ski-doo®

RACING HANDBOOK 1999

484 300 004

1999 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.

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 Motor Corp of America
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

Snocross Grass Drag, Oval, Cross Country Hillclimb

Bill Rader	Phone hotline	715-847-6884
	Fax hotline	715-847-6869

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.

OVAL
ATTN: Bill Rader
FAX: 715-847-6869
PHONE: 715-847-6884

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 GEARING:	Top: ____________________
	Arm Type: ____________________		Bottom: ____________________

LIST PROBLEMS OBSERVED AND RECOMMENDED SOLUTIONS OR SUGGESTIONS,
PLEASE INCLUDE SKETCHES:
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SNO CROSS
ATT: Bill Rader
FAX: 715-847-6869
PHONE: 715-847-6884

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 GEARING: Top:_______________

Arm Type: _______________ Bottom: _______________

LIST PROBLEMS OBSERVED AND RECOMMENDED SOLUTIONS OR SUGGESTIONS,
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HILLCLIMB

ATT: Bill Rader
FAX: 715-847-6869
PHONE: 715-847-6884

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 GEARING: Top: ____________________

Arm Type: ____________________ Bottom: ____________________

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

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GRASS DRAG

ATT: Bill Rader
FAX: 715-847-6869
PHONE: 715-847-6884

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: ____________________
Ramps: ____________________
Adjuster Position: ____________________
Pins: ____________________
Arm Type: ____________________

DRIVEN: Spring: ____________________
Cam: ____________________
Pre-Load: ____________________

CHAINCASE GEARING: Top: ____________________
Bottom: ____________________

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

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CROSS COUNTRY
ATT: Bill Rader
FAX: 715-847-6869
PHONE: 715-847-6884

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 GEARING:	Top:____________________
	Arm Type: ____________________		Bottom: ____________________

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

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ASPHALT

ATT: Bill Rader
FAX: 715-847-6869
PHONE: 715-847-6884

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 GEARING:	Top:______________
	Arm Type: ______________		Bottom: _____________

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

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Engines

VEHICLE MODEL			TUNDRA	TUNDRA R	FORMULA S	TOURING E SKANDIC 380 FORMULA DELUXE 380
ENGINE TYPE			**277**	**277**	**377**	**377**
Number of Cylinders			1	1	2	2
Bore		mm (in)	72.00 (2.835)	72.00 (2.835)	62.00 (2.441)	62.00 (2.441)
Stroke		mm (in)	66.00 (2.598)	66.00 (2.598)	61.00 (2.402)	61.00 (2.402)
Displacement		cm^3 (in^3)	268.70 (16.40)	268.70 (16.40)	368.30 (22.48)	368.30 (22.48)
Compression Ratio (corrected)			6.7	6.7	6.8	6.8
Maximum Power Engine Speed ①		± 100 RPM	6900	6900	6900	6900
Piston Ring Type		1st/2nd	ST/R	ST/R	ST/R	ST/R
Ring End Gap	(new) (wear limit)	mm (in) mm (in)	0.2 (.008) 1.0 (.039)	0.2 (.008) 1.0 (.039)	0.2 (.008) 1.0 (.039)	0.2 (.008) 1.0 (.039)
Ring/Piston Groove Clearance	(new) (wear limit)	mm (in) mm (in)	0.04 (.0016) 0.2 (.008)	0.025 (.001) 0.2 (.008)	0.04 (.0016) 0.2 (.008)	0.04 (.0016) 0.2 (.008)
Piston/Cylinder Wall Clearance	(new) (wear limit)	mm (in) mm (in)	0.090 (.0031) 0.2 (.008)	0.090 (.0031) 0.2 (.008)	0.060 (.0024) 0.2 (.008)	0.060 (.0024) 0.2 (.008)
Connecting Rod Big End Axial Play	(new) (wear limit)	mm (in) mm (in)	0.20 (.0079) 1.0 (.0394)	0.20 (.0079) 1.0 (.0394)	0.20 (.0079) 1.0 (.0394)	0.20 (.0079) 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	240
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)	1.62 (.064)	3.04 (.120)	1.38 (.054)	2.79 (.110)
Trigger Coil Air Gap		mm (in)	N.A.	0.40 – 1.10 (.016 – .043)	0.45 – 0.55 (.018 – .022)	0.40 – 1.10 (.016 – .043)
Trigger Coil ⑤		Ω	N.A.	160 – 180	140 – 180	160 – 180
Generating Coil ⑤	Low Speed	Ω	40 – 76	N.A.	N.A.	N.A.
	High Speed	Ω	N.A.	5.1 – 6.2	230 – 330	5.1 – 6.2
Lighting Coil ⑤		Ω	0.05 – 0.6	0.17 – 0.21	0.23 – 0.28	0.17 – 0.21
High Tension Coil ⑤	Primary	Ω	0.11 – 0.21	N.A.	N.A.	N.A.
	Secondary	kΩ	4.9 – 7.5	0.9 – 1.1	5.1 – 6.3	0.9 – 1.1
Carburetor Type		PTO/MAG	VM 34-529	VM 34-537	2 x VM 30-195	2 x VM 30-196
Main Jet		PTO/MAG	190	190	140/140	140/140
Needle Jet			159 O-8	159 O-8	159 P-0	159 P-0
Pilot Jet			40	40	40	40
Needle Identification — Clip Position			6DH4-2	6DH4-2	6DP9-3	6DP9-3
Slide Cut-Away			2.5	2.5	2.5	2.5
Float Adjustment		± 1 mm (± .040 in)	23.9 (.94)	23.9 (.94)	23.9 (.94)	23.9 (.94)
Air Screw Adjustment		± 1/16 turn	1	1	1-1/4	1-1/4
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	Radial Fan	Axial Fan	Axial Fan
Axial Fan Belt Adjustment	Deflection	mm (in)	N.A.	N.A.	8 – 9 (.31 – .35)	8 – 9 (.31 – .35)
	Force ⑥	kg (lbf)	N.A.	N.A.	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)	25 (18)	22 (16)	22 (16)
	Magneto Ring Nut		90 (66)	90 (66)	105 (77)	105 (77)
	Crankcase Nuts or Screws	M6 M8	— 22 (16)	— 22 (16)	10 (7) 22 (16)	10 (7) 22 (16)
	Crankcase/Engine Support Nuts or Screws		21 (15)	21 (15)	39 (29)	39 (29)
	Cylinder Head Nuts		26 (19)	26 (19)	22 (16)	22 (16)
	Crankcase/Cylinder Nuts or Screws		N.A.	N.A.	N.A.	N.A.
	Axial Fan Shaft Nut		N.A.	N.A.	48 (35)	48 (35)

VEHICLE MODEL			FORMULA SL	TOURING LE	SKANDIC 500 TOURING SLE FORMULA DELUXE 500
ENGINE TYPE			**503**	**443**	**503**
Number of Cylinders			2	2	2
Bore		mm (in)	72.00 (2.835)	67.5 (2.658)	72.00 (2.835)
Stroke		mm (in)	61.00 (2.402)	61.00 (2.402)	61.00 (2.402)
Displacement		cm^3 (in^3)	496.70 (30.31)	436.6 (26.64)	496.70 (30.31)
Compression Ratio (corrected)			6.2	6.4	6.2
Maximum Power Engine Speed ①		± 100 RPM	7000	7000	7000
Piston Ring Type		$1^{st}/2^{nd}$	ST/R	ST/R	ST/R
Ring End Gap	(new) (wear limit)	mm (in) mm (in)	0.2 (.008) 1.0 (.039)	0.2 (.008) 1.0 (.039)	0.2 (.008) 1.0 (.039)
Ring/Piston Groove Clearance	(new) (wear limit)	mm (in) mm (in)	0.04 (.0016) 0.2 (.008)	0.04 (.0016) 0.2 (.008)	0.04 (.0016) 0.2 (.008)
Piston/Cylinder Wall Clearance	(new) (wear limit)	mm (in) mm (in)	0.090 (.0035) 0.2 (.008)	0.070 (.0028) 0.2 (.008)	0.080 (.0031) 0.2 (.008)
Connecting Rod Big End Axial Play	(new) (wear limit)	mm (in) mm (in)	0.2 (.0079) 1.0 (.0394)	0.20 (.0079) 1.0 (.0394)	0.2 (.0079) 1.0 (.0394)
Maximum Crankshaft End-Play ②		mm (in)	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)
Rotary Valve Timing ③		Opening Closing	N.A.	N.A.	N.A.
Magneto Generator Output		W	240	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)
Ignition Timing BTDC ④		mm (in)	1.66 (.065)	2.79 (.110)	2.76 (.109)
Trigger Coil Air Gap		mm (in)	0.45 – 0.55 (.018 – .022)	0.40 – 1.10 (.016 – .043)	0.40 – 1.10 (.016 – .043)
Trigger Coil ⑤		Ω	140 – 180	160 – 180	160 – 180
Generating Coil ⑤	Low Speed	Ω	N.A.	N.A.	N.A.
	High Speed	Ω	230 – 330	5.1 – 6.2	5.1 – 6.2
Lighting Coil ⑤		Ω	0.23 – 0.28	0.17 – 0..21	0.17 – 0.21
High Tension Coil ⑤	Primary	Ω	N.A.	N.A.	N.A.
	Secondary	kΩ	5.1 – 6.3	0.9 – 1.1	0.9 – 1.1
Carburetor Type		PTO/MAG	VM 34-532/533	VM 34-530/531	VM 34-532/533
Main Jet		PTO/MAG	180/170	205/195	180/170
Needle Jet			159 P-0	159 P-0	159 P-0
Pilot Jet			40	35	40
Needle Identification — Clip Position			6DH2-3	6DH2-3	6DH2-3
Slide Cut-Away			2.5	2.5	2.5
Float Adjustment		± 1 mm (± .040 in)	23.9 (.94)	23.9 (.94)	23.9 (.94)
Air Screw Adjustment		± 1/16 turn	1-7/8	1-1/2	1-7/8
Idle Speed RPM		± 200 RPM	1650	1650	1650
Gas Type/Pump Octane Number			Unleaded/87	Unleaded/87	Unleaded/87
Gas/Oil Ratio			Injection	Injection	Injection
Type			Axial Fan	Axial Fan	Axial Fan
Axial Fan Belt Adjustment	Deflection	mm (in)	9 – 10 (.35 – .39)	9 – 10 (.35 – .39)	9 – 10 (.35 – .39)
	Force ⑥	kg (lbf)	5 (11)	5 (11)	5 (11)
Thermostat Opening Temperature		°C (°F)	N.A.	N.A.	N.A.
Radiator Cap Opening Pressure		kPa (PSI)	N.A.	N.A.	N.A.
ENGINE COLD N•m (lbf•ft)	Drive Pulley Retaining Screw ⑦		95 (70)	95 (70)	95 (70)
	Exhaust Manifold Nuts or Bolts		22 (16)	22 (16)	22 (16)
	Magneto Ring Nut		105 (77)	105 (77)	105 (77)
	Crankcase Nuts or Screws	M6 M8	— 22 (16)	— 22 (16)	— 22 (16)
	Crankcase/Engine Support Nuts or Screws		39 (28)	39 (28)	39 (28)
	Cylinder Head Nuts		22 (16)	22 (16)	22 (16)
	Crankcase/Cylinder Nuts or Screws		N.A.	N.A.	N.A.
	Axial Fan Shaft Nut		48 (35)	48 (35)	48 (35)

