next colder heat range spark plug.

Most Ski-Doo's are equipped stock with NGK BR-9ES spark plugs. These are resistor-type plugs which help reduce radio frequency interference. In racing applications, the resistor feature is not required. The typical spark plug used in a modified Formula engine is an NGK B10ES or B10EV.

SECTION 04 - ENGINE PREPARATION

Design Symbols Used on NGK Spark Plugs

First letter prefix for thread and hexagon size			Second and third letter prefix for construction feature, except single prefix		Heat rating number		First letter suffix for thread: reach		Second letter suffix for construction feature, etc.	
Letter	Thread size	Hexagon size	Letter	Construction feature			Letter	Thread reach	Letter	Construction feature, etc.
A	18 mm	25.4 mm	B	Hexagon size 20.6 mm	2	Hotter type		12.0 mm (thread dia. 18 mm)	A	-Specials
B	14 mm	20.6 mm	C	Hexagon size 16.0 mm	4			9.5 mm (thread dia. 14 mm)	B	-Special plug for Honda vehicles
C	10 mm	16.0 mm	G	Hexagon size 23.8 mm	5			22.5 mm (thread dia. PF 1/2 in-14 mm)	C	-Competition type
D	12 mm	18.0 mm	L	Compact type (SHORTY)	6			16.0 mm (thread dia. 7/8 in-18mm)	G	-Racing plugs, center electrode of nickel alloy
F	7/8 in-18	23.8 mm	M	Compact type (BANTAM)	7			11.2 mm	GV	-Racing plugs, center electrode of precious metal
G	PF 1/2 in-14	23.8 mm	P	Projected ineulator nose type	8			12.7 mm (racing type 18.0 mm)	N	-Racing plugs, nickel electrode
			R	Resistor type	9	(85)		19.0 mm (racing type 18.0 mm)	P	-Racing plugs, platinum ground electrode
			S	Shielded type	10	(95)		Conical seat type	R	-Shielded resistor plugs
			U	Surface discharge type	11	(105)		A - F 10.9 MM	S	-Copper core center electrode (Super)
					12			B - F 11.2 MM	V	-Center electrode of precious metal
					13	Coder type		BE - F 17.5 MM	W	-Tungsten electrode
					14				X	-Series gap plugs
									Y	-V-Grooved center electrode
										Multiple ground electrodes type
										K 2 T 3
										M 2 Q 4
										Others Expect for above letters, there are special plugs of J, L, Z, etc

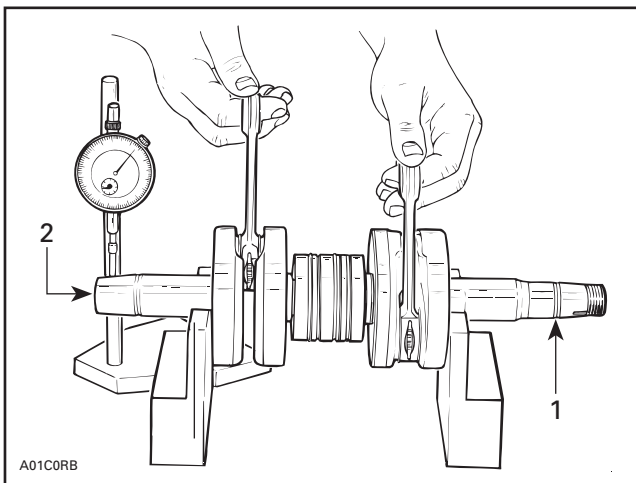
*Standard regulation is drawn here. There also exist a few extraordinary symbole.

A01E1GS

STOCK CLASS PREPARATION

NOTE: Any machining and/or grinding is illegal in stock class racing. Keep your machine legal !

1. Remove and disassemble the engine according to correct *Shop Manual* procedures.
2. With the crankshaft resting in the lower half of the crankcase, set up a dial indicator and check the run out of the crankshaft at both ends. You should see no more than 0.05 mm (0.002 in) run out. If you have the capability, adjust the crankshaft as close to perfect as possible.



1. Measure behind the key
2. Measure at 6 mm (1/4 in) from edge

3. Set your cylinder base gaskets and cylinders on the upper half of the crankcase, and lightly torque the cylinders to the half. Be sure to install exhaust manifold on the cylinders before tightening them to the upper crankcase half to ensure the same position of the cylinders on final assembly.

Check the match of the gaskets and cylinders to the base ; match them perfectly with a die grinder in the areas of transfer port passages. Also check for any over lap of the exhaust manifold gaskets where the exhaust manifold joins the cylinders. Before reassembling make sure that parts are free of any dust or particles.

4. Check ports alignment between the cylinder casting and the sleeve. If the sleeve is off in one direction on all ports, heat the cylinder in the oven at 350°F for 45 minutes. Drop a rag that has been soaked in ice water into the sleeve, and quickly align the sleeve with the cylinder casting. Apply constant pressure to the top of the sleeve while letting the sleeve and cylinder cool down at room temperature.

5. Check piston to cylinder clearances, ring end gap, cylinder taper and out-of round.
6. Assemble the engine using the correct sealants where needed.

Rotary valve timing should be set with the closing edge as close to specs as possible or slightly higher.

NOTE: Refer to chart page.

7. The engine should be pressure-tested for air leaks. It should hold 6 PSI for 6 minutes with no more than a 1 PSI/min. loss.
8. Lube the rewind and inspect the rope for frays or cuts.
9. Oval racing must use taillight, brake light element on continuously (jumper from taillight wire terminal to brake light terminal on taillight assembly), regulator, tachometer, and temperature gauge.
10. Adjust ignition timing to the advanced limits. (.010" advance from spec.)

1996, 1997 AND 1998 IGNITION TIMING (BTDC) @ 6000 RPM	
454 Except 1998 MX Zx	1.48 mm (.058 in)
583	1.75 mm (.069 in)
670 Except 1996 Summit X	1.93 mm (.076 in)
779	2.11 mm (.083 in)
599	2.18 mm (.086 in)
494	1.81 mm (.071 in)
699	2.08 mm (0.82 in)
809	2.11 mm (0.83 in)

11. Synchronize carburetors so that they open precisely together and ensure that the cut aways of the slides clear the inlet bores of the carburetors. After carb adjustment, adjust oil injection pump.

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12. On RAVE valve-equipped engines, check for free movement of the RAVE valve mechanism. Check the passageways between valve piston and exhaust port for any carbon build-up.

Adjust RAVE preload. It is better to have the valve open a little earlier than later.

13. Use non resistor spark plugs — B9ES, B9EV, B10ES, B10EV of heat range required.

14. Use premium fuel 93 octane.

NOTE: Pump fuels can be oxygenated or contain alcohol. Have your fuel tested prior to the race.

Do not use fuel de-icers.

15. Tie wrap ignition wire connectors together.

16. Adjust carburetors for atmospheric conditions. (See carburetion section.)

17. Break in a new engine before racing it. Performance can be gained by getting some run time on the engine. Ten hours of break-in is recommended.

Notes Regarding Engine Modification

1. Tunnel porting

This procedure refers to the grinding out of the crankcase from the rotary valve inlet towards the transfer ports at the cylinder base. The effort here streamlines the flow from the rotary valve inlet to the cylinders. This modification benefits engines running at high RPM (8000 and up).

When installing larger carburetors, opening of the rotary valve cover and the crankcase openings may also be included in a tunnel porting job to match the new carburetor bore. When installing carburetors larger than 42 mm, however, do not enlarge the opening at the valve side of the cover beyond 42 mm. Taper the opening smoothly from the carburetor flange down to 42 mm on the disc valve side. The opening in the crankcase should match it at 42 mm and “trumpet” out towards the transfer ports.

Tunnel porting should be done only by accomplished engine modifiers.

2. Porting

When porting cylinders, remove any burrs, rough spots or irregularities you may find in passages or port windows, but do not alter the outlet angle of any transfer ports. The ports and their passages should be left smooth and clean. The only port worth spending time polishing is the exhaust port.

If you are changing any port dimensions, be sure to chamfer all edges of the port windows when you are finished.

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SECTION 05 - TRANSMISSION SYSTEM

BASIC FUNCTIONS OF THE SYSTEM

The TRA Clutch

We call it "a clutch" but that set of pulleys is a lot more than simply a clutch. Once the system reaches its low ratio speed, the clutch function ends and the pulleys become a completely automatic transmission searching for the highest gear ratio that can be pulled at the engine's given output. In the case of our TRA clutch, the pulleys will begin shifting from a 3.8:1 ratio in low gear to a .8:1 overdrive ratio in high gear. That is a lot of ratio change. A typical six-speed motorcycle gearbox, for instance, will change from a 2.38:1 ratio in low gear to a .96:1 overdrive ratio in high gear.

The ratio changing is done by opening and closing a drive and driven pulley and forcing a fixed length drive belt to turn around different diameters on each pulley. The force used to "close" the engine or drive pulley is centrifugal force. As a radial force, the centrifugal force must be converted to an axial force which can be controlled and used to move the sliding half of the drive pulley. It is the job of the ramps, rollers and lever arms to convert and control the centrifugal force.

Centrifugal force is simply the outward acceleration of a body swung around an axis. Mathematically, centrifugal force in pounds is equal to:

$$\frac{WV_2}{gR}$$

where:

W = weight in pounds

V = linear velocity in ft per second

g = acceleration of gravity
(32.174 ft/sec.²)

R = radius of the center of mass from the axis of rotation measured in feet

This formula can be converted for easier application in our use to $F = (.00034084) WRN^2$

where:

F = centrifugal force in pounds

W = weight in pounds

R = radius the weight rotates at in feet

N = RPM

As the formula illustrates, we can control the size of the centrifugal force by varying the size of the weight we are rotating and by varying the radius of the circle we rotate the weight around. The largest influence on the force, however, is the rotational speed because the force increases with the **square** of this speed. This is important to realize when one begins working with high RPM competition engines. Use and control of this centrifugal force is discussed in the following sections.

Each engine will produce its minimum horsepower at a particular RPM. Power will decrease at engine speeds on either side of the peak power RPM. The usable width of the power band will dictate where the clutch must be calibrated to keep the engine performing at its peak. In the power curve the mildly-tuned engine has its peak horsepower of 64 at 5800 RPM and has a usable power band width of 1500 RPM. The race tuned engine produces its peak of 92 horsepower at 9300 RPM, but only has a usable power band width of 400 RPM. The race engine will have to have a much more accurately calibrated clutch to be able to keep the engine running within a 400 RPM range compared to the 1500 RPM wide range of the mildly-tuned engine.

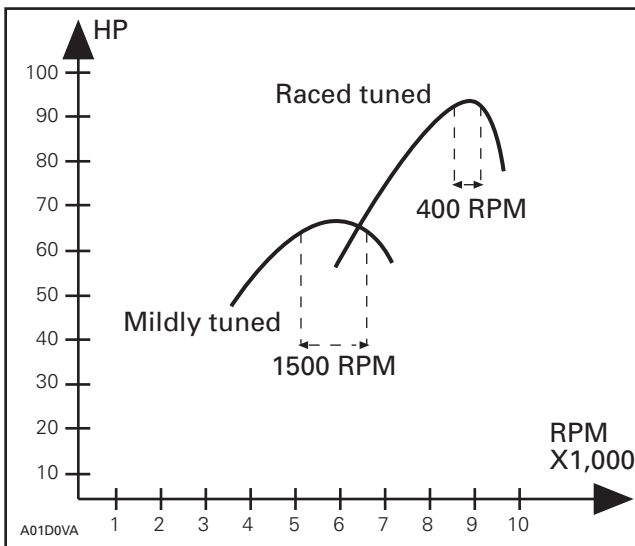
The goal of clutch calibration is to keep the engine, at full throttle at its peak horsepower RPM and, at the same time, to select the highest possible gear ratio as dictated by the load on the drive axle. The speed diagram illustrates what the goal of good clutch calibration is.

In the speed diagram, the inclined line labelled "low ratio" indicates the vehicle speed at each RPM when locked into the 3.8:1, "low gear" ratio. At 8000 RPM, the vehicle speed would be just under 20 MPH if held in this ratio. The "high ratio" line compares vehicle speed with engine RPM when the transmission is locked into the .8:1 "high gear". At this ratio, the vehicle speed would be just under 80 MPH when the engine is turning 8000 RPM. In calibrating the clutches, the objective will be to maintain as horizontal a line as possible between the low ratio and high ratio lines. This transition line or "shift speed" must be as close as possible to the engine peak horsepower RPM.

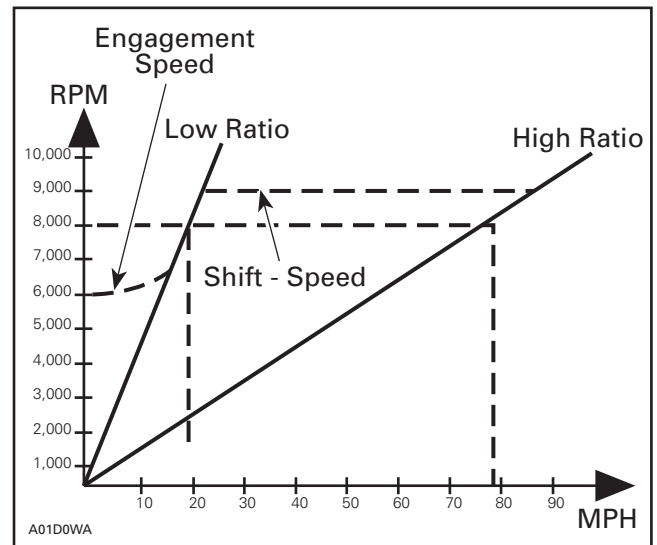
Engagement speed of the clutch is always set as **low** as possible to avoid track slippage and to prolong drive belt life. The clutch must be engaged at an RPM that is high enough, however, that the engine will be producing enough horsepower to overcome drag and allow acceleration without bogging. In the speed diagram, the acceleration period between 0 and about 20 MPH illustrates the actual clutching period of the transmission. During this time the rollers in the clutch are on the initial angles of the clutch ramps and the drive belt is actually slipping in the engine pulley as engine and vehicle speeds increase to about 9000 RPM at 25 MPH. The transmission then begins upshifting to the high ratio at a constant engine RPM. Engine speed should not increase above the calibration RPM until the high ratio is achieved. If the engine RPM exceeds the calibration RPM once the high gear position is achieved, it is an indication that the chaincase gearing is too low. If clutch calibration is accurate, engine speed should never vary more than 50 RPM from the peak power RPM. This is the optimum shift curve.

The following section will discuss each of the "tunable" components of both the drive and driven pulleys and provides some insight and data necessary for tuning the system.

POWER CURVES MILDLY TUNED VS. RACE TUNED



SPEED DIAGRAM ENGINE SPEED VS. VEHICLE SPEED



EFFECTS OF THE DRIVE PULLEY LEVER ARM, ROLLER AND ROLLER PIN WEIGHT

As you have seen in the formula defining centrifugal force, the force increases directly with the weight of the components involved. If you want to increase the centrifugal force, therefore, the shift force, it is a simple matter to increase the weight of the pressure levers. If the overall RPM is too high, a heavier lever arm or roller pin could be installed. The opposite would apply if the RPM is too low.

The major factor controlling centrifugal force is engine RPM. Because the force increases with the square of this speed, you can quickly have too much force if heavy weights are used on a clutch fitted to a high RPM engine. Because of this relationship, you will find heavy weights used on low RPM, high torque engine types and much lighter weights used on the high RPM engines.

The effect of the weights will always be greater at high RPM, and at higher ratios. This is true because of the relation of the force to the square of the engine speed. Also the radius from the axis of rotation to the center of mass of the counterweights increases as the roller is allowed to move down the ramps. As this radius increases, the centrifugal force increases directly. Addition of weight will affect engagement speed very little compared to the effect the weight will have at mid-range to top speed.

SECTION 05 - TRANSMISSION SYSTEM

Minor changes in weight are accomplished by using various weight roller pins. The effects of adding weight are illustrated in the following illustration. The three curves show the engine RPM increasing from engagement speed (4000 RPM) to about 6500 RPM which is achieved at about 30 MPH. From this point on, if calibration is accurate, there is no change in engine RPM as the vehicle speed increases. From the machine standing at rest to about 30 MPH, belt slippage and other factors are involved that allow the engine to get "on the power".

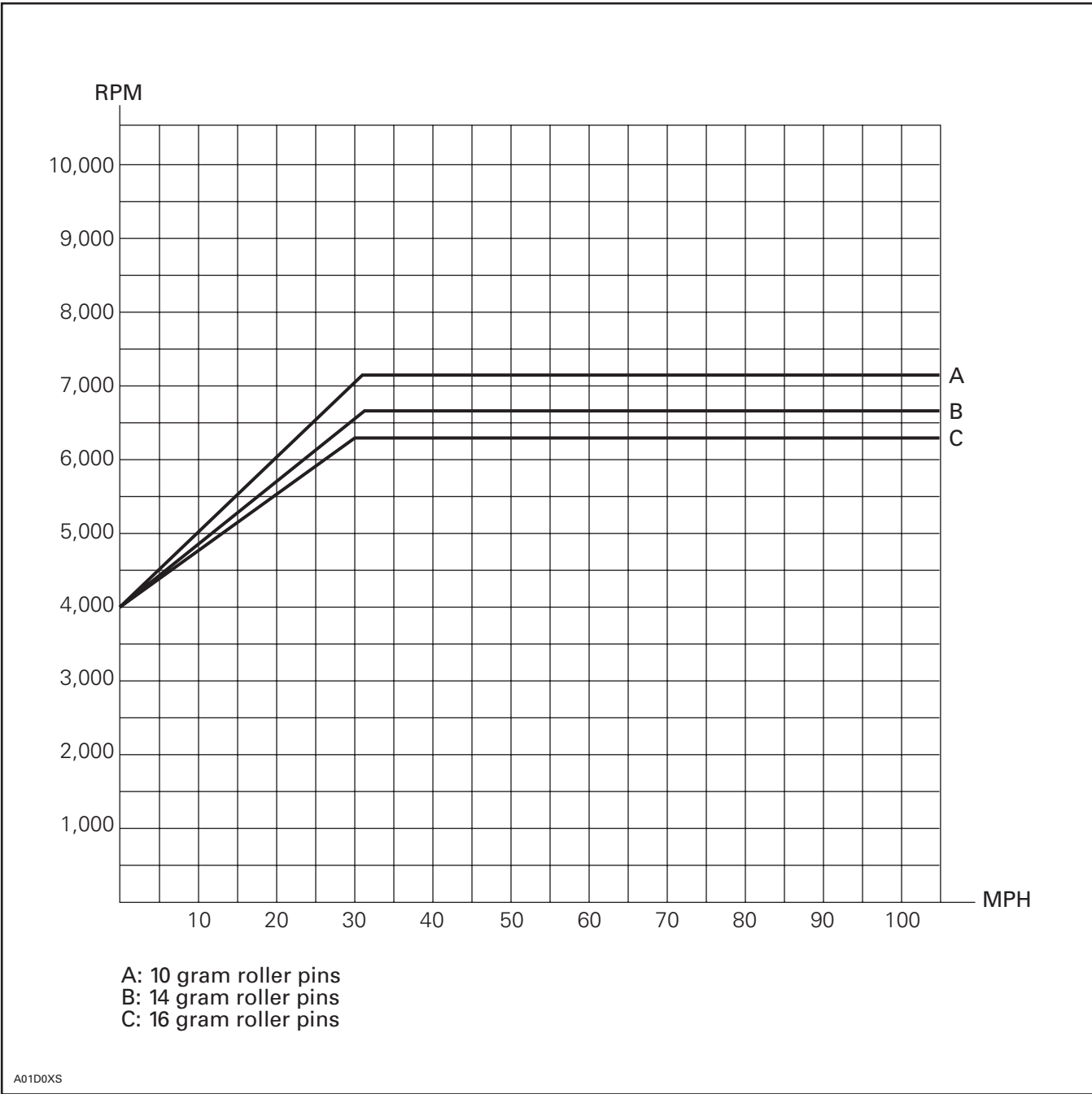
Curve "A" shows a clutch set up with three 10-gram type roller pins. This amount of weight will govern the engine to 7200 RPM and allow engagement of the clutch at 4000 RPM.

Curve "B" illustrates the effect of exchanging the three 10-gram pins for three 14-gram roller pins. The additional weight has virtually no effect on engagement speed but pulls the peak RPM of the engine down to 6800 RPM.

Curve "C" illustrates the effect of using three 16-gram roller pins. Again, the additional weight has little effect on the engagement RPM but further reduces the top RPM to 6400 RPM. For example, by adding 2 grams per arm for a total weight increase of 6 grams on an engine turning at around 7500 RPM, there would be about a 200 RPM decrease in full power engine speed — approximately the same effect as going 1 "clicker" position lower.

On a high RPM race engine like our twin track and Formula III sleds, it may only take a 1 gram, increase per arm to see a 200 RPM decrease in peak operating RPM.

Drive Clutch Roller Pins



SECTION 05 - TRANSMISSION SYSTEM

The solid steel roller pins can be drilled axially (lengthwise) with various size holes to vary the weight from 16.5 grams down to 10.3 grams (about a 1/4 inch diameter hole), which is the weight of the hollow steel pin. A 1/8 inch diameter hole drilled in the solid steel pin will give you about 14.5 grams. Also available are threaded steel and aluminum pins. These pins are used with set screws to allow for very small weight changes.

The weight of the lever arms will have a similar effect on the shift RPM. Early TRA clutches used an aluminum arm that weighed 37.9 grams. Starting in 1993, a heavier, reinforced aluminum arm was used on larger engine types. This heavier arm is now standard in all TRA clutches. It weighs 39.1 grams. Most of the reinforcing is concentrated at the pivot end of the arm, so the additional weight does not have a major effect on the shift curve, but changing from light aluminum arms to heavy aluminum arms will require small adjustments to the pin weight to obtain the same shift curve. A magnesium arm is also available (P/N 417 0043 01) which weighs 27.3 grams.

The location of the center of gravity of the lever arm assembly will also affect the shift curve. Magnesium arms with solid steel pins will "feel" different than aluminum arms with threaded aluminum pins with 1 set screw. Both of these combinations have a total weight within 0.1 gram of each other, but the center of gravity of the magnesium arm set up is much farther away from the pivot pin than the aluminum arm set up. This magnesium arm set up will be "revier" at low ratios and part throttle settings.

By adding or removing weight to or from the arms, we can fine tune the shift RPM to the engine power peak.

If you increase the horsepower of the engine at the same RPM, you would normally add more weight to keep the engine pulling as hard as possible and not over rev.

If you lighten the weights on the arms, you will be increasing the shifting RPM. However, your vehicle will not "pull" as hard, since less centrifugal force is being generated.

This should be optimized by accurate testing under duplicatable conditions until the best weight is found for your use.

On the newer TRA clutches, the 6 mm allen bolt that the roller arms pivot on is easily removable. However, a steel, gold color tube is left in the clutch holding the arm in place. This tube can be very difficult to remove. A simple solution to this is to remove the 6 mm Allen bolt and coat it with red, Loctite 271 and reinstall the bolt, let it cure, and when fully cured, you can remove the Allen bolt along with the sleeve since the two are now "locked" together.

Heavy aluminum arm	39.1	420 4484 55
Magnesium lever arm	27.3	417 0043 01
Solid steel roller pin	16.4 (black)	504 2596 00
Hollow steel roller pin	10.3	420 4291 40
Threaded steel roller pin	10.3	504 2606 00
Solid aluminum roller pin	5.9	N/A
Threaded aluminum pin	3.8	504 2603 00
Allen set screw 1/4" - 28 N.F. x 1/4"	0.9	365 2020 00
Steel roller	9.8	420 4291 32
Aluminum roller	4.1	860 4118 00 (kit)

SECTION 05 - TRANSMISSION SYSTEM

Combination Weight

Alum. Lever	Steel Roller	Solid steel pin		66.8 grams
Alum. Lever	Steel Roller	Threaded steel	+ 4 set screws	64.2
Alum. Lever	Steel Roller	Threaded steel	+ 3 sets	63.3
Alum. Lever	Steel Roller	Threaded steel	+ 2 sets	62.4
Alum. Lever	Steel Roller	Threaded steel	+ 1 set	61.5
Alum. Lever	Alum. Roller	Solid steel pin		61.2
Alum. Lever	Steel Roller	Hollow steel pin		60.4
Alum. Lever	Alum. Roller	Threaded steel	+ 4 sets	58.4
Alum. Lever	Steel Roller	Threaded alum.	+ 4 sets	57.6
Alum. Lever	Alum. Roller	Threaded steel	+ 3 sets	57.5
Alum. Lever	Steel Roller	Threaded alum.	+ 3 sets	56.7
Alum. Lever	Alum. Roller	Threaded steel	+ 2 sets	56.6
Alum. Lever	Steel Roller	Solid alum. pin		56.0
Alum. Lever	Steel Roller	Threaded alum.	+ 2 sets	55.8
Alum. Lever	Alum. Roller	Threaded steel	+ 1 set	55.7
Mag. Lever	Steel Roller	Solid steel pin		55.0
Alum. Lever	Steel Roller	Threaded alum.	+ 1 set	54.9
Alum. Lever	Alum. Roller	Hollow steel pin		54.8
Alum. Lever	Steel Roller	Threaded alum. pin		54.0
Mag. Lever	Steel Roller	Threaded steel	+ 4 sets	52.0
Alum. Lever	Alum. Roller	Threaded alum.	+ 4 sets	51.7
Mag. Lever	Steel Roller	Threaded steel	+ 3 sets	51.1
Alum. Lever	Alum. Roller	Threaded alum.	+ 3 sets	50.8
Alum. Lever	Alum. Roller	Solid alum.pin		50.4
Mag. Lever	Steel Roller	Threaded steel	+ 2 sets	50.2
Alum. Lever	Alum. Roller	Threaded alum.	+ 2 sets	49.9
Mag. Lever	Alum. Roller	Solid steel pin		49.4
Mag. Lever	Steel Roller	Threaded steel	+ 1 set	49.3
Alum. Lever	Alum. Roller	Threaded alum.	+ 1 set	49.0
Mag. Lever	Steel Roller	Hollow steel pin		48.6

SECTION 05 - TRANSMISSION SYSTEM

Alum. Lever	Alum. Roller	Threaded alum. pin		48.2
Mag. Lever	Alum. Roller	Threaded steel	+ 4 sets	46.5
Mag. Lever	Alum. Roller	Threaded steel	+ 3 sets	45.6
Mag. Lever	Steel Roller	Threaded alum.	+ 4 sets	45.5
Mag. Lever	Alum. Roller	Threaded steel	+ 2 sets	44.7
Mag. Lever	Steel Roller	Threaded alum.	+ 3 sets	44.6
Mag. Lever	Steel Roller	Solid alum. pin		44.3
Mag. Lever	Alum. Roller	Threaded steel	+ 1 set	43.8
Mag. Lever	Steel R.oller	Threaded alum.	+ 2 sets	43.7
Mag. Lever	Alum. Roller	Hollow steel pin		42.9
Mag. Lever	Steel Roller	Threaded alum.	+ 1 set	42.8
Mag. Lever	Steel Roller	Threaded alum. pin		41.9
Mag. Lever	Alum. Roller	Threaded alum.	+ 4 sets	40.0
Mag. Lever	Alum. Roller	Threaded alum.	+ 3 sets	39.1
Mag. Lever	Alum. Roller	Solid alum. pin		38.5
Mag. Lever	Alum. Roller	Threaded alum.	+ 2 sets	38.2
Mag. Lever	Alum. Roller	Threaded alum.	+ 1 set	37.3
Mag. Lever	Alum Roller	Threaded alum. pin		36.4

EFFECTS OF THE RAMP PROFILE ON THE SHIFT FORCE

The shift force is the component or part of the centrifugal force that is used to actually move the sliding half of the drive pulley. This force is applied to the sliding half at the three lever arm pivot points (following illustration item 49). The ramp profiles are used to control the size of this shift force.

As the clutch rotates around the center line of the crankshaft, the axis of rotation, centrifugal forces begin building and act on the center of mass of the lever arm, roller combination trying to pull the lever away from the axis of rotation. The center of mass of the lever arm assembly is the point where all the centrifugal force acts (following illustration item 70).

The ramp provides an angled surface for the roller to push against and the angle of the ramp at the point of contact with the roller determines how much of the centrifugal force is translated into axial force. The axial force pushes the sliding half in and the remainder of the centrifugal force is unused and absorbed by the integrity of the sliding half. A steeper ramp angle gives less shift force, while a smaller angle gives more shift force.

As you can see in following illustration, the angle of the ramp varies constantly from start to finish. The angle varies to achieve the proper axial force to transmit a given amount of torque through the drive belt at each diameter of the pulley.

As discussed before, the centrifugal force generated by the lever arm assembly increases at higher ratios. This is why the ramp profile is much steeper at the high ratio end. This reduces the shift force in order to maintain the correct load on the belt.

Remember, it is the angle of the ramp at the point of roller contact that will help determine the shift force at any given ratio. Think of the ramp profile as a hill that the roller must climb. A small angle or hill can be overcome easily thus providing a faster shift out to a higher ratio which will lower the engine RPM. If the hill is steeper (the ramp angle is larger) the roller will not be able to climb it as quickly thus staying in a lower ratio longer which will keep the engine RPM higher.

Note that at engagement and very low ratios, many ramp angles actually go "downhill". These are generally used on engines with good low RPM power. Engines with narrower power bands and less low RPM power will usually have a flatter angle at engagement and low speed. A ramp with a small "bump" at engagement is used to raise the engagement RPM. Again, the steeper the "hill" the roller must overcome, the higher the RPM will be before the clutch shifts out. If the spring selection cannot give the desired engagement RPM, then use a ramp with a bump or grind a notch at the point where the roller sits at engagement. Of course if the shift profile was good at higher ratios, then you would want to use a ramp with only changes at the low speed area.

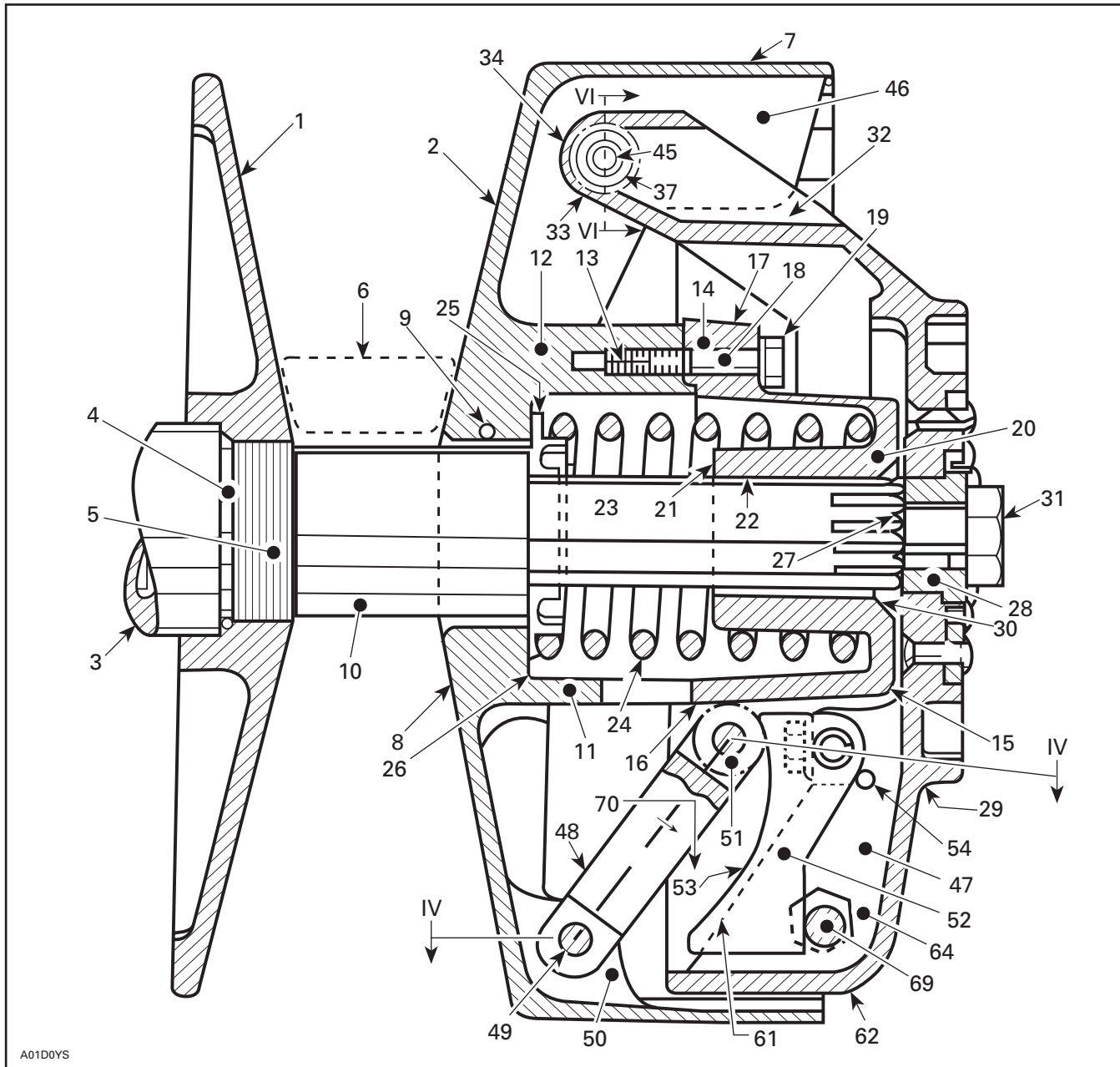
Also, a thicker or taller ramp will provide higher RPM than a thinner ramp with the same profile because the lever arm assembly is "tucked in" further by the taller ramp.