Vehicles

VEHICLE MODEL				TUNDRA	TUNDRA R	SKANDIC 380
ENGINE TYPE				**277**	**277**	**377**
Chain Drive Ratio				14/25	14/25	18/44
Chain	Pitch		in	1/2	1/2	3/8
	Type/Links Qty/Plates Qty			Single/62	Single/62	Silent/70/11
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	1143 2 x C	1181 1 x C, 1 x S21
	Spring Color			Turquoise	Turquoise	Green/Green
	Spring Length		± 1.5 mm (± .060 in)	85.3 (3.36)	85.3 (3.36)	72 (2.835)
	Clutch Engagement		± 200 RPM	3100	3100	2500
Driven Pulley	Type of Driven Pulley			Tundra	Tundra Reverse	LPV27
	Spring Preload		± 0.7 kg (± 1.5 lb)	3.6 (7.9)	N.A.	N.A.
	Cam Angle		degree	37.8	37.8	47 – 44
Pulley Distance Z			(+ 0, - 1) mm ((+ 0, - 1/32) in)	37.0 + 0, - 1.5 (1.457 + 0, - .060)	37.0 + 0, - 1.5 (1.457 + 0, - .060)	26.0 ± 0.5 (1.024 ± .020)
Offset	X		mm (in)	36.0 ± 1.0 (1.417 ± .040)	36.0 ± 1.0 (1.417 ± .040)	33.4 ± 0.5 (1.315 ± .020)
	Y – X		MIN. MAX.	- 0 (- 0) + 1.5 (+ .059)	- 0 (- 0) + 1.5 (+ .059)	+ 0.5 (+ .020) + 1.5 (+ .059)
Drive Belt Part Number (P/N)				414 827 600	414 827 600	415 060 600
Drive Belt Width (new) ③			mm (in)	33.3 (1-5/16)	33.3 (1-5/16)	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)
		Force ④	kg (lbf)	6.8 (15)	6.8 (15)	11.3 (25)
Track	Width		cm (in)	38.1 (15)	38.1 (15)	38.1 (15)
	Length		cm (in)	354 (139)	354 (139)	345 (136)
	Profile Height		mm (in)	18.4 (.724)	18.4 (.724)	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		Torque Reaction Slide	Torque Reaction Slide	SC-10 Touring
		Ski		Telescopic Strut	Telescopic Strut	DSA
Length			cm (in)	284.5 (112)	284.5 (112)	294 (115.7)
Width			cm (in)	95.3 (37.5)	95.3 (37.5)	108 (42.5)
Height			cm (in)	114 (44.9)	114 (44.9)	122 (48.0)
Ski Stance			cm (in)	81.3 (32.0)	81.3 (32.0)	94 (37)
Mass (dry)			kg (lb)	173 (380)	173 (380)	209 (459)
Ground Contact Area			cm^2 (in^2)	7570 (1173)	7570 (1173)	7227 (1120)
Ground Contact Pressure			kPa (PSI)	2.24 (.325)	2.24 (.325)	2.84 (.412)
Frame Material				Steel	Steel	Aluminum
Bottom Pan Material				Polyethylene High Density	Polyethylene High Density	Impact Copolymer
Hood Material				Polyethylene High Density	Polyethylene High Density	RRIM Polyurethane
Battery			V (A•h)	N.A.	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	N.A.	N.A.	3
Fuel and Temperature Gauge Bulb			W	N.A.	N.A.	N.A.
Fuse	Starter Solenoid		A	N.A.	N.A.	N.A.
	Tachometer		A	N.A.	N.A.	N.A.
Fuel Tank			L (U.S. gal)	26 (6.9)	26 (6.9)	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)	1.9 (64)	2.55 (86)

VEHICLE MODEL				SKANDIC 500	TOURING E	TOURING LE
ENGINE TYPE				503	377	443
Chain Drive Ratio				18/44	18/44	21/44
Chain	Pitch		in	3/8	3/8	3/8
	Type/Links Qty/Plates Qty			Silent/70/11	Silent/70/11	Silent/72/11
Drive Pulley	Type of Drive Pulley			TRA	Bombardier Lite	TRA
	Ramp Identification			292X ①	N.A.	284 ①
	Calibration Screw Position or Calibration Part ②			3	1181 1 x C, 1 x S21	2
	Spring Color			Red/Red	Green/Green	Red/Yellow
	Spring Length		± 1.5 mm (± .060 in)	97.2 (3.87)	72.0 (2.83)	87.9 (3.46)
	Clutch Engagement		± 200 RPM	2900	2500	2900
Driven Pulley	Type of Driven Pulley			LPV27	LPV27	LPV27
	Spring Preload		± 0.7 kg (± 1.5 lb)	N.A.	N.A.	N.A.
	Cam Angle		degree	47 – 44	47 – 44	47 – 44
Pulley Distance Z			mm (in)	17.0 ± 0.5 (.669 ± .020)	26.0 ± 0.5 (1.024 ± .020)	17.0 ± 0.5 (.669 ± .020)
Offset	X		mm (in)	35.5 ± 0.5 (1.398 ± .020)	33.4 ± 0.5 (1.315 ± .020)	35.5 ± 0.5 (1.398 ± .020)
	Y – X		MIN. MAX.	+ 1 (+ .039) + 2 (+ .079)	+ 0.5 (+ .020) + 1.5 (+ .059)	+ 1 (+ .039) + 2 (+ .079)
Drive Belt Part Number (P/N)				415 060 600	415 060 600	415 060 600
Drive Belt Width (new) ③			mm (in)	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)
	Force ④		kg (lbf)	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)	23..2 (.913)	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)	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
	Ski			DSA	DSA	DSA
Length			cm (in)	294 (115.7)	294 (115.7)	294 (115.7)
Width			cm (in)	108 (42.5)	115.6 (45.5)	120.7 (47.5)
Height			cm (in)	122 (48.0)	122 (48.0)	122 (48.0)
Ski Stance			cm (in)	94 (37)	101.6 (40)	106.7 (42)
Mass (dry)			kg (lb)	225 (494)	193 (425)	202 (445)
Ground Contact Area			cm^2 (in^2)	7227 (1120)	7227 (1120)	7227 (1120)
Ground Contact Pressure			kPa (PSI)	3.05 (.442)	2.62 (.380)	2.74 (.397)
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)	N.A.	12 (22)	12 (22)
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	3	3	3
Fuel and Temperature Gauge Bulb			W	N.A.	N.A.	N.A.
Fuse	Starter Solenoid		A	N.A.	30	30
	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)

VEHICLE MODEL				TOURING SLE	FORMULA S	FORMULA SL
ENGINE TYPE				**503**	**377**	**503**
Chain Drive Ratio				21/44	18/44	21/44
Chain	Pitch		in	3/8	3/8	3/8
	Type/Links Qty/Plates Qty			Silent/72/11	Silent/72/11	Silent/72/11
Drive Pulley	Type of Drive Pulley			TRA	Bombardier Lite	TRA
	Ramp Identification			291X ①	N.A.	291 ①
	Calibration Screw Position or Calibration Part ②			3	1181 1 x C, 1 x S21	3
	Spring Color			Red/Red	Red/Blue	Yellow/Red
	Spring Length		± 1.5 mm (± .060 in)	97.2 (3.83)	96 (3.78)	121.1 (4.77)
	Clutch Engagement		± 200 RPM	2900	3500	3300
Driven Pulley	Type of Driven Pulley			LPV27	Formula	Formula
	Spring Preload		± 0.7 kg (± 1.5 lb)	N.A.	4.8 (10.6)	4.8 (10.6)
	Cam Angle		degree	47 – 44	44	44
Pulley Distance Z			mm (in)	17.0 ± 0.5 (.669 ± .020)	25.5 ± 0.5 (1 ± .020)	16.5 ± 0.5 (.650 ± .020)
Offset	X		± 0.4 mm (± 1/64 in)	35.5 ± 0.5 (1.398 ± .020)	33.4 ± 0.5 (1.315 ± .020)	35.5 ± 0.5 (1.398 ± .020)
	Y – X		MIN. MAX.	+ 1 (+ .039) + 2 (+ .079)	+ 0.5 (+ .020) + 1.5 (+ .059)	+ 0.5 (+ .020) + 1.5 (+ .059)
Drive Belt Part Number (P/N)				415 060 600	415 060 600	415 060 600
Drive Belt Width (new) ③			mm (in)	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)
	Force ④		kg (lbf)	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)	307 (121)	307 (121)
	Profile Height		mm (in)	18.4 (.724)	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)	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 Sport	SC-10 Sport
	Ski			DSA	DSA	DSA
Length			cm (in)	294 (115.7)	272.5 (107.3)	272.5 (107.3)
Width			cm (in)	120.7 (47.5)	115.6 (45.5)	120.7 (47.5)
Height			cm (in)	122 (48.0)	112 (44.1)	112 (44.1)
Ski Stance			cm (in)	106.7 (42)	101.6 (40)	106.7 (42)
Mass (dry)			kg (lb)	216 (475)	193 (425)	202 (445)
Ground Contact Area			cm^2 (in^2)	7227 (1120)	6503 (1008)	6503 (1008)
Ground Contact Pressure			kPa (PSI)	2.93 (.425)	2.91 (.422)	3.05 (.442)
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	3	5	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)

VEHICLE MODEL				FORMULA DELUXE 380	FORMULA DELUXE 500
ENGINE TYPE				**377**	**503**
Chain Drive Ratio				18/44	21/44
Chain	Pitch		in	3/8	3/8
	Type/Links Qty/Plates Qty			Silent/72/11	Silent/72/11
Drive Pulley	Type of Drive Pulley			Bombardier Lite	TRA
	Ramp Identification			N.A.	291X ①
	Calibration Screw Position or Calibration Part ②			1181 1 x C, 1 x S21	3
	Spring Color			Red/Blue	Yellow/Red
	Spring Length		± 1.5 mm (± .060 in)	96 (3.78)	121 (4.77)
	Clutch Engagement		± 200 RPM	3500	3300
Driven Pulley	Type of Driven Pulley			LPV27	LPV27
	Spring Preload		± 0.7 kg (± 1.5 lb)	N.A.	N.A.
	Cam Angle		degree	47 – 44	47 – 44
Pulley Distance Z			mm (in)	26.0 ± 0.5 (1.024 ± .020)	17.0 ± 0.5 (.669 ± .020)
Offset	X		mm (in)	33.4 ± 0.5 (1.315 ± .020)	35.5 ± 0.5 (1.315 ± .020)
	Y – X		MIN. MAX.	+ 0.5 (+ .020) + 1.5 (+ .059)	+ 0.5 (+ .020) + 1.5 (+ .059)
Drive Belt Part Number (P/N)				415 060 600	415 060 600
Drive Belt Width (new) ③			mm (in)	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)	11.3 (25)	11.3 (25)
Track	Width		cm (in)	38.1 (15)	38.1 (15)
	Length		cm (in)	307 (121)	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)
Suspension Type		Track		SC-10 Sport	SC-10 Touring
		Ski		DSA	DSA
Length			cm (in)	272.5 (107.3)	272.5 (107.3)
Width			cm (in)	115.6 (45.5)	120.7 (47.5)
Height			cm (in)	116.9 (46)	116.9 (46)
Ski Stance			cm (in)	101.6 (40)	106.7 (42)
Mass (dry)			kg (lb)	202 (445)	211 (465)
Ground Contact Area			cm^2 (in^2)	6503 (1008)	6503 (1008)
Ground Contact Pressure			kPa (PSI)	3.05 (.442)	3.18 (.461)
Frame Material				Aluminum	Aluminum
Bottom Pan Material				Impact Copolymer	Impact Copolymer
Hood Material				RRIM Polyurethane	RRIM Polyurethane
Battery			V (A•h)	12 (22)	12 (22)
Headlight			W	H4 60/55	H4 60/55
Taillight and Stoplight			W	8/27	8/27
Tachometer and Speedometer Bulb			W	5	2 x 3
Fuel and Temperature Gauge Bulb			W	N.A.	N.A.
Fuse	Starter Solenoid		A	30	30
	Tachometer		A	N.A.	N.A.
Fuel Tank			L (U.S. gal)	40 (10.6)	40 (10.6)
Chaincase Gearbox			mL (U.S. oz)	250 (8.5)	250 (8.5)
Cooling System			L (U.S. oz)	N.A.	N.A.
Injection Oil Reservoir			L (U.S. oz)	2.55 (86)	2.55 (86)

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 series. 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 417 004 309) (Hollow).