The TRA clutch allows you to "fine tune" the ramp profile by using the adjusters provided (following illustration item 69). The adjusters are cams which allow you to raise and lower the outer end of the ramp through six different positions. Moving the ramp end toward the lever arm makes the ramp angles steeper, thereby raising engine speed and slowing the upshift. As the ramp is adjusted away from the lever arm, the engine speed is lowered and the upshift is faster.

In clinical condition such as on a dynamometer, moving the adjusters up will result in a 150 to 200 RPM increase with each position change. Lowering the adjuster positions will result in a decrease of 150 to 200 RPM with each number. On the snowmobile, however, depending on the operating conditions, a change of one adjuster position may not show up on the tachometer, but the shift speed of the pulley will have changed. The upshift or downshift, depending on which way you moved the adjusters, will be faster and your acceleration rate and top speed will have changed. When using the TRA adjusters, the acceleration rate and speed should be checked as well as the engine RPM.

On the DSA chassis and with the new driven pulley bushing material, the friction in the driven pulley and chassis is reduced, thus a one position change on the TRA adjuster will usually result in a RPM change.

SECTION 05 - TRANSMISSION SYSTEM

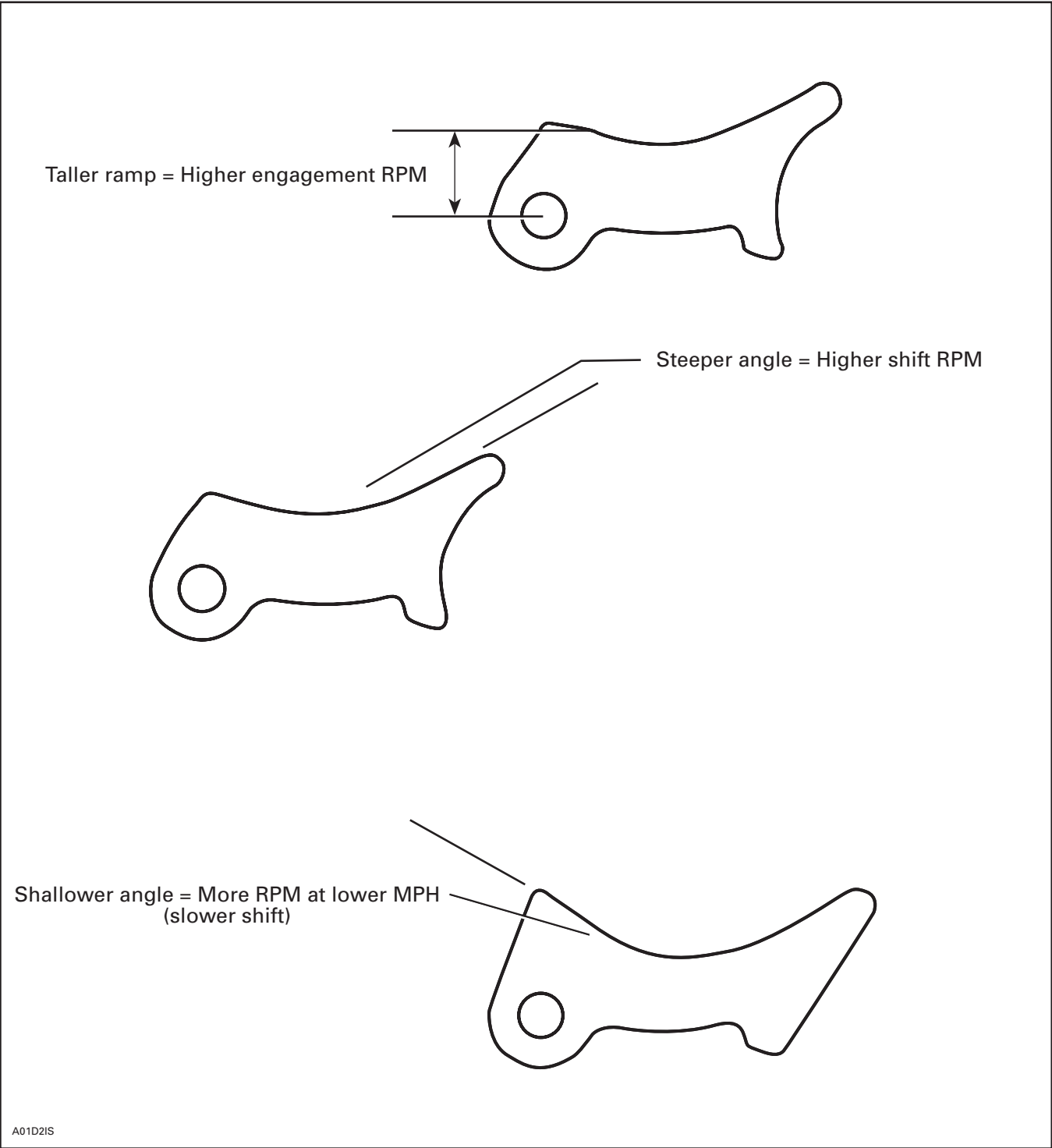


For drag racing and radar running, it is usually better to try to go as low as possible on the adjusters without dropping the engine peak RPM too much as this will give the vehicle its fastest acceleration and top speed.

For oval racing or tight sno-cross type courses, you may find you need to be one or two numbers higher on your TRA adjuster to give the best throttle response possible out of the corners.

This will be where the winners spend their time testing different combinations of lever arm weights, TRA adjustments, and ramp profiles until they find the best possible setup.

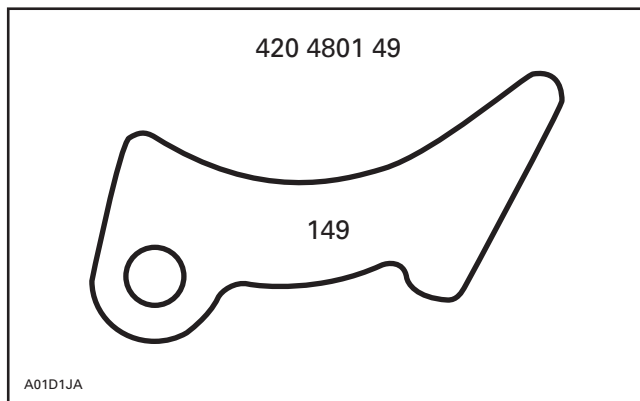
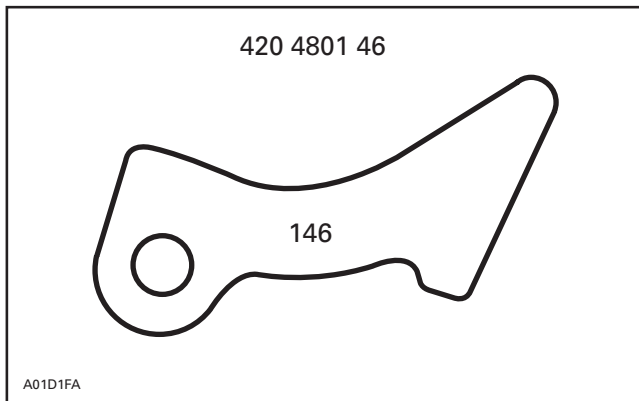
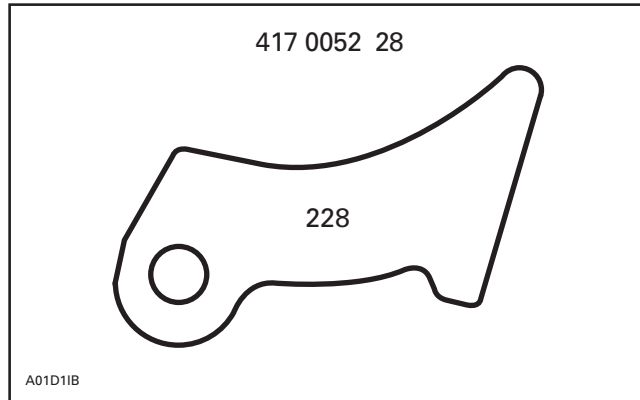
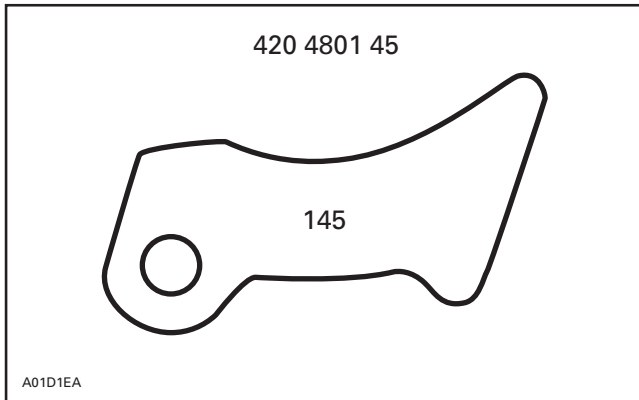
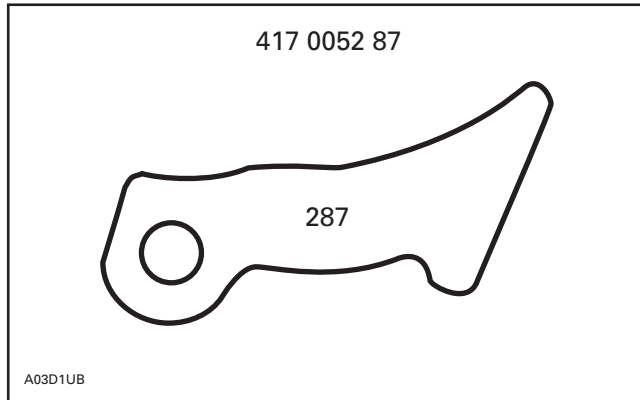
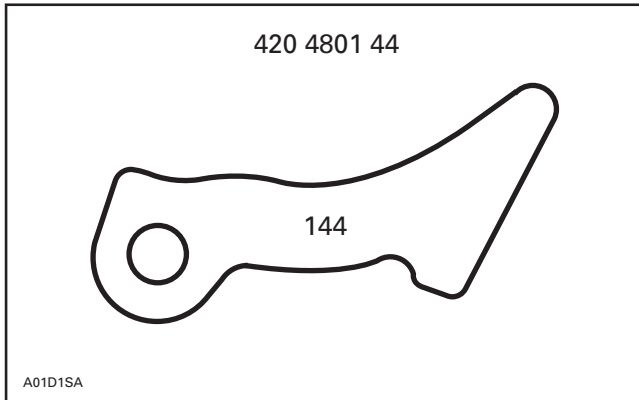
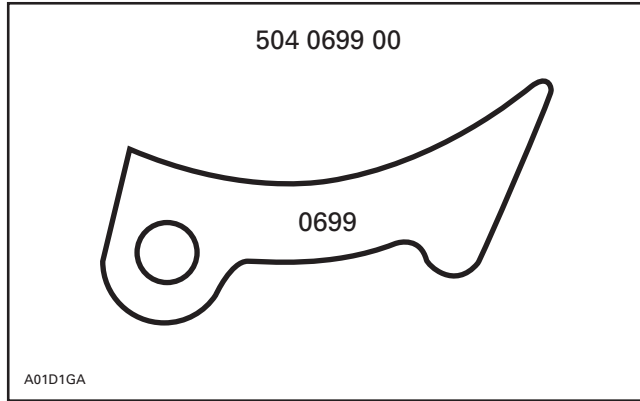
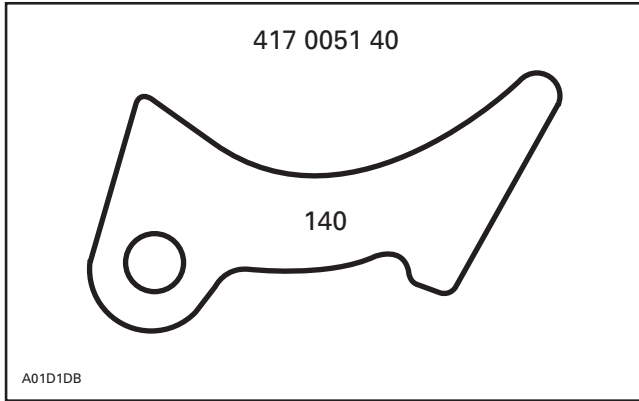
RAMP CHARACTERISTICS



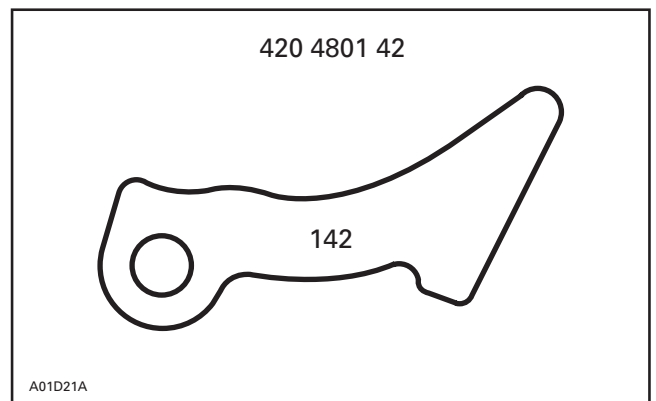
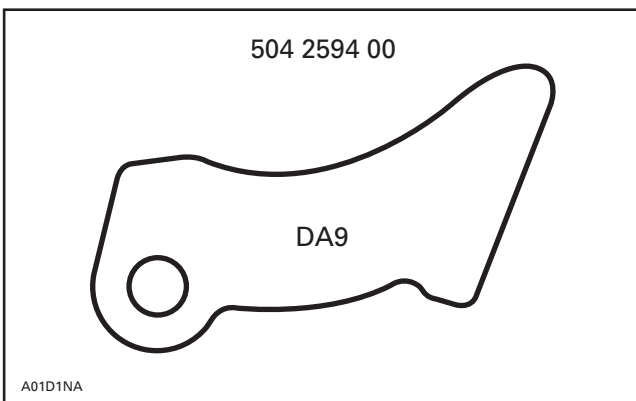
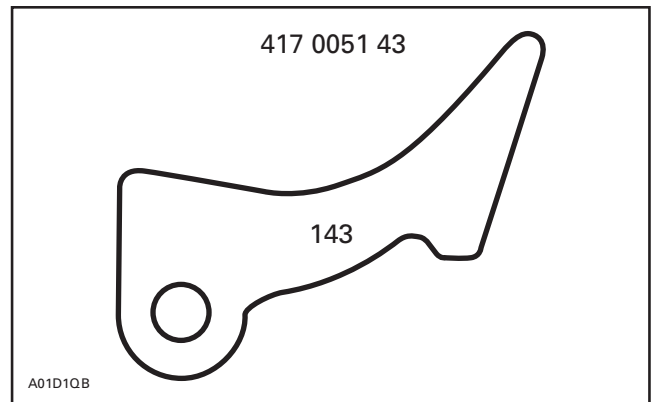
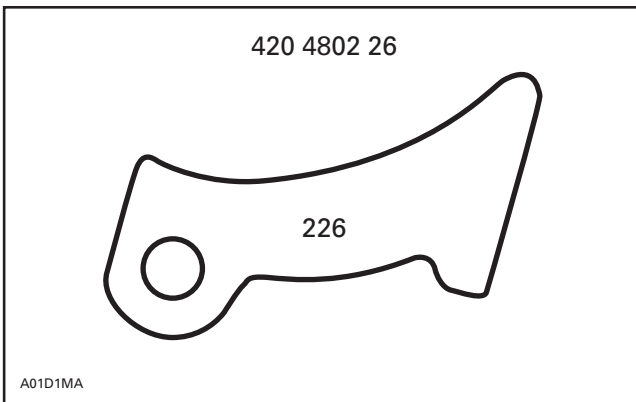
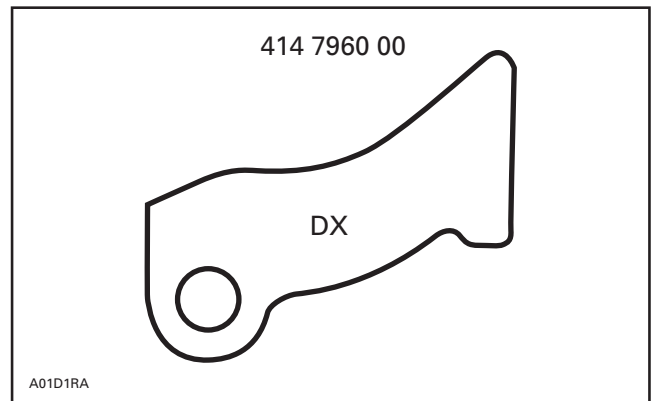
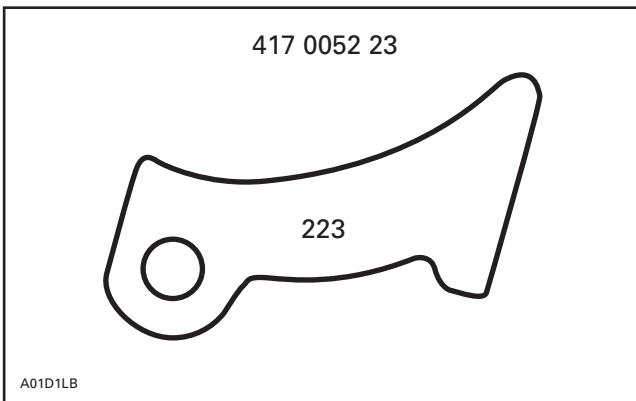
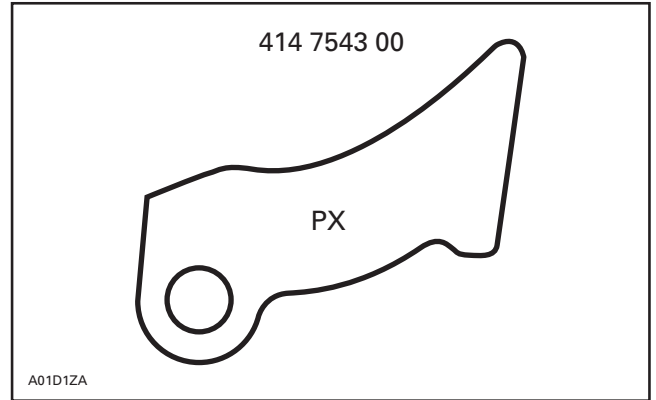
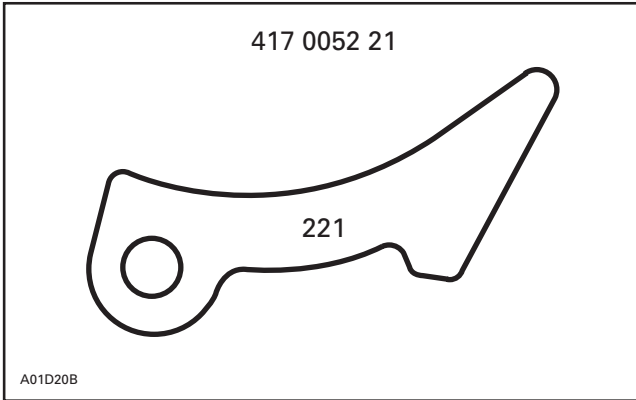
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SECTION 05 - TRANSMISSION SYSTEM

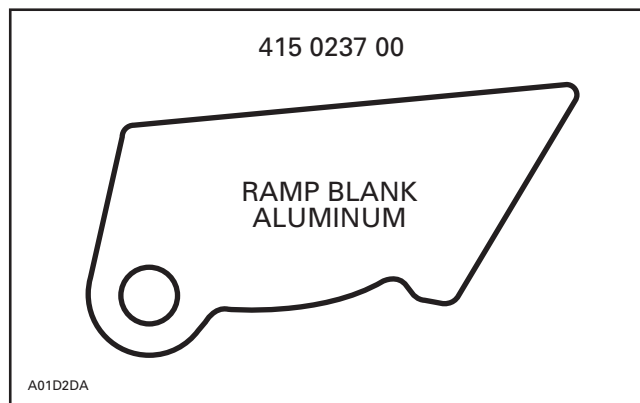
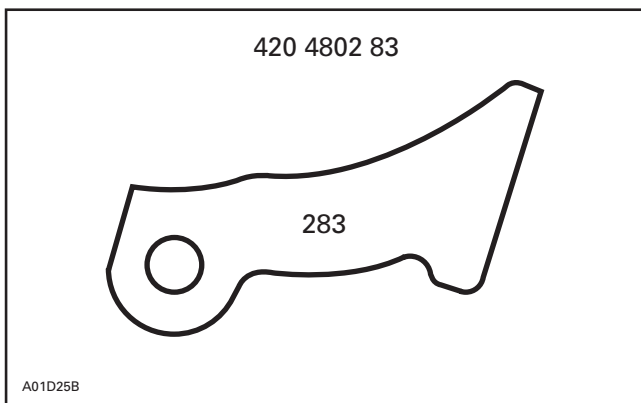
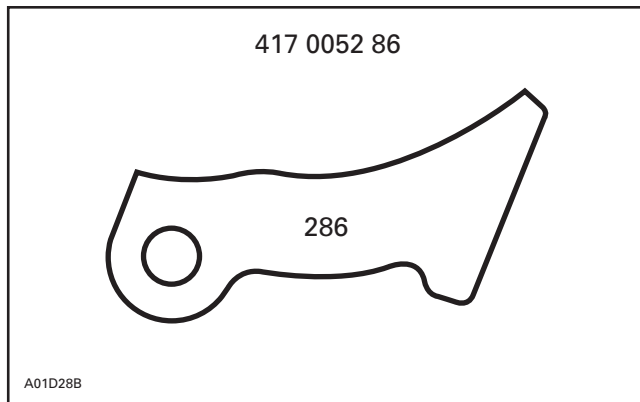
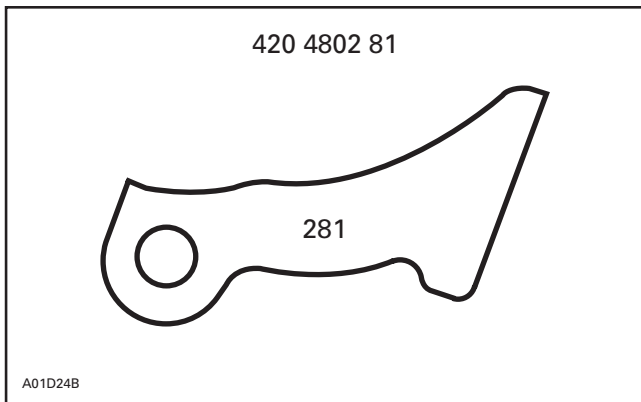
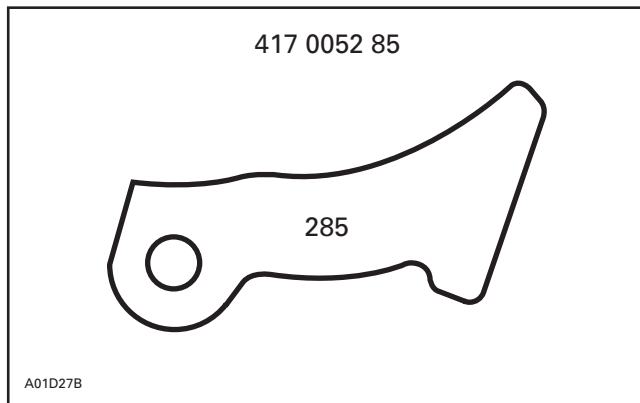
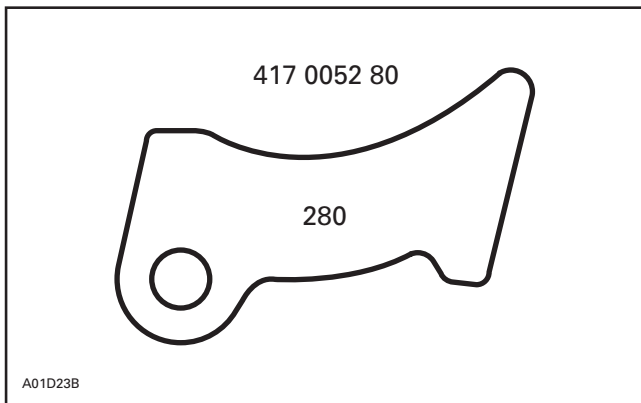
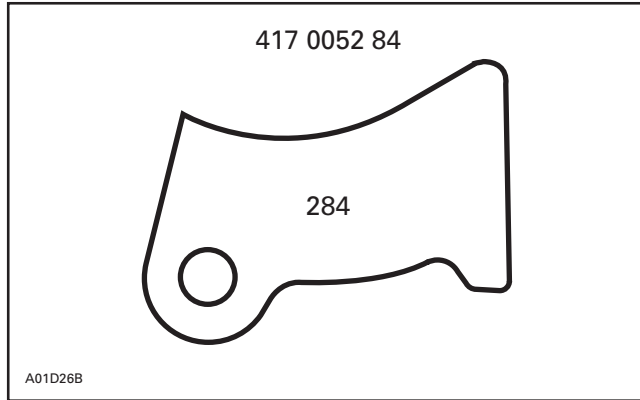
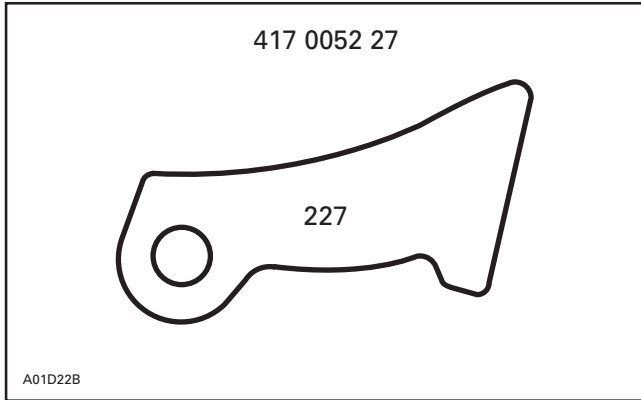
TRA RAMP PROFILES



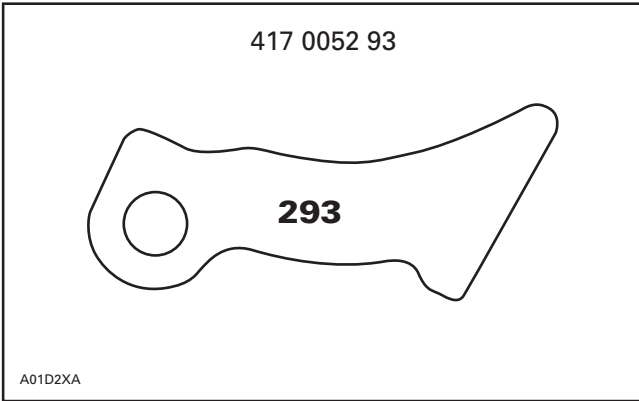
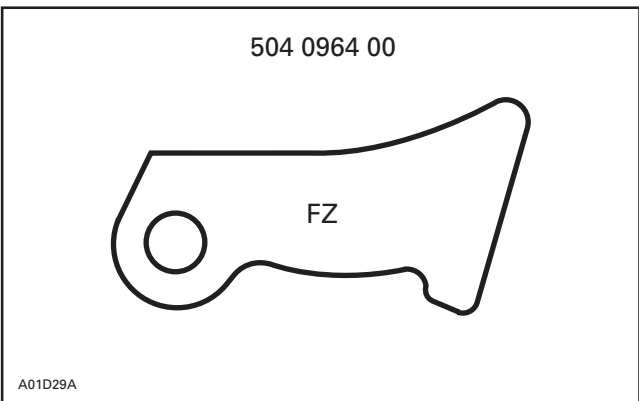
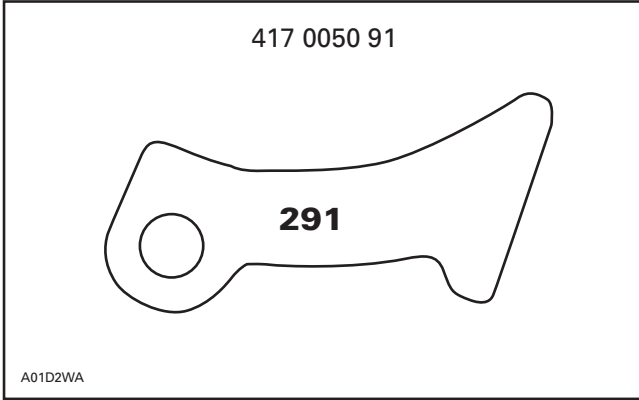
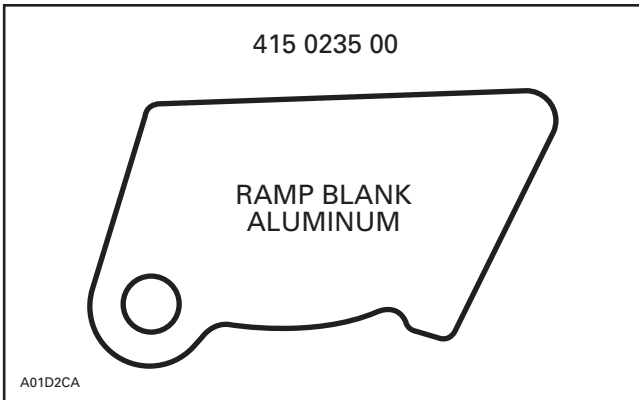
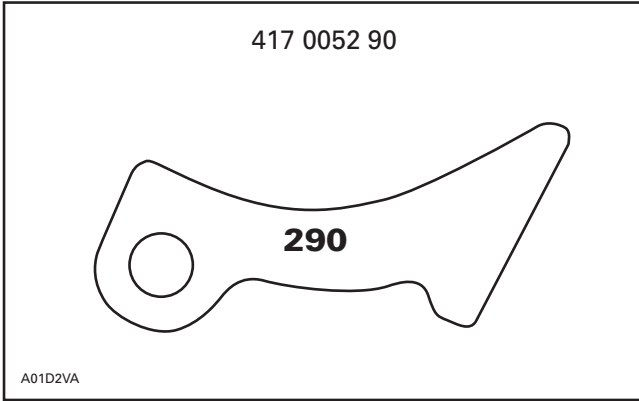
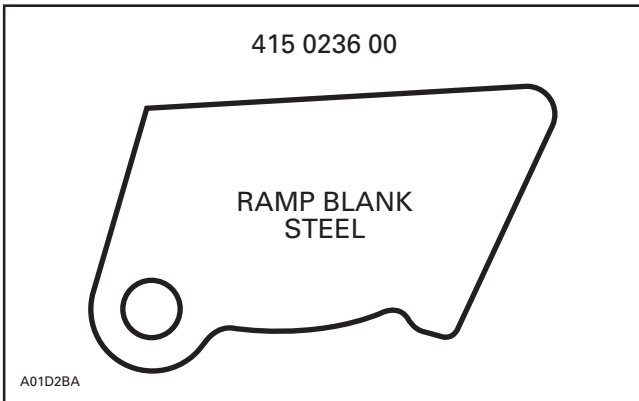
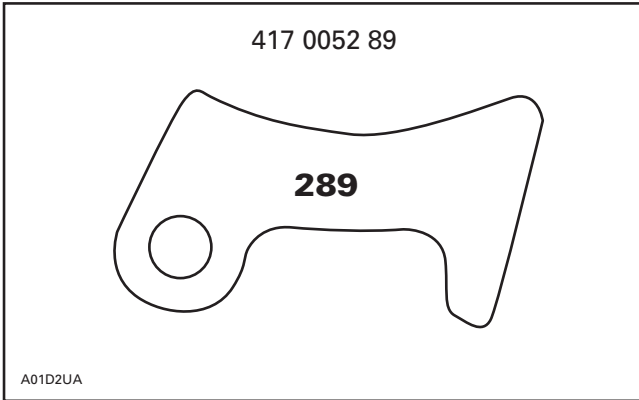
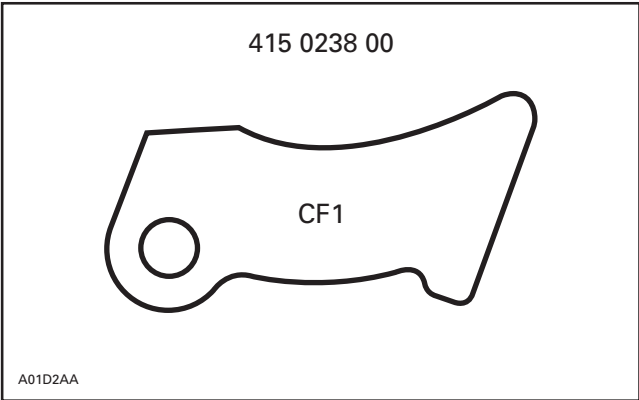
SECTION 05 - TRANSMISSION SYSTEM



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EFFECTS OF THE DRIVE PULLEY SPRING

The purpose of the clutch release spring is to return the sliding half of the engine pulley and the associated moving parts to the disengaged or neutral position at low engine RPM. The spring tension is calibrated to work with the pressure levers and ramp angles to allow clutch engagement at the desired RPM. As the engine speed increases, centrifugal forces increase and eventually overcome the tension of the release spring and allow the pulley halves to contact the drive belt. As engine speed decreases, centrifugal forces decrease and the clutch spring returns the sliding half toward the neutral position.