② For Bombardier Lite drive pulleys:
1157 = Red block, push type 38 g (P/N 417 115 700).
1181 = Black block, screw type 39.6 g (P/N 417 118 100).
1143 = Red block, screw type 41.8 g (P/N 417 114 300).

W = Washer 1.8 g (P/N 417 115 800).
C = Cap 1.65 g (P/N 417 114 500).
S3.4 = Weight, screw type 3.4 g (P/N 417 114 400).
S21 = Weight, screw type 21 g (P/N 417 120 400).

③ Minimum allowable width may not be less than 3.0 mm (1/8 in) of a 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.

Engines

VEHICLE MODEL			MX Z 440	MX Z 500	MX Z 670 HO
ENGINE TYPE			**443**	**494**	**670**
Number of Cylinders			2	2	2
Bore		mm (in)	67.5 (2.6575)	69.5 (2.736)	78.0 (3.071)
Stroke		mm (in)	61.0 (2.402)	65.8 (2.59)	70.0 (2.760)
Displacement		cm³ (in³)	436.6 (26.64)	499.3 (30.47)	668.97 (40.82)
Compression Ratio (corrected)			6.4	6.8	6.2
Maximum Power Engine Speed ①		± 100 RPM	7000	7800	8000
Piston Ring Type		1st/2nd	ST/R	ST/R	ST/R
Ring End Gap	New	mm (in)	0.2 (.008)	0.25 (.010)	0.25 (.010)
	Wear Limit	mm (in)	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)
	Wear Limit	mm (in)	0.2 (.0079)	0.2 (.0079)	0.2 (.0079)
Piston/Cylinder Wall Clearance	New	mm (in)	0.07 (.0028)	0.11 (.0043)	0.10 (.0039)
	Wear Limit	mm (in)	0.2 (.008)	0.15 (.0059)	0.15 (.0059)
Connecting Rod Big End Axial Play	New	mm (in)	0.2 (.0079)	0.39 (.0156)	0.39 (.0156)
	Wear Limit	mm (in)	1.0 (.0394)	1.2 (.0472)	1.2 (.0472)
Maximum Crankshaft End-Play ②		mm (in)	0.3 (.012)	0.3 (.012)	0.3 (.012)
Maximum Crankshaft Deflection		mm (in)	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)
Rotary Valve Timing ③ and P/N 420 924 XXX		Opening Closing	N.A.	146° – 65° 502	145° – 71° 500
Magneto Generator Output		W	240	220	220
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)
Ignition Timing BTDC ④⑧		mm (in)	1.38 (.054)	1.81 (.071)	3.20 (.126)
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	0.3 – 0.7
	Secondary	kΩ	5.1 – 6.3	8 – 16	8 – 16
Carburetor Type		PTO/MAG	VM 34 530/531	VM 38 412/413	VM 44 36/37
Main Jet		PTO/MAG	205/195	300/280	340/310
Needle Jet			159 P-0	480-Q4	224 AA-4
Pilot Jet			35	50	55
Needle Identification — clip position			6DH2-3	6DGY9-3	7ECY1-3
Slide Cut-Away			2.5	2.5	2.5
Float Adjustment		± 1 mm (± .040 in)	23.9 (.94)	18.1 (.71)	22.9 (.90)
Air Screw Adjustment		± 1/16 Turn	1-1/2	2-1/2	1-3/4
Idle Speed		± 200 RPM	1650	1800	1700
Gas Type/Pump Octane Number			Unleaded/87	Unleaded/87	Super Unleaded/ 91
Gas/Oil Ratio			Injection	Injection	Injection
Type			Axial Fan	Liquid	Liquid
Axial Fan Belt Adjustment	Deflection ⑥	mm (in)	9 – 10 (.35 – .39)	N.A.	N.A.
	Force	kg (lbf)	5 (11)	N.A.	N.A.
Thermostat Opening Temperature		°C (°F)	N.A.	42 (108)	42 (108)
Radiator Cap Opening Pressure		kPa (PSI)	N.A.	90 (13)	90 (13)
ENGINE COLD N•m (lbf•ft)	Drive Pulley Retaining Screw		⑦	⑦	⑦
	Exhaust Manifold Nuts or Bolts		22 (16)	23 (17)	23 (17)
	Magneto Ring Nut		105 (77)	125 (92)	125 (92)
	Crankcase Nuts or Screws	M6 M8	10 (7) 22 (16)	9 (6.5) 29 (21)	9 (6.5) 29 (21)
	Crankcase/Engine Support Nuts or Screws		38 (28)	39 (29)	39 (29)
	Cylinder Head Nuts		22 (16)	29 (21)	29 (21)
	Crankcase/Cylinder Nuts or Screws		N.A.	29 (21)	29 (21)
	Axial Fan Shaft Nut		50 (37)	N.A.	N.A.

VEHICLE MODEL			FORMULA Z 500 FORMULA DLX 500	FORMULA DLX 583	FORMULA Z 583	FORMULA Z 670 FORMULA DLX 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)			6.7	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 Wear Limit	mm (in) mm (in)	0.25 (.010) 1.0 (.039)	0.25 (.010) 1.0 (.039)	0.25 (.010) 1.0 (.039)	0.35 (.014) 1.0 (.039)
Ring/Piston Groove Clearance	New Wear Limit	mm (in) mm (in)	0.04 (.0016) 0.2 (.0079)	0.04 (.0016) 0.2 (.0079)	0.04 (.0016) 0.2 (.0079)	0.04 (.0016) 0.2 (.0079)
Piston/Cylinder Wall Clearance	New Wear Limit	mm (in) mm (in)	0.11 (.0043) 0.15 (.0059)	0.11 (.0043) 0.15 (.0059)	0.11 (.0043) 0.15 (.0059)	0.10 (.0039) 0.15 (.0059)
Connecting Rod Big End Axial Play	new wear limit	mm (in) mm (in)	0.39 (.0156) 1.2 (.0472)	0.39 (.0156) 1.2 (.0472)	0.39 (.0156) 1.2 (.0472)	0.39 (.0156) 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	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 ④⑧		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 38 408/409	VM 38 416/417	VM 40 105/106	VM 40 109/110
Main Jet		PTO/MAG	300/280	270/260	280/260	310/290
Needle Jet			480-Q3	480-P7	224 AA-2	224 AA-3
Pilot Jet			50	50	60	60
Needle Identification — clip position			6DGY9-2	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	2	2.0	2.0	2-1/4
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 M8	9 (6.5) 29 (21)	9 (6.5) 23 (17)	9 (6.5) 23 (17)	9 (6.5) 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.

VEHICLE MODEL			SUMMIT 500	SUMMIT x 670	GRAND TOURING 500	GRAND TOURING 583
ENGINE TYPE			**494**	**670**	**494**	**583**
Number of Cylinders			2	2	2	2
Bore		mm (in)	69.5 (2.736)	78.0 (3.071)	69.5 (2.736)	76.0 (2.992)
Stroke		mm (in)	65.8 (2.59)	70.0 (2.760)	65.8 (2.59)	64.0 (2.52)
Displacement		cm^3 (in^3)	499.3 (30.47)	668.97 (40.82)	499.3 (30.47)	580.7 (35.44)
Compression Ratio (corrected)			6.8	6.2	6.7	6.7
Maximum Power Engine Speed ①		± 100 RPM	7800	8000	7800	7900
Piston Ring Type		1st/2nd	ST/R	ST/R	ST/R	ST/N.A.
Ring End Gap	New Wear Limit	mm (in) mm (in)	0.25 (.010) 1.0 (.039)	0.25 (.0098) 1.0 (.039)	0.25 (.010) 1.0 (.039)	0.25 (.010) 1.0 (.039)
Ring/Piston Groove Clearance	New Wear Limit	mm (in) mm (in)	0.04 (.0016) 0.2 (.0079)	0.04 (.0016) 0.2 (.0079)	0.04 (.0016) 0.2 (.0079)	0.04 (.0016) 0.2 (.0079)
Piston/Cylinder Wall Clearance	New Wear Limit	mm (in) mm (in)	0.11 (.0043) 0.15 (.0059)	0.10 (.0039) 0.15 (.0059)	0.11 (.0043) 0.15 (.0059)	0.11 (.0045) 0.15 (.0059)
Connecting Rod Big End Axial Play	New Wear Limit	mm (in) mm (in)	0.39 (.0156) 1.2 (.0472)	0.39 (.0154) 1.2 (.0472)	0.39 (.0154) 1.2 (.0472)	0.39 (.0154) 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	145° – 71° 500	135° – 64° 509	140° – 71° 502
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 ④⑧		mm (in)	1.81 (.071)	3.20 (.126)	1.81 (.071)	1.75 (.069)
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.) 414/415	VM 44 38/39	VM 38 410/411	VM 38 416/417
Main Jet		PTO/MAG	350/330	350/340	300/280	270/260
Needle Jet			480-Q6	224 AA-8	480-Q3	480-P7
Pilot Jet			75	55	50	50
Needle Identification — clip position			6DHY48-4	7ECY1-2	6DGY9-2	6DEY4-2
Slide Cut-Away			2.5	2.5	2.5	2.5
Float Adjustment		± 1 mm (± .040 in)	18.1 (.71)	22.9 (.90)	18.1 (.71)	18.1 (.71)
Air Screw Adjustment		± 1/16 Turn	2	1-3/4	2	2
Idle Speed		± 200 RPM	1800	1700	1800	1800
Gas Type/Pump Octane Number			Unleaded/87	Super Unleaded/91	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)	100 (74)	125 (92)
Crankcase Nuts or Screws		M6 M8	9 (6.5) 29 (21)	9 (6.5) 29 (21)	9 (6.5) 29 (21)	9 (6.5) 23 (17)
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.

VEHICLE MODEL			SKANDIC WT	SKANDIC SWT	SKANDIC WT LC
ENGINE TYPE			**503**	**503**	**494**
Number of Cylinders			2	2	2
Bore		mm (in)	72.0 (2.835)	72.0 (2.835)	69.5 (2.736)
Stroke		mm (in)	61.0 (2.402)	61.0 (2.402)	65.8 (2.59)
Displacement		cm^3 (in^3)	496.7 (30.31)	496.7 (30.31)	499.3 (30.47)
Compression Ratio (corrected)			6.2	6.2	6.8
Maximum Power Engine Speed ①		± 100 RPM	6800	6800	7000
Piston Ring Type		$1^{st}/2^{nd}$	ST/R	ST/R	ST/R
Ring End Gap	New Wear Limit	mm (in) mm (in)	0.2 (.0079) 1.0 (.039)	0.2 (.0079) 1.0 (.039)	0.25 (.010) 1.0 (.039)
Ring/Piston Groove Clearance	New Wear Limit	mm (in) mm (in)	0.04 (.0016) 0.2 (.0079)	0.04 (.0016) 0.2 (.0079)	0.04 (.0016) 0.2 (.0079)
Piston/Cylinder Wall Clearance	New Wear Limit	mm (in) mm (in)	0.9 (.0035) 0.2 (.0079)	0.9 (.0035) 0.2 (.0079)	0.11 (.0043) 0.15 (.0059)
Connecting Rod Big End Axial Play	New Wear Limit	mm (in) mm (in)	0.2 (.0079) 1.0 (.0394)	0.2 (.0079) 1.0 (.0394)	0.39 (.0154) 1.2 (.0472)
Maximum Crankshaft End-Play ②		mm (in)	0.3 (.012)	0.3 (.012)	0.3 (.012)
Maximum Crankshaft Deflection		mm (in)	0.08 (.0031)	0.08 (.0031)	0.08 (.0031)
Rotary Valve Timing ③ and P/N 420 924 XXX		Opening Closing	N.A.	N.A.	148° – 52° 509
Magneto Generator Output		W	240	240	220
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)
Ignition Timing BTDC ④⑧		mm (in)	1.66 (.065)	1.66 (.065)	1.81 (.071)
Trigger Coil ⑤		Ω	140 – 180	140 – 180	190 – 300
Generating Coil ⑤		Ω	230 – 330	230 – 330	10 – 17
Lighting Coil ⑤		Ω	0.23 – 0.28	0.23 – 0.28	0.20 – 0.35
High Tension Coil ⑤	Primary	Ω	N.A.	N.A.	0.3 – 0.7
	Secondary	kΩ	5.1 – 6.3	5.1 – 6.3	8 – 16
Carburetor Type		PTO/MAG	2 x VM 34	2 x VM 34	VM 34 501/500
Main Jet		PTO/MAG	210	185	250/240
Needle Jet			159 P4	159 P-1	159-P2
Pilot Jet			40	40	40
Needle Identification — clip position			6DH2-3	6DH2-3	6DH4-2
Slide Cut-Away			2.5	2.5	2.5
Float Adjustment		± 1 mm (± .040 in)	36.5 (1.44)	36.5 (1.44)	36.5 (1.44)
Air Screw Adjustment		± 1/16 Turn	1	1-1/4	1
Idle Speed		± 200 RPM	1900	1900	1900
Gas Type/Pump Octane Number			Unleaded/87	Unleaded/87	Unleaded/87
Gas/Oil Ratio			Injection	Injection	Injection
Type			Axial Fan	Axial Fan	Liquid
Axial Fan Belt Adjustment	Deflection ⑥	mm (in)	9 – 10 (.35 – .39)	9 – 10 (.35 – .39)	N.A.
	Force	kg (lbf)	5 (11)	5 (11)	N.A.
Thermostat Opening Temperature		°C (°F)	N.A.	N.A.	42 (108)
Radiator Cap Opening Pressure		kPa (PSI)	N.A.	N.A.	90 (13)
ENGINE COLD N•m (lbf•ft)					
Drive Pulley Retaining Screw			⑦	⑦	⑦
Exhaust Manifold Nuts or Bolts			22 (16)	22 (16)	22 (16)
Magneto Ring Nut			105 (77)	105 (77)	125 (92)
Crankcase Nuts or Screws		M6 M8	— 22 (16)	— 22 (16)	9 (6.5) 21 (16)
Crankcase/Engine Support Nuts or Screws			39 (29)	39 (29)	39 (29)
Cylinder Head Nuts			22 (16)	22 (16)	29 (21)
Crankcase/Cylinder Nuts or Screws			N.A.	N.A.	29 (21)
Axial Fan Shaft Nut			48 (35)	48 (35)	N.A.

Vehicles

VEHICLE MODEL				MX Z 440	MX Z 500	MX Z 670 HO	FORMULA Z 500
ENGINE TYPE				443	494	670	494
Chain Drive Ratio				21/44	23/43	25/43	23/43
Chain	Pitch		in	3/8	3/8	3/8	3/8
Chain	Type/Links Qty/Plates Qty			Silent 72/11	Silent 72/13	Silent 74/13	Silent 72/11
Drive Pulley	Type of Drive Pulley			TRA	TRA	TRA	TRA
Drive Pulley	Ramp Identification			291X ⑤	281 ⑤	297 ⑥	281 ⑤
Drive Pulley	Calibration Screw Position or — calibration disc quantity			3	2	2	2
Drive Pulley	Spring Color			Blue/Yellow	Violet/Yellow	Green/Blue	Violet/Yellow
Drive Pulley	Spring Length		± 1.5 mm (± .060 in)	115.1 (4.53)	157.9 (6.22)	147.4 (5.80)	157.9 (6.22)
Drive Pulley	Clutch Engagement		± 200 RPM	3700	4100	4200	4100
Driven Pulley Spring Preload Cam Angle			± 0.7 kg (± 1.5 lb) Degree	6.1 (13.4) 47°	7.0 (15.4) 50°	7.0 (15.4) 50°	7.0 (15.4) 50°
Pulley Distance Z			(+ 0, - 1) mm ((+ 0, - 1/32) in)	16.5 ± 0.5 (.650 ± .020)	16.5 (.650)	16.5 (21/32)	16.5 (21/32)
Offset	X		± 0.5 mm (± .020 in)	35.5 (1.398)	35.5 (1.398)	35.5 (1.398)	35.5 (1.398)
Offset	Y – X	MIN. – MAX.	mm (in)	+ 0.5 (+ .020) + 1.5 (+ .059)	1.0 – 2.0 (.039 – .079)	1.0 – 2.0 (.039 – .079)	1.0 – 2.0 (.039 – .079)
Drive Belt Part Number (P/N)				414 060 600	414 860 700	417 300 067	414 860 700
Drive Belt Width (new) ①			mm (in)	34.7 (1.366)	35.3 (1.390)	35.0 (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)	32 (1-1/4)
Drive Belt Adjustment		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)
Track	Length		cm (in)	307 (121)	307 (121)	307 (121)	307 (121)
Track	Profile Height		mm (in)	18.4 (.724)	22.3 (.878)	22.3 (.878)	18.4 (.724)
Track	Adjustment	Deflection	mm (in)	35 – 40 (1-3/8 – 1-3/4)	30 – 35 (1-3/16 – 1-3/8)	30 – 35 (1-3/16 – 1-3/8)	30 – 35 (1-3/16 – 1-3/8)
Track	Adjustment	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 Sport
Suspension Type		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)	117.4 (46.2)	117.4 (46.2)	117.4 (46.2)	117.4 (46.2)
Height			cm (in)	108 (42.5)	108 (42.5)	108 (42.5)	118 (46.5)
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)	216 (475)
Ground Contact Area			cm^2 (in^2)	6671 (1034)	6671 (1034)	6671 (1034)	6671 (1034)
Ground Contact Pressure			kPa (PSI)	2.96 (.429)	3.18 (.461)	3.35 (.486)	3.18 (.461)
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	3	3	3	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.
Fuse	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)

VEHICLE MODEL				FORMULA DLX 500 LC	FORMULA Z 583	FORMULA DLX 583	FORMULA Z 670
ENGINE TYPE				494	583	583	670
Chain Drive Ratio				23/44	25/43	23/44	25/43
Chain	Pitch		in	3/8	3/8	3/8	3/8
	Type/Links Qty/Plates Qty			Silent 72/11	Silent 74/13	Silent 72/13	Silent 74/13
Drive Pulley	Type of Drive Pulley			TRA	TRA	TRA	TRA
	Ramp Identification			286 ⑤	286 ⑤	286 ⑤	286 ⑥
	Calibration Screw Position or — calibration disc quantity			2	3	3	3
	Spring Color			Violet/Blue	Violet/Blue	Violet/Blue	Violet/Yellow
	Spring Length		± 1.5 mm (± .060 in)	114.6 (4.51)	114.6 (4.51)	114.6 (4.51)	157.9 (6.22)
	Clutch Engagement		± 200 RPM	3800	4100	4100	3800
Driven Pulley Spring Preload Cam Angle			± 0.7 kg (± 1.5 lb) Degree	7.0 (15.4) 50°	7.0 (15.4) 50°	7.0 (15.4) 50°	7.0 (15.4) 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		± 0.5 mm (± .020 in)	35.5 (1.398)	35.5 (1.398)	35.5 (1.398)	35.5 (1.398)
	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)				414 860 700	414 860 700	414 860 700	417 300 067
Drive Belt Width (new) ①			mm (in)	35.3 (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)	22.3 (.878)	22.3 (.878)	22.3 (.878)
	Adjustment	Deflection	mm (in)	30 – 35 (1-3/16 – 1-3/8)	30 – 35 (1-3/16 – 1-3/8)	30 – 35 (1-3/16 – 1-3/8)	30 – 35 (1-3/16 – 1-3/8)
		Force ③	kg (lbf)	7.3 (16)	7.3 (16)	7.3 (16)	7.3 (16)
Suspension Type		Track		SC-10 HP	SC-10 HP	SC-10 HP	ARM
		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)	120.0 (47.2)	117.4 (46.2)	120.0 (47.2)	117.4 (46.2)
Height			cm (in)	106.9 (42.1)	108 (42.5)	106.9 (42.1)	108 (42.5)
Ski Stance			cm (in)	106.7 (42)	104.1 (41)	106.7 (42)	104.1 (41)
Mass (dry)			kg (lb)	230 (505)	227 (499)	240 (529)	227 (499)
Ground Contact Area			cm^2 (in^2)	6671 (1034)	6671 (1034)	6671 (1034)	6771 (1034)
Ground Contact Pressure			kPa (PSI)	3.38 (.490)	3.34 (.484)	3.53 (.512)	3.34 (.484)
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)	12 (22)	N.A.	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	3	3	3	3
Fuel and Temperature Gauge Bulbs			W	N.A.	3/3	N.A.	3/3
Fuse	Starter Solenoid		A	30	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)	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)

VEHICLE MODEL				FORMULA DLX 670	SUMMIT 500	SUMMIT x 670	GRAND TOURING 500
ENGINE TYPE				**670**	**494**	**670**	**494**
Chain Drive Ratio				25/43	21/43	23/43	23/44
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 72/11
Drive Pulley	Type of Drive Pulley			TRA	TRA	TRA	TRA
	Ramp Identification			286 ⑥	294 ⑤	286 ⑤	228 ⑤
	Calibration Screw Position or — calibration disc quantity			3	4	5	2
	Spring Color			Violet/Yellow	Violet/Yellow	Violet/Yellow	Blue/Green
	Spring Length		± 1.5 mm (± .060 in)	157.9 (6.22)	157.9 (6.22)	157.9 (6.22)	105.7 (4.16)
	Clutch Engagement		± 200 RPM	3800	4200	4100	3600
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°	44°	50°	44°
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		± 0.5 mm (± .020 in)	35.5 (1.398)	35.5 (1.398)	35.0 (1-3/8)	35.5 (1.398)
	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)				417 300 067	415 860 700	415 099 000	414 860 700
Drive Belt Width (new) ①			mm (in)	35.0 (1-3/8)	35.3 (1-3/8)	35.0 (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)	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)	22.3 (.878)	36.8 (1.449)	50.8 (2.000)	18.4 (.724)
	Adjustment	Deflection	mm (in)	30 – 35 (1-3/16 – 1-3/8)	35 – 40 (1-3/8 – 1-3/4)	35 – 40 (1-3/8 – 1-3/4)	30 – 35 (1-3/16 – 1-3/8)
		Force ③	kg (lbf)	7.3 (16)	7.3 (16)	7.3 (16)	7.3 (16)
Suspension Type		Track		ARM	SC-10 Mountain	SC-10 Mountain	SC-10 Touring
		Ski		DSA	DSA	DSA	DSA
Length			cm (in)	272.5 (107.3)	293.9 (115.7)	293.9 (115.7)	297.8 (117.2)
Width			cm (in)	120.0 (47.2)	107.3 (42.3)	107.3 (42.3)	120.0 (47.2)
Height			cm (in)	107 (42.1)	113 (44.5)	113 (44.5)	128.3 (50.5)
Ski Stance			cm (in)	106.7 (42)	94 (37)	94 (37)	106.7 (42)
Mass (dry)			kg (lb)	242 (533)	220 (484)	229 (503)	251 (553)
Ground Contact Area			cm^2 (in^2)	6771 (1034)	7356.7 (1140.3)	7357 (1140)	7423.2 (1150.6)
Ground Contact Pressure			kPa (PSI)	3.56 (.516)	2.93 (.425)	3.05 (.442)	3.32 (.481)
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)	12 (22)	N.A.	N.A.	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	3	3	3	3
Fuel and Temperature Gauge Bulbs			W	3/3	N.A.	N.A.	3
Fuse	Starter Solenoid		A	30	N.A.	N.A.	30
	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)