As the clutch shifts out to a higher ratio, the spring balances the shift forces being generated by the levers and ramps.

The spring tension will affect the entire shifting sequence of the engine pulley. The effect that it has will depend upon the construction of the spring. Three things must be known about the spring to be able to predict its effect in the clutch: 1. The spring free length; 2. The spring pressure when compressed to 74 mm (2.9 in); 3. The spring pressure when compressed to 41 mm (1.6 in). These three factors are listed on the accompanying sheet.

The spring free length will give you an idea of the condition of the spring. If the spring has lost more than 6.35 mm (1/4 in) of its listed free length, the spring is fatigued or has taken too great a set. The spring should be replaced. The free length of the spring is its overall length when resting freely on a table top.

In the TRA clutch, the installed length of the clutch release spring is 74 mm (2.9 in). This is the length of the spring when the pulley is in its neutral position. The pressure that the spring applies at this length is the factor that controls the engagement speed (all other things kept constant). When the engine pulley is in its highest ratio position, the spring will be compressed to 41 mm (1.6 in). The pressure the spring applies at this length will determine the RPM required to reach high gear; again, with all other tunable factors kept constant.

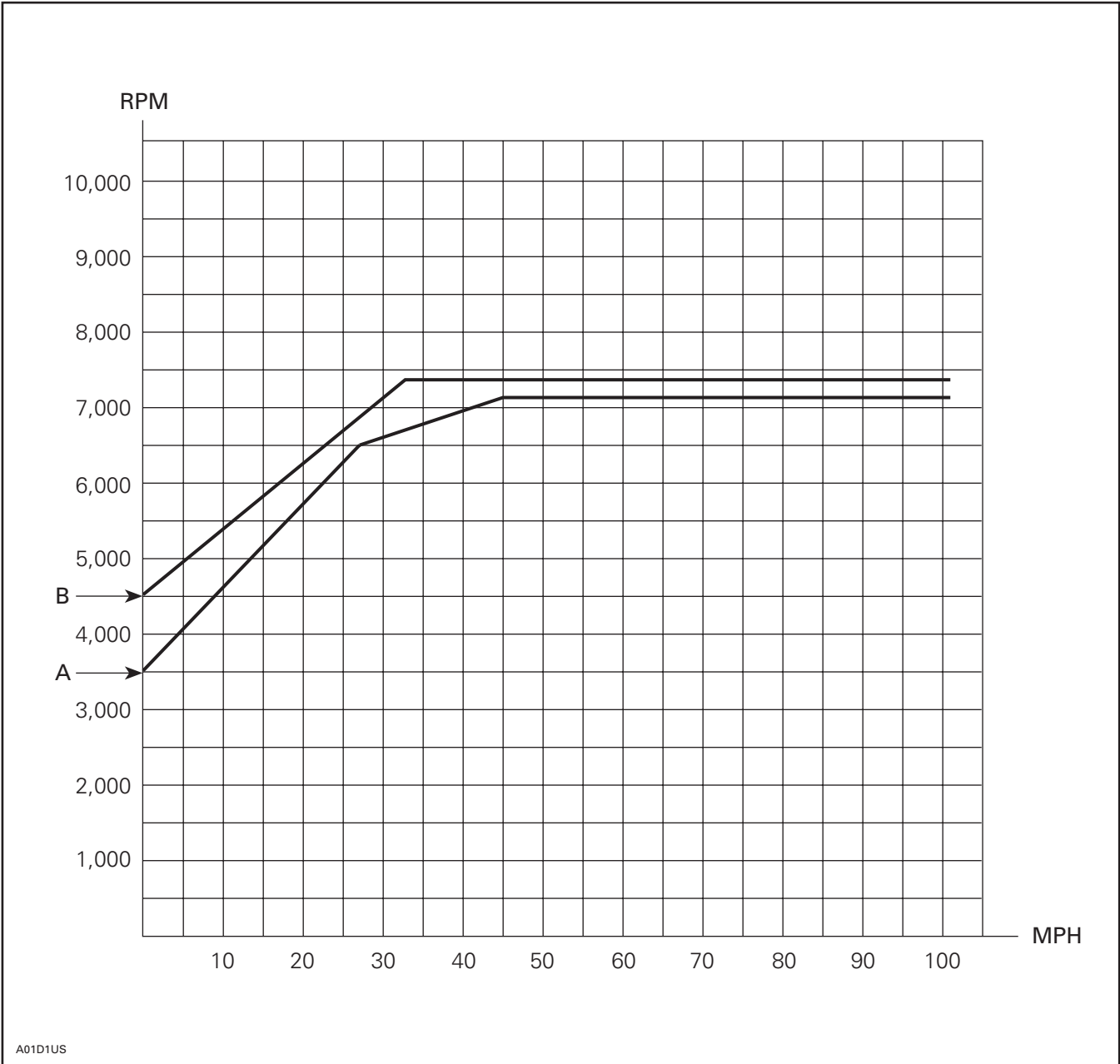
As you look through the spring chart, you will see that springs are available with equal pressures at 74 mm (2.9 in), but very different pressures at 41 mm (1.6 in). You will also note varying pressures at 74 mm (2.9 in) and equal pressures at 41 mm (1.6 in). Simply by working with the spring charts, one can easily see how the shift speed (the speed with which the change from one gear ratio to the next is made) and the engagement speed can be altered.

As the pressure of the spring when 74 mm (2.9 in) long is increased, the clutch engagement speed will increase. As the spring rate is increased, the engine will be required to turn more RPM to achieve a given gear ratio. Again, these facts hold true when all other tunable components are kept constant.

On chart 1, spring "A" has a pressure of 311 N (70 lb) at 74 mm (2.9 in) and a pressure of 1157 N (260 lb) when compressed to 41 mm (1.6 in). With no other changes made in the clutch, spring "B" was installed. The spring has a preload of 712 N (160 lb) at 74 mm (2.9 in) and a pressure of 1201 N (270 lb) at 41 mm (1.6 in). As the chart indicated, the engagement RPM increased 1000 RPM while the shift curve from 30 MPH up remained relatively unchanged.

Chart 2 illustrates the effect of keeping the spring preload pressure at 74 mm (2.9 in) constant and increasing the pressure at the 41 mm (1.6 in) length. In this example, spring "A" has a pressure of 311 N (70 lb) at 74 mm (2.9 in) and a pressure of 756 N (170 lb) at 41 mm (1.6 in). Spring "B" also has a pressure of 311 N (70 lb) at 74 mm (2.9 in) but increases to 1157 N (260 lb) at 41 mm (1.6 in). The projected effect of this spring change is shown on chart 2. Since the preload pressure at 74 mm (2.9 in) is equal for springs "A" and "B", the engagement speed is not affected. At 95 MPH, however, there is a loss of RPM with spring "A" in place.

**Drive Clutch Spring
Effect at Engagement**

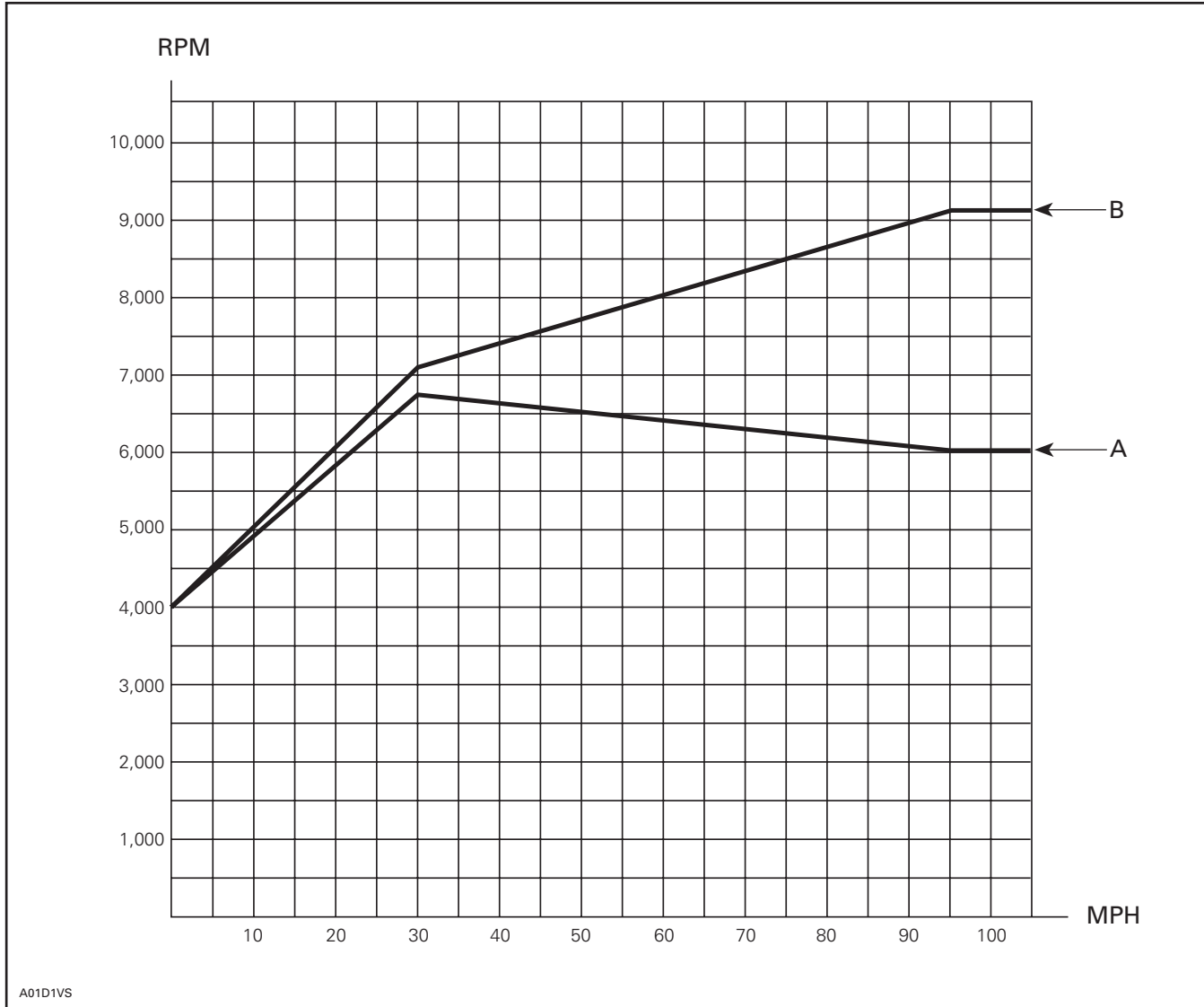


	Load at 74 mm (2.9 in)	Load at 41 mm (1.6 in)
A	311 N (70 lb)	1157 N (2601 lb)
B	712 N (160 lb)	1201 N (270 lb)

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Drive Clutch Spring

Effect at Top Speed



	Load at 74 mm (2.9 in)	Load at 41 mm (1.6 in)
A	311 N (70 lb)	756 N (170 lb)
B	311 N (70 lb)	1157 N (260 lb)

SECTION 05 - TRANSMISSION SYSTEM

TRA Spring Chart

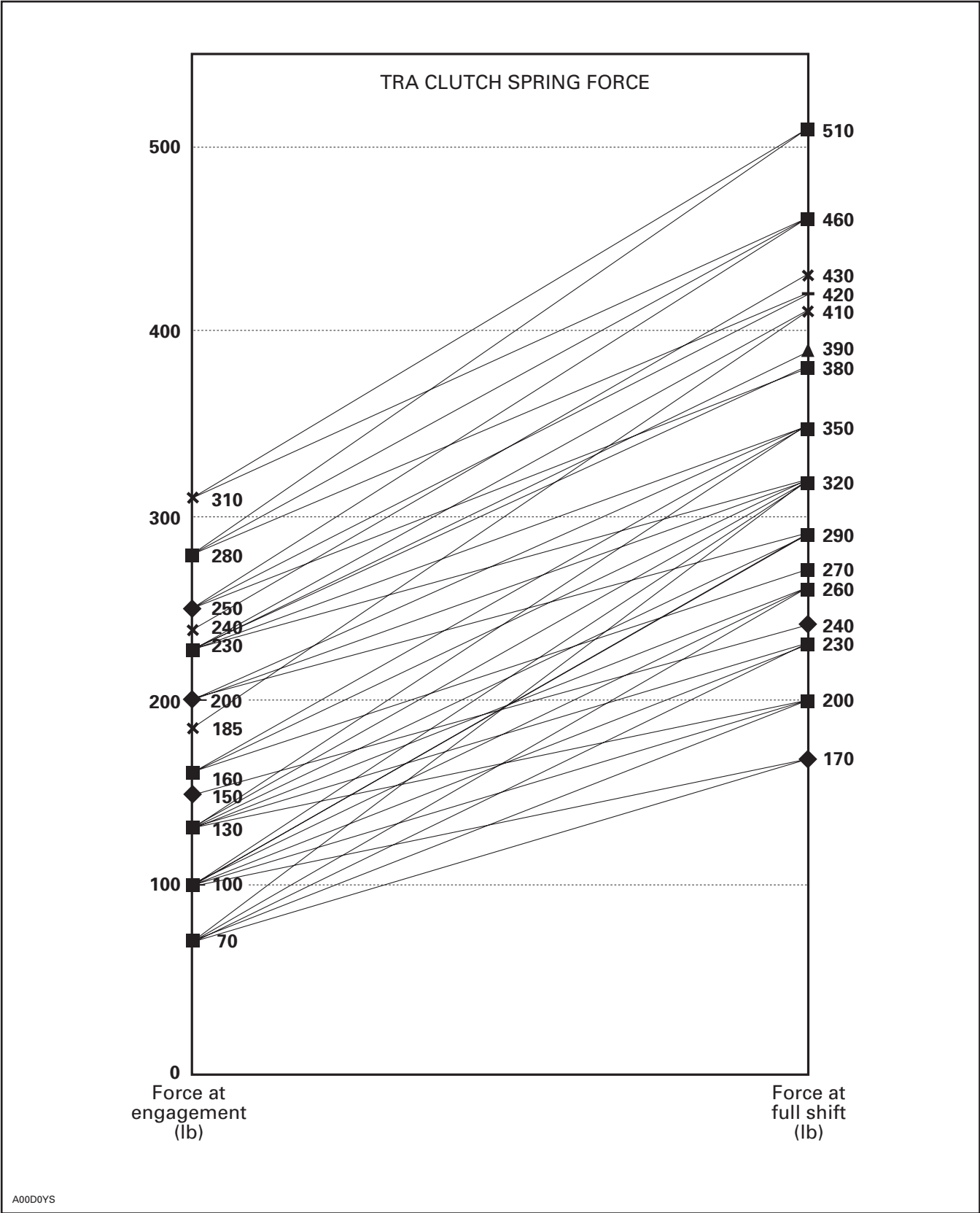
FORCE @ (pounds) 74 mm - 41 mm	FORCE @ (Newton) 74 mm - 41 mm	P/N BOMBARDIER	COLOR CODE	FREE LENGTH (mm)	WIRE DIA. (mm)	NO OF COILS
70-170	311-756	414 6898 00	RED-RED	96,3	5,0	5,3
70-200	311-890	415 0152 00	RED-ORANGE	91,2	5,25	5,1
70-230	311-1023	414 8175 00	RED-YELLOW	87,9	5,6	5,0
70-260	311-1157	414 6892 00	RED-GREEN	85,9	6,0	5,3
70-290	311-1290	414 6915 00	RED-BLUE	84,1	6,0	4,8
70-320	311-1423	414 7010 00	RED-PURPLE	83,1	6,3	5,0
100-170	445-756	414 9930 00	YELLOW-RED	121,1	4,88	7,1
100-200	445-890	414 6897 00	YELLOW-ORANGE	105,7	5,25	6,2
100-230	445-1023	414 7486 00	YELLOW-YELLOW	100,3	5,4	6,6
100-260	445-1157	414 7421 00	YELLOW-GREEN	94,0	6,0	6,1
100-290	445-1290	414 8180 00	YELLOW-BLUE	90,7	6,0	5,3
100-320	445-1423	414 6784 00	YELLOW-PURPLE	88,4	6,3	5,5
130-200	579-890	414 6390 00	BLUE-ORANGE	135,5	4,88	7,25
130-230	579-1023	414 6895 00	BLUE-YELLOW	115,1	5,25	6,8
130-260	579-1157	414 8177 00	BLUE-GREEN	105,7	5,6	5,8
130-290	579-1290	414 6894 00	BLUE-BLUE	99,8	6,0	6,1
130-320	579-1424	414 8178 00	BLUE-PURPLE	96,6	6,17	6,6
130-350	579-1557	414 9163 00	BLUE-PINK	93,5	6,3	5,6
160-230	712-1023	415 0153 00	PURPLE-YELLOW	149,4	4,88	72,2
160-270	712-1157	415 0054 00	PURPLE-GREEN	126,8	5,25	6,8
160-290	712-1290	415 0349 00	PURPLE-BLUE	114,6	5,54	6,5
160-320	712-1423	414 8179 00	PURPLE-PURPLE	105,7	6,0	6,1
160-350	712-1557	414 9495 00	PURPLE-PINK	101,8	6,17	6,6
200-290	890-1290	414 7682 00	GREEN-BLUE	147,4	5,25	7,4
200-320	890-1423	414 7628 00	GREEN-PURPLE	126,7	5,72	7,11
200-350	890-1557	414 7569 00	GREEN-PINK	118	5,72	6,38
200-380	890-1690		GREEN-WHITE	110,7	5,94	6,2
230-320	1023-1423	414 7542 00	PINK-PURPLE	154,7	5,25	7,02
230-350	1023-1557	415 0748 00	PINK-PINK	137,2	5,54	6,88
230-380	1023-1690	415 0193 00	PINK-WHITE	124,5	5,94	7,1

SECTION 05 - TRANSMISSION SYSTEM

TRA Spring Chart (continued)

P/N	Load at 74 mm (2.9 in) N (lb) ± 5%	Load at 41 mm (1.6 in) N (lb) ± 5%	Color Code
415 0195 00	823 (185)	1824 (410)	BLACK
415 0193 00	1023 (230)	1690 (380)	PINK-WHITE
415 0196 00	1023 (230)	1725 (390)	GREEN
415 0197 00	1023 (230)	1824 (410)	RED
415 0198 00	1067 (240)	1913 (430)	BLUE
417 2220 04	1112 (250)	1690 (380)	WHITE-GREEN
415 0200 00	1112 (250)	1868 (420)	ORANGE
415 0199 00	1112 (250)	2064 (460)	PINK
415 0201 00	1245 (280)	1868 (420)	GREEN-GREEN
415 0202 00	1245 (280)	2064 (460)	RED-RED
415 0203 00	1245 (280)	2268 (510)	BLUE-BLUE
415 0204 00	1379 (310)	2064 (460)	OLD PINK-PINK
415 0205 00	1379 (310)	2268 (510)	ORANGE-ORANGE

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SECTION 05 - TRANSMISSION SYSTEM

EFFECTS OF THE DRIVEN PULLEY SPRING

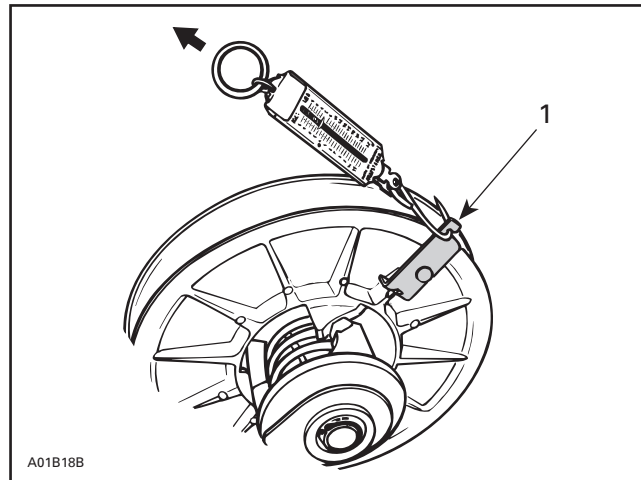
The driven pulley spring is needed to keep the plastic slider buttons in contact with the cam and to provide enough side force on the belt in the low gear position to allow initial acceleration while the torque rises to a point where the torque sensing cam begins to take over. At full load, the driven pulley spring has much less effect on the driven pulley shifting sequence than does the cam, especially at low shift ratios. At the part throttle loads at low ratios, the spring has the main effect on the shift characteristics of driven pulley.

Increases in the driven pulley spring preload will bring the engine speed up before the pulley starts shifting and will help backshift the clutch quicker. Decreasing the preload will allow a faster upshift but a slower backshift thus lowering the engine RPM.

NOTE: Control of the engine speed is done by calibrating the engine pulley not by adjusting the driven pulley spring preload. An attempt to lower the engine RPM by decreasing the spring preload in the driven pulley will result in belt slippage on acceleration. An attempt to increase engine RPM by increasing the preload will result in excessive drive belt wear and decreased efficiency in the transmission.

The driven pulley spring preload is listed in the basic specifications for all our machines. This preload tension will vary from 4 kg (9 lbs) to 7.5 kg (17 lb) on models equipped with the TRA clutch.

The preload figure given in our specifications is quoted in kg (lb) of force for each machine, not in inch-pounds or foot-pounds of torque. A figure given in units of torque would require multiplying the radius of the pulley by the pull recorded on the scale. Our figures are quoted for each pulley size and it is only necessary to record the pull of the spring by attaching a scale to the rim of the pulley. The scale must be positioned at 90° to the radius of the pulley. Holding the fixed half of the pulley still, pull until the sliding half just begins to rotate. At this point, read the scale.



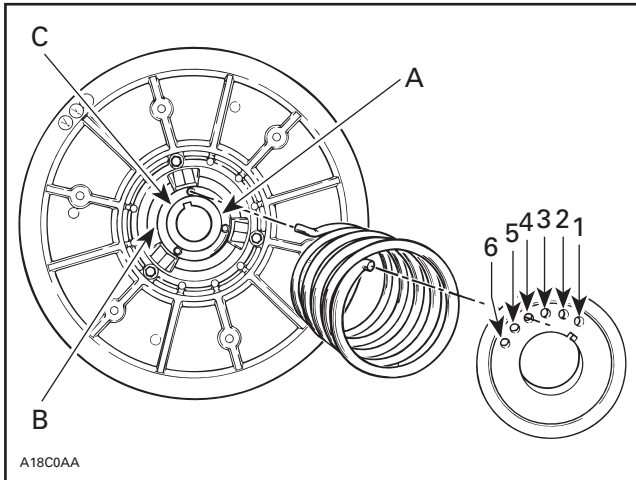
TYPICAL

1. Spring scale hook (529 0309 00)

To change the spring tension, relocate the spring end in the sliding pulley half or reposition the spring end in the cam.

There are six holes available on a Formula cam. They are numbered 1-6. Most Formula driven pulleys have three adjustment holes in the sliding half. They are lettered A, B, C. When adjusting driven pulley tension, always refer to the tension in kg (lb) — not B-6 or A-5 hole positions for accuracy and repeatability. Moving the spring from one numbered hole to a hole adjacent will change the preload by 1.35 -1.8 kg (3-4 lb). Remember, use the number and letters as references — measure the tension for accuracy. By using various combinations, the preload is adjustable from 5 to 35 pounds (depending on spring type).

NOTE: If spring pre-load cannot be adjusted, try to relocate the other end of spring in sliding pulley (holes A, B and C).



Letters and numbers shown in illustration are actual letters and numbers embossed on parts

NOTE: Always recheck torsional pre-load after adjusting.

We have three different driven pulley springs available that fit the Formula driven pulleys. By experimenting with them, you may find a more efficient combination of minimum side pressure yet adequate back shifting for your particular racing application.

Color	Wire Diameter	Part Number
Black	.177 in	414 3385 00
Orange	.187 in	414 5058 00
Beige	.207 in	414 5589 00

EFFECTS OF THE DRIVEN PULLEY CAM

The purpose of the driven pulley cam is to sense the torque requirements of the drive axle and feed a portion of the engine torque, which has been applied to the driven pulley, back to the sliding half of the pulley. It is this side force that signals the downshift and provides side thrust to give traction to the drive belt.

The cam is acting like a screw pushing against the sliding half of the pulley. A large cam angle will act like a coarse thread while a small cam angle will act similar to a fine thread. The smaller the cam angle, the greater the side force on the sliding half of the pulley and the slower the upshift will be. This will result in higher engine RPM.

A larger cam angle will allow the pulley to upshift at a lower engine speed. Less side force will be exerted on the sliding half of the pulley and the pulley will upshift more rapidly.

On downshift, a smaller cam angle will backshift more easily and, again, tend to keep the engine RPM higher. A larger cam angle will be harder to downshift and will load the engine and reduce the RPM.

If all other variables in the pulleys are kept constant, a cam change with a smaller angle will result in a slower upshift and a faster downshift. Engine RPM will remain higher. A change to a cam with a larger angle will result in a faster upshift and the downshift will be "slower". Engine RPM will be lower.

Remember the drive pulley signals or controls the upshift of the transmission while the driven pulley signals the downshift largely because of the effect of the cam.

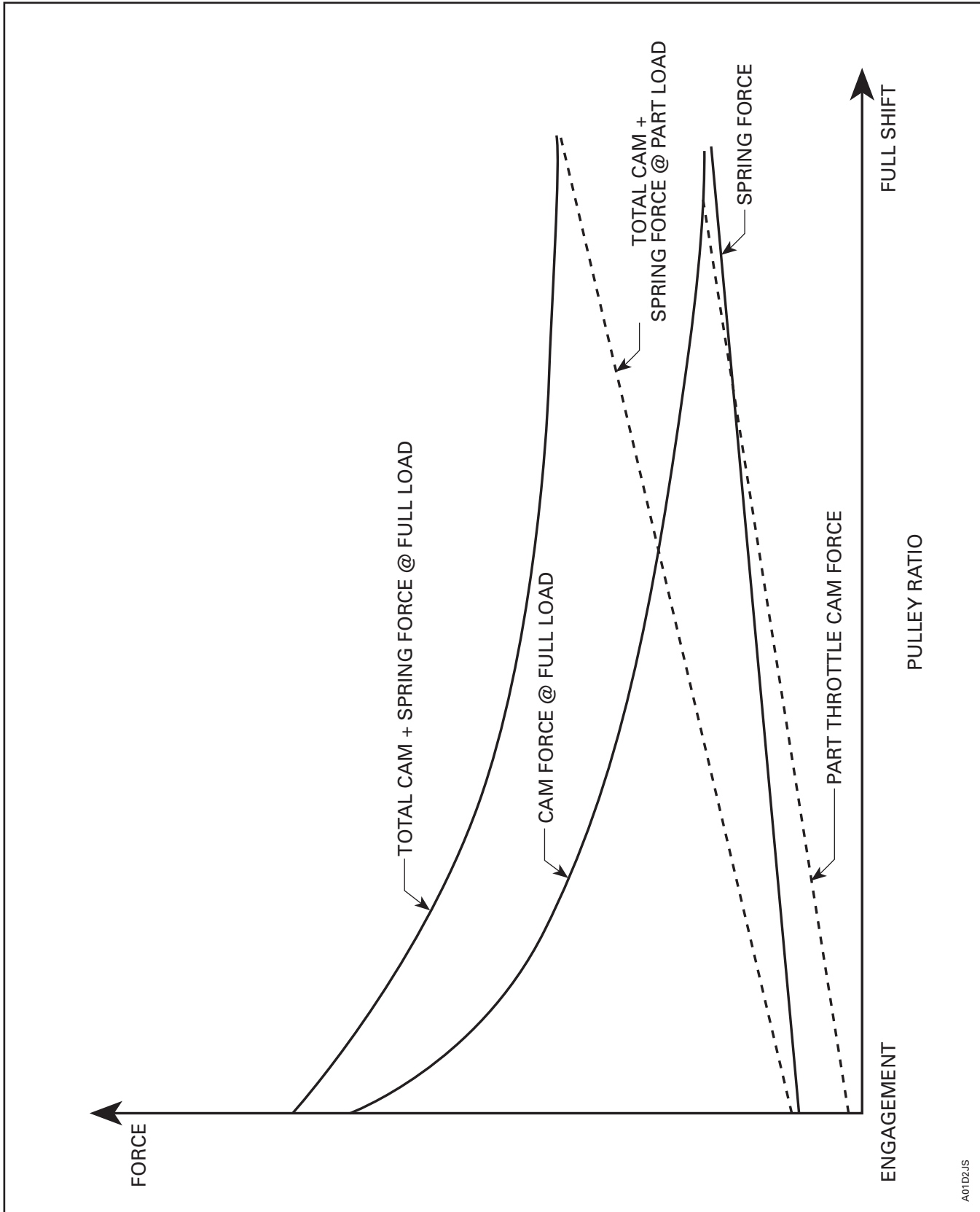
The standard factory cam will probably work well for most "woods" type cross-countries, while a smaller angled cam may prove to be better for high speed lake cross-countries.

Top speed and low ET's are drag racers' and radar runners' most important concerns. Because backshifting is not at all important in these races, most racers experiment with larger cam angles for the fastest possible upshift.

Multi-angle cams are sometimes used by racers needing a good holeshoot. They generally work best on vehicles where no track spin is encountered. As a vehicle idles on the starting line, the exhaust temperature cools thus slightly lowering the optimum HP RPM of the engine. Because of this, a steeper (larger) angle cam can be used to upshift more quickly, and lower the RPM to work with the cooler exhaust. As the exhaust heats up, the optimum HP RPM increases. A multi-angle cam reduces to a shallower (smaller) angle as the clutch shift out and the RPM is increased to match the "hot" HP curve of the engine. This phenomena is more pronounced on engines with narrower powerbands.

Oval and snowcross racers need the best of both worlds. A good holeshoot is critical but backshifting must be quick in order to have good response out of the corners. They may have to change cam angles depending on what type of track layout is encountered.

SECTION 05 - TRANSMISSION SYSTEM

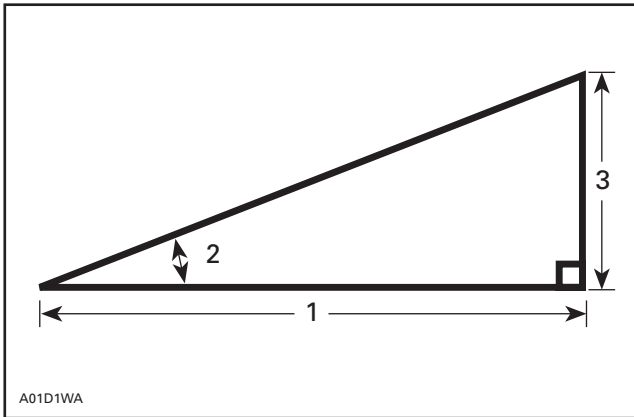


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SECTION 05 - TRANSMISSION SYSTEM

Driven pulley cams are helices. A helix is measured in "lead". Lead is the distance a point moves along the axis of rotation in one revolution of the helix. (Screw threads are a helix.)

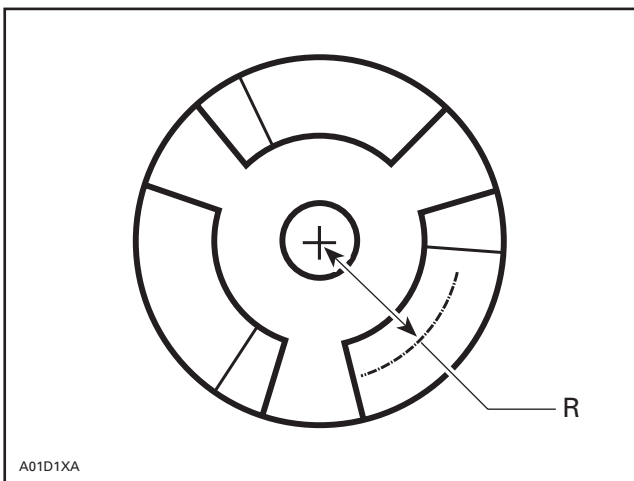
The helix angle is computed from the lead and the circumference of the helix.