VEHICLE MODEL				GRAND TOURING 583	SKANDIC WT	SKANDIC SWT	SKANDIC WT LC
ENGINE TYPE				583	503	503	494
Chain Drive Ratio				23/44	N.A.	N.A.	N.A.
Chain	Pitch		in	3/8	N.A.	N.A.	N.A.
	Type/Links Qty/Plates Qty			Silent 72/13	N.A.	N.A.	N.A.
Drive Pulley	Type of Drive Pulley			TRA	TRA	TRA	TRA
	Ramp Identification			285 ⑤	290 ⑤	290 ⑤	290 ⑥
	Calibration Screw Position or — calibration disc quantity			3	4	2	4
	Spring Color			Red/Orange	Yellow/Orange	Yellow/Orange	Yellow/Blue
	Spring Length		± 1.5 mm (± .060 in)	91.2 (3.56)	105.7 (4.16)	105.7 (4.16)	90.7 (3.57)
	Clutch Engagement		± 200 RPM	3100	3000	3000	3000
Driven Pulley Spring Preload Cam Angle			± 0.7 kg (± 1.5 lb) Degree	7.0 (15.4) 47°	7.0 (15.4) 40°	7.0 (15.4) 40°	7 (15.4) 40°
Pulley Distance Z			(+ 0, - 1) mm ((+ 0, - 1/32) in)	16.5 (21/32)	32.3 (1-9/32)	32.3 (1-9/32)	32.3 (1-9/32)
Offset	X		± 0.5 mm (± .020 in)	35.5 (1.398)	35.0 (1.380)	35.0 (1.380)	35.0 (1.380)
	Y – X	MIN. – MAX.	mm (in)	1.0 – 2.0 (.039 – .079)	0.75 – 2.25 (.030 – .086)	1.0 – 2.0 (.039 – .079)	0.75 – 2.25 (.030 – .086)
Drive Belt Part Number (P/N)				414 860 700	414 633 800	414 633 800	414 633 800
Drive Belt Width (new) ①			mm (in)	35.3 (1-3/8)	34.6 (1-3/8)	34.6 (1-3/8)	34.6 (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)	50.0 (19.7)	60.0 (23.6)	50.0 (19.7)
	Length		cm (in)	345.5 (136)	396.8 (156.2)	396.8 (156.2)	396.8 (156.2)
	Profile Height		mm (in)	18.4 (.724)	23.5 (.925)	23.5 (.925)	23.5 (.925)
	Adjustment	Deflection	mm (in)	30 – 35 (1-3/16 – 1-3/8)	40 – 50 (1-9/16 – 1-31/32)	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)
Suspension Type		Track		SC-10 Touring	Skandic WT	Skandic WT	Skandic WT
		Ski		DSA	Telescopic Strut	Telescopic Strut	Telescopic Strut
Length			cm (in)	297.8 (117.2)	302.0 (118.9)	315.0 (124.0)	302.0 (118.9)
Width			cm (in)	120.0 (47.2)	104.5 (41.1)	110.0 (43.3)	104.5 (41.1)
Height			cm (in)	128.3 (50.5)	122 (48)	133 (52.4)	122 (48)
Ski Stance			cm (in)	106.7 (42)	90.0 (35.4)	90.0 (35.4)	90.0 (35.4)
Mass (dry)			kg (lb)	251 (553)	255 (562)	277 (611)	281 (620)
Ground Contact Area			cm^2 (in^2)	7423.2 (1150.6)	10793 (1672.9)	13986 (2167.8)	11213 (1738)
Ground Contact Pressure			kPa (PSI)	3.32 (.481)	2.35 (.341)	1.98 (.287)	2.27 (.329)
Frame Material				Aluminum	Steel	Steel	Steel
Bottom Pan Material				Impact Copolymer	HD Polyethylene	HD Polyethylene	HD Polyethylene
Hood Material				RRIM Polyurethane	RRIM	RRIM	RRIM
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	3	3	3	3
Fuel and Temperature Gauge Bulbs			W	3	N.A.	N.A.	N.A.
Fuse	Starter Solenoid		A	30	20	20	20
	Tachometer		A	N.A.	N.A.	N.A.	N.A.
Fuel Tank			L (U.S. gal)	40 (10.6)	42 (11.1)	42 (11.1)	42 (11.1)
Chaincase/Gearbox			mL (U.S. oz)	250 (8.5)	400 (13.5)	400 (13.5)	400 (13.5)
Cooling System ④			L (U.S. oz)	5.0 (169)	N.A.	N.A.	N.A.
Injection Oil Reservoir			L (U.S. oz)	2.8 (95)	2.5 (84.5)	2.5 (84.5)	2.5 (84.5)

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-trapeze

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 All models except MX Z 670 HO and Summit X 670: 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).

⑧ MX Z 670 HO and Summit X 670: At 3500 RPM (engine cold) with headlamp turned on.

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 a 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 417 004 309 (hollow).

⑥ Lever with roller pin P/N 417 004 308 (solid).

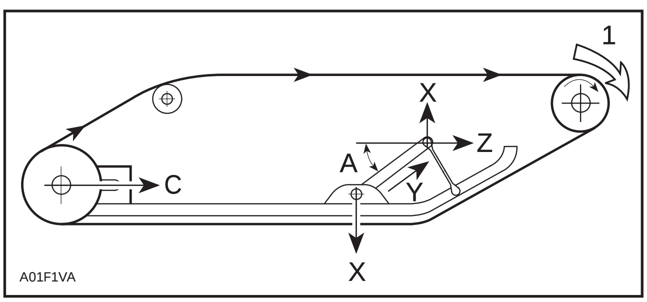
TABLE OF CONTENTS

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 for 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 axel 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.

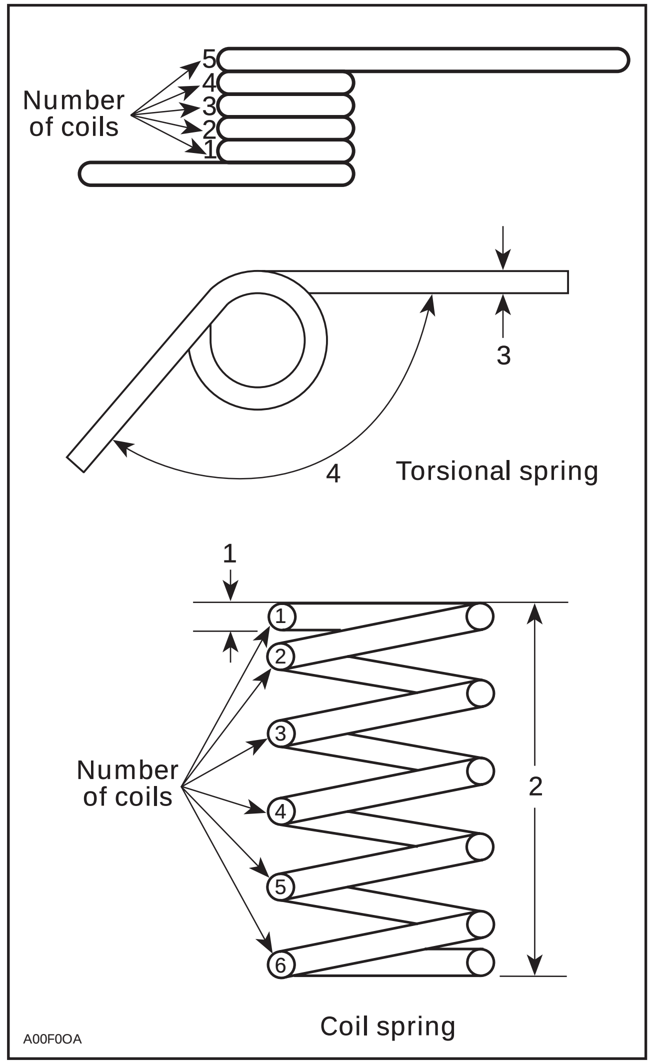
A.C.M.

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.



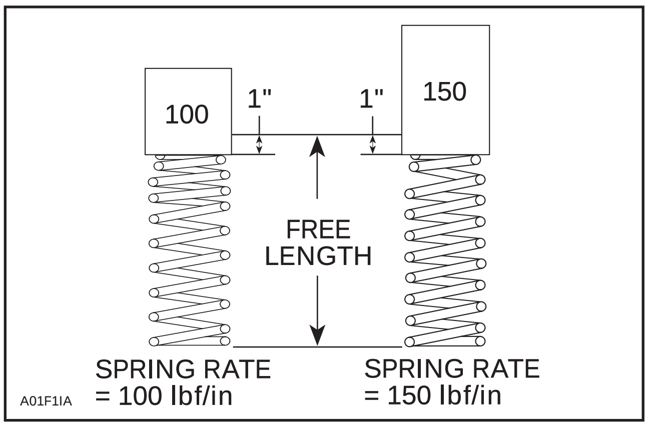
1. *Wire diameter*
2. *Free length*
3. *Wire diameter*
4. *Opening angle*

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.