1. Circumference (C)
2. Helix Angle A
3. Lead (L)

$$\tan A = \frac{L}{C}$$

Helix angles for Ski-Doo cams are measured at the mean circumference of the cam. This is at the midpoint of the ramp surface.



$$\text{Circumference (mean)} = 2\pi R$$

$$\tan A = \frac{L}{C} \text{ or } L = C \times \tan A$$

Where:

- L = Lead in inches
- C = Circumference on outside diameter
- A = Cam angle on outside diameter

NOTE: $C_{(\text{mean})}$ for all Formula and Blizzard cams is 247 mm (9.72 in)

$D_{(\text{mean})}$ for all Formula and Blizzard cams is 78.6 mm (3.09 in)

Example:

$$L = 9.72'' \times \tan 44^\circ$$

$$L = 9.72 \times .966$$

$$L = 9.39 \text{ inches of lead}$$

Measuring a cam on the outside diameter will produce a different angle than on the mean diameter. A cam angle measured on the outside diameter can be converted to the "Ski-Doo spec" mean diameter angle as follows:

$$L = C \times \tan A$$

Where:

L = Lead

C = Circumference on outside diameter

A = Cam angle on outside diameter

NOTE: $C_{(\text{outside})}$ for Formula and Blizzard cams is 276 mm (10.866 in) ('79-'93)

$C_{(\text{outside})}$ for '94 and newer DSA cams is 279 mm (11.0 in)

Example:

A Ski-Doo 44° cam will measure about 40.5° at the outside diameter.

$$L = C_{(\text{outside})} \times \tan A_{(\text{outside})}$$

$$L = 11.00'' \times \tan 40.5^\circ$$

$$L = 9.39 \text{ inches of lead}$$

Inches of lead are directly comparable.

$$\begin{aligned} A_{(\text{MEAN})} &= \text{INVERSE TAN } \frac{L}{C_{(\text{MEAN})}} \\ &= \text{INVERSE TAN } \frac{9.39}{9.72} \end{aligned}$$

$$A_{(\text{MEAN})} = 44^\circ = \text{SKI-DOO } 44^\circ \text{ cam.}$$

To simplify things, just remember that if you measure a Ski-Doo cam at the outside circumference the angle will be about 4° less than the specification (mean circumference).

Many after-market cams are measured at the outside circumference. By adding 4° you can compare them to Ski-Doo cams.

SECTION 05 - TRANSMISSION SYSTEM

Example:

FAST 46° cam = Ski-Doo 50° cam

Multi-angle cams are converted in the same manner.

HRP 50° – 40° cam = Ski-Doo 54° – 44° cam

Polaris cams are approximately the same diameter as Ski-Doo cams and are also measured at the outside circumference. Thus a 40° cam in a Polaris clutch will act similar to a Ski-doo clutch with a 44° cam (spring rate and preload being equal).

Driven Pulley Cam Specification

NOTE: All 88.9 mm diameter cams are interchangeable.

95-9 DSA		88.9 mm DIAMETER		8 mm KEYWAY	
P/N	MULTI-ANGLE CAM ANGLE	P/N	CAM ANGLE		
415 0211 00	44°-40°	415 0228 00	30°		
415 0212 00	46°-42°	415 0229 00	32°		
415 0213 00	48°-40°	415 0230 00	34°		
415 0214 00	48°-44°	415 0231 00	36°		
415 0215 00	50°-36°	415 0227 00	38°		
415 0216 00	50°-40°	504 0921 00	40°		
415 0217 00	50°-44°	415 0225 00	42°		
415 0218 00	54°-40°	504 0960 00	44°		
415 0219 00	54°-44°	415 0232 00	46°		
415 0220 00	54°-46°	504 1409 00	47°		
415 0221 00	54°-48°	415 0224 00	48°		
415 0222 00	58°-44°	504 0961 00	50°		
415 0234 00	58°-48°	415 0223 00	52°		
	40°-44°	415 0210 00	54°		
	44°-40°	415 0226 00	56°		
		415 0233 00	58°		

NOTE: 1995 and newer cams have more surface area to support large bushing. MX Zx all aluminum, 2 key way.

BALANCING OF PULLEYS

Each half of Ski-Doo driven pulley is individually balanced. This means that parts can be interchanged and that no alignment marks are needed for assembling for the complete assembly to be in balance.

The TRA clutch is similar to our driven pulleys in the sense that each major component is balanced separately.

However, there are arrows to align when reassembling this clutch. The first one is on the spring cup or cover to the sliding half. The next is between the governor cup and the sliding half. Once these have been indexed properly, the fixed half can be inserted into the clutch assembly and no alignment is needed between the inner pulley and the sliding half on 1994 and older TRA's. 1995 inner pulleys **do** have an alignment mark.

Some 1995 and 1996 models have the new cushion drive, governor cup as standard equipment. This governor cup can't be retro-fitted to other non-cushion drive vehicles due to weight imbalance. Use only complete clutch assemblies on non-cushion drive vehicles.

Truing Pulley Surfaces

The surfaces of a die cast pulley sheave are not always perfectly true. The casting cools in the die at slightly different rates which makes the surface uneven. Trueing the surface in a lathe can increase efficiency of the transmission. The driven pulley sheaves have a 13.75° angle while TRA drive pulley sheaves have a 12° angle. Always remove as little material as possible when trueing these surfaces. Pulley halves need to be rebalanced after any machining.

NOTE: On 1996 and newer liquid cooled models, the drive and driven clutch surfaces are machined.

Windage Plates

"Windage plates" which cover the reinforcing webs on each sheave simply make the pulley more aerodynamic and reduce the amount of energy lost from "pumping air". The use of these plates or covers can make a difference of one to two MPH on top end. The down side of the use of these plates is the increase in sheave temperature due to the reduction of air cooling.

Installation

◆ WARNING

Do not apply anti-seize compound or any lubricant on crankshaft and drive pulley tapers.

◆ WARNING

Never use any type of impact wrench at drive pulley removal and installation.

Drive Pulley Ass'y

The installation procedure must be strictly adhered to as follows:

Lock crankshaft in position as explained in removal procedure.

Install drive pulley on crankshaft extension.

Install lock washer and screw.

◆ WARNING

Never substitute lock washer and/or screw with "jobber" ones. Always use Bombardier genuine parts for this particular case.

Torque screw to 105 N•m (77 lbf•ft).

Install drive belt and pulley guard.

Raise and block rear of vehicle and support it with a mechanical stand.

◆ WARNING

Ensure that the track is free of particles which could be thrown out while is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at intermediate speed and apply brake. Repeat five times.

Reduce the screw torque to 85 N•m (63 lbf•ft) then, retorque to 95 N•m (70 lbf•ft).

◆ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

DRIVE BELTS

The drive belt is the critical link in transmitting power from one "clutch" to the other. The changes in belt technology and materials have allowed us to take for granted the kind of reliability and efficiency that not many years ago we all only dreamed about.

One of the more important changes in drive belts has been the introduction of Kevlar® Fiber B to replace fiberglass or polyester cord in the tensile layer of modern drive belts. This material is much stronger, more flexible, and allows a better adhesive bond with the various rubber compounds used to build a drive belt.

Another important change in drive belts is the increase in width. The extra width allows us to add more Kevlar cords in the tensile layer for strength with today's high output sleds.

Use only the specific Bombardier drive belt listed for your application. The drive belt is a calibrated part of the transmission system. Different belts with different compounds or angles will change how your transmission shifts.

Drive belts can vary +/- 6 mm (1/4 in) length from belt to belt. Because of this manufacturing tolerance, we recommend measuring your drive belts and marking their length on the outer cover. Try to use only belts that are the same length while racing to keep your clutch set up as consistent as possible.

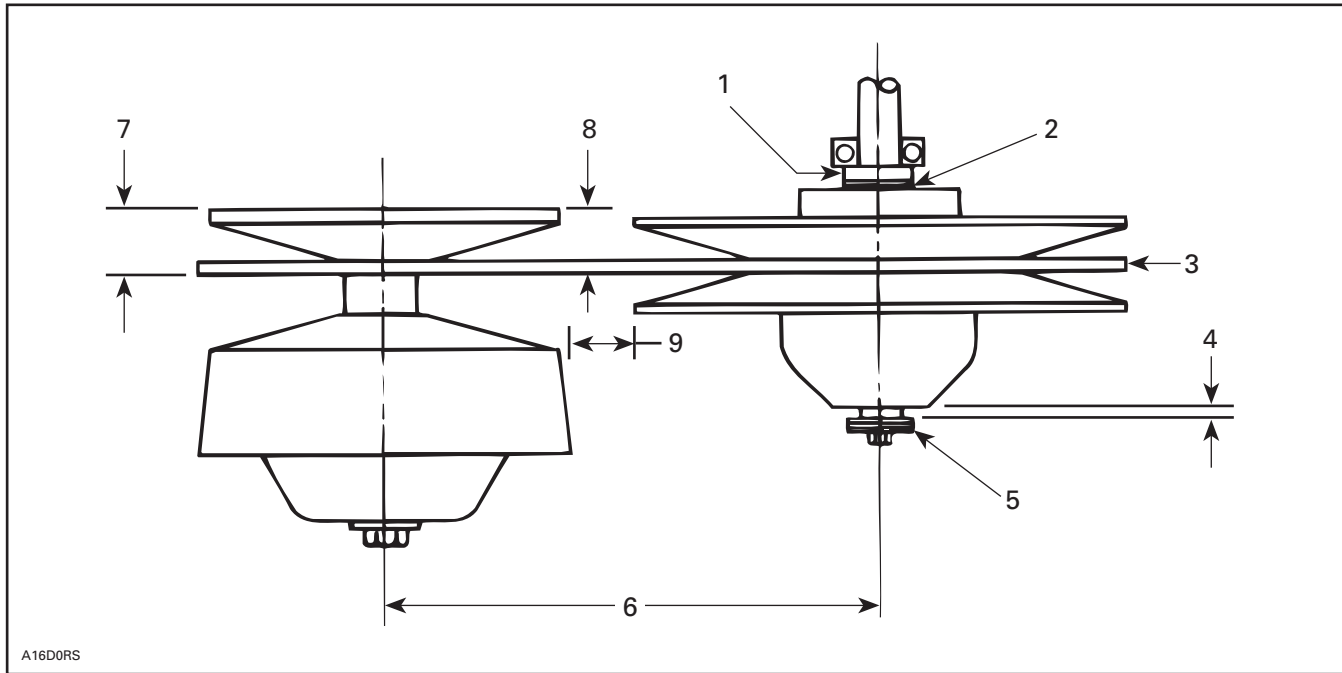
Always break in a new belt by running it easy for 10-15 miles. Vary the vehicle speed and throttle setting without going over 2/3 throttle. It is also a good idea to mark the direction of rotation on the belt. Once the belt has been used, always run it in the same direction.

Be careful not to bend sharply or coil up these new hard compound drive belts since they are much more prone to cracking in cold weather than earlier belts.

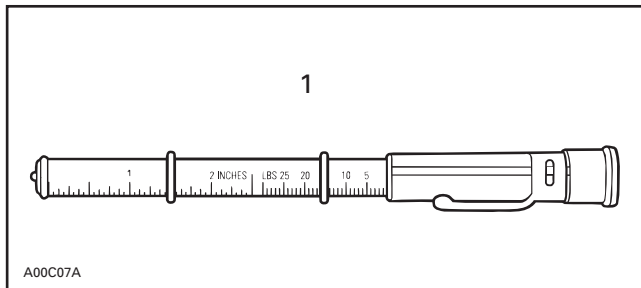
Proper deflection, setup, alignment, and break-in will help insure maximum performance and longevity from the drive belt.

SECTION 05 - TRANSMISSION SYSTEM

Proper Alignment of the TRA Clutch on a FORMULA Model



1. Sleeve (Note: no clearance to this side of driven pulley)
2. 2 shims (504-1082-00)
3. Use straight bar (.375 in x 19 in)
4. DSA: 0-1 mm (0-.040 in)
5. Shim as required to achieve clearance
6. PRS: 268.3 (10-9/16 in)
DSA: 257.5 (10-9/64 in)
CK3: 361.0 (14-7/32 in)
7. $Y = X + 1.5 \text{ mm } (.060 \text{ in})$
8. $X =$ PRS: 36.0 mm (1.460 in)
DSA: 35.0 mm (1.380 in)
CK3: 35.5 (1.398 in)
9. $Z =$ PRS: 27.0 mm (1.060 in)
DSA: 16.5 mm (.650 in)
CK3: 120.0 (4.724 in)

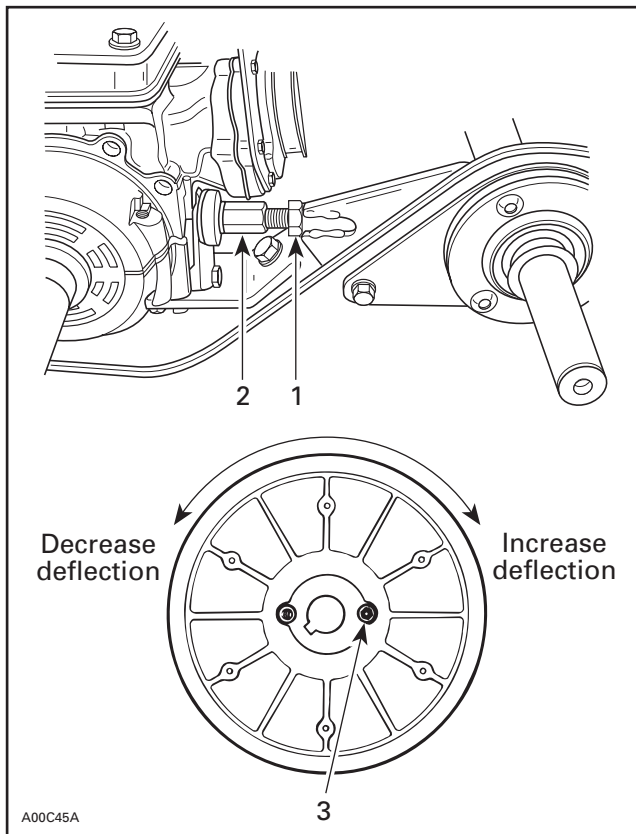


1. Use Ski-Doo tool (P/N 414 3482 00)

Proper belt deflection and alignment are extremely important. Included is a page on proper alignment procedures and deflection measurement methods for your use.

Do not forget about the torque limiter rod on Formula models. This bolt is located between the jackshaft and the engine on the left side. It should be lightly snugged **after** the proper alignment and center to center distances have been set.

NOTE: Do not overtighten, it will misalign pulleys.



TYPICAL

1. Jam nut
2. Adjuster
3. Allen screw with jam nut

The driven pulley has one, two or three (depending upon the year) set screws on the fixed half that are used for setting belt deflection. These 3 mm Allen screws can be moved in or out to open or close the sheaves to lower or raise the drive belt in the driven pulley to achieve the correct deflection.

It is best to accurately align the pulleys and then shim the driven clutch tight. Some feel it is better to let it “float” and align itself. But this doesn’t happen in a dynamic situation when there is load on the belt. If you have a lot of float in the driven and you back off the throttle and the pulley misaligns, when power is applied again, the pulley will stay misaligned because of the force on the countershaft. Shimming the driven pulley tightly to the jackshaft bearing also helps to positively position the jackshaft and its left side bearing.

CHAINCASE GEARING

Contrary to popular belief, small gear changes do not directly affect top speed as long as the clutches are functioning properly. Gearing one or two teeth taller on the top will not generally make the vehicle any faster on top end unless the clutches are fully shifted out and the engine is starting to overrev.

With the TRA clutch, we have about 20 percent more shift ratio available compared to previous designs. Because of this, we have been able to lower the gearing in our chaincase considerably. For example: ‘85 Plus square shaft = 26/38 gearing; ‘86 Plus with TRA = 20/38. Yet, we still have the same overall top gear ratio because of the 0.8:1 top ratio of the TRA clutch.

This gives us better belt life by allowing our clutches to “slip” for a shorter period of time at engagement. It also provides more torque to the drive axle for acceleration.

Most snowmobiles are geared on the “high” side from the factory. They are usually geared for 8 -16 km (5-10 MPH) more than they would reach in average conditions. Because of this, the belt does not seem to go all the way to the top of the drive clutch. This is a normal situation. Snowmobiles run under widely varying conditions. If all snowmobiles were geared to attain a full shift under average conditions and then the vehicle were run on a perfectly smooth frozen surface, it would easily shift out to its geared top speed. Since the drag is so low under these conditions, the engine would begin to over-rev, eventually lose power, possibly damage the engine, and you will not achieve top speed.

There are other factors involved here also. As clutches shift through their range, the efficiency with which they transmit power decreases as the clutch ratio exceeds about 1.5: 1. Efficiency also drops as belt speed (RPM) increases. For optimum chaincase performance ensure that you use the synthetic chain case oil.

SECTION 05 - TRANSMISSION SYSTEM

The following chart illustrates the effects of increased R.P.M. on delivered horsepower. As motor R.P.M. is raised to attain higher maximum horsepower, efficiency of both the drive and driven clutch drop considerably. This loss will often exceed the horsepower gained from the installation of aftermarket exhausts or engine modifications. The only way extra horsepower can increase your snowmobile performance is if it reaches the track.

CRANKSHAFT H.P. (DYNO H.P.)	ENGINE R.P.M.	CLUTCH EFFICIENCY	H.P. TO TRACK (USEABLE H.P.)
115	7800	84.8%	97.5
115	8000	83.9%	96.5
115	8200	83.1%	95.6
115	8400	82.3%	94.6
115	8600	81.4%	93.6
115	8800	80.6%	92.7
115	9000	79.8%	91.8
115	9200	79.0%	90.0
115	9400	78.1%	89.8
115	9600	77.3%	88.9
115	9800	76.4%	87.9
115	10000	75.6%	86.9

Because newer clutch designs shift beyond a 1:1 ratio, belt speed increases dramatically and the diameter that the belt follows around the driven pulley decreases considerably. This wastes energy and efficiency as the belt is being bent around a smaller diameter and centrifugal force is trying to pull the belt into a circular path instead of following the pulleys.

This is why for years manufacturers kept their clutch ratios around 1:1 to keep belt speeds down.

Now with the advent of larger displacement, high torque, lower RPM engines, we can use "over-drive" transmissions and still keep our belt speeds within reason.

As we mentioned, as belt speeds go up, efficiency drops. This is one reason many radar runners gear extremely high sometimes even approaching 1:1 in the chaincase. They have found through diligent testing that they can achieve a higher top speed without shifting their clutches all the way out because of a decrease in belt speed which means an increase in transmission efficiency. That is their bottom line.

For oval racing, the small benefit you may achieve in top end speed would probably be lost by the loss of acceleration on the start and out of the corners on a tight oval circuit.

This holds true for cross-country and snow crossers also. Top speed is not as important as quick acceleration out of the corners and ditches.

You can easily check your gearing selection by marking your drive clutch with a black marker with straight lines from bottom to top on the belt surfaces of the clutch. Go out and ride your sled under your normal conditions and stop to see how far the belt has rubbed the marker off the clutch surfaces. If it has shifted the belt all the way to the top, you may be able to pull one or two more teeth on the top sprocket. Experiment!

If it is down about 1/2 in or more from the top, you could consider trying a one tooth smaller top gear depending upon your type of racing.

The best combination of gearing for speed and acceleration you can achieve is far more important than shifting the belt "all the way to the top" of the clutches.

The following formula can be used to calculate the theoretical top speed of your Ski-Doo. The formula assumes the transmission is shifted out to its top gear ratio. Make sure you use the correct track pitch and transmission ratio for your machine.

Square shaft clutch top ratio = 1

TRA clutch top ratio = .83

Pitch of internal drive track = 2.52 in

Number of teeth on internal drive sprocket = 9

NOTE: Some Summit and long track models use 8 tooth drive sprockets.

SECTION 05 - TRANSMISSION SYSTEM

$$\text{top speed in MPH} = \frac{\text{engine RPM}}{\text{clutch ratio}} \times \frac{\text{teeth, top sprocket}}{\text{teeth, bottom sprocket}} \times \frac{(\text{pitch of track} \times \text{No. of teeth on drive sprocket})}{12} \times \frac{60}{5280}$$

Example: 1995 Formula Z – gearing 25/44 peak power at 7800 RPM

$$\frac{7800}{.83} \times \frac{25}{44} \times \frac{(2.52 \times 9)}{12} \times \frac{60}{5280} = 115 \text{ MPH}$$

For quick reference, use the gear ratio charts provided.

A little known fact that can seriously impair a racer's performance is the misconception that the factory stated peak horsepower RPM or the peak power point you find on a dyno is the correct figure to "clutch" your race sled to.

Generally, this is not the case. The figures that are printed by the factory are determined on a dynamometer in clinical test conditions.

There are many dynamic considerations that affect this figure in the field. Drastic temperature changes under the hood, pressure changes both under the hood and near the air box inlet, exhaust system temperature changes, and even rotating parts such as clutches, jackshafts, and brake discs causing air turbulence under the hood all affect where the engine peak power is when the engine is doing its work under the hood.

Because of these uncontrollable circumstances, it is always best to try varying your clutch setup 200-300 RPM above and below the dyno specification. Most field testing has proven that 200-300 RPM below the dyno figure gives the most consistent overall performance.

Remember this when it is time to go out "fine tuning" your clutch setup and your gearing.

SECTION 05 - TRANSMISSION SYSTEM

Sprocket/Chain Chart

1996	S/L SPROCKETS	1997	S/L SPROCKETS	1998	S/L SPROCKETS
MACH 1	26 × 44	FORMULA S	21 × 44	FORMULA S	21 × 44
SUMMIT 500	22 × 44	FORMULA SL	22 × 44	MX Z 440	22 × 44
FORMULA SLS	25 × 44	FORMULA 500	22 × 44	MX Zx 440	21 × 43
FORMULA Z	25 × 44	FORMULA 583	25 × 44	FORMULA 500	23 × 43
FORMULA SS	26 × 44	MX Z 440 F	22 × 44	MX Z 500	23 × 43
MX Z 440	23 × 44	MX Z 440	23 × 44	SUMMIT 500	22 × 43
SUMMIT 583	22 × 44	MX Z 583	25 × 44	FORMULA SL	22 × 44
MX Z 583	25 × 44	MX Z 670	26 × 44	FORMULA Z 583	25 × 43
FORMULA III	25 × 44	FORMULA III	25 × 44	MX Z 583	25 × 43
FORMULA III LT	23 × 44	MACH 1	26 × 44	SUMMIT 583	22 × 43
SUMMIT 670	23 × 44	MACH Z	26 × 44	FORMULA III 600	25 × 43
MACH Z	26 × 44	SUMMIT 500	22 × 44	FORMULA Z 670	26 × 43
MACH Z LT	25 × 44	SUMMIT 583	22 × 44	MX Z 670	26 × 43
		SUMMIT 670	23 × 44	SUMMIT 670	23 × 43
		MX Zx	23 × 43	SUMMIT X	21 × 43
				MACH 1	26 × 43
				FORMULA III 700	26 × 43
				MACH Z	27 × 43

SECTION 05 - TRANSMISSION SYSTEM

Sprocket/Chain Chart (cont'd)

RATIOS AND CHAIN LENGTHS						
	21	22	23	24	25	26
38	1.81 68	1.73 70	1.65 70	1.58 70	1.52 70	1.46 70
40	1.90 70	1.82 70	1.74 70	1.67 72	1.60 72	1.54 72
43						
44	2.10 72	2.00 72	1.91 72	1.83 74	1.76 74	1.69 74

CHAINS		
LINKS	NARROW	WIDE
68	412 1060 00	—
70	412 1059 00	412 1068 00
72	412 1055 00	412 1067 00
74	412 1058 00	412 1069 00

NARROW SPROCKETS		TEETH	WIDE SPROCKETS	
STEEL	POWDER		STEEL	POWDER
504 0747 00	504 0560 00	22	504 0835 00	504 0911 00
504 0784 00	504 0878 00	23	504 0854 00	504 0910 00
504 0786 00	504 0561 00	24	504 1397 00	504 0909 00
504 0841 00	504 0852 00	25	—	504 0843 00
—	504 0559 00	26	—	504 0853 00
414 3396 00	504 0562 00	40	—	504 0890 00
—	504 0573 00	44	—	504 0855 00
504 0765 00	504 0882 00	44R	—	504 0844 00
504 0718 00	—	17	—	—
—	504 0701 00	18	—	—
—	414 6805 00	19	—	—
504 0748 00	—	20	—	—
504 0840 00	—	21	504 1393 00	—
504 0564 00	—	38	—	—
—	—	43	—	504 1485 00

All chain and sprockets silent type, 3/8" pitch.

Upper sprockets are 1" shaft, 15 splines.

Lower sprockets are 1-1/8" shaft, 17 splines.

SECTION 05 - TRANSMISSION SYSTEM

F 2000 and S 2000

F 2000 AND S 2000 (INTERNAL DRIVE SPROCKET)															
SPROCKET COMBINATION/GEAR RATIO/CHAIN LENGTH															
MAXIMUM TOP SPEED (MPH)															
	17/38 2.23 66	17/40 2.35 68	17/43 2.52 70	17/44 2.58 70	18/38 2.11 68	18/40 2.22 68	18/43 2.38 70	18/44 2.44 70	19/38 2.00 68	19/40 2.10 68	19/43 2.26 72	19/44 2.31 72	20/38 1.90 68	20/40 2.00 70	20/43 2.15 72
6500	62.5	59.3	55.2	53.9	66.1	62.8	58.4	57.1	69.8	66.3	61.7	60.3	73.5	69.8	64.9
6600	63.4	60.2	56.0	54.8	67.1	63.8	59.3	58.0	70.9	67.3	62.6	61.2	74.6	70.9	65.9
6700	64.4	61.2	56.9	55.6	68.2	64.8	60.2	58.9	71.9	68.4	63.58	62.1	75.7	71.9	66.9
6800	65.3	62.1	57.7	56.4	69.2	65.7	61.1	59.7	73.0	69.4	64.5	63.1	76.9	73.0	67.9
6900	66.3	63.0	58.5	57.3	70.2	66.7	62.0	60.6	74.1	70.4	65.4	64.0	78.0	74.1	68.9
7000	67.3	63.9	59.4	58.1	71.2	67.7	62.9	61.5	75.2	71.4	66.4	64.9	79.1	75.2	69.9
7100	68.2	64.8	60.2	58.9	72.2	68.6	63.8	62.4	76.2	72.4	67.3	65.8	80.3	76.2	70.9
7200	69.2	65.7	61.1	59.7	73.2	69.6	64.7	63.3	77.3	73.5	68.3	66.8	81.4	77.3	71.9
7300	70.1	66.6	62.0	60.6	74.3	70.6	65.6	64.1	78.4	74.5	69.2	67.7	82.5	78.4	72.9
7400	71.1	67.5	62.8	61.4	75.3	71.5	66.5	65.0	79.5	75.5	70.2	68.6	83.6	79.5	73.9
7500	72.1	68.5	63.6	62.2	76.3	72.5	67.4	65.9	80.5	76.5	71.2	69.6	84.8	80.5	74.9
7600	73.0	69.4	64.5	63.1	77.3	73.5	68.3	66.8	81.6	77.5	72.1	70.5	85.9	81.6	75.9
7700	74.0	70.3	65.3	63.9	78.3	74.4	69.2	67.7	82.7	78.6	73.0	71.4	87.0	82.7	76.9
7800	74.9	71.2	66.2	64.7	79.4	75.4	70.1	68.5	83.8	79.6	74.0	72.3	88.2	83.8	77.9
7900	75.9	72.1	67.0	65.6	80.4	76.4	71.0	69.4	84.8	80.6	74.9	73.3	89.3	84.8	78.9
8000	76.9	73.0	67.9	66.4	81.4	77.3	71.9	70.3	85.9	81.6	75.9	74.2	90.4	85.9	79.9
8100	77.8	73.9	68.7	67.2	82.4	78.3	72.8	71.2	87.0	82.6	76.8	75.1	91.6	87.0	80.9
8200	78.8	74.8	69.6	68.0	83.4	79.3	73.7	72.0	88.1	83.7	77.8	76.0	92.7	88.1	81.9
8300	79.7	75.8	70.4	68.9	84.4	80.2	74.6	72.9	89.1	84.7	78.8	77.0	93.8	89.1	82.9
8400	80.7	76.7	71.3	69.7	85.5	81.2	75.5	73.8	90.2	85.7	79.7	77.9	95.0	90.2	83.9
8500	81.7	77.6	72.1	70.5	86.5	82.2	76.4	74.7	91.3	86.7	80.6	78.8	96.1	91.3	84.9
8600	82.6	78.5	73.0	71.4	87.5	83.1	77.3	75.6	92.4	87.7	81.6	79.8	97.2	92.4	85.9
8700	83.6	79.4	73.8	72.2	88.5	84.1	78.2	76.4	93.4	88.8	82.6	80.7	98.3	93.4	86.9
8800	84.6	80.3	74.7	73.0	89.5	85.1	79.1	77.3	94.5	89.8	83.5	81.6	99.5	94.5	87.9
8900	85.5	81.2	75.6	73.9	90.5	86.0	80.0	78.2	95.6	90.8	84.5	82.5	100.6	95.6	88.9
9000	86.5	82.2	76.4	74.7	91.6	87.0	80.9	79.1	96.6	91.8	85.4	83.5	101.7	96.6	89.9
9100	87.4	83.1	77.2	75.5	92.5	87.9	81.8	80.0	97.7	92.8	86.3	84.4	102.9	97.7	90.9
9200	88.4	84.0	78.1	76.3	93.6	88.9	82.7	80.8	98.8	93.9	87.3	85.3	104.0	98.8	91.9
9300	89.4	84.9	78.9	77.2	94.6	89.9	83.6	81.7	99.9	94.9	88.2	86.3	105.1	99.9	92.9
9400	90.3	85.8	79.8	78.0	95.6	90.8	84.5	82.6	100.9	95.9	89.2	87.2	106.3	100.9	93.9
9500	91.3	86.7	80.6	78.8	96.6	91.8	85.4	83.5	102.0	96.9	90.1	88.1	107.4	102.0	94.9
9600	92.2	87.6	81.5	79.7	97.7	92.8	86.3	84.3	103.1	97.9	91.1	89.0	108.5	103.1	95.9
9700	93.2	88.5	82.3	80.5	98.7	93.7	87.2	85.2	104.2	99.0	92.1	90.0	109.6	104.2	96.9
9800	94.2	89.5	83.2	81.5	99.7	94.7	88.1	86.1	105.2	100.0	93.0	90.9	110.8	105.2	97.9
9900	95.1	90.4	84.0	82.2	100.7	95.7	89.0	87.0	106.2	101.0	93.9	91.8	111.9	106.3	98.9
10000	96.1	91.3	84.9	83.0	101.7	96.6	89.9	87.9	107.2	102.0	94.9	92.7	113.0	107.4	99.9

NOTE: CLUTCH RATIO IS 1 TO 1

SECTION 05 - TRANSMISSION SYSTEM

F 2000 and S 2000 (cont'd)