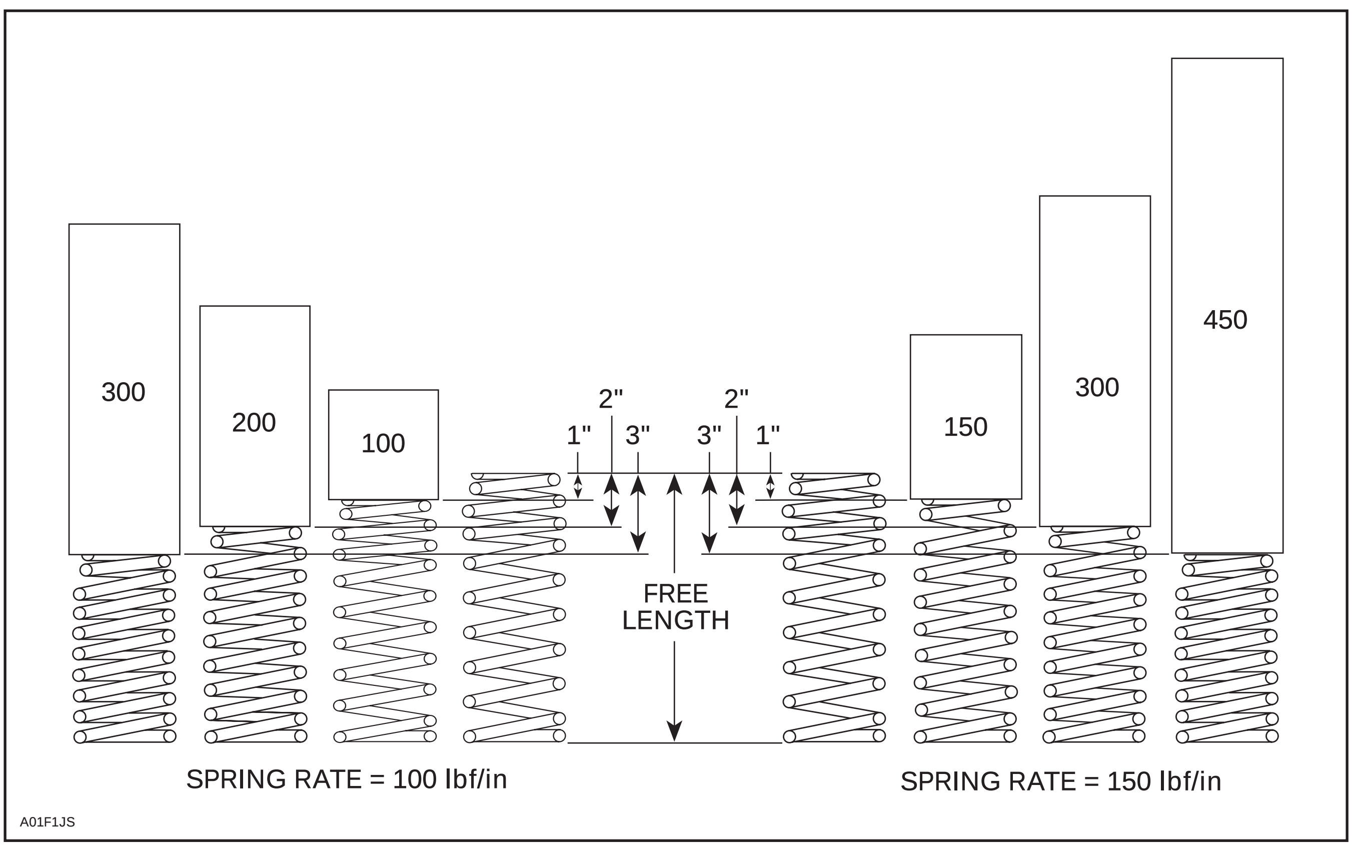
Coil Springs

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

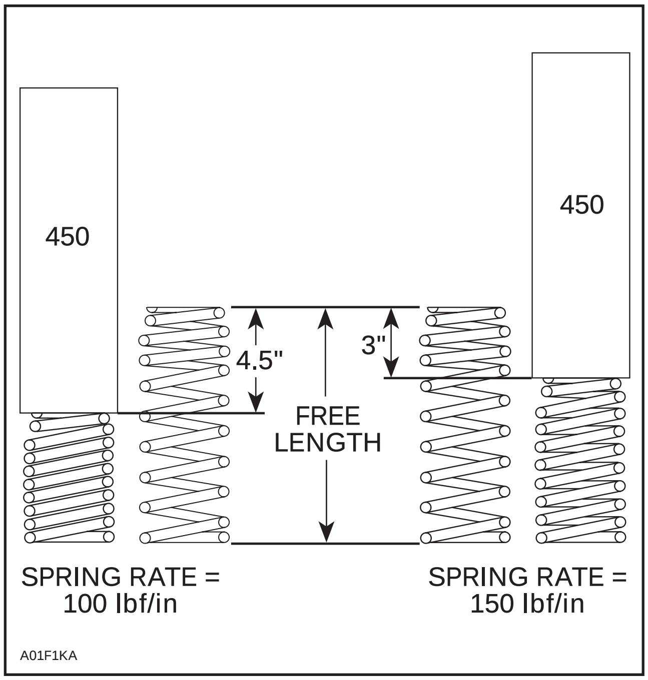
The spring rate of a coil spring is defined as the amount of force required to compress the spring one inch. If a 100 pound force compresses a spring 1 inch it is referred to as having a rate of 100 lbf/in (pounds per inch). If 150 pounds of force is required to compress a spring 1 inch then it would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



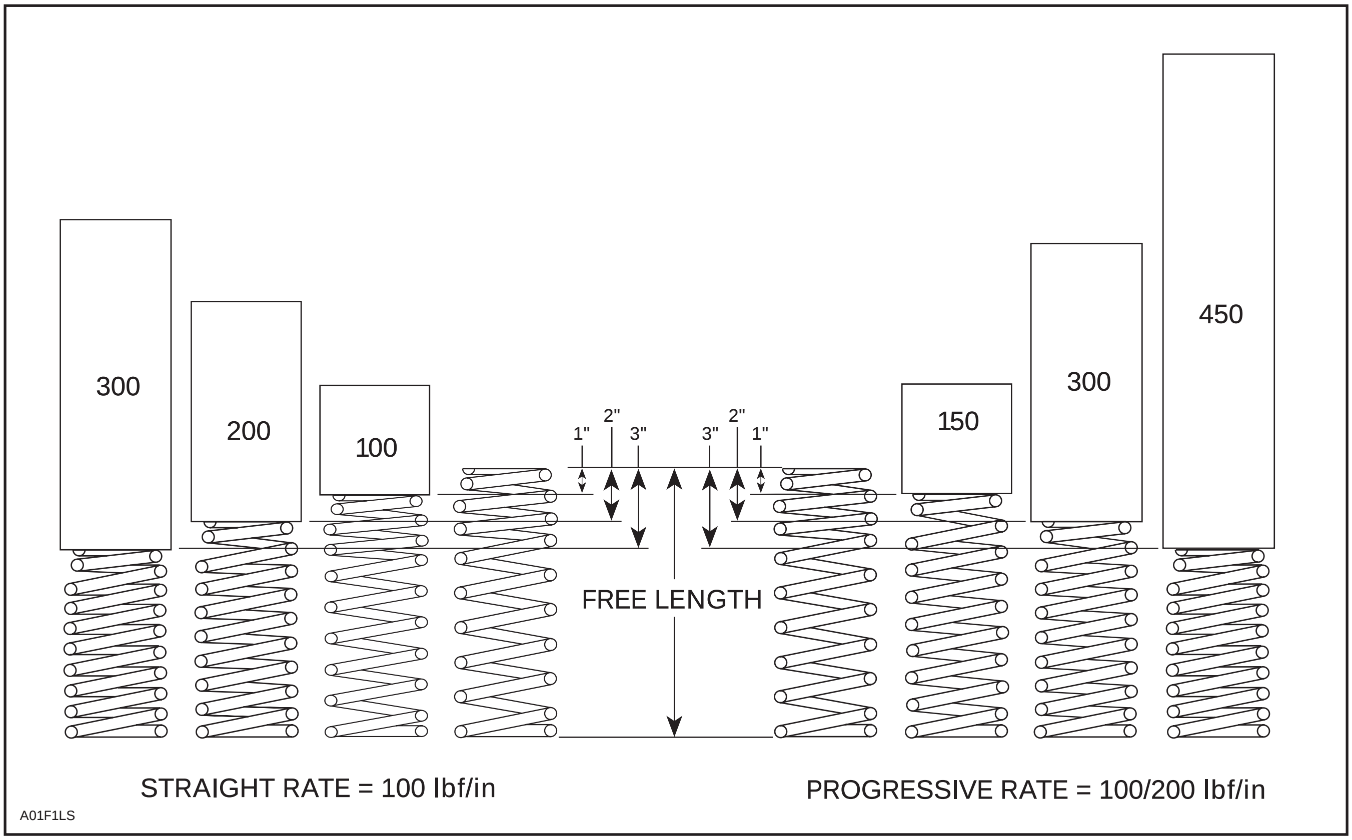
Most springs are designed as a straight rate spring. This means that the spring requires the same force to compress the last one inch of travel as the first one inch of travel. Example: A 100 lbf/in rate spring will compress one inch for every 100 pounds applied. A force of 200 pounds will compress the 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 45 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).



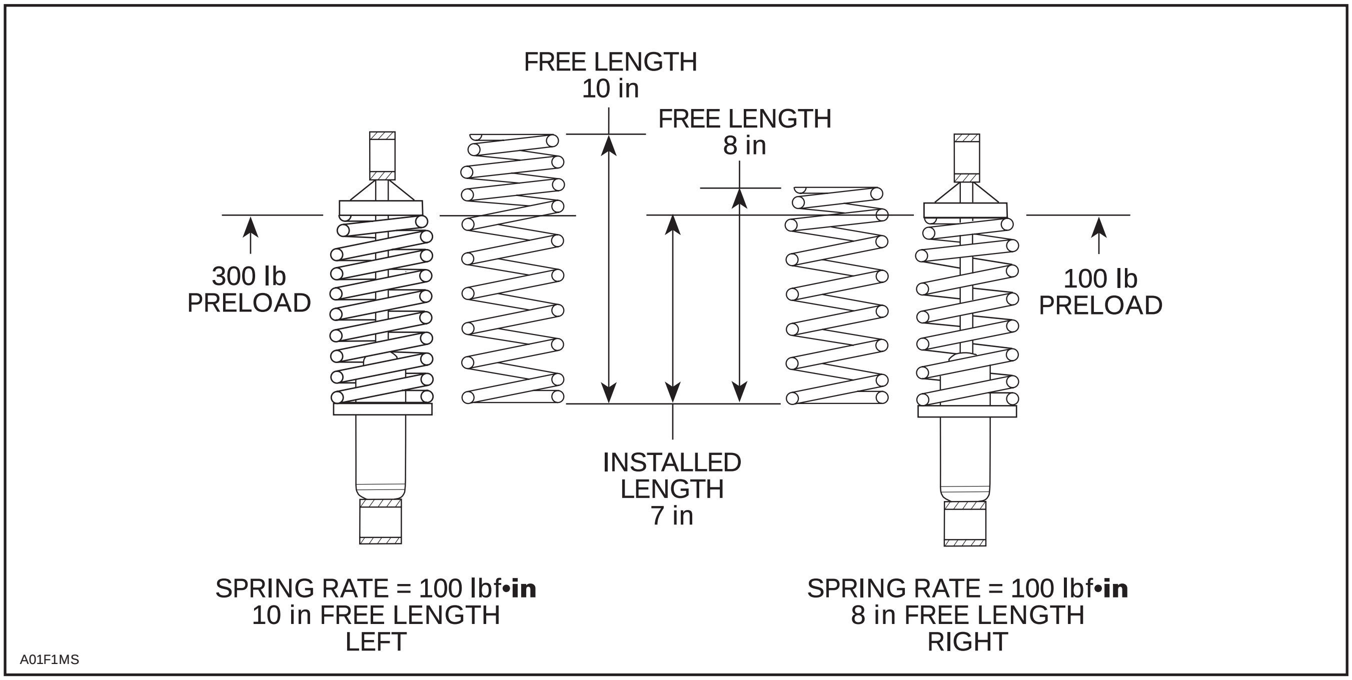
A spring can also be progressively wound. This means that the rate of the spring is increasing as it is compressed. A 100/200 lbf/in progressive spring will require 100 pounds to compress the first one inch but will require 200 additional pounds to compress the last one inch (see following illustration).