F 2000 AND S 2000 (INTERNAL DRIVE SPROCKET)															
SPROCKET COMBINATION/GEAR RATIO/CHAIN LENGTH															
MAXIMUM TOP SPEED (MPH)															
	20/44 2.20 72	21/38 1.80 68	21/40 1.90 70	21/43 2.04 72	21/44 2.09 72	22/38 1.72 70	22/40 1.81 70	22/43 1.95 72	22/44 2.00 72	23/38 1.65 70	23/40 1.74 70	23/43 1.86 72	23/44 1.91 72	24/38 1.58 70	24/40 1.66 70
6500	63.5	77.1	73.3	68.2	66.6	80.8	76.8	71.4	69.8	84.5	80.3	74.6	73.0	88.2	83.8
6600	64.4	78.3	74.4	69.2	67.7	82.1	78.0	72.5	70.9	85.8	81.5	75.8	74.1	89.5	85.1
6700	65.4	79.5	75.5	70.2	68.7	83.3	79.1	73.6	71.9	87.1	82.7	76.9	75.2	90.9	86.3
6800	66.4	80.7	76.7	71.3	69.7	84.6	80.3	74.7	73.0	88.4	84.0	78.1	76.3	92.2	87.6
6900	67.4	81.9	77.8	72.3	70.7	85.8	81.5	75.8	74.1	89.7	85.2	79.2	77.5	93.6	88.9
7000	68.3	83.1	78.9	73.4	71.8	87.0	82.7	76.9	75.2	91.0	86.4	80.4	78.6	95.0	90.2
7100	69.3	84.3	80.1	74.5	72.8	88.3	83.9	78.0	76.2	92.3	87.7	81.56	79.7	96.3	91.5
7200	70.3	85.5	81.2	75.5	73.8	89.5	85.1	79.1	77.3	93.6	88.9	82.7	80.8	97.7	92.8
7300	71.3	86.6	82.3	76.5	74.8	90.8	86.2	80.2	78.4	94.9	90.2	83.8	82.0	99.0	94.1
7400	72.2	87.8	83.4	77.6	75.9	92.0	87.4	81.3	79.5	96.2	91.4	85.0	83.1	100.4	95.4
7500	73.2	89.0	84.6	78.7	76.9	93.3	88.6	82.4	80.5	97.5	92.6	86.1	84.2	101.7	96.6
7600	74.2	90.2	85.7	79.7	77.9	94.5	89.8	83.5	81.6	98.8	93.9	87.3	85.3	103.1	97.9
7700	75.2	91.4	86.8	79.7	78.9	95.7	91.0	84.6	82.7	100.1	95.1	88.4	86.4	104.4	99.2
7800	76.1	92.6	87.9	81.8	80.0	97.0	92.1	85.7	83.8	101.4	96.3	89.6	87.6	105.8	100.5
7900	77.1	93.8	89.1	82.8	81.0	98.2	93.3	86.8	84.8	102.7	97.6	90.7	88.7	107.2	101.8
8000	78.1	95.0	90.2	83.9	82.0	99.5	94.5	87.9	85.9	104.0	98.8	91.9	89.8	108.5	103.1
8100	79.1	96.1	91.3	85.0	83.0	100.7	95.7	89.0	87.0	105.3	100.0	93.0	90.9	109.9	104.4
8200	80.1	97.3	92.5	86.0	84.1	102.0	96.9	90.1	88.1	106.6	101.3	94.2	92.1	111.2	105.7
8300	81.0	98.5	93.6	87.0	85.1	103.2	98.0	91.2	89.1	107.9	102.5	95.3	93.2	112.6	107.0
8400	82.0	99.7	94.7	88.1	86.1	104.4	99.2	92.3	90.2	109.2	103.7	96.5	94.3	113.9	108.2
8500	83.0	100.9	95.8	89.1	87.1	105.7	100.4	93.4	91.3	110.5	105.0	97.6	95.4	115.3	109.5
8600	84.0	102.1	97.0	90.2	88.2	106.9	101.6	94.5	92.4	111.8	106.2	98.8	96.6	116.7	110.8
8700	84.9	103.3	98.1	91.2	89.2	108.2	102.8	95.6	93.4	113.1	107.4	99.9	97.7	118.0	112.1
8800	85.9	104.4	99.2	92.3	90.2	109.4	104.0	96.7	94.5	114.4	108.7	101.1	98.8	119.4	113.4
8900	86.9	105.6	100.4	93.3	91.2	110.7	105.1	97.8	95.6	115.7	109.9	102.2	99.9	120.7	114.7
9000	87.9	106.8	101.5	94.4	92.3	111.9	106.3	98.9	96.6	117.0	111.1	103.4	101.0	122.1	116.0
9100	88.8	108.0	102.6	95.4	93.3	113.2	105.7	100.0	97.7	118.3	112.4	104.5	102.2	123.4	117.3
9200	89.8	109.2	103.7	96.5	94.3	114.4	108.7	101.1	98.8	119.6	113.6	105.7	103.3	124.8	118.6
9300	90.8	110.4	104.9	97.5	95.3	115.6	109.9	102.2	99.8	120.9	114.8	106.8	104.4	126.2	119.8
9400	91.8	111.6	106.0	98.6	96.4	116.9	111.0	103.3	100.9	122.2	116.1	107.9	105.5	127.5	121.1
9500	92.7	112.8	107.1	99.6	97.4	118.1	112.2	104.4	102.0	123.5	117.3	109.1	106.7	128.9	122.4
9600	93.7	113.9	108.2	100.7	98.4	119.4	113.4	105.5	103.1	124.8	118.6	110.2	107.8	130.2	123.7
9700	94.7	115.1	109.4	101.7	99.4	120.6	114.6	106.6	104.2	126.1	119.8	111.4	108.9	131.6	125.0
9800	95.7	116.3	110.5	102.8	100.5	121.9	115.8	107.7	105.2	127.4	121.0	112.6	110.0	132.9	126.3
9900	96.7	117.5	111.6	103.8	101.5	123.1	116.9	108.8	106.3	128.7	122.3	113.7	111.1	134.3	127.6
10000	97.6	118.7	112.8	104.9	102.5	124.3	118.1	109.9	107.4	130.0	123.5	114.8	112.3	135.6	128.9

NOTE: CLUTCH RATIO IS 1 TO 1

SECTION 05 - TRANSMISSION SYSTEM

F 2000 and S 2000 (cont'd)

F 2000 AND S 2000 (INTERNAL DRIVE SPROCKET)															
SPROCKET COMBINATION/GEAR RATIO/CHAIN LENGTH															
MAXIMUM TOP SPEED (MPH)															
	24/43	24/44	25/38	25/40	25/43	25/44	26/38	26/40	26/43	26/44					
	1.79	1.83	1.52	1.60	1.72	1.76	1.46	1.54	1.65	1.69					
	74	74	70	72	74	74	70	72	74	74					
6500	77.9	76.1	91.8	87.3	81.1	79.3	95.5	90.7	84.4	82.5					
6600	79.11	77.3	93.3	88.6	82.4	80.5	97.0	92.1	85.7	83.8					
6700	80.3	78.5	94.7	89.9	83.7	81.8	98.5	93.5	87.0	85.0					
6800	81.5	79.7	96.1	91.3	84.9	83.0	99.9	94.9	88.3	86.3					
6900	82.7	80.8	97.5	92.6	86.2	84.2	101.4	96.3	89.6	87.6					
7000	83.9	82.0	98.9	94.0	87.4	85.4	102.9	97.7	90.9	88.8					
7100	85.1	83.2	100.3	95.3	88.6	86.6	104.3	99.1	92.2	90.1					
7200	86.3	84.3	101.7	96.6	89.9	87.9	105.8	100.5	93.5	91.4					
7300	87.5	85.5	103.1	98.0	91.1	89.1	107.3	101.9	94.8	92.6					
7400	88.7	86.7	104.6	99.3	92.4	90.3	108.7	103.3	96.1	93.9					
7500	89.9	87.9	106.0	100.7	93.6	91.5	110.2	104.7	97.4	95.2					
7600	91.1	89.0	107.4	102.0	94.9	92.7	111.7	106.1	98.7	96.5					
7700	92.3	90.2	108.8	103.4	96.1	94.0	113.2	107.5	99.9	97.7					
7800	93.5	91.4	110.2	104.7	94.4	95.2	114.6	108.9	101.3	99.0					
7900	94.6	92.5	111.6	106.0	98.6	96.4	116.1	110.3	102.5	100.3					
8000	95.8	93.7	113.0	107.4	99.8	97.6	117.6	111.7	103.8	101.5					
8100	97.0	94.9	114.5	108.7	101.1	98.8	119.0	113.1	105.1	102.8					
8200	98.3	96.1	115.9	110.1	102.3	100.1	120.5	114.5	106.5	104.1					
8300	99.4	97.2	117.3	111.4	103.6	101.3	122.0	115.9	107.8	105.3					
8400	100.7	98.4	118.7	112.8	104.8	102.5	123.4	117.3	109.0	106.6					
8500	101.9	99.6	120.1	114.1	106.1	103.7	124.9	118.7	110.4	107.9					
8600	103.0	100.7	121.5	115.4	107.4	104.9	126.4	120.1	111.7	109.1					
8700	104.2	101.9	122.9	116.8	108.6	106.2	127.8	121.5	112.9	110.4					
8800	105.5	103.1	124.3	118.1	109.9	107.4	129.3	122.9	114.3	111.7					
8900	106.7	104.3	125.8	119.5	111.1	108.6	130.8	124.2	115.5	113.0					
9000	107.9	105.4	127.2	120.8	112.4	109.8	132.3	125.6	116.8	114.2					
9100	109.0	106.6	128.6	122.2	113.6	111.0	133.7	127.0	118.2	115.5					
9200	110.3	107.8	130.0	123.5	114.9	112.3	135.2	128.4	119.5	116.8					
9300	111.5	108.9	131.4	124.8	116.1	113.5	136.7	129.8	120.8	118.0					
9400	112.7	110.1	132.8	126.2	117.4	114.7	138.1	131.2	122.0	119.3					
9500	113.8	111.3	134.2	127.5	118.6	115.9	139.6	132.6	123.4	120.6					
9600	115.1	112.5	135.6	128.9	119.9	117.1	141.1	134.0	124.7	121.8					
9700	116.3	113.6	137.1	130.2	121.1	118.4	142.5	135.4	125.9	123.1					
9800	117.5	114.8	138.5	131.5	122.4	119.6	144.0	136.8	127.3	124.4					
9900	118.7	116.0	139.9	132.9	123.6	120.8	145.5	138.2	128.6	125.6					
10000	119.9	117.1	141.3	134.2	124.9	122.0	146.9	139.6	129.9	126.9					

NOTE: CLUTCH RATIO IS 1 TO 1

SECTION 05 - TRANSMISSION SYSTEM

F 2000 and S 2000 (cont'd)

F 2000 AND S 2000 (INTERNAL DRIVE SPROCKET)																
SPROCKET COMBINATION/GEAR RATIO/CHAIN LENGTH																
MAXIMUM TOP SPEED (MPH)																
	24/43 1.79 74	24/44 1.83 74	25/38 1.52 70	25/40 1.60 72	25/43 1.72 74	25/44 1.76 74	26/38 1.46 70	26/40 1.54 72	26/43 1.65 74	26/44 1.69 74						
6500	93.8	91.7	110.7	105.1	97.8	95.6	115.1	109.3	101.7	99.4						
6600	95.3	93.2	112.4	106.7	99.3	97.0	116.9	111.0	103.2	100.9						
6700	96.7	94.6	114.1	108.4	100.8	98.5	118.6	112.7	104.8	102.4						
6800	98.2	96.0	115.8	110.0	102.3	100.0	120.4	114.4	106.4	104.0						
6900	99.6	97.4	117.5	111.6	103.8	101.4	122.2	116.1	107.9	105.5						
7000	101.1	98.8	109.2	113.2	105.3	102.9	123.9	117.7	109.5	107.0						
7100	102.5	100.2	120.9	114.8	106.8	104.4	125.7	119.4	111.1	108.6						
7200	103.9	101.6	122.6	116.4	108.3	105.9	127.5	121.1	112.6	110.1						
7300	105.4	103.0	124.3	118.1	109.8	107.3	129.2	122.8	114.2	111.6						
7400	106.8	104.4	126.0	119.7	111.3	108.8	131.0	124.5	115.7	113.1						
7500	108.3	105.9	127.7	121.3	112.8	110.3	132.8	121.1	117.3	114.7						
7600	109.7	107.3	129.4	122.9	114.3	111.7	134.6	127.8	118.9	116.2						
7700	111.2	108.7	131.1	124.5	115.8	113.2	136.3	129.5	120.5	117.7						
7800	112.6	110.1	132.8	126.1	117.3	114.7	138.1	131.2	122.0	119.3						
7900	114.1	111.5	134.5	127.8	118.8	116.1	139.9	132.9	123.6	120.8						
8000	115.5	112.9	136.2	129.4	120.3	117.6	141.6	134.6	125.2	122.3						
8100	116.9	114.3	137.9	131.0	121.8	119.1	143.4	136.2	126.7	123.9						
8200	118.4	115.7	139.6	132.6	123.3	120.6	145.2	137.9	128.3	125.4						
8300	119.8	117.1	141.3	134.2	124.8	122.0	146.9	139.6	129.8	126.9						
8400	121.3	118.6	143.0	135.9	126.3	123.5	148.7	141.3	131.4	128.4						
8500	122.7	120.0	144.7	137.5	127.8	125.0	150.5	143.0	132.9	130.0						
8600	124.2	121.4	146.4	139.1	129.4	126.4	152.3	144.6	134.5	131.5						
8700	125.6	122.8	148.1	140.7	130.8	127.9	154.0	146.3	136.1	133.0						
8800	127.0	124.2	149.8	142.3	132.4	129.4	155.8	148.0	137.6	134.6						
8900	128.5	125.6	151.5	143.9	133.9	130.9	157.6	149.7	139.2	136.1						
9000	129.9	127.0	153.2	145.6	135.4	132.3	159.3	151.4	140.8	137.6						
9100	131.4	128.4	154.9	147.2	136.9	133.8	161.1	153.1	142.4	139.1						
9200	132.8	129.9	156.6	148.8	138.4	135.3	162.9	154.7	143.9	140.7						
9300	134.9	131.3	158.3	150.4	139.9	136.7	164.7	156.4	145.5	142.2						
9400	135.7	132.7	160.0	152.0	141.4	138.2	166.4	158.1	147.0	143.7						
9500	137.2	134.1	161.7	153.6	142.9	139.7	168.2	159.8	148.6	145.3						
9600	138.6	135.5	163.4	155.3	144.4	141.1	170.0	161.5	150.2	146.8						
9700	140.0	136.9	165.1	156.9	145.9	142.6	171.7	163.1	151.7	148.3						
9800	141.5	138.3	166.8	158.5	147.4	144.1	173.5	164.8	153.3	149.8						
9900	142.9	139.7	168.5	160.1	148.9	145.6	175.3	166.5	154.9	161.4						
10000	144.4	141.1	170.2	161.7	150.4	147.0	177.0	168.2	156.4	152.9						

NOTE: CLUTCH RATIO IS 0.83 TO 1, INCLUDING FULL OVERDRIVE OF T.R.A.

SECTION 05 - TRANSMISSION SYSTEM

The new CK 3 chassis uses a different chain case than the F 2000 and S 2000 chassis. Therefore, the chain used in some gear combinations may be different.

Consult the following information.

Gear ratios and maximum top speed (MPH) will remain the same.

CK 3 CHASSIS	
Gear ratio	Chain
17/44	70
18/44	70
19/44	70
20/44	70
21/44	70
22/44	72
23/44	72
24/44	72
25/44	72
26/44	72
17/43	68
18/43	68
19/43	70
20/43	70
21/43	70
22/43	70
23/43	72
24/43	72
25/43	72
26/43	72
17/40	66
18/40	68
19/40	68
20/40	68
21/40	68
22/40	68
23/40	70
24/40	70
25/40	70
26/40	70

TRANSMISSION CALIBRATION PROCEDURE

1. A new vehicle should be broken-in before fine tuning the transmission. 200-300 miles will allow things like bearings and the track to loosen-up. This will allow the sled to roll much freer which may slightly change the clutch calibration.
2. Set up the chassis configuration (lowering, weight transfer, traction).
3. Adjust the carburetor calibration to match the condition of the day.
4. Pick the chain case ratio.
5. Define the driven pulley calibration. Stock is a good starting point. Drag racers may consider trying a larger cam angle. Use multi-angle cams only for fine tuning after working with the drive clutch.
6. Choose the drive belt (compound, length, width).
7. Define the TRA calibration
 - Start with the stock ramp in position #3
 - For most forms of racing, a higher engagement RPM can be utilized. The better the traction, the higher the engagement that can be used. Most stock rules limit engagement to 5000 RPM. That's 5000 RPM on the technical inspector's tachometer and it may not agree with your dash tachometer. If in doubt, get the tech. man to verify your engagement. The easiest way to raise engagement is to use a spring with a higher start load and a similar finish load. Remember, the stiffer spring at start will also affect the shift curve at 0 to 1/2 ratio.
 - If the stiffer spring slowed down the shift at low ratios, try more roller pin weight. The pin weight will not change engagement much but will shift faster. Utilize the threaded roller pins to achieve pin weights in between the hollow steel and solid steel pin.
 - Fine tune the shift curve by trying different adjuster positions. Use the lowest adjuster number that still allows you to maintain RPM.

- Pin weight and ramp angle are interrelated, but can be varied to achieve certain results. A 16.5 gram pin and the adjuster set in #5 may produce the same full throttle RPM as a 14.5 gram pin with the adjuster set in #3, but the lighter pin will be revier at part throttle setting at low ratios. This may work better for snow cross or woods racing whereas the heavier pin may be better in a drag race. Some ramp profiles will achieve better top speed with the adjusters set in lower numbers (1-4). If you are in position 5 or 6, try a slightly lighter pin weight (1.5 to 2 grams) and lower the adjuster position.

NOTE: Never use adjuster position #6 with the FZ ramp. The tip of the ramp may touch the lever arm.

- If your shift curve is perfect but the engagement is too low, a flat or notch can be ground in the ramp right where the roller sits at neutral position. This is a touchy procedure and should only be attempted as a last resort. Be prepared to scrap some ramps during the learning procedure.
8. The best way to test clutching is with a set of timing lights or side by side comparison with a similar vehicle. Leave one machine as a base line reference while tuning the test vehicle. Don't change things on both vehicles at the same time or you won't know if you are gaining or losing. Also, only change one parameter at time on your test vehicle so you know exactly what results from the change.
 9. For drag racers, try running the engine down to several hundred RPM below the stated power peak. When the exhaust is cold, the peak power RPM drops. How much lower depends on the engine type, exhaust type, jetting and underhood temperature. Summer and fall grass draggers should especially try lower RPM.
 10. This is where the winners become winners. Test, test, test and then go test some more.
 11. **KEEP DETAILED NOTES OF ALL YOUR TESTINGS!!!** No matter how good you think your memory is, after you test your hundredth combination, things can get overwhelming.

SECTION 05 - TRANSMISSION SYSTEM

Transmission Tuning Test Sheet

DATE: _____ VEHICLE: _____ SHEET NO.: _____
 TENT SITE: _____ TEMPERATURE: _____ SURFACE COND. _____

	Test 1	Test 2	Test 3	Test 4	Test 5
Cam Angle					
Spring Color Code					
Spring Preload, lb					
Spring Position ex. (A-4)					
Chaincase Gearing					
Lever Arm and Pin Type					
Weight Each Assembly					
Ramp Identification					
No. of Set Screws Added (if used)					
Spring Color Code/ Tension					
TRA Adjuster Position					
Belt Part Number					
Width					
Length					
Engagement RPM					
Shift RPM					
Top Speed					
Time for Run/ Measured Distance					
Variation Min./Max.					
Special Notes					

SECTION 05 - TRANSMISSION SYSTEM

Racers Log

Vehicle:		Date:		Sheet Number:	
Location:		Surface Conditions:			
Temperature:		Barometric Pressure:		Humidity:	
Carburetor Size:		Fuel:		C.R.A.D.:	
	PTO	MAG	Carburetion notes:		
Main Jet					
Needle Jet					
Jet Needle					
E-Clip Position					
Slide Cutaway					
Pilot Jet					
Drive Pulley			Clutching notes:		
Lever Arm/Pin Type					
Pin Weight					
Ramp Identification					
T.R.A. Adjuster Position					
Spring Identification					
Spring Pressure @ Engagement					
Spring Pressure @ Full Shift					
Engagement RPM					
Shift RPM					
Drive Belt Identification					
Driven Pulley					
Cam Identification					
Spring Identification					
Spring Preload and Location					
Chaincase Gearing					
	LH	RH	Chassis notes:		
Inches of Carbide/ski					
Camber					
Front Spring Ident.					
Ride Height					
Center Spring Ident.					
Limiter Adjustment					
Rear Spring Ident.					
Ride Height					
Stud Quantity and Type					

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SECTION 06 - TECHNICAL PUBLICATIONS AND RACING PARTS

HIGH PERFORMANCE PARTS

DESCRIPTION	P/N
Magnesium clutch lever	417 0043 01
Driven pulley windage plate	504 1420 00 (OUTER) 504 1421 00 (INNER)
Screw for windage plate	732 6010 67 (12)
Extension bushing (Formula 1) (For double driven pulley large bushings)	486 0197 00
High revolution tachometer	486 0371 00 (2 PULSES) 486 0521 00 (6 PULSES)
Tachometer holder (Formula 1)	486 0030 00
Low friction bearing (replace P/N 405 4045 00)	486 0472 00
Master cylinder	486 0452 00
Brake pad insulator Kelsey-Hayes	486 0424 00
Brake pad Kelsey-Hayes	486 0238 00
Support for stud on track (2" angle plate)	486 0493 00
High grip spark plug cap	414 8640 00
Throttle handle (44 mm-metal-twin track)	414 4871 00 plastic
Housing	414 4411 00 plastic
Magneto assembly (12 V, 160 W) (race)	486 0143 00
CDI box	486 0144 00
Carburetor intake bell	486 0157 00
44 mm carburetor MAG (Mach 1-X 1991)	4031123 00
44 mm carb PTO (Mach 1-X 1991)	403 1122 00
Handle bar (Twin track)	486 0242 00
Formula 1 ski (aluminum)	486 0278 00
Small fuel tank	486 0494 00
Mechanical temperature gauge	486 0373 00
Fiberglass gas or lube tank	486 0495 00
15" x 121" High profile track	570 2090 00
Stabilizing bar assembly 3/4"	580 6045 00 (kit)
SC10 front arm quick adj ass'y	861 7602 00
UHMW ski skin - MXZ 94/95/96	
Asphalt track 40 durometer	*Camoplast 679-9802
Asphalt track 60 durometer	*Camoplast 679-9805
Racing brake disc	486 0734 00
5/8" sway bar 1996 MX Z	506 1327 00
3/4" sway bar 1996 MX Z	506 1328 00
1/2" lug drag track	*Camoplast 679-9811
Snocross racing track	*Camoplast 700-9850
Oval racing track	*Camoplast 679-9844

* Available through Camoplast distributors

SECTION 06 - TECHNICAL PUBLICATIONS AND RACING PARTS

USEFUL PUBLICATIONS

DESCRIPTION	P/N
Shop Manuals x 3 for 1996	
Vol. 1 Élan, Tundra II LT, Touring E/E LT/LE/SLE, Formula S/SL, Skandic 380/500	484 0628 00
Vol. 2 Grand Touring 500/580/SE, Formula SLS/STX/STX LT (2), Summit 500, Mach 1	484 0628 01
Vol. 3 MX Z 440/583, Formula Z/SS/III/ II LT, Summit 583/670, Mach Z/Z LT, Skandic WT	484 0628 02
Shop Manuals x 3 for 1997	
Vol. 1 Tundra II LT, Touring E/E LT/LE/SLE, Formula S/SL, Skandic 380/500	484 0647 00
Vol. 2 MX 440F/440/583/670, Formula 500/500 Deluxe/583/Z, Summit 500/583/670, Grand Touring 500/583, Skandic WT/SWT/WT LC	484 0647 01
Vol. 3 Formula III/ III LT, Mach 1 Z/Z LT	484 0647 02
Supplement MX Zx 440 LC 1997	484 0647 03
Supplement Grand Touring SE 1997	484 0647 04
Racing Handbook 1997	484 0649 00
Shop Manuals x 3 for 1998	
Vol. 1 Tundra II LT, Touring E/LE, Formula S/S Electric/SL, Skandic 380/500	484 0680 00
Vol. 2 MX Z 440/500/583/670, Formula 500/500 DL/583 DL/Z 583/Z 670, Summit 500/583/670, Grand Touring 500/583, Skandic WT/SWT/WT LC	484 0682 00
Vol. 3 Grand Touring 700/SE, Formula III 600/600 R/600 LT/700/700 R, Mach 1/1 R/Z/Z R/Z LT/Z LT R	484 0684 00
Shop Manual Mini Z 1998	484 0693 00
Supplement MX Zx 440 LC 1998	484 0695 00
Supplement Touring SLE, Tundra R 1998	484 0696 00
Supplement Summit x 670 1998	484 0697 00
High Altitude and Sea Level Technical Data 1994-1998	480 0686 00
Specification Booklet 1995-1998	480 0685 00

SECTION 06 - TECHNICAL PUBLICATIONS AND RACING PARTS

TECHNICAL DATA

Supplement for Model: 1998 Mach Z 809

MODEL: 1998 Mach Z 809		PRELIMINARY			
RACING TYPE		-Grass drags-			
	Maximum horsepower *	RPM			
C A R B U R E T O R	Carburetor type		3 - TM38		
	Main jet		PTO	CENTER	MAG
	Needle		250	250	250
	Needle clip position		8ABY1-40	8ABY1-40	8ABY1-40
	Slide cut-away		2	2	2
	Pilot jet		2.0	2.0	2.0
	Needle jet		50	50	50
	Air screw adjustment	± 1/8 turn	0-3 (327)	0-3 (327)	0-3 (327)
	Needle valve		3.0	3.0	3.0
			1.5	1.5	1.5
		Super unleaded			
D R I V E R A T I O	Drive ratio		23-43		
	Chain		Links		
	Drive pulley	Type of drive pulley	TRA		
		Ramp identification	280		
		Calibration screw position	2		
		Spring color	250/460 (Pink)		
	Clutch engagement	RPM			
		Pin	Pn=M17 004 308		
		Lever	Solid 23 gr		
	Driven pulley	Spring	Color	Std 98	
Preload			Beige		
Cam		Angle	(B-1)		
Drive belt	Part number	50°-47°			
Spring rave	Part number	415 0450 00			
Calibration done at temperature of		30°C			
* The maximum horsepower RPM is applicable on the vehicle. It may be different under certain circumstances and BOMBARDIER INC. reserves the right to modify it without obligation.					

SECTION 06 - TECHNICAL PUBLICATIONS AND RACING PARTS

Supplement for Model: 1998 MX Z 500

MODEL: 1998 MXZ 500		PRELIMINARY		
RACING TYPE		-Grass drags-		
	Maximum horsepower *	RPM	7700-7800	
C A R B U R E T O R	Carburetor type		2 x VM38	
	Main jet		<i>PTO</i>	
			<i>MAG</i>	
			230	220
	Needle		6DHY48	6DHY48
	Needle clip position		4	4
	Slide cut-away		2.5	2.5
	Pilot jet		50	50
	Needle jet		Q-3 (480)	Q-3 (480)
	Air screw adjustment	± 1/8 turn	1.5	1.5
	Needle valve		1.5	1.5
Gas grade		<i>Super unleaded</i>		
D R I V E R A T I O	Drive ratio		21-43	
	Chain		<i>Links</i> 72	
	Drive pulley	Type of drive pulley		<i>TRA</i>
		Ramp identification		<i>CF-1</i>
		Calibration screw position		3
		Spring color		<i>160/320 (Pu/Pu)</i>
		Clutch engagement	RPM	
		Pin		<i>Steel threaded + 2 screw sets</i>
		Lever		<i>Std 98</i>
	Driven pulley	Spring	Color	<i>Beige</i>
Preload			kg (lb) 19 lbs - B6	
Cam		Angle	<i>54°-48°</i>	
Drive belt		Part number	<i>414 8607 00</i>	
Spring rave		<i>1.0 x 38 mm</i>	Part number	<i>420 2399 48</i>
Calibration done at temperature of			30°C	
* The maximum horsepower RPM is applicable on the vehicle. It may be different under certain circumstances and BOMBARDIER INC. reserves the right to modify it without obligation.				

SECTION 06 - TECHNICAL PUBLICATIONS AND RACING PARTS

Supplement for Model: 1997 Mach 1 700

MODEL: 1997 Mach 1 700					
RACING TYPE		-Grass drags-			
	Maximum horsepower *	RPM	8500		
			VM-38		
C A R B U R E T O R	Carburetor type				
			<i>PTO</i>	<i>CENTER</i>	<i>MAG</i>
	Main jet		240	240	240
	Needle		Stock	Stock	Stock
	Needle clip position		5	5	5
	Slide cut-away		Stock	Stock	Stock
	Pilot jet		Stock	Stock	Stock
	Needle jet		Stock	Stock	Stock
	Air screw adjustment	± 1/8 turn	1-1/4 turn	1-1/4 turn	1-1/4 turn
	Needle valve		Stock	Stock	Stock
			<i>Unleaded</i>		
D R I V E R A T I O	Drive ratio		21-44		
	Chain		Links 72		
	Drive pulley	Type of drive pulley	TRA		
		Ramp identification	386		
		Calibration screw position	4		
		Spring	230/280		
		Clutch engagement	RPM	4500	
		Pin		Solid	
		Lever		New 97 alum.	
	Driven pulley	Spring	Color	Beige	
Preload			kg (lb)	19 lbs (A-6)	
Cam		Angle	52°		
Drive belt		Part number	415 0603 00		
Calibration done at temperature of			30°C		
* The maximum horsepower RPM is applicable on the vehicle. It may be different under certain circumstances and BOMBARDIER INC. reserves the right to modify it without obligation.					

SECTION 06 - TECHNICAL PUBLICATIONS AND RACING PARTS

Supplement for Model: 1997 Formula MX Z 440 Fan

MODEL: 1997 Formula MX Z 440 Fan					
RACING TYPE		-Grass drags-		500'	660'
	Maximum horsepower *	RPM		7000	7000
ROTARY VALVE	Rotary valve	Part number			
		Timing	opening		
			closing		
C A R B U R E T O R	Carburetor type			VM 34	VM 34
	Main jet			<i>PTO</i>	<i>MAG</i>
				150	135
	Needle			Stock	Stock
	Needle clip position			4	4
	Slide cut-away			Stock	Stock
	Pilot jet			Stock	Stock
	Needle jet			Stock	Stock
	Air screw adjustment	± 1/8 turn		1-1/4	1-1/4
	Needle valve			Stock	Stock
	Idle speed	RPM			
	Gas grade			Super unleaded	Super unleaded
D R I V E R A T I O	Drive ratio			18-44	19-44
	Chain			70 links	72 links
	Drive pulley	Type of drive pulley		TRA	TRA
		Ramp identification		CF1	CF1
		Calibration screw position		2	
		Spring color		Pos. 3	Pos. 3
		Clutch engagement	RPM	4750	4750
		Pin		Hollow	Hollow
		Lever		Std alu.	Std alu.
	Driven pulley	Spring	Color	Orange	Orange
			Preload kg (lb)	16.5 lbs	17.5 lbs
		Cam	Angle	54°-40°	54°-40°
Drive belt		Part number	415 0606 00	415 0606 00	
Calibration done at temperature of			30°C (86°F)	30°C (86°F)	
* The maximum horsepower RPM is applicable on the vehicle. It may be different under certain circumstances and BOMBARDIER INC. reserves the right to modify it without obligation.					

SECTION 06 - TECHNICAL PUBLICATIONS AND RACING PARTS

Supplement for Model: 1996 Mach Z

MODEL: 1996 Mach Z					
RACING TYPE		-Grass drags-			
	Maximum horsepower *	RPM	8250		
			TM-38		
C A R B U R E T O R	Carburetor type				
			PTO	CENTER	MAG
	Main jet		250	250	250
	Needle		Stock	Stock	Stock
	Needle clip position		4	4	4
	Slide cut-away		Stock	Stock	Stock
	Pilot jet		Stock	Stock	Stock
	Needle jet		Stock	Stock	Stock
	Air screw adjustment	± 1/8 turn	3/4 turn	3/4 turn	3/4 turn
	Needle valve		Stock	Stock	Stock
			Super unleaded		
D R I V E R A T I O	Drive ratio		22-44		
	Chain		Links 72		
	Drive pulley	Type of drive pulley	TRA		
		Ramp identification	286		
		Calibration screw position	2		
		Spring	230/350 (Pink/Pink)		
		Clutch engagement	RPM	4500	
		Pin		Solid	
		Lever		Std alum.	
	Driven pulley	Spring	Color	Beige	
Preload			kg (lb)	23 lbs (B-5)	
Cam		Angle	54°-48°		
Drive belt		Part number	415 0603 00		
Calibration done at temperature of			30°C		
* The maximum horsepower RPM is applicable on the vehicle. It may be different under certain circumstances and BOMBARDIER INC. reserves the right to modify it without obligation.					

SECTION 06 - TECHNICAL PUBLICATIONS AND RACING PARTS

Supplement for Model: 1996 Formula III

MODEL: 1996 Formula III				
RACING TYPE		-Grass drags-		500'
	Maximum horsepower *	RPM		8300
				TM-38
C A R B U R E T O R	Carburetor type			
				<i>PTO</i> <i>CENTER</i> <i>MAG</i>
	Main jet			250 250 250
	Needle			6DEY2 6DEY2 6DEY2
	Needle clip position			5 5 5
	Slide cut-away			2.5 2.5 2.5
	Pilot jet			55 55 55
	Needle jet			<i>P-O 286</i> <i>P-O 286</i> <i>P-O 286</i>
	Air screw adjustment	± 1/8 turn		1.5 1.5 1.5
	Needle valve			1.5 V 1.5 V 1.5 V
				<i>Unleaded</i>
D R I V E R A T I O	Drive ratio			22-44
	Chain			Links
	Drive pulley	Type of drive pulley		TRA
		Ramp identification		CF1
		Calibration screw position		4
		Spring		230/350
		Clutch engagement	RPM	5200
		Pin		<i>Hollow steel + sets screws</i>
		Lever		<i>Std aluminum</i>
	Driven pulley	Spring	Color	<i>Beige</i>
			Preload kg (lb)	19 lbs (B-6)
		Cam	Angle	54°-48°
Drive belt		Part number	415 0603 00	
Calibration done at temperature of			25°C	
* The maximum horsepower RPM is applicable on the vehicle. It may be different under certain circumstances and BOMBARDIER INC. reserves the right to modify it without obligation.				

SECTION 06 - TECHNICAL PUBLICATIONS AND RACING PARTS

Supplement for Model: 1996 Formula MX Z 583

MODEL: 1996 Formula MX Z 583				
RACING TYPE		<i>-Grass drags-</i>		
	Maximum horsepower *	RPM	7750	
C A R B U R E T O R	Rotary valve	Part number	502	
		Timing	opening	140°
			closing	71
	Carburetor type			
			PTO	MAG
	Main jet		230	220
	Needle		Stock	Stock
	Needle clip position		5	5
	Slide cut-away		Stock	
	Pilot jet		50	50
	Needle jet		Stock	
	Air screw adjustment	± 1/8 turn	1 turn	1 turn
	Needle valve		Stock	
	Idle speed	RPM		
Gas grade		Super unleaded		
D R I V E R A T I O	Drive ratio		22-44	
	Chain		Links (412 00)	
	Drive pulley	Type of drive pulley	TRA	
		Ramp identification	286	
		Calibration screw position	2	
		Spring color	220/290 (Green/Blue)	
		Clutch engagement	RPM	4600
		Pin	Steel threaded + 1set screws	
		Lever		
	Driven pulley	Spring	Color	
			Preload	kg (lb)
Cam		Angle	54°	
Drive belt	Part number			
Calibration done at temperature of			15°C	
* The maximum horsepower RPM is applicable on the vehicle. It may be different under certain circumstances and BOMBARDIER INC. reserves the right to modify it without obligation.				

SECTION 06 - TECHNICAL PUBLICATIONS AND RACING PARTS

Supplement for Model: 1996 Formula SLS

MODEL: 1996 Formula SLS				
RACING TYPE		-Grass drags-		
	Maximum horsepower *	RPM	7700	
C A R B U R E T O R	Rotary valve	Part number		
		Timing	opening	
			closing	
	Carburetor type		VM38	
	Main jet	PTO		MAG
		230		220
	Needle	Stock		
	Needle clip position	4		
	Slide cut-away	Stock		
	Pilot jet	Stock		
	Needle jet	Stock		
	Air screw adjustment	± 1/8 turn		Stock
	Needle valve	Stock		
	Idle speed	RPM		Stock
Gas grade	Super unleaded			
D R I V E R A T I O	Drive ratio		22-44	
	Chain		Links (412 00)	
	Drive pulley	Type of drive pulley		TRA
		Ramp identification		CF1
		Calibration screw position		3
		Spring color		160/320 (Pu/Pu)
		Clutch engagement	RPM	4700
		Pin		Steel threaded + 2 set screws
		Lever		Srd aluminum
	Driven pulley	Spring	Color	Beige
			Preload	kg (lb) 19 lbs (B-6)
Cam		Angle	54°-48°	
Drive belt		Part number	8607	
Calibration done at temperature of			25°C	
* The maximum horsepower RPM is applicable on the vehicle. It may be different under certain circumstances and BOMBARDIER INC. reserves the right to modify it without obligation.				

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SECTION 07 - COMPETITION PREPARATION

These are general guide lines for preparing a stock DSA chassis for various forms of competition. Refer to the appropriate section of the book for more detailed information.

HILL CLIMBING

Front Suspension

- Use soft springs. You want the skis to compress very easily and not transmit any upward force into the chassis.
- Use minimal rebound dampening in the shock absorbers and on HPG T/A shocks, the gas pressure can be reduced to 200psi.

Center

- Use medium spring pressure. You need some track pressure for traction but the front arm must be able to compress easily to absorb bumps.
- The limiter strap should be fairly short to keep front end lift to a minimum. Two to three inches of lift is plenty. A balance must be maintained between having enough traction and keeping the front end down for steering.

Rear Suspension

- Spring pressure should be kept firm in order to reduce weight transfer and help keep the front end down on the ground.
- When rules allow, use rebuildable shocks. This will allow you to calibrate compression and rebound dampening. This is necessary when changing spring rates.

Track

- Use the highest profile track available.
- On sleds with less than 80 horsepower use a 121 inch track. A deep profile long track might actually give you too much traction and the lower HP won't be able to spin the track in certain conditions.
- Bigger HP sleds should use the 136 inch "paddle track". This track has 1.5 inch tall paddles molded into the track. This is standard on the Summit.
- 570 2086 00 15 x 136 x 1.5 Paddle track
- 570 2089 00 15 x 121 x 1.5 Paddle track

- 861 7598 00 15 x 136 x 2 Paddle track (Kit includes drive axle ass'y)
- 570 2102 00 15 x 136 x 2 Paddle track
- 860 3045 00 Ski stance widening kit 1996-98 Summit

Transmission

- Good backshifting is important. Use a few pounds more than normal preload on the driven pulley.
- Adjust the TRA to maintain optimum RPM.

Driving Style

- Contrary to popular belief, constant full throttle is not always the fastest way to the top. Use your thumb to adjust for the conditions. Sometimes you need to back out of it to keep the track from spinning excessively. You need to keep your momentum up but you must keep the sled on the ground so your track is hooked up and the skis can steer you around any obstacles.

For more Hillclimb information contact Mark Thompson by fax at (801) 753-3034.

DRAG RACING (ICE AND GRASS)

Special Rules

- Snow flap must be retained by 1/8 inch diameter cable.
- Double limiter straps are required by many organizations.

Front Suspension

- Lower the ride height as far as possible but maintain the legal travel requirement of two inches. Shorter springs are available.
- 415 0206 00 DSA front spring 125 lbs/in 8 inch free length.
- Trim the rubber blocks under the ski legs to reduce and adjust the amount of heel pressure on the ski.
- Use steel runners on the grass and stock trail carbide runners on the ice.

Center

- Use fairly stiff springs and preload.
- Shorter limiter straps will be required (414 9553 00). On grass, more weight transfer can be used to keep the weight off the skis. On ice, run the limiter very short to keep ski lift to a maximum of six inches.

Rear Suspension

- Lower the ride height to the two inch minimum.
- Grass: Soften preload to help weight transfer and keep the skis from dragging.
- Ice: Use a lot of preload to help keep the front end down for better top speed at the end of the chute.
- Add two pairs of additional idler wheels and replace the 135 mm diameter wheels with 141 mm diameter wheels.
- Shave the slider shoes down to a 3mm (1/8 inch) thickness.

Traction

- Most rules limit maximum stud height to 3/4 inch over the tallest part of the track. Taller tunnel protectors will be required.
- Generally, fewer studs are required on grass than on ice. Also, less studs are needed on good, thick sod or hard clay. More studs will be needed on loose grass, dirt and sand.
- Grass: Four steel picks per bar (4 × 48 pitches on 121 inch track=192 studs). Large horsepower machines may need more studs. Exchange some picks for grass hooks on looser track surfaces. Use “chisel” style studs. They have a wider profile but are still sharp on the ends.
- Ice: Stud quantity is directly related to horsepower on the ice. Up to about 80 HP, 4 to 5 ice picks per pitch should be used for a total of 200-250 studs. 80 to 105 HP should need 6 to 7 picks per pitch for a total of 300-350 studs. Over 110 HP will require 7 to 8 picks per pitch and possibly hooker plates welded to the track guides.

NOTE: The installation of hooker plates will require modification to the tunnel protection system and should be approached with caution.

- Two inch, two hole angled aluminum backer plates should be used when many studs are required. They should form the basis of your stud pattern with single, square, flat or angled backer plates used in between.
- Studs should be placed so the pattern does not repeat itself for 4 to 6 pitches.

Transmission

- Gear for about 10% over the actual speed you will run in the race. On grass, your upper sprocket should be about two teeth smaller than on the ice.
- Always stay with the same belt type and size, belt deflection, and center to center distance. Have several belts of the same size broken in and ready to race. Don't test with one belt and then “throw on a new one” for race day.
- Use a ramp and spring combination to achieve a 5500 RPM engagement. It is best to stay around 5300-5400 unless you know how your tachometer compares to the tech. inspectors tach.
- Keep the clutches clean! The pulley faces and belt should be wiped down with acetone before every run. Excessive pulley heat indicates belt slippage and you may need to recalibrate your clutch to “squeeze” the belt harder.
- Torque is what overcomes resistance to rolling. Normally peak torque is about 200 to 300 RPM below peak horsepower. Try to clutch to the peak torque RPM.
- Tune your clutches so that you run best for the final which means everything will be heat soaked. If your sled requires different set ups between early runs when everything is cold and later runs, know what to change and when to change it. Test under a variety of conditions so you are prepared for any track and race conditions.

SECTION 07 - COMPETITION PREPARATION

Cooling

- Install a pair of hydraulic quick couplers in the coolant hoses at a convenient location on the sled. Make a cooling "cart" using a cooler filled with ice and several winds of copper tubing inside (or another type of heat exchanger) connected to an electric pump and another set of quick couplers. Connect your sled to this mobile refrigerator between runs to circulate coolant through the system and cool the engine down. Cool the engine to the same temperature every time so your runs are consistent.

For more drag racing information contact Bill Rader by fax at (715) 847-6869, phone (715) 847-6884.

SPEED RUNS

Generally, a speed run sled will be set up very similar to an ice drag sled with the following differences.

- Some organizations do not allow lowering for stock class sleds. Check your rules. Shorter springs may be an option to try.
- Because holeshots are not important, engagement speed does not have to be set at 5000 RPM. Top speed at the end of the course is the only concern.
- Chaincase gearing can be set for high theoretical top speeds. Use the largest top and smallest bottom sprocket available. This will keep the belt low in the drive pulley which lowers the belt and countershaft speed which makes the transmission more efficient.
- As few studs as possible should be used. It takes energy to push a stud into the ice and pull it back out again. Since holeshots are not important, use only enough studs to maintain control at top speed.
- Use standard trail carbide runners with the sharp edge worn down a bit. This way you will have steering control without sacrificing speed.
- Run with a very short limiter strap and soft center spring. This will reduce the track approach angle which helps top speed.

For more speed run information contact Bill Rader by fax at (715) 847-6869, phone (715) 847-6884.

OVAL RACING

Special Rules

- Rear of tunnel must be enclosed per specifications in the I.S.R rulebook.
- Snowflap must be retained by chains or 1/8 inch diameter cable.
- Tail light AND brake light element must be on at all times! Add a jumper wire inside the taillight assembly.
- Any glass lenses must be taped over with clear tape.

Front Suspension

- Lower the ride height to the two inch minimum travel requirement. Shorter springs are available.

415 0206 00	DSA front spring	125 lbs/in	8 inch free length
415 0207 00	DSA front spring	150 lbs/in	8 inch free length

- Camber: Left = 0 degrees
Right = Negative 2 to 4 degrees
- Verify ski toe out at the carbide edge.
- Another trick is to fill the swing arms with spray foam insulation. When the foam hardens it helps the swing arms resist bending without adding much weight.
- Steering ball joints should have as many jam nuts added as will fit between the tie rod and the ball joint. This helps prevent bending of the threaded portion of the ball joint.

Center

- Use spring P/N 415 0208 00 (70 lbs/inch, 6 inch free length) and soft preload.
- Use SC-10 front arm quick adjust ass'y (P/N 861 7547 00).

Rear Suspension

- Lower the ride height to the two inch minimum travel requirement.
- Install a 4th idler wheel on the rear axle.
- Stiffer springs and firm preload may be required to reduce weight transfer and help keep the skis on the ice. If the handling is generally good but the inside ski is lifting, increase the right rear spring preload.
- Remove non guide clips and install taller track guides on the right side of the track or use designated oval track.

Traction

- Most rules limit maximum stud height to 3/8 inch over the tallest part of the track. Track cutting is illegal. A camoplast oval track is available P/N 679 9812, it has 1/2 " lug height and tall guide clips for oval racing.
- Use a thin profile, sharp tipped stud for hard ice conditions. If the track conditions get sloppy, exchange some picks for a chisel or wedge type stud.
- Seven picks per bar for a total of 336 studs will be required for all sleds up to about 100 HP. Bigger sleds may require more picks and/or hooker plates.
- Use 2 inch, 2 hole angled aluminum backer plates for the majority of your pattern, especially on the outside belts. The right hand belt will need a 2 inch plate on every pitch. Fill in the pattern with 1 inch square backer plates. The pattern should not repeat itself for at least 5 pitches.
- Use a good quality square bar carbide runner with 10 inches of carbide for starters. As you gain experience, try 14 inches of carbide for more front end bite.
- Studs and carbides need to be SHARP! The carbide must shave your fingernail when scraped across and studs must prick your finger.

Controls

- You will probably be more comfortable in the corners if you make a curved extension for the left side of the handlebars. Many drivers make a new set of bars from the same size tubing and custom bend it to fit their preference. (Check your rule book for requirements on handlebars).

- You may also want to fabricate a stirrup for your right foot.

Transmission

- Use a spring and ramp combination in the drive clutch to get a 5000 RPM engagement (verify your tachometer with your tech. inspectors tach).
- You need aggressive shifting to get a good holeshoot but you also need good backshifting. Here again, testing is the key to success.
- Use the lowest TRA setting that still allows you to maintain correct RPM when exiting the corners.
- Gear for the speed you will go on the course.
- Break in several belts of the same type and size and set up your pulleys to work with these belts.
- Maintain your clutches on a weekly basis. A clean, free moving driven pulley is important to good backshifting. Clean the pulley faces with acetone on a regular basis.

For more Oval Racing information contact Bill Rader by fax at (715) 847-6869, phone (715) 847-6884.

Physical Conditioning

- While a well set up sled will be easier to drive than a poor one, it still takes good arm strength to turn a stocker with aggressive carbide. Train your upper body for strength and endurance. A good overall conditioning program that also works your legs and respiratory system is a smart idea. While it may not seem like 3 lap heats are very long, 10 lap finals on a short track with tight corners can really wear you down.

CROSS-COUNTRY/ SNOW-CROSS RACING

Your team should be organized well in advance and hold regular meetings to cover key information. It is very important that all team members be familiar with each others duties and be prepared to assist one another as required. Remember situations develop with little or no notice and a well organized team can turn negatives into positives and increase the team's chance of winning!

SECTION 07 - COMPETITION PREPARATION

Recommended Team Structure

IT IS RECOMMENDED THAT THE MINIMUM TEAM STRUCTURE BE AS FOLLOWS;

1. RACE DRIVER
2. CHIEF MECHANIC
3. ASSISTANT MECHANIC
4. TEAM MANAGER

Duties of the Mechanic and Team Manager

THE MECHANIC(S)

1. **PRE RACE PREPARATION** — To ensure that they are familiar with all aspects of the Ski-Doo snowmobile and capable of doing the worst case scenarios, which are track changes and motor repairs. These and other repairs such as those to suspensions must be practiced enough times to ensure perfection. Remember power tools are seldom accessible when working at the start line therefore get used to hand tools and operating in the cold.
2. **ON RACE DAY** — Each morning it is recommended that the mechanic(s) warm up, refuel and move the sled to the start line as directed by the race officials and as early as possible to get a good spot. The mechanics should take a warm up stand and cover with them to the start line. Take a spark plug wrench and spare plugs so the driver's spares don't have to be used.
3. **AT THE FINISH LINE** — Intercept the driver and ask what has to be done to the machine to get ready for the next heat or day and start planning the work session. You may have to really question your driver closely for feedback on the sled's requirements as he may be too tired to recall or too busy "bench racing" with the other drivers. Remember you may be working outside in the open and must be prepared to operate in rain or snow.
4. **DAILY WORK PERIOD** — Use the maintenance checklist as a guide line and add on must-doo items resulting from day's ride.

Post this list on the tool box and check off items as they are completed so that one mechanic doesn't repeat the other's work in error.

THE FIRST ITEM CHECKED SHOULD BE THE TRACK, AS DAMAGE TO IT OR SUSPENSION PARTS MAY NOT HAVE BEEN NOTED BY THE DRIVER. THE TRACK MUST BE ROTATED FOR ONE COMPLETE REVOLUTION TO PROPERLY CHECK. BOTH MECHANICS SHOULD OBSERVE AT THE SAME TIME. THIS IS THE IDEAL OPPORTUNITY TO INSPECT THE FRONT END, INCLUDING SKIS AND THEIR CARBIDES.

Make sure that you have a parts runner(s) at the fence closest to your area and use them to bring the parts from your race trailer. I-500 type events have regulations to control parts delivery and usage so make sure you check with race officials before doing something which could penalize your driver.

5. **POST RACE PERIOD** — Make sure you have all your own tools back and replace or re-order parts used and be ready for the next day. Go over your work with the other mechanic and driver to compare notes and things to watch for during the next day's ride. Get ready for the crew/driver meetings and maybe fit in some dinner.

DUTIES OF THE TEAM MANAGER

1. **PRE RACE PREPARATION** — The team manager has an important job to do and must pull everyone and everything together in an organized fashion. Time spent in preparation is seldom wasted. He/she must assemble all the documentation and paperwork for the whole team and maintain a master file. All snowmobile registration, insurance, hotel arrangements, entry information, etc., and back up copies must be available quickly. It is a good idea to confirm your hotel reservations one week before and ask for a fax map if you are not sure of the location. File everything in your driver's race binder for easy access.

SECTION 07 - COMPETITION PREPARATION

2. **DAILY START LINE** — Get up first and make sure all mechanics are up and getting ready to leave. Let your driver sleep in as long as possible but make sure your vehicle (the second one) starts before the mechanics leave for the impound area. Ensure all rooms are checked out of and paid for. Phone ahead to confirm the next hotel's reservations. Get your driver up on time and get him to the start line at least 15 minutes before his flight leaves. Make sure that you have an overcoat for your driver to wear at the start line to keep warm until he leaves. Wait until your driver(s) leave the start and then make your way to the finish line and work area for that night.
3. **DAILY FINISH LINE** — Get on the road as soon as possible leaving the mechanic(s) and the registered support vehicle to follow along the official route and the various checkpoints. Make sure you have your drivers warm up coat and gear bag with his post race clothing. Check in to the next hotel and get all the room keys before going to the finish line. Get any parts or support organized that couldn't be done by the mechanics and try to intercept your driver as soon as he gets in. Ask him for sled feedback as soon as possible so that the work plan can be initiated even before the mechanics arrive. Remember on multi day events the sled may be impounded at this point and therefore may not be inspected prior to work period.
4. **WORK PERIOD** — You may not be able to get inside the work area but should position yourself along the fence closest to your mechanic's area. Be ready to run for parts and assist as required. Keep track of the parts used, borrowed or given away to your driver and other teams. Make sure the warm up stand and cover are available for overnight storage.
5. **POST WORK PERIOD** — Help sort out the parts and get ready for the next day's routine. Look for a convenient place to eat and make sure everyone is on time for the crew/driver meetings. The team manager must attend the crew meeting with the mechanics while the driver attends his separate meeting. Make sure all keys are handed out prior to the meetings as the drivers normally meet longer and it would be nice to get the support crew back to the hotel first. Make sure wake up calls are in and backup alarms on. Make a list of room numbers for quick use.

RACE CIRCUIT RULES

Remember it is the driver and team's responsibility to have the sled race-ready in accordance with the rules of the circuit you race in. All races approved for Ski Doo's Winners Circle contingency awards are governed by the general rules laid out in the ISR annual handbook. It is common practise for the various race associations across North America to modify the ISR rules for local use. This does result in conflicting standards and therefore every driver must carefully check the rules.

Contact the following circuits for detailed race rules for Cross-Country and Sno-Cross competition;

ISR	International Racing Association	414-335-2401
ISOC	International Series Of Champions	218-722-9500
MRP	Motorsports Racing Plus	612-287-9774 Fax 287 8414
HRA	Heartland Racing Association	218-547-1714
RMXCRC	Rocky Mountain Cross Country	406-838-2247
RMR	Rock Maple Racing	802-368-2747
CCMQ	Circuit de Courses de Motoneiges du Québec Inc.	514-794-2298
CSRA	Canadian Sno-X Racing Association	905-476-7182 Fax 476-7157
CAN-AM	Cross-Country Racing Circuit	204-772-5300

PARTS SUPPORT

The factory may have an inventory of parts available to support various races but you should not count on it for total support. A well organized racer must be **self-contained** and should not count on anyone but himself for parts support!

SECTION 07 - COMPETITION PREPARATION

CROSS BORDER INFORMATION

1. **IF YOU ARE A CANADIAN OR US CITIZEN** — You will need valid ID at both borders. This would include a birth certificate or a drivers license or a passport for all team members. The team manager should double check all members for ID before leaving the home town.
2. **OTHER COUNTRIES** — You will need a valid passport for all team members from countries other than the US or Canada.
3. **BORDER CONFIRMATION** — It is better to be safe than sorry, so if you have any doubt contact a border official directly and do it well before race time.
4. **SNOWMOBILES AND SUPPORT VEHICLES** — Ensure that all support vehicles and snowmobiles have valid ownerships, registrations and insurance for the state or province of origin. Do not forget about your trailer!
5. **PARTS AND EQUIPMENT** — As a general rule the border officials will let race teams pass with little difficulty but large inventories of parts that appear to have a retail use may be subject to a temporary bond.
6. **HEALTH INSURANCE** — Check your personal health insurance plan to see what coverage is in effect while in another country. You may want to supplement your existing policy with temporary Blue Cross or equivalent for the driver and all team members.

Team Press Coverage and Sponsor Recognition

You should make sure that all current and future potential sponsors are looked after in a professional manner. Here are a few tips ;

1. PRE RACE COVERAGE — press articles and newsletters
2. SLED AND TEAM IDENTIFICATION — jackets, hats, trailer graphics
3. RACE REPORT – phone back home daily to a central contact
4. POST RACE TEAM PHOTO AND REPORT — take a camera
5. THANK YOU LETTERS AND PRESENTATIONS — remember your crew

Front Suspension

- Adjust the spring preload to get about 1.5 inches of sag from full extension to normal ride height with the driver on board.
- For more front end bite, use the 5/8 inch diameter sway bar.
- Steering ball joints should have as many jam nuts added as will fit between the tie rod and the ball joint. This helps prevent bending of the threaded portion of the ball joint.

Front End Alignment-Steel Ski

The OEM skis are all tapered from front to back and will therefore give you an incorrect measurement when checking alignment using the outside edges as reference points. Measure your skis to determine the variance and compensate accordingly. Of course any carbide runner must be checked from the underside position across the sharpened edges for true alignment first.

Traction

- Most rules limit maximum stud height to 3/8 inch over the tallest part of the track. Always verify your stud heights!
- Use a thick profile, carbide tipped stud for most conditions. 3 picks per bar with stock 8 inch carbide runners work well for terrain races while 4 picks per bar with square bar 10 inch carbide runners work well on ice races. Sharper, thinner studs can be used on lake events. Consult the rule book.

Transmission

- Trail clutching with good backshifting will work for most terrain type races, while many lake events put a premium on top speed.
- Snow cross events will require an excellent holeshot and also good back shifting while top speed is not important. Lower engagement may be used if traction is less than desirable.
- Maintain your clutches on a weekly basis. A clean, free moving driven pulley is important to good backshifting. Clean the pulley faces with acetone on a regular basis.

Miscellaneous

- HPG T/A shocks should only be serviced by an authorized dealer using approved tools. However some drivers have removed and retightened the acorn nut, covering the schraeder valve itself, with too much torque. When the acorn nut is later removed it may break the seal of the valve to shock body and cause the accidental loss of the nitrogen charge. As a precaution recharge the shock if in doubt.
- If the acorn nut is removed inspect the position of the internal O-ring-style seal to ensure correct seating. If it sits in there off-center it may prematurely release the nitrogen charge when the acorn nut is replaced.

High pressure gas can be dangerous — consult the HPG manual prior to attempting any service work!

- Ensure that your tether cord is a full 5 feet at extension (as per ISR rules) to avoid accidental shutdown in minor get offs. Use a second tether cord attached to the first and adjusted for proper length using tie raps or equivalent. This method also provides you with a handy spare.

SECTION 07 - COMPETITION PREPARATION



1996 Ski-Doo MX Z Racing Tip Sheet

Ski-Doo Racing, P.O. Box 8035, Wausau, WI 54402-8035, Phone: 715-847-6849

Number: 96-01 - November 15, 1995

Number of pages: 03

◆ WARNING

This information relates to the preparation and use of snowmobiles in competitive events. Bombardier, Inc. and Bombardier Corporation disclaims liability for all damages and/or injuries resulting from the improper use of the contents. We strongly recommend that these modifications be carried out and/or verified by a highly skilled professional racing mechanic. It is understood that racing or modifications of any Bombardier made snowmobile voids the vehicle warranty and that such modifications may render use of the vehicle illegal in other than sanctioned racing events under existing federal, provincial and state regulations.

CROSS COUNTRY/SNOWCROSS — MX Z 440 1996

Clutch

Ramp	CF1	P/N 415 0238 00
Spring	230/380 (Pink/White)	P/N 414 9914 00
Pin	Steel threaded pin and 2 set screws	
Lever	Stock standard aluminum lever	
Clicker	Position: 4	
Cam	46/42	P/N 415 0212 00
Spring	Beige at 18 pounds	
Gearing	22/44	

Front Shock Valving

Rebound:	1 x 12 x 0.203	Compression	3 x 30 x 0.152
	15 x 26 x 0.203		2 x 12 x 0.152
	2 slit piston		7 x 30 x 0.152
			1 x 18 x 0.152
			1 x 15 x 0.152

We recommend that you replace the stock 100 pound spring with one of the following:

125 pound	1/2 in pre-load	P/N 414 8690 00	
135 pound	1/2 in pre-load	P/N 414 7713 00	
150 pound	1/2 in pre-load	P/N 414 7882 00	

The 150 pound spring will only be needed if you are experiencing repeated bottoming of the front suspension. Recommended shock gas pressure: 300 PSI.

SECTION 07 - COMPETITION PREPARATION

Center Shock

Rebound:	1 x 12 x 0.203	Compression	4 x 30 x 0.203
	1 x 18 x 0.203		1 x 16 x 0.203
	4 x 26 x 0.254		5 x 30 x 0.254
	3 x 26 x 0.203		2 x 16 x 0.254
	4 slit piston		1 x 16 x 0.203

We used a 125 pound spring (414 8091 00) with zero (0) preload. Refer to the 1996 or 1997 Ski-Doo Racing Handbook for floating piston depth. Recommended shock gas pressure: 370 PSI.

Rear Shock

Rebound:	1 x 15 x 0.203	Compression	4 x 30 x 0.203
	14 x 26 x 0.152		1 x 15 x 0.152
	2 slit position		4 x 30 x 0.203
			3 x 15 x 0.203

Recommended shock gas pressure: 370 PSI.

1. Install the adjustable limiter strap kit — P/N 861 7547 00.
2. Adjust front limiter strap to 5 inches of distance between front arm and bump stop.
3. Install skid plate:
 - P/N 861 7498 00 Yellow
 - P/N 861 7497 00 Black
 - P/N 861 7534 00 Red
4. The MX Z comes stock with the following rear suspension torsion springs:
 - Left: 414 9436 00(White)
 - Right: 414 9435 00 (White)

For a heavier rider you may want to install the following:

 - Left: 415 0106 00 (Red)
 - Right: 415 0105 00 (Red)

For a very heavy driver over 200 pounds:

 - Left: 414 9443 00 (Green)
 - Right: 414 9442 00 (Green)

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LOWERED ICE SET-UP — MX Z 440 1996

Clutch

Ramp	CF1	P/N 415 0238 00
Spring	185/410 (Black)	P/N 415 0195 00
Pin	Hollow pin	
Lever	Stock standard aluminum lever	
Clicker	Position: 4	
Cam	50°	P/N 504 4961 00
Spring	Beige at 18 pounds	
Gearing	23/40 — Long straight away	
	23/44 — Short to medium straight away	
	22/44 — Snow and short straight away	

Front Ski Shock

100 pound stock spring with 3/4 in pre-load 1-1/2 in spacer installed in the shock Stock valving Stock sway bar 0° to 2° negative camber Carbide: 50/50 or 40/60

Center Shock

Stock 100 pound spring -or-125 pound 8 in free length with no pre-load (P/N 415 0206 00) Stock valving Adjust limiter to 1 in to 1-1/2 in from front arm to bump stops
--

Rear Shock

Stock valving Install 2-3/8 in (60 mm) spacer Stock rear springs ACM relaxed

SECTION 07 - COMPETITION PREPARATION



1997 Ski-Doo MX Zx Racing Tip Sheet

Ski-Doo Racing, P.O. Box 8035, Wausau, WI 54402-8035, Phone: 715-847-6849

Number: 97-06 - March 4, 1997

Number of pages: 04

◆ WARNING

This information relates to the preparation and use of snowmobiles in competitive events. Bombardier, Inc. and Bombardier Corporation disclaims liability for all damages and/or injuries resulting from the improper use of the contents. We strongly recommend that these modifications be carried out and/or verified by a highly skilled professional racing mechanic. It is understood that racing or modifications of any Bombardier made snowmobile voids the vehicle warranty and that such modifications may render use of the vehicle illegal in other than sanctioned racing events under existing federal, provincial and state regulations.

1) As a result of testing in Valcourt, we have a revised Shock Calibration for SnoCross.

SHOCK CALIBRATION WORK SHEET				
MODEL: MX Zx 1997				
RIDING CONDITIONS: Sno Cross				
	FRONT	CENTER	REAR	OPTION
PISTON SLITS	6	4	2	
IFP HEIGHT	40.5 mm	141 mm	190 mm	
COMP.	3 x 30 x .203 1 x 12 x .114 5 x 30 x .254	3 x 30 x .203 1 x 15 x .114 3 x 30 x .254	4 x 30 x .203 1 x 21 x .114 5 x 30 x .203	2 x 30 x .254 2 x 30 x .254 1 x 30 x .203
	1 x 24 x .114 1 x 20 x .114 1 x 16 x .114	1 x 28 x .203 1 x 26 x .203 1 x 24 x .114 1 x 22 x .152 1 x 18 x .152 1 x 16 x .152	1 x 21 x .114 6 x 30 x .203 1 x 28 x .152 1 x 26 x .152 1 x 24 x .114 1 x 22 x .152 1 x 20 x .152	3 x 30 x .254
REBOUND	6 x 26 x .254 1 x 15 x .203	6 x 26 x .254 1 x 20 x .203 1 x 15 x .152	1 x 26 x .203 2 x 26 x .254 1 x 16 x .114 6 x 26 x .254 1 x 22 x .203 1 x 18 x .203 1 x 15 x .203	
SPRING	stock 125# BL/BL/BL	stock	stock	
PRELOAD	1/2" – 9-3/4" spring length 300 PSI	* installed in sled 300 PSI	Cam pos. 2 300 PSI	

*NOTE: Sway bar installed, ACM tight.

SECTION 07 - COMPETITION PREPARATION

TRANSMISSION SYSTEM

Racers Log

Vehicle: 1997 MX Zx	Date: 11/8/96	Sheet #1
Location:	Surface Cond: Sno Cross	
Temperature: + 8°F	Fuel: 87 Octane Unleaded Pump	

	PTO	MAG	Carburetion Notes:	
Main Jet	260	250	Stock	
Needle Jet	P8	P8	Stock	
Jet Needle	6FJ43	6FJ43	Stock	
E-Clip Position	2	2	Stock	
Slide Cutaway	2.5	2.5	Stock	
Pilot Jet	45	45	Stock	
Drive Pulley		Best	Clutching Notes:	Option 2 nd Best
Lever Arm/Pin Type (STD Aluminum)		Steel Hollow	Stock	Steel THD 504 2606 00
Pin Weight		10.3 GR		+ 2 set screws 12.2 GM
Ramp Identification		287	417 0052 87	Stock
T.R.A. Adjuster Position		3		3
Spring Identification		Pink/White	415 0193 00	Stock
Spring Pressure @ Engagement		230		230
Spring Pressure @ Full Shift		380		350
Engagement RPM		5000		5050
Shift RPM		8450-8500		8500
Drive Belt Identification		414 8607 00	Stock	
Driven Pulley				
Cam Identification		40/44	Stock	
Spring Identification		Beige	Stock	
Spring Preload & Location		17# B-6		
Chaincase Gearing		21/43	21 #504 1393 00	
	LH	RH	Chassis Notes:	
Inches of Carbide/ski	8" 60°	8" 60°		
Camber	2° Neg	2° Neg		
Front Spring Ident.	Stock	Stock		
Ride Height	Full Extension	Full Extension		
Center Spring Ident.	Stock	Stock		
Limiters Adjustment				
Rear Spring Ident.	Stock	Stock		
Ride Height	Full Travel	Full Travel		
Stud Quantity & Type	144	.875 w/ 1/8"	Backer Plate	

SECTION 07 - COMPETITION PREPARATION

SHOCK CALIBRATION WORK SHEET

MODEL: MX Zx 1997	DATE: November 12, 1996
RIDING CONDITIONS: ICE LEMANS	

	FRONT	CENTER	REAR	OPTION
PISTON SLITS	6	4	2	
IFP HEIGHT	40.5 mm	141 mm	190 mm	
COMP.	3 x 30 x .203	10 x 30 x .203	3 x 30 x .203	
	1 x 12 x .152	3 x 16 x .203	1 x 15 x .114	
	3 x 30 x .203		5 x 30 x .203	
	1 x 20 x .114		1 x 20 x .114	
	1 x 16 x .114		7 x 30 x .203	
REBOUND	7 x 26 x .203	1 x 12 x .203	9 x 26 x .203	
	1 x 15 x .203	8 x 26 x .152	1 x 15 x .203	
	Install 55 mm spacer	NO SPACER	Install 45 mm spacer	
				Option Rear Spring
SPRING	125# Stock	414 8593 00 BL/WH	STOCK	486 0711 00 YL/YL 486 0712 00 YL/YL
PRELOAD	5/8"	0	1 st Cam	3 rd or 4 th Cam
	300 PSI	300 PSI	300 PSI	

NOTE: ACM tight, install 1/2" diameter steel sway bar (P/N 506 1343 00), levers (P/N 506 1344 02) and bushings (P/N 415 0395 00).