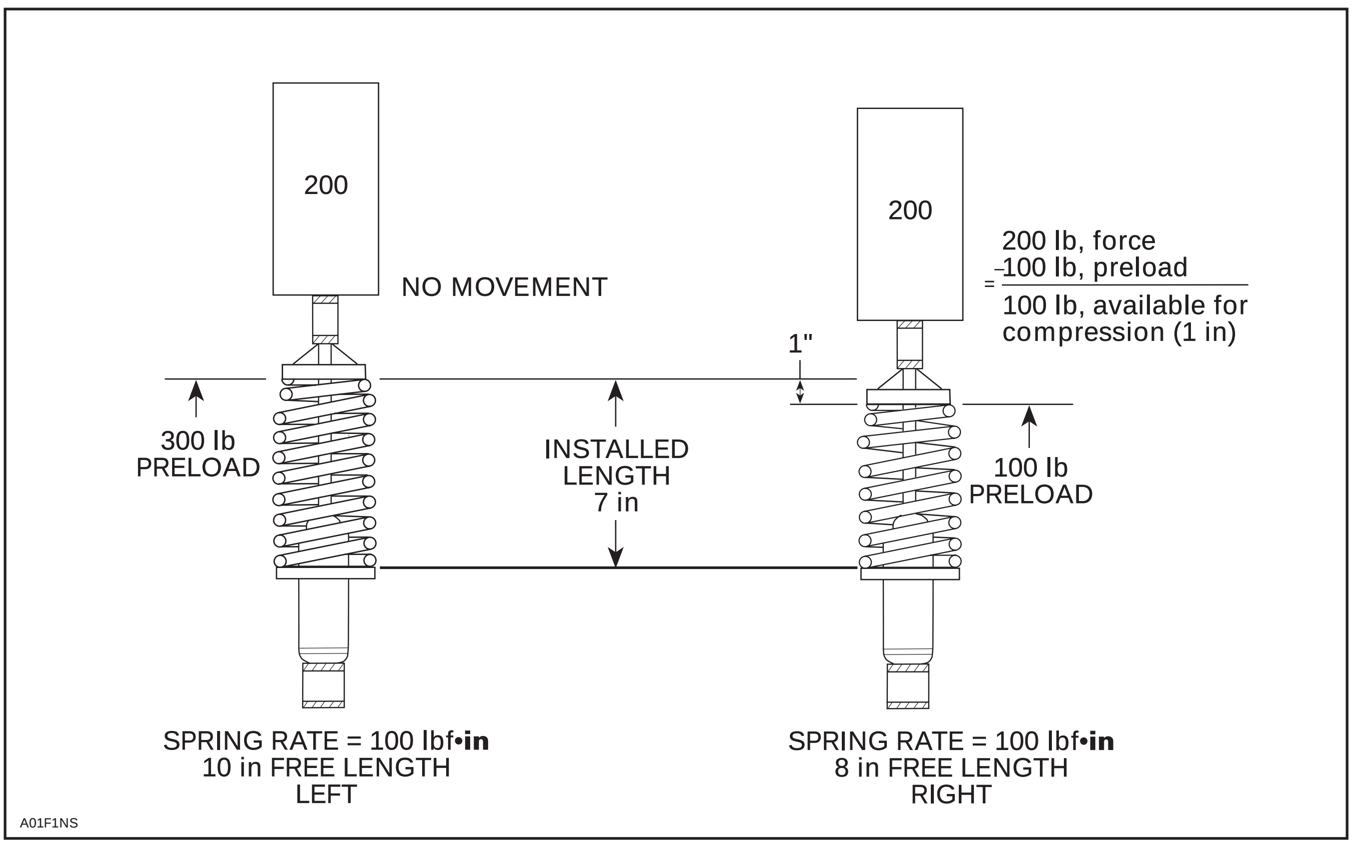
An easy way to measure coil springs is to put a bathroom scale in a press with the spring resting on the scale. Measure the free length and then apply a load until the spring compresses 1 inch. The reading on the scale will approximate the rate of the spring. Now compress the spring another 1 inch. If 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.

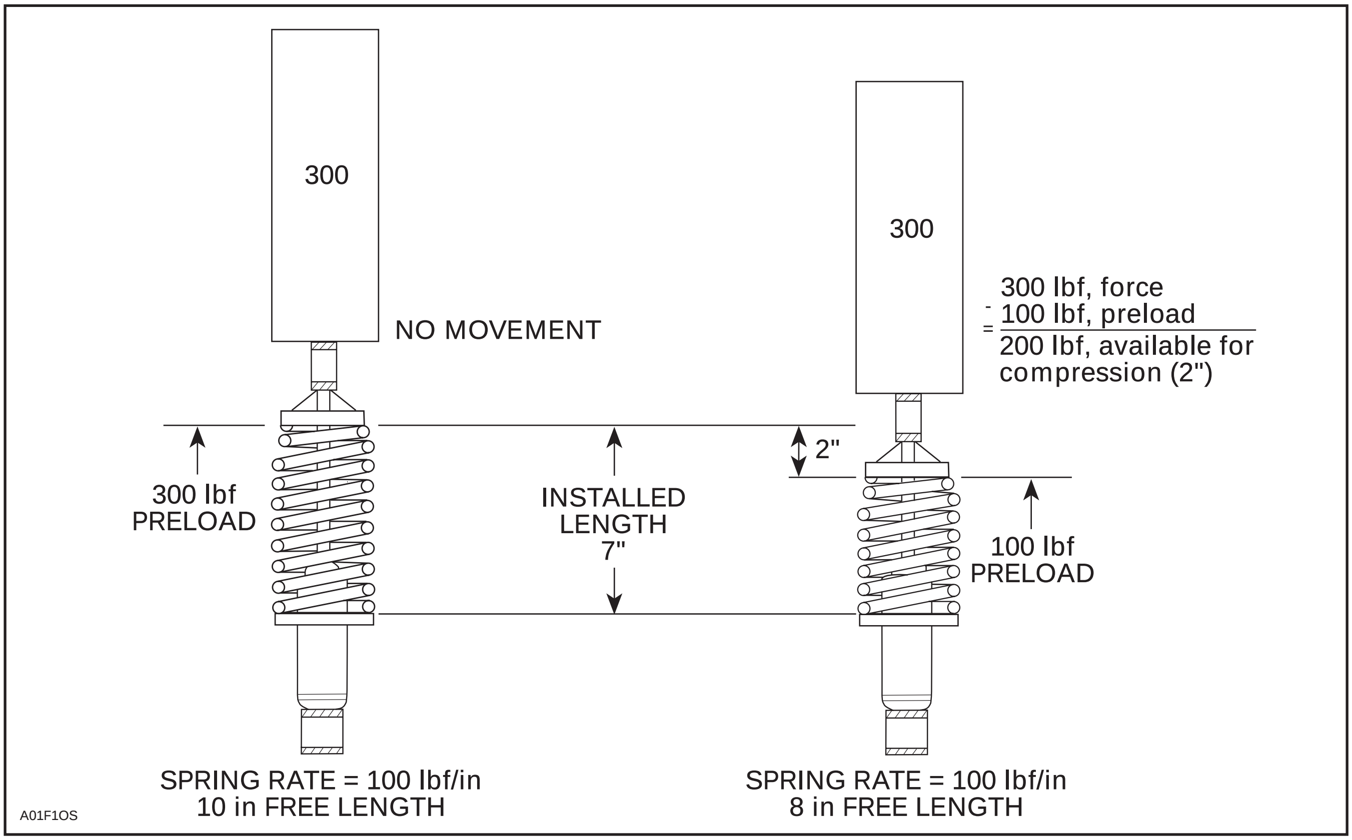
Let us see what happens if we make 2 100 lbf/in springs. One with a free length of 10 inches and one at 8 inches. We will put them both onto a shock with an installed length of 7 inches. The 10 inch spring will need to be compressed 3 inches. This will give us a preload of 300 pounds. The 8 inch spring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



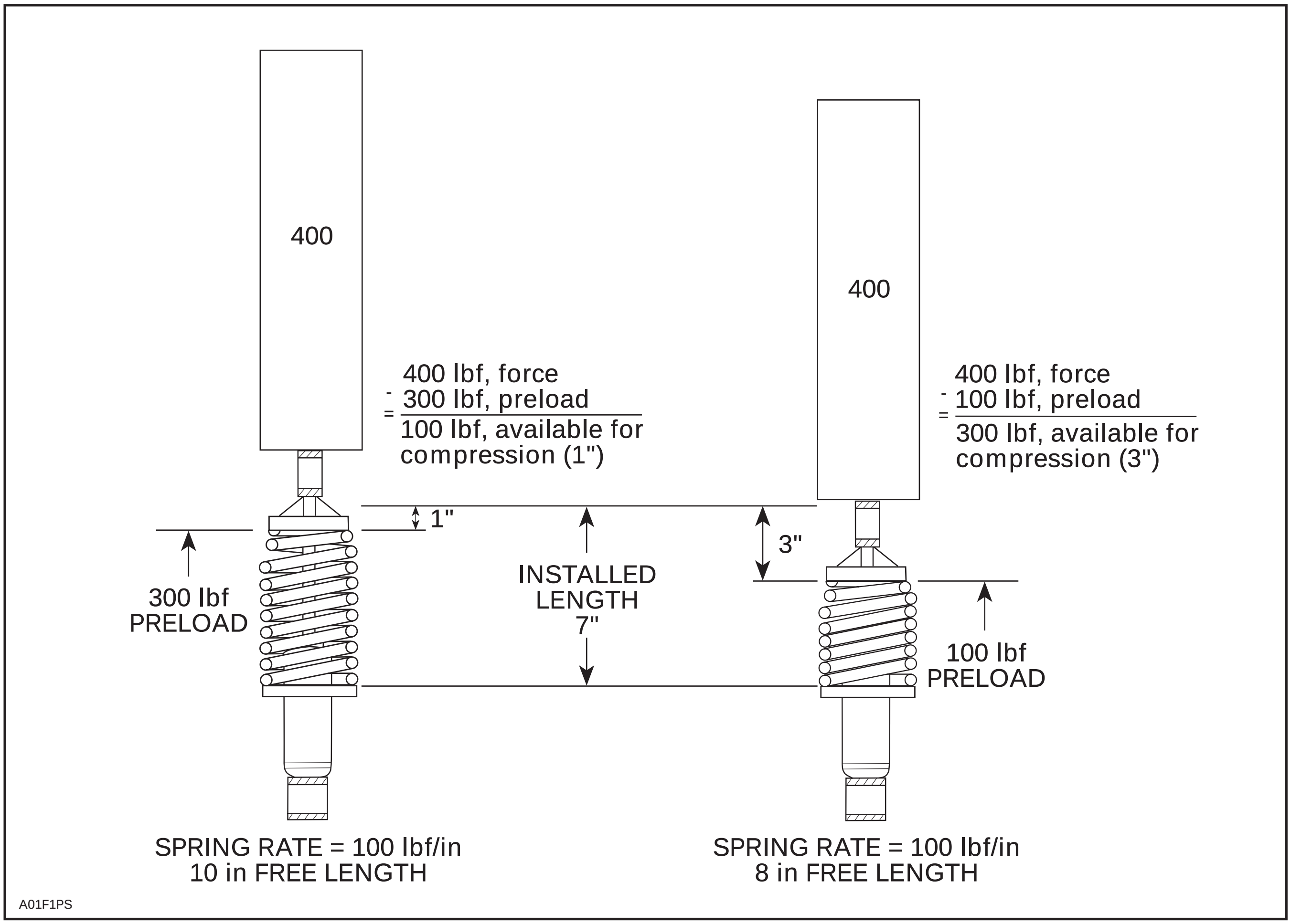
If we now apply a 200 pound load to the system, the 10 inch spring will not move because it has 300 pounds of preload. But the 8 inch spring will compress one inch (see following illustration).