Install bushings (P/N 572 0861 00) in rear torsion springs.

SECTION 07 - COMPETITION PREPARATION

TRANSMISSION SYSTEM

Racers Log

Vehicle: 1997 MX Zx	Date: 11/12/96	Sheet #1
Location:	Surface Cond: ICE LEMANS	
Temperature: - 5°F	Fuel: 87 Octane Unleaded Pump	

	PTO	MAG	Carburetion Notes:	
Main Jet	260	250	Stock	
Needle Jet	P8	P8	Stock	
Jet Needle	6FJ43	6FJ43	Stock	
E-Clip Position	2	2	Stock	
Slide Cutaway	2.5	2.5	Stock	
Pilot Jet	45	45	Stock	
Drive Pulley			Clutching Notes:	Option
Lever Arm/Pin Type		Stk/Hollow	Stock	
Pin Weight		10.3 GR		
Ramp Identification		CF1	415 0238 00	
T.R.A. Adjuster Position		4		
Spring Identification		Pink/White		
Spring Pressure @ Engagement		230		
Spring Pressure @ Full Shift		380		
Engagement RPM		5050		
Shift RPM		8400		
Drive Belt Identification		414 8607 00	Stock	
Driven Pulley				
Cam Identification		40/44	Stock	
Spring Identification		Beige	Stock	
Spring Preload & Location		15#		
Chaincase Gearing		23/43	Stock	
	LH	RH	Chassis Notes:	
Inches of Carbide/ski	8" 60°	8" 60°		
Camber	2° Neg	2° Neg	@ Static Ride Height	
Front Spring Ident.	Stock	Stock		
Ride Height				
Center Spring Ident.	90# BL/WH	414 8593 00		
Limiters Adjustment	2" Front	Arm to Bump Stop		
Rear Spring Ident.	Stock	Stock		
Ride Height				
Stud Quantity & Type	192 Picks	.875 w/ 1/8"	Aluminium Backer Plate	

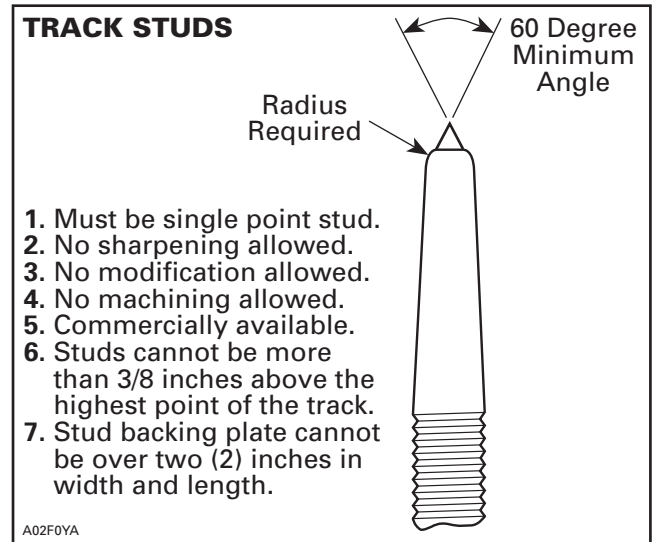
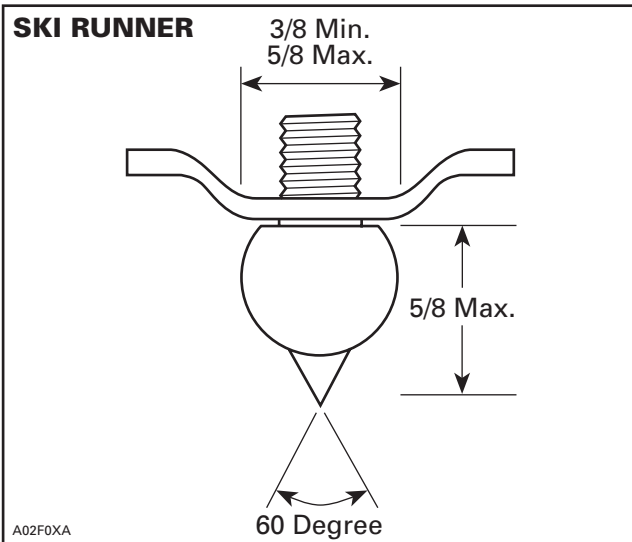


1998 Ski-Doo MX Zx Racing Tip Sheet

*Ski-Doo Racing, P.O. Box 8035, Wausau, WI 54402-8035, Phone: 715-847-6849
Number: 98-01 - October 17, 1997
Number of pages: 03*

◆ WARNING

This information relates to the preparation and use of snowmobiles in competitive events. Bombardier, Inc. and Bombardier Corporation disclaims liability for all damages and/or injuries resulting from the improper use of the contents. We strongly recommend that these modifications be carried out and/or verified by a highly skilled professional racing mechanic. It is understood that racing or modifications of any Bombardier made snowmobile voids the vehicle warranty and that such modifications may render use of the vehicle illegal in other than sanctioned racing events under existing federal, provincial and state regulations.



SECTION 07 - COMPETITION PREPARATION

1) The '97-98 Race Season is fast approaching. There are significant rule changes regarding traction products for Sno Cross Racing.

The Rule Reads as Follows...

1. Snowmobile is limited to 96, 60 degree unsharpened, unmodified single point picks/studs.
1. Backing plates may not extend beyond the height of the rib. No sharpening (vertically or horizontally) of the backing plate.
2. Traction devices must be located in the center of the track between the two slide rails.
3. No grass hooks or paddles allowed.

Note courses run on ice will not have a restriction on studs or carbides.

SKI-RUNNER...

1. Must be commercially available.
2. The minimum carbide cutting angle is 60 degrees. No grinding or modification of the host bar or cutting edge is allowed.
3. Host bar must be round or oval section and a flat top is permissible.
4. 3/8" (.375 inch) minimum width
5. 5/8" (.625 inch) maximum width
6. Maximum height equal to or less than the width plus 1/8" (.125 inch) with a limit of 5/8" (.625 inch)

2) For the upcoming Race Season you can run the O.E.M. Track as built or one additional track per model, as filed by the manufactures. This is for SnoCross and Cross Country.

They will be as follows:

SnoCross Model	Stock Track	Lug Height	Optional Track	Lug Height
MX Z 440 Fan	570-2113	.725"	570 2126	.875"
MX Zx	570-2126	.875"	* 700-9850	1.100"
MX Z 500	570-2122	.912"	* 700-9850	1.100"
MX Z 583	570-2122	.912"	* 700-9850	1.100"
MX Z 670	570-2124	.880"	* 700-9850	1.100"

* Denotes Camoplast Part #

#700-9850 track is allowed as an optional track for SnoCross on models built prior to 1998.

For SnoCross and Cross Country the maximum stud height is 3/8" (.375 inch) past the highest part of the track.

Approximate stud lengths are:

- .920" with 570-2126 MX Zx Track
- 1.075" with Campolast 700-9850 Track
- with a backer plate thickness of 1/4" (.250")

Roetin and Woody's are manufacturing a legal carbide for Sno Cross with 10" of carbide.

Roetin Part #	SX-434 for '97 MX Zx SX-440 for '98 MX Zx
Woody's Part #	SCS - 6700 for '97 MX Zx SCS - 6800 for '98 MX Zx

We hope to have the designated track available at the Race Schools, November 17-20th.

SECTION 07 - COMPETITION PREPARATION

They will also be available at the CAMOPLAST DISTRIBUTORS listed:

Bay City Supply 1819 St George St, PO Box 8955 Green Bay, WI 54308-8955 Phone: 920-430-3700 Fax: 920-430-3701 Contact: Thomas Weid, Gen Mgr	Marshall Distributing, Inc. PO Box 113, 4162 Doerr Rd Cass City, MI 48726 Phone: 517-872-2109 Fax: 517-872-5350 Contact: Roger Marshall	Tri-State Dist, LTD Box 277, 40 King Street Burlington, VT 05402-0277 Phone: 802-864-7073 or 451-3232 Fax: 802-862-4262 Contact: Paul Wentworth
Western Power Sports 5272 Irving St Boise, ID 83706-1210 Phone: 208-376-8400 Fax: 208-375-8901 Contact: Ron Bentzinger	Bell Industries 500 Hardman Ave South St Paul, MN 55075 Phone: 612-450-9020 Fax: 612-450-0844 Contact: Rich Foss	D.I. Performance 905 Gaudette, Suite 101 St Jean, QC J3B 7S7 Phone: 514-359-7858 Fax: 514-359-9257 Contact: Pierre LaFrance
Gamma Sales Progress Industrial Park Orillia, Ontario L3V 6H1 Phone: 705-325-3088 Fax: 705-325-2126 Contact: Peter Ramsay	B.S.L. Distributions Inc 609 Chemin Rivière-Verte Saint Antonin, Rivière-du-Loup Québec, Canada DN G0L 2J0 Phone: 418-862-6423 Fax: 418-862-2980 Contact: Jean-Claude Saindoin	Marr's Leisure Holdings, Inc. PO Box 732, 1865 Burrows Ave Winnipeg, Manitoba R3C 2L4 Phone: 204-633-9740 Fax: 204-632-7827 Contact: Ronald Everett

SECTION 07 - COMPETITION PREPARATION

SUGGESTED SPARE PARTS

You should have a self-contained parts supply. The factory parts truck won't always be there to back you up.

TEAM SPARE PARTS:

- parts book
- piston assembly and circlips
- rotary valve disc
- tuned pipe
- radiator cap
- gas cap
- drive belts
- carb. inlet needle and seat
- drive and driven clutch springs
- drive and driven slider buttons
- TRA adjuster screws and nuts
- drive clutch retainer bolt
- brake fluid
- steering tie rods and ball joints
- ski shock assembly
- skis and carbide runners
- ski bolt and nut
- track guides
- speedometer cable
- idler/rear axle wheels with bearings
- track adjuster bolts
- light bulbs
- high windshield and O-rings
- tether cord and switch
- injection oil studs
- handle bars and grips
- shop manual/specification booklet
- engine gaskets, seals and o-rings
- rewind assembly and components
- exhaust springs
- spark plugs
- spark plug caps and wires
- primer line fuel line and filters
- primer
- main jets

- chaincase chain and sprockets
- TRA clutch puller and forks
- TRA clutch rollers
- driven pulley circlip and keys
- brake lever
- radius rods and rod ends
- brake pads
- steering arms
- padding and tape for ski loops
- front swing arms
- throttle cable
- throttle lever and housing
- rear axle spacers, washers, bolts
- rubber suspension bump stops
- tail light assembly
- hood latch rubbers
- synthetic chaincase oil

SUGGESTED SPARE PARTS ON BOARD SLED

Enough tools to perform all maintenance period requirements in the event that your crew is delayed enroute to the impound.

- spark plugs
- drive belts
- rear idler wheel and bolt
- long rubber bungees
- small hatchet and hammer
- shop rags
- tie rod ends
- small flashlight
- small container of injection oil
- throttle cable and lever
- windshield O-rings
- safety wire, tie wraps and duct tape
- de-icer
- pry bar
- emergency starter rope
- bolt and nut assortment
- small tape measure
- camping knife

SECTION 07 - COMPETITION PREPARATION

Maintenance Check List

Driver: _____ Mechanic(s): _____

Problems observed/reported: (Double check with driver) _____

Parts needed for work period/pit area: (Fuel and lubes) _____

Tools/Equipment needed for work period/pit area:

- cover and jackstand
- pieces of carpet to lay on
- 3 flashlights
- one magnet
- pop riveter
- WD40
- shop rags
- contact gloves
- tie wraps
- brake fluid
- antifreeze
- big hammer and pry bar
- clip board, checklist and markers
- other:
- toboggan/cart for tools and parts
- 1 tool set per mechanic
- clutch tools including alignment bar
- hand drill and bits
- devcon
- contact cleaner or acetone
- silicone seal
- duct and electrical tape
- injection and chaincase oil
- deicer
- tape measures

- grease gun
- safety wire

Things to "DOO" During Work Period or Between Heats:

- carefully remove ice and snow from
- front and rear suspension
- inspect suspension components
- check/replace studs
- check camber
- check tightness of all suspension
- bolts
- check all idler wheels for missing
- rubber and condition of bearings
- lube steering and front suspension
- ball joints
- check chain tension and oil level
- check clutch alignment and clean
- pulley faces
- check carb. and air box tightness
- coolant hose condition/routing
- check electrical connections
- other work:
- inspect track for damage and
- missing guide clips
- check skis and carbides
- check ski toe out
- check drive axle seal

SECTION 07 - COMPETITION PREPARATION

- check brake disc and pad condition
- grease all zerk fittings
- check track tension and alignment
- check brake fluid and operation
- inspect drive belt
- check exhaust system and springs
- check throttle and oil cable and
- check light bulbs

Replace any tools or parts used from race vehicle supply.

Shut off fuel before impound.

FAX HOTLINE SERVICE

To keep you up to date with the latest XC and Sno Cross tips, a fax hotline service is available to all licensed Ski-Doo racers. To initiate service have your dealer contact on his letterhead. We encourage 2 way feedback and would like to hear about any problems and possible solutions you may have which will improve the performance of the MX Z.

Contact Bill Rader at fax (715) 847-6869, phone (715) 847-6884.

ENDURO RACING

Enduro racing is a race of distance found primarily in Michigan but occasionally elsewhere in the U.S. Racers compete on ice ovals, three eighths to one mile in length, and travel 150 to 500 miles non stop. The races take approximately two to eight hours depending on the course and conditions. Driving is usually shared by two or more drivers but change is not mandatory and some racers prefer to run the distance unassisted, fuel and maintenance stops give the racers short breaks or time to switch drivers but many times the engines are never stopped during the entire event so the action never stops. Like auto racing, caution flags often come out to slow the pace while mishaps are tended to or for track grooming. As many as 35 sleds may be on the track at one time which keeps the action fast and furious.

The racing machines resemble F-III type sleds and Michigans M.I.R.A. uses many ISR F-III rules. However many cross country techniques and strategies are also used because of the length and rugged nature of the races. To prepare a machine for this type of racing one would combine a cross country sled with a Formula III sled.

The engines may be up to 600cc in size and are usually modified to various degrees. Some racers prefer highly modified engines for maximum HP, others prefer milder engines for reliability. Either way, the engines are many times lowered in the chassis for a low center of gravity. The suspensions are usually lowered or shock travel limited to further lower the machines much like oval racers. However during long rough races like the 500 in Sault Ste-Marie, full travel is sometimes best. As with cross country racing the high stress parts of the machines must be reinforced. The ice ovals exert tremendous forces on front end components, especially when the maximum of 13 gallons of fuel is on board and the track gets rough.

To determine the starting grid for an endurance race ; qualification, heat racing or timed qualifications usually run the day or days before the race. A racer should have his engine and sled in a qualification mode to ensure a spot on the starting grid. At Michigan's "500", as many as 70 teams may try to qualify for the 35 positions available. Competition is fierce for these 35 spots and requires a much different strategy than race day.

The machine should be low, light, and sharp with high HP engine components. Many racers use "qualifying" cylinders, pipes, carburetors and clutching, then switch to a milder state of tune for the long race. This requires that mechanics and tuners be able to tune two completely different racers and can be very stressful. Many teams will qualify with chassis very low. For better cornering in smooth ice then switch to more travel to soak up the big bumps on race day. This requires knowledge of the sleds handling characteristics in both modes. Testing is the key here; many hours of testing.

During the race, drivers must pit to take on fuel, change carbides, switch drivers and perform any other maintenance required. This requires a very organized pit crew. A crew chief will constantly analyze the race progress and conditions and make necessary decisions on when to make repairs or adjustments. Constant communication with the driver by hand signals or radio keeps everyone informed as to the situation of the race. The pit crew must be very knowledgeable of the machine and must practice the adjustments or repairs which will be encountered during the race.

Personal training and conditioning is also a must for the serious enduro racer. A fatigued driver has no business on an ice oval with 30 fellow drivers in pursuit. Everyone's safety is at stake and should be taken seriously.

Enduro racing is a team effort and very rewarding. Drivers get a lot of track time for their dollar and a well prepared team can be quite successful.

NUTRITION

It is recommended that you consult a physician before designing your own nutrition and fitness program.

No single food can make you healthy, fit, nor race ready!

Eating the right combination of these 25 foods will improve your health and athletic performance;

1. **Bananas** the perfect "portable snack", rich source of potassium good source of fiber, helps prevent muscle cramps.
2. **Lean beef** great source of iron, zinc and high quality protein, choose only lean cuts.
3. **Black beans** excellent source of soluble fibers, folic acid, will help lower cholesterol levels.
4. **Broccoli** one of the best! Vitamins C & D, folic acid, calcium.
5. **Brown rice** complex carbohydrates, twice the fiber of white rice, zinc, magnesium, protein, vitamin B6, selenium.
6. **Carrot juice** the most concentrated source of beta-carotene, may boost your ability to fight bacterial and viral infections.
7. **White chicken** use low fat varieties, note that thigh with skin can contain as much fat as beef! Provides B6 Vit.
8. **Corn** source of fiber and carbs, use fresh corn or frozen/can.
9. **Dried fruit** with water removed they become terrific source of concentrated energy, iron, apricots, figs, raisins.
10. **Fat-free yogurt** calcium, riboflavin, convenient (use non-sugar)
11. **Fig bars** strong carbo "punch". convenient, fiber, low in fat.
12. **Grapes** boron, good for bones.
13. **Low or fat-free cheeses** calcium, sodium.

14. **Kiwi** strange little fruit from New Zealand, vitamin C, fiber.
15. **Oatmeal** soluble fiber.
16. **Lentils** proteins, complex carbs, iron for low/non meat eaters.
17. **Orange juice** liquid "punch". Vit C, potassium, folic acid.
18. **Papaya** potassium, vitamin C, beta-carotene.
19. **Potatoes** one of the most underrated foods! Complex carbs, twice as much potassium as a banana, Vit C, iron; baked are best. **Avoid the drive thru species!**
20. **Pasta** the runner's staple. Complex carbs, thiamin, riboflavin, niacin. athletes need to get 60-65 % of their daily calories from carbs, pasta is a convenient source.
21. **Salmon** rich in omega-3 fatty acids (good for the heart) eat fish twice per week. Fish oils help combat arthritis.
22. **Skim milk** low-fat source of calcium, vitamin D, good for bones.
23. **Strawberries** fiber, vitamin C, ellagic acid.
24. **Whole grains cereals** complex carbs, fiber.
25. **Water** the mineral content of water varies greatly whether it is bottled or from the tap drinks lots, 8 plus glasses per day.

PHYSICAL TRAINING

Start tomorrow and change the way you "DOO" business! Get into a daily routine that includes balanced nutrition, rest, exercise, riding and vehicle service.

You can not change a week before the race and undo bad habits that may have taken many years to perfect!

Personal discipline and sacrifice is required before achieving success on the track.

You owe it to yourself and your sponsors to deliver the best return on time and money invested in your effort.

SECTION 07 - COMPETITION PREPARATION

Some Ideas

1. Consume a high carbohydrate diet (see nutrition tips). These foods will nourish your muscles with muscle sugars (glycogens) the better your muscles are "fueled" the less fatigued you will be during and after training and on race day. The less time you have for training the more important it is to eat properly and let's face it, we all have jobs that get in the way of your sport so plan accordingly.
 2. Right after training or a race, start consuming carbs such as fig bars, fruit etc., to start replacing depleted stores.
 3. Drink lots of fluids to maintain hydration and make sure you "warm down" after training to bring your heart rate down slowly and to gently work out the by-products of exercise.
 4. A small cup of caffeine coffee might be consumed just prior to race. It may enhance your performance by making you more alert. This should be experimented first in training to ensure there are only positive effects.
 5. For XC and SNO-CROSS racing, endurance type training activities that enhance your stamina and breathing control are best. Running for periods exceeding 30 minutes is the best way to improve stamina. The more and faster you run the better your breathing control will become. These abilities will pay off in short burst, SNO CROSS events and long distance events like the I-500. When you lose breathing control and start hyper-ventilating you quickly lose concentration and then 2 things generally happen; you slow down and get passed or you suddenly become part of the landscape adjacent to the trail!
 6. A good daily routine should involve a cheap and highly portable format that relies on no equipment and can be done just about anywhere therefore making it "excuse proof". Try this one;
 - a. 8 chinups — full arm extension.
 - b. 25 push-ups — chest [not belly] touching the floor.
 - c. 32 sit-ups — knees bent, hands locked behind head.
- As you start training, quality is more important than quantity therefore do 1 good chin-up at a time if that is all you are capable of completing. The next day try 2 and so on until you are up to 8. The secret to improving is not quantity of exercise but frequency and quality; in other words you will see more progress by doing 1 good chin-up 8 times daily than doing 8 poor ones once a day. You must pace yourself or you are inviting muscle damage that will prevent you from riding.
7. As mentioned previously, running is one of the best ways to improve stamina and cardiovascular efficiency. Try running a 4 mile distance in 32 minutes. Concentrate on finishing the distance first before looking at the watch. The real mental test and training opportunity will come around the 2 mile mark when your brain is trying to tell you to quit. You must fight these thoughts and concentrate on positive things like how you are going to spend Ski-Doo's contingency money!
 8. It is very important that you become very familiar with all of your personal riding gear and how it works for you. All combinations of clothing must be tested well before race day and in all weather conditions so that you know how they will affect your riding style. There should be no surprises on the start line such as goggles fogging because you taped up a different way than normal. You have to develop and follow standard operating procedures that work for you; the biggest mistake made by new drivers is to overdress. At the start line you should only be able to maintain warmth by wearing an overcoat which is handed over to your mechanic as you start.
 9. It is also important to know your sled and its systems very intimately. Even if you have the best mechanics for your wrench sessions, the driver is ultimately responsible for any failures. The driver must be able to conduct all trail side repairs to get across the finish line. The driver and team must train together regularly to get to know the sled intimately. Do not test any setup during competition, this is the quickest way out of the winner's circle. Test one change at the time and verify against an untouched reference sled. Keep detailed notes on all tests or you are doomed to repeat past mistakes and waste valuable time.

"You must first finish before you can finish in first place".

SERVICE TOOLS

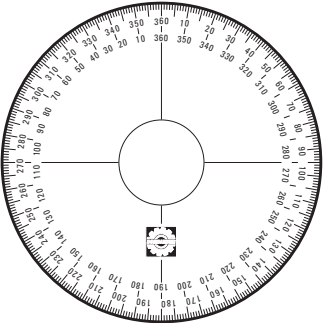
This is a list of tools to properly service Ski-Doo snowmobiles. The list includes both the mandatory tools and the optional tools that are ordered separately. The list of Service Products, both mandatory and optional, are not part of any kit and must all be ordered separately. If you need to replace or add to your tool inventory these items can be ordered through the regular parts channel.

NOTE: The numbers outlined in black (example: **1**) are reference numbers to tools from other divisions (Sea-Doo Watercraft and/or Sea-Doo Jet Boats). Matching reference numbers indicate the same tool is being used even if the part numbers are different.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

ENGINE — MANDATORY SERVICE TOOLS

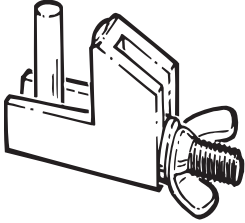
Degree wheel
(P/N 414 3529 00) **1**



A00B334

APPLICATION
All rotary valve engines.

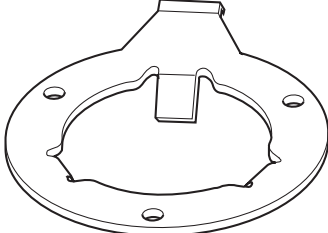
Hose pincher (qty 2)
(P/N 529 0099 00) **2**



A01B2I4

APPLICATION
All models.

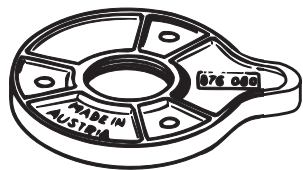
Fan holder
(P/N 420 8763 57) **3**



A00C0Q4

APPLICATION
377, 443 and 503 engines.

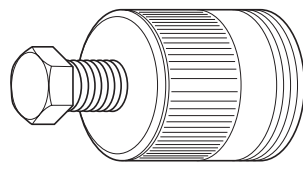
Magneto puller ring
(P/N 420 8760 80) **4**



A00C1R4

APPLICATION
All engines.

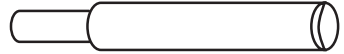
Magneto puller
A) (P/N 529 0225 00)
B) (P/N 529 0355 47) **5**



A00C1A4

APPLICATION
A) 2-cylinder engines
B) 3-cylinder engines

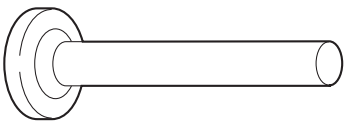
Aligning pin (qty 4)
(P/N 529 0189 00) **6**



A00A1D4

APPLICATION
494 engine.

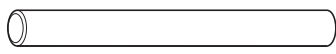
Pusher
(washer behind the impeller)
(P/N 529 0207 00) **7**



A00C3H4

APPLICATION
Rotary valve engines.

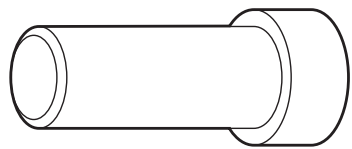
Rotary valve shaft pusher
(P/N 420 8766 12) **8**



A00C0F4

APPLICATION
Rotary valve engines with a 10 mm impeller shaft.


Rotary valve seal pusher
(valve side)
(P/N 420 8766 07) **9**



A00C0Y4

APPLICATION
Rotary valve engines.

Rotary valve shaft seal pusher
(inner, water pump side)
(P/N 420 8765 12) **10**



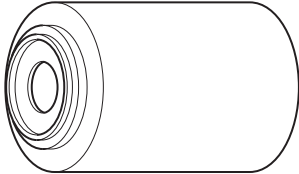
A00C374

APPLICATION
Rotary valve engines.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

ENGINE (continued) — MANDATORY SERVICE TOOLS

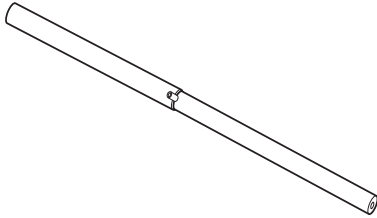
11
Rotary valve shaft seal pusher
(outer, water pump side)
(P/N 420 8770 50)



A00C0X4

APPLICATION
Rotary valve engines.

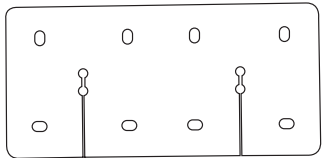
19
Choke plunger tool
(P/N 529 0321 00)



A01C5D4

APPLICATION
All models equipped with chokes except Mach Z series.

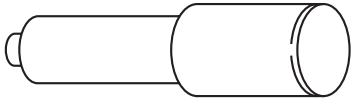
17
Rubber pad
(P/N 529 0234 00)



A01B4C4

APPLICATION
All cageless bearing engines.

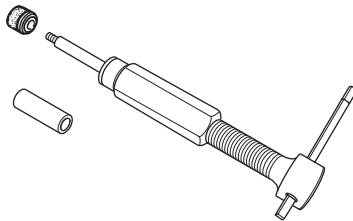
12
Bearing pusher
(rotary valve)
(P/N 420 8765 00)



A00B2J4

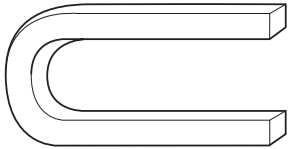
APPLICATION
Rotary valve engines.

16
1) Piston pin puller
(P/N 529 0355 03)



A01B594

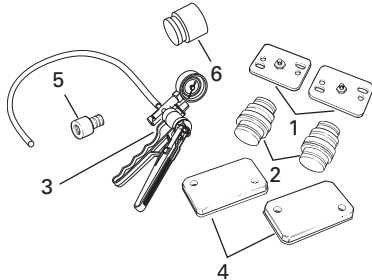
18
Rotary valve circlip tool
(P/N 529 0291 00)



A00C3I4

APPLICATION
All rotary valve engines.

14
Engine leak tester kit
(P/N 861 7491 00)

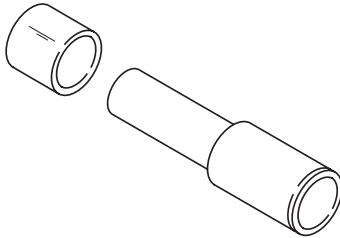


A01B2D4

APPLICATION
All engines.

2) Sleeve kit 18 mm
(P/N 529 0355 41)

3) Sleeve kit 20 mm
(P/N 529 0355 42)

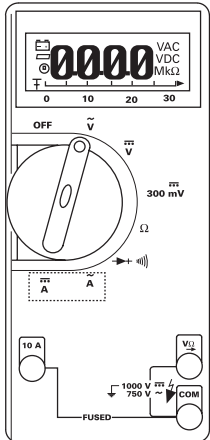


A01B5A4

APPLICATION
1) All engines.
2) 809 engine.
3) 277 and 670 engines.

NOTE: The previous piston pin puller (P/N 529 0290 00) can be upgraded by replacing the locating sleeve and expansion sleeve with appropriate sleeve kit.

242
Fluke multimeter
(P/N 529 0220 00)



F01B1O4

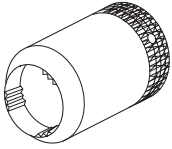
APPLICATION
All models.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

ENGINE (continued) — MANDATORY SERVICE TOOLS

Choke nut tool
(P/N 529 0322 00)

782



A01B554

APPLICATION

All models equipped with a choke and/or a DESS.

Programmer
(P/N 529 0355 02)



A01B5B4

APPLICATION

All models equipped with a DESS.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

ENGINE (continued) — RECOMMENDED SERVICE TOOLS

The following tools are highly recommended to optimize your basic tool kit and reduce repair time.

1-2) Crankshaft bearing puller with screw (P/N 420 8762 98) **200**

A

A00C3L5

APPLICATION
443, 503 and 583 engines.

1-2) Crankshaft bearing puller with screw (P/N 420 8776 35) **250**

B

A01B545

APPLICATION
277, 377, 443, 494, 503, 583, 599, 670, 699 and 809 engines.

Use with crankshaft bearing pullers A (P/N 420 8762 98) or B (P/N 420 8776 35).		
2) Bolt (M16 x 1.5 x 150) For either A or B pullers.	(P/N 420 9407 55)	258
3) Screw M8 x 40 (qty 4) A puller MAG side, B puller MAG and PTO side.	(P/N 420 8406 81)	559
4) Screw M8 x 70 (qty 4) A puller only, PTO side.	(P/N 420 8412 01)	560
5) Crankshaft protector PTO A or B puller; all engines.	(P/N 420 8765 52)	259
6) Crankshaft protector MAG A or B puller; all engines.	(P/N 420 8765 57)	554
7) Distance ring PTO A puller; 443, 503 and 583 engines.	(P/N 420 8765 69)	557
8) Puller ring Use with half rings (P/N 420 9774 75 or 420 2760 25).	(P/N 420 9774 90)	555
9) Half ring (2) A or B puller; for 72 mm O.D. bearings.	(P/N 420 9774 75)	556
10) Half ring A or B puller; for 62 mm O.D. bearings.	(P/N 420 2760 25)	558
11) Puller ring For half rings (P/N 420 9774 79).	(P/N 420 9774 94)	251
12) Half ring B puller only; 80 mm O.D. bearings.	(P/N 420 9774 79)	252

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

ENGINE (continued) — RECOMMENDED SERVICE TOOLS

Bypass wires
(P/N 529 0333 00)



A00I094

APPLICATION

Grand Touring 700/SE.

Adaptor
(P/N 529 0338 00)



A00B4H4

APPLICATION

Grand Touring SE.

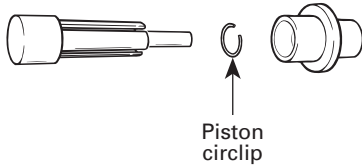
Piston circlip installer

A) (P/N 529 0169 00)

202

B) (P/N 290 8770 16)

548



Piston
circlip

A01B1P4

APPLICATION

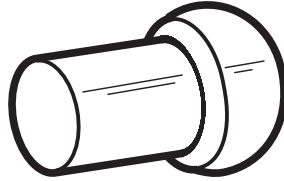
A) All engines except 670.

B) 670 engines.

Piston pin/connecting
rod bearing centering tool
(P/N 529 0091 00)

203

NOTE: New diameter is 9.65 mm
(0.380").



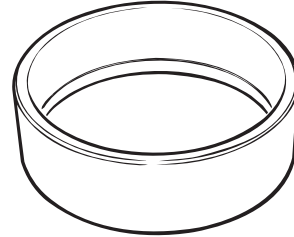
A01B1R4

APPLICATION

All engines.

Magneto coil centering
ring
(P/N 420 8769 22)

209



A01B1V4

APPLICATION

All engines with Nippondenso CDI
(160 W).

Ring compressor

A) (P/N 420 8760 90)
(62 mm)

204

B) (P/N 420 8769 70)
(72 mm)

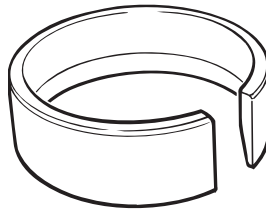
206

C) (P/N 420 8769 72)
(76 mm)

207

D) (P/N 529 0308 00)
(78 mm)

262



A01B1T4

APPLICATION

A) 377 and 443 engine.

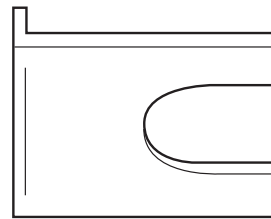
B) 503 engine.

C) 583 engine.

D) 670 engine.

Crankshaft feeler gauge
(P/N 420 8766 20)

216



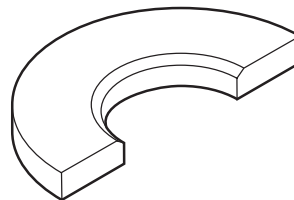
A00C114

APPLICATION

377, 443 and 503 engines.

Crankshaft distance
gauge (5.7 mm)
(P/N 420 8768 22)

217



A00C294

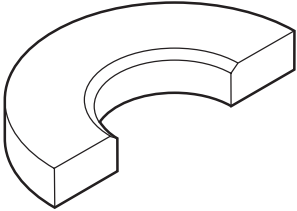
APPLICATION

377 and 443 engines.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

ENGINE (continued) — RECOMMENDED SERVICE TOOLS

Crankshaft distance gauge (12.7 mm)
(P/N 420 8768 24) **218**



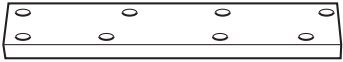
A00C3A4

APPLICATION
503 engine.

Cylinder aligning tool

A) (P/N 420 8769 02) **220**
(on exhaust side)

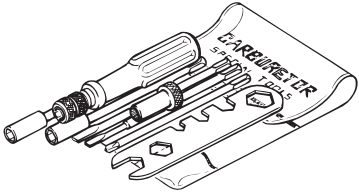
B) (P/N 420 8761 71) **221**
(on intake side)



A00B084

APPLICATION
A) 583 and 670 engines.
B) 377, 443 and 503 engines.

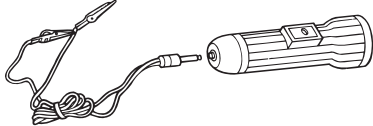
Mikuni carburetor tool kit
(P/N 404 1120 00) **222**



A00B2F4

APPLICATION
All models.

Circuit tester (continuity light)
(P/N 414 0122 00) **223**



A00C214

APPLICATION
All models.

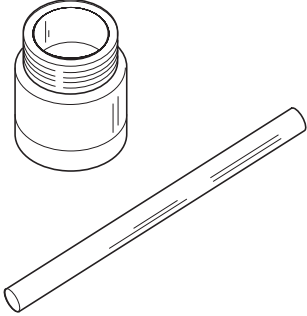
Stroboscopic timing light
(P/N 529 0319 00) **225**



A00B4F4

APPLICATION
All engines.

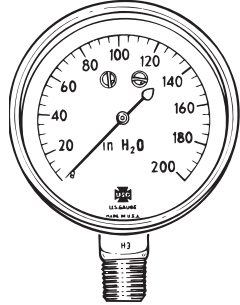
RAVE movement indicator
(P/N 861 7258 00) **226**



A18B014

APPLICATION
All RAVE equipped engines.

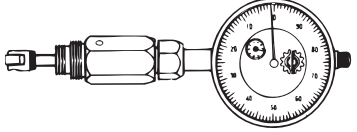
Air pressure gauge, 0-200 inch of water
(P/N 529 0104 00) **227**



A18B034

APPLICATION
For pressure testing gauge.

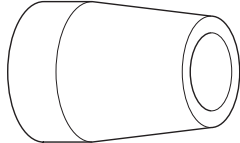
Dial indicator (TDC gauge)
(P/N 414 1047 00) **230**



A00B4E4

APPLICATION
All engines.

Seal protector sleeve (for 10 mm shaft)
(P/N 420 8769 80) **231**



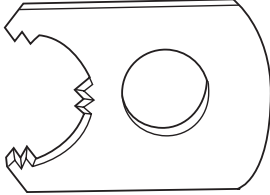
A00C0D4

APPLICATION
494, 583 and 670 engines.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

ENGINE (continued) — RECOMMENDED SERVICE TOOLS

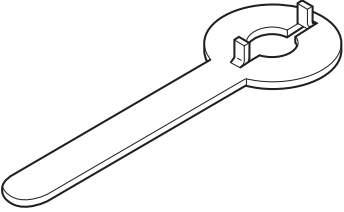
Injection pump gear holder
(P/N 420 8766 95) **234**



A00B314

APPLICATION
377, 443 and 503 engines.

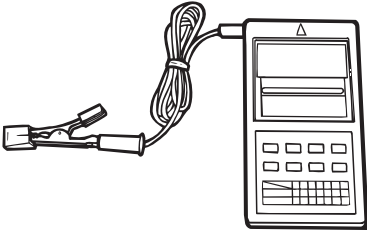
Injection pump gear holder
(P/N 420 2779 05) **235**



A00C164

APPLICATION
494, 583, 599, 670, 699 and 809 engines.

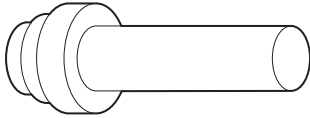
Digital/induction type tachometer
(P/N 529 0145 00) **237**



F01B1G4

APPLICATION
All engines.

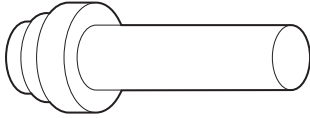
MAG seal pusher
(P/N 420 2778 75) **243**



A00C0V4

APPLICATION
277 engine.

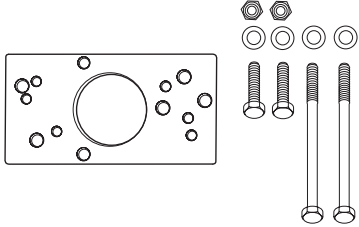
PTO seal pusher
(P/N 420 8766 60) **244**



A00C0V4

APPLICATION
277 engine.

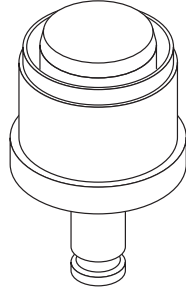
Base puller plate kit
(P/N 529 0249 00) **245**



A05C0M4

APPLICATION
277 engine.

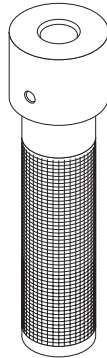
Injection jig (magneto seal)
(P/N 420 8765 14) **248**



A00C3U4

APPLICATION
494, 599, 670, 699 and 809 engines.

Handle for insertion jig
(P/N 420 8776 50) **249**



A00C3V4

APPLICATION
494, 599, 670, 699 and 809 engines.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

ENGINE (continued) — RECOMMENDED SERVICE TOOLS

Exhaust spring installer/
remover
(P/N 529 0281 00)

253



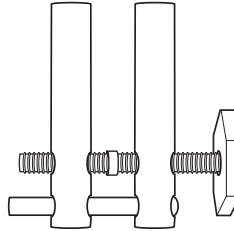
A01B584

APPLICATION

All models.

Large hose pincher
(P/N 529 0325 00)
(TYPICAL)

773



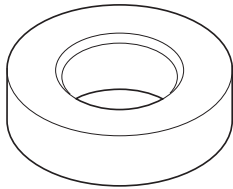
F01B234

APPLICATION

All models.

Bearing simulator
(P/N 420 8761 55)

219



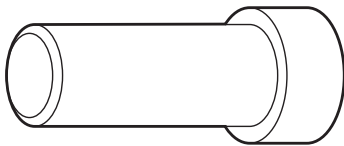
A00C1H4

APPLICATION

253, 305, 343, 402 and 440
engines.

Rotary valve seal and
shaft pusher
(P/N 420 8766 05)

229



A00C0Y4


APPLICATION

Rotary valve engines 1990 models
and older.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

TRANSMISSION — MANDATORY SERVICE TOOLS

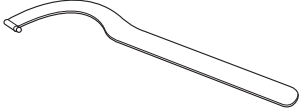
Clutch holder
(P/N 529 0064 00) **51**



A01B154

APPLICATION
All TRA drive pulleys.

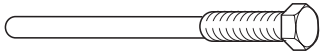
Clutch holder
(P/N 529 0276 00) **79**



A02B034

APPLICATION
Bombardier Lite drive pulley.

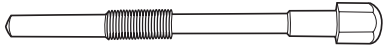
Drive pulley puller
(P/N 529 0314 00) **53**



A18B044

APPLICATION
Bombardier Lite drive pulley.

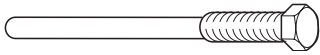
TRA drive pulley puller
(P/N 529 0224 00) **75**



A06B014

APPLICATION
TRA drive pulley for the 494, 599, 670, 699 and 809 engines.

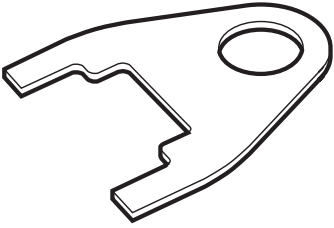
TRA drive pulley puller
(P/N 529 0079 00) (25 mm) **55**



A18B044

APPLICATION
TRA drive pulley for the 443 and 503 engines.

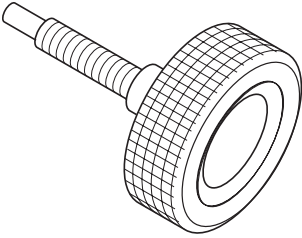
Forks (qty 3)
(P/N 529 0055 00) **57**



A16B014

APPLICATION
All models equipped with a TRA drive pulley.


Drive belt installer
(P/N 529 0172 00) **58**



A00A1A4

APPLICATION
All models except Tundra II LT and Skandic WT Series.

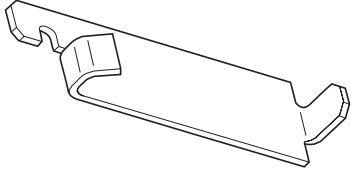
Transmission alignment bar
A) (P/N 529 0267 00) **78**
B) (P/N 529 0269 00) **60**
C) (P/N 529 0300 00) **80**
D) (P/N 529 0355 02)
E) (P/N 529 0355 27)



A01B4D4

APPLICATION
A) S-Series with TRA.
B) Tundra II LT.
C) S-Series with Bombardier Lite.
D) Skandic WT/WT LC/SWT.
E) CK3 series.

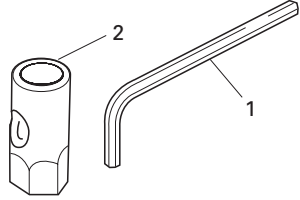
Spring scale hook (long)
(P/N 529 0309 00) **84**



A00B4A4

APPLICATION
All models except Tundra series.

Drive belt tension adjuster tool
(P/N 529 0087 00) **63**



A15B044

APPLICATION
All models except Skandic WT and Tundra Series.

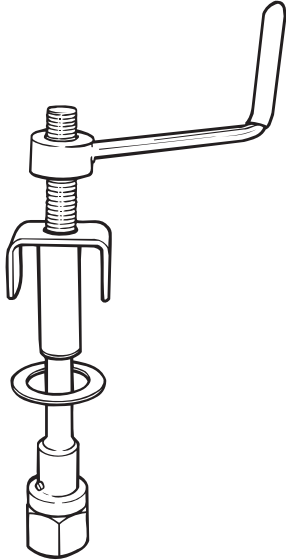
Parts included:

- 1) Hex wrench (P/N 420 8767 30)
- 2) Socket wrench (P/N 529 0150 00)

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

TRANSMISSION (continued) — MANDATORY SERVICE TOOLS


Spring compressor/
TRA clutch flare tool
(P/N 529 0186 00)
Parts included in the kit:
Spring compressor
(P/N 529 0151 00)



A01B334

APPLICATION
All models.

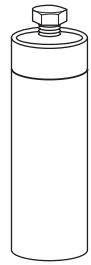
Tension tester
(P/N 414 3482 00)



A00C074

APPLICATION
All models.

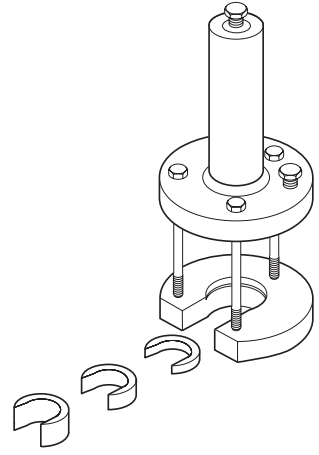
Countershaft bearing
installer
(P/N 529 0302 00)



A00A194

APPLICATION
S-Series.

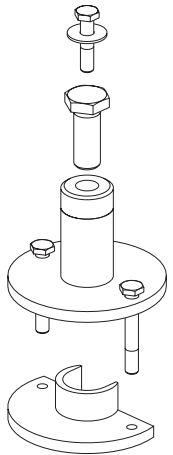
Countershaft bearing
remover
(P/N 529 0301 00)



A00A274

APPLICATION
S-Series.

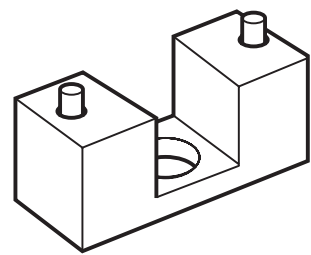
Countershaft bearing
remover/installer
(P/N 529 0355 54)



A01B5C4

APPLICATION
CK3 Series.

Spring cover tool
(P/N 529 0273 00)



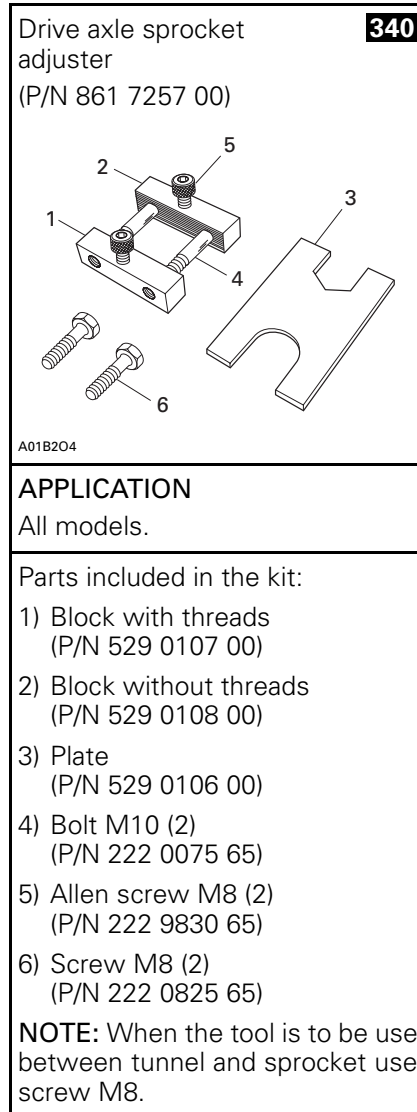
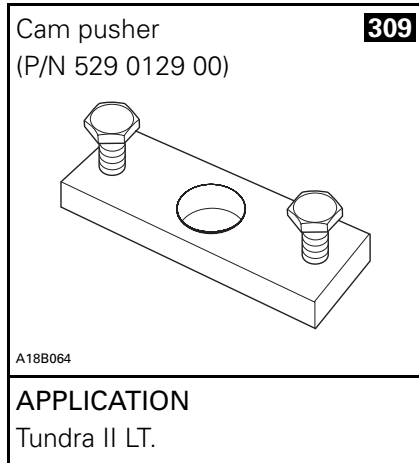
A01B4M4

APPLICATION
Bombardier Lite drive pulley.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

TRANSMISSION (continued) — RECOMMENDED SERVICE TOOLS

The following tools are highly recommended to optimize your basic tool kit and reduce repair time.



SUSPENSION — MANDATORY SERVICE TOOLS

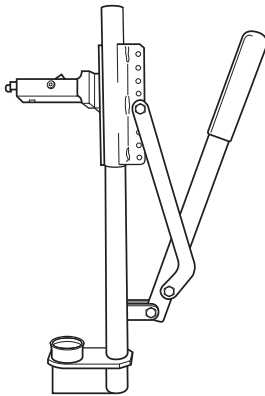
Shock spring removal kit

65

(P/N 529 0355 04)

Replacement clevis pin:

(P/N 414 5284 00)



NOTE: The previous shock spring removal kit (P/N 529 0271 00) can be upgraded by replacing the stopper with a wider stopper (P/N 529 0355 51).

A01B404

APPLICATION

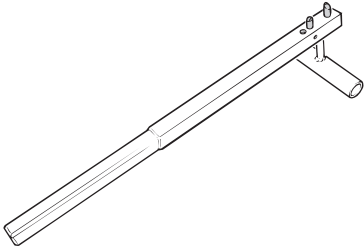
All suspensions with coil spring.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

SUSPENSION (continued) — RECOMMENDED SERVICE TOOLS

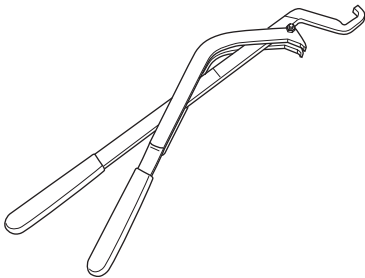
- A) Track cleat remover
(P/N 529 0082 00) **345**
- Pins
(P/N 529 0082 04) **346**

NOTE: Pins can be rotated 180° depending on whether the tool is used by a left-hander or right-hander.



A01B1J4

- B) TRA track cleat remover
(P/N 529 0287 00) **254**

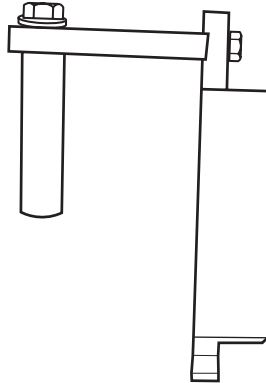


A01F224

APPLICATION

- A) Tundra series.
B) All models except Tundra series and Skandic WT series.

- Camber angle tool
(P/N 529 0216 00) **343**
- NOTE:** Angle finder with a magnetic base must be used.
Suggestion: K-D tool no. 2968

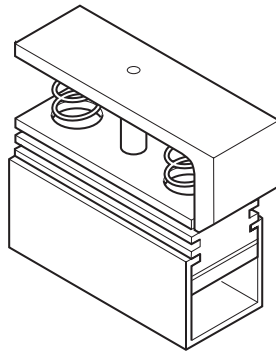


A06B024

APPLICATION

All models.

- Track tension gauge
(P/N 529 0215 00) **342**

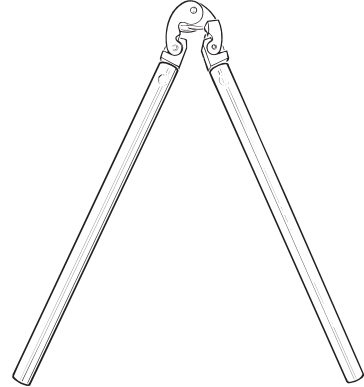


A00B3X4

APPLICATION

All models.

- Track cleat installer
A) (P/N 529 0085 00) **347**
Narrow
B) (P/N 529 0288 00) **255**
Narrow



A01B1M4

APPLICATION

- A) Tundra and fan-cooled S-Series.
B) Liquid-cooled S-Series and CK3 series.

- Dome guide
(P/N 529 0265 00) **349**

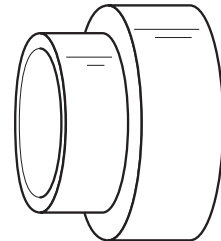


A06F1B4

APPLICATION

MX Z T/A shocks.

- Piston guide
(P/N 529 0266 00) **500**



A06F1C4

APPLICATION

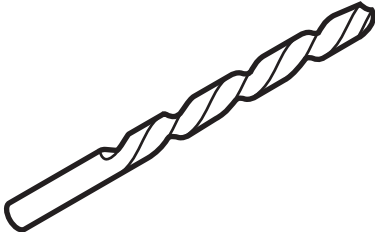
MX Z T/A shocks.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

SUSPENSION (continued) — RECOMMENDED SERVICE TOOLS

Drill bit
(P/N 529 0318 00)

508

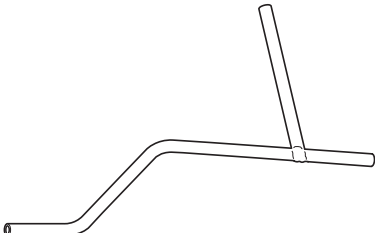


A01B564

APPLICATION
All 3/16 inch rivets.

Spring installer (bar)
(P/N 529 0050 00)

326

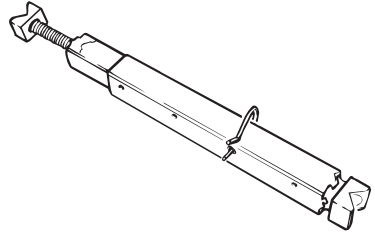


A00C114

APPLICATION
All SC-10 suspension models and Tundra series.

Drive axle holder
(P/N 529 0072 00)

333

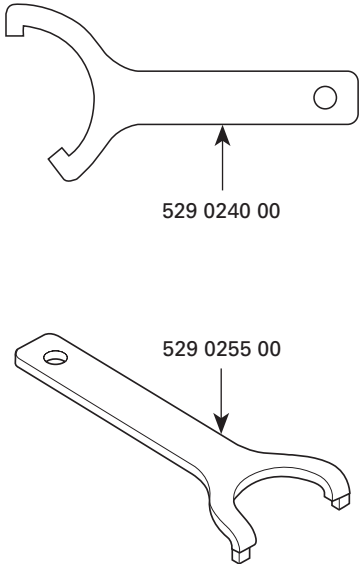


A01B1E4

APPLICATION
All models.

Adjustment wrench
(P/N 861 7439 00)

Consists of:



529 0240 00

529 0255 00

A00B4B4

APPLICATION
T/A shock.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

VEHICLES — RECOMMENDED SERVICE TOOLS

Protective mat
(P/N 529 0306 00)

503



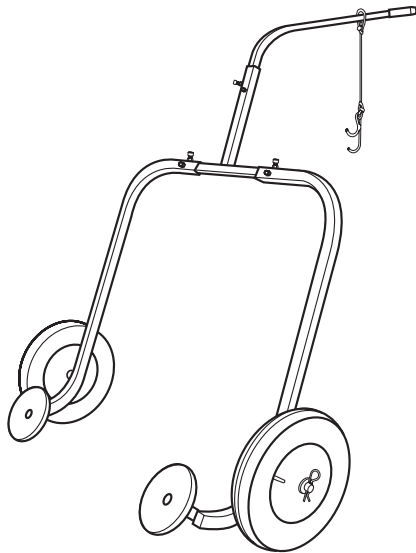
A01B45W

APPLICATION

All models.

Dolly
(P/N 529 0299 00)

348



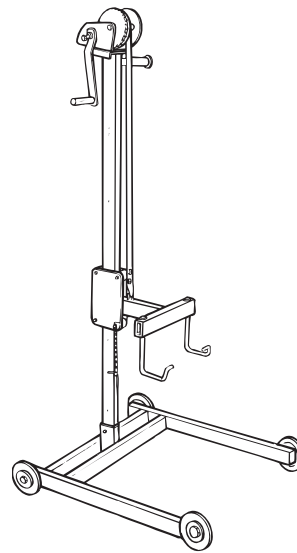
A00B4CJ

APPLICATION

All models.

Snowmobile jack
(P/N 529 0200 00)

341



A01A1JJ

APPLICATION

All models.

SERVICE PRODUCTS


NOTE: The numbers outlined in black (example: **1**) are reference to tool numbers from other divisions (Sea-Doo Watercraft and/or Sea-Doo Jet Boats). Matching reference numbers indicate the same tool is being used, even if the part numbers are different.

MANDATORY SERVICE PRODUCTS

Loctite® is a trademarks of Loctite Corporation.

Dow Corning® is a trademarks of Dow Corning Corporation.


Retaining compound (P/N 413 7031 00) **151**
 Loctite® RC/609:
 Retaining compound (10 mL) (green)



A00B2S4

APPLICATION
 Used for retaining bushings, bearings in slightly worn housing or on shaft.


Medium-strength threadlocker (P/N 413 7030 00) **154**
 Loctite® 242:
 Threadlocker (10 mL) (blue, medium strength)



A00B324

APPLICATION
 Flywheel nut, crankcase studs, etc.


High strength threadlocker (P/N 413 7074 00) **155**
 Loctite® 271:
 Threadlocker (10 mL) (red, high strength)



A00B2U4

APPLICATION
 Fasteners and studs up to 1 inch diameter.

Paste gasket (P/N 413 7027 00) **152**
 Loctite® 515:
 Gasket eliminator (50 mL)



A00B2T4

APPLICATION
 Crankcase halves, transmission and gearbox mating surfaces.

Gasket/paint remover (P/N 413 7085 00) **156**
 Loctite® 79040 Chisel
 510 g (18 oz)



A00B3L4

APPLICATION
 Clean mating surfaces of cylinders and crankcase. Remove carbon in combustion chambers.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

MANDATORY SERVICE PRODUCTS (continued)

Cleaning solvent
(P/N 413 7082 00)
Loctite® 755-59
340 g (12 oz)

157



A00B3M4

APPLICATION

Clean carburetor parts and degrease all oily surfaces.

Silicone compound
(P/N 420 8970 61)
Dow Corning® MS4

159



A00B3R4

APPLICATION

Lubricate pawl and pawl lock of rewind starter.

Loctite® primer
(P/N 413 7081 00)
Loctite® 764-56
Primer N
170 g (6 oz)

158



A00B3N4

APPLICATION

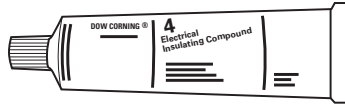
To prepare mating surfaces before applying paste gasket, retaining compound or threadlockers.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

RECOMMENDED SERVICE PRODUCTS

Silicone dielectric grease (3 oz)
(P/N 413 7017 00)

350



A00B1X4

APPLICATION

On all electric connections. High tension coil and spark plug connections. Connector housings, etc.

Grease LMZ no. 1 (400 g)
(P/N 413 7075 00)

351



A00B1Y4

APPLICATION

Mainly used between regulators or rectifiers and upper column to transfer the heat build-up and to assure a good ground.

Clutch lube (60 mL (4 oz))
(P/N 413 8007 00)

352



A00B1Z4

APPLICATION

Roller round shaft drive pulleys.

Chaincase oil (16 x 250 mL)
(P/N 413 8019 00)

353



A00B2R4

APPLICATION

Chaincase lubricant for fan-cooled engine models except Skandic WT series.

Synthetic chaincase oil (12 x 355 mL)
(P/N 413 8033 00)

354



A01B4Q4

APPLICATION

Chaincase lubricant for liquid-cooled engine models and Skandic WT series.

Blizzard oil (12 x 500 mL)
(P/N 413 8031 00)

355



A02B074

APPLICATION

All models.

Injection oil (P/N 413 8029 00)
(12 x 1 liter) (P/N 413 8030 00)
(3 x 4 liters)

356

357



F01B2H4

APPLICATION

All engines.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

RECOMMENDED SERVICE PRODUCTS (continued)

Bombardier-Rotax Formula XP-S
synthetic injection oil
(P/N 413 7110 00) **969**
(3 x 4 liters)
(P/N 413 7107 00) **970**
(205 liters)

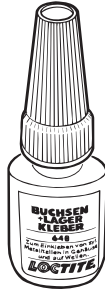


F01B354

APPLICATION

All engines.

High temperature
threadlocker **359**
(P/N 420 8997 88)
Loctite 648 (green)
(5 g)



A00B3D4

APPLICATION

For TRA spring cover bushing.

Bearing grease **363**
(400 g)
(P/N 413 7061 00)



A01B574

APPLICATION

For idler bearings, ski legs, seal
interior lips drive axle bearings,
suspension and steering, etc.

Bombardier-Rotax Formula XP-S
synthetic injection oil
(P/N 413 7105 00)
(12 x 1 liter)



F01B2G4

APPLICATION

All models.

Anti-seize lubricant **362**
(P/N 413 7010 00)
Loctite anti-seize
lubricant 454 g (16 oz)



F01B174

APPLICATION

Unpainted surfaces of drive pulley
countershaft.

Storage oil **364**
(350 g spray can)
(12 x 350 g)
(P/N 413 7116 00)



A02B054

APPLICATION

All models.

Pipe sealant **358**
(P/N 413 7023 00)
Loctite 592 (50 mL)



A00B2W4

APPLICATION

Engine plugs and senders.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

RECOMMENDED SERVICE PRODUCTS (continued)

365

Degreaser
(P/N 413 7084 00)
Permatex® 48TA
433 g (15 oz)

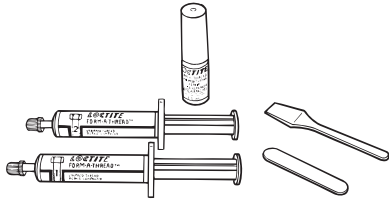


A00B3K4

APPLICATION
Engine, chaincase, pulleys and any greasy surfaces.

368

Stripped threads
repair kit
(P/N 413 7086 00)
Loctite 81668
Form-A-thread 81668




A00A1J4

APPLICATION
Repair damaged threads of grade 5 (SAE) or 8.8 (metric) maximum. Do not use in applications where temperatures will exceed 149°C (300°F) or on critical assemblies.

370

Paint for frame touch-up
(P/N 413 4010 00)
Black semi-gloss
(spray can)




A00B3H4

APPLICATION
All models with a black frame.

366

Gel instant adhesive
(P/N 413 7083 00)
Loctite 454-40
20 g (.70 oz)




A00B3O4

APPLICATION
Isolating foam and rubber strip.

369

HYLOMAR sealant
(100 g)
(P/N 413 7071 00)

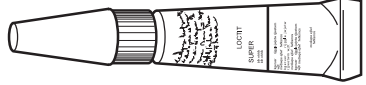


A00B3F4

APPLICATION
To form an oil resistant seal (ex: gearbox).

373

General purpose
instant adhesive
(P/N 413 7032 00)
Loctite 495 (3 g)




A00B2V4

APPLICATION
Rubber to metal bonding and most hard plastic.

367

Tough adhesive
(P/N 413 4083 00)
Loctite Black Max 38004
3 mL (.10 oz)



A00B3P4

APPLICATION
Shifter boot or grip.

SECTION 08 - SERVICE TOOLS AND SERVICE PRODUCTS

RECOMMENDED SERVICE PRODUCTS (continued)


Sealant
(P/N 413 7103 00)
Loctite 179 (80 mL)



A02B044

APPLICATION
All models.


Molykote 111
(P/N 413 7070 00)



A00B3W4

APPLICATION
Rotary valve shaft seals.


Shock oil
(32 oz)
(P/N 413 7094 00)



A06F0P4

APPLICATION
MX Z T/A shocks.

BOMBARDIER LUBE
(12 x 14 oz)
(P/N 293 6000 16)



A01B4P4

APPLICATION
Steering ball joints on all models.


Fuel stabilizer
(12 x 8 oz)
(P/N 413 4086 00)



A00B3V4

APPLICATION
All models.

Super Lube (grease)
(P/N 293 5500 14)



A00B474

APPLICATION
Tie rod bushings.

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