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).

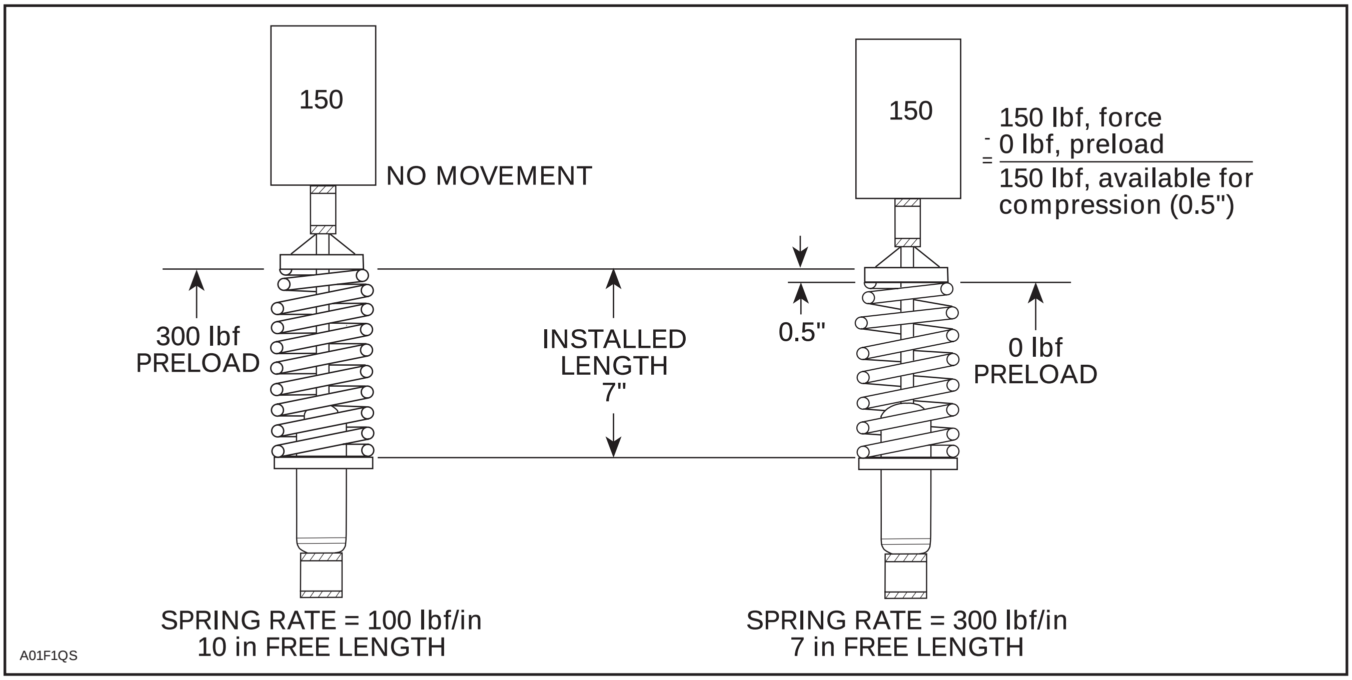


Finally, if more than 300 pounds is applied, the 10 inch spring will start to compress. If 400 pounds were applied the 10 inch spring will compress one inch and the 8 inch spring will compress 3 inches. Notice that each additional 100 pounds added after movement begins compresses the system one inch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

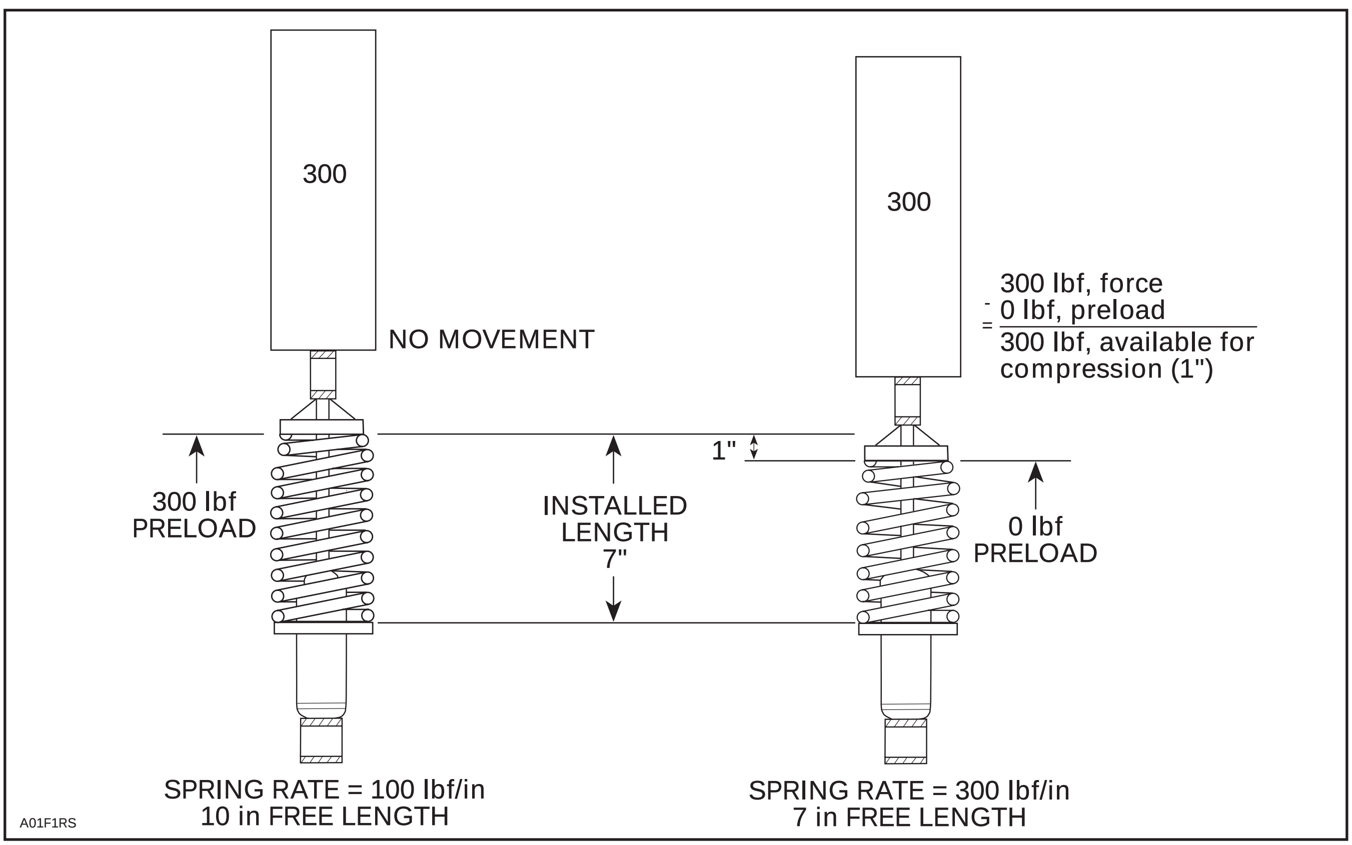


Now let's see what happens if we use a long, soft spring and a short, stiff spring. We will use a 100 lbf/in rate spring with a free length of 10 inches. Our 2nd spring will be a 300 lbf/in rate spring with a free length of 7 inches. The installed length will be 7 inches as in the previous example, thus 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.

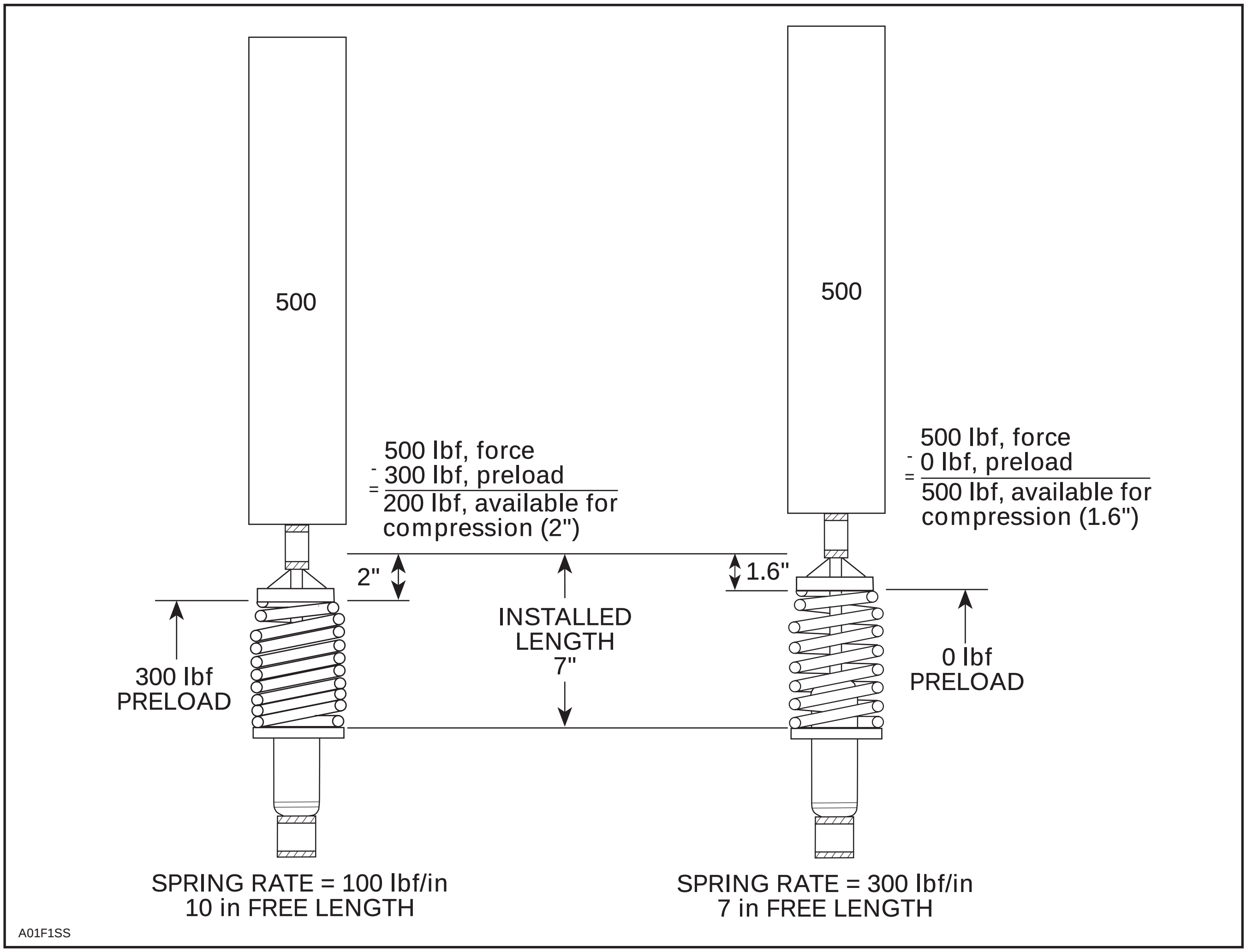
So if we apply 150 pounds of force, the 1st spring will not move, while the 2nd spring will compress 0.5 inches (see following illustration).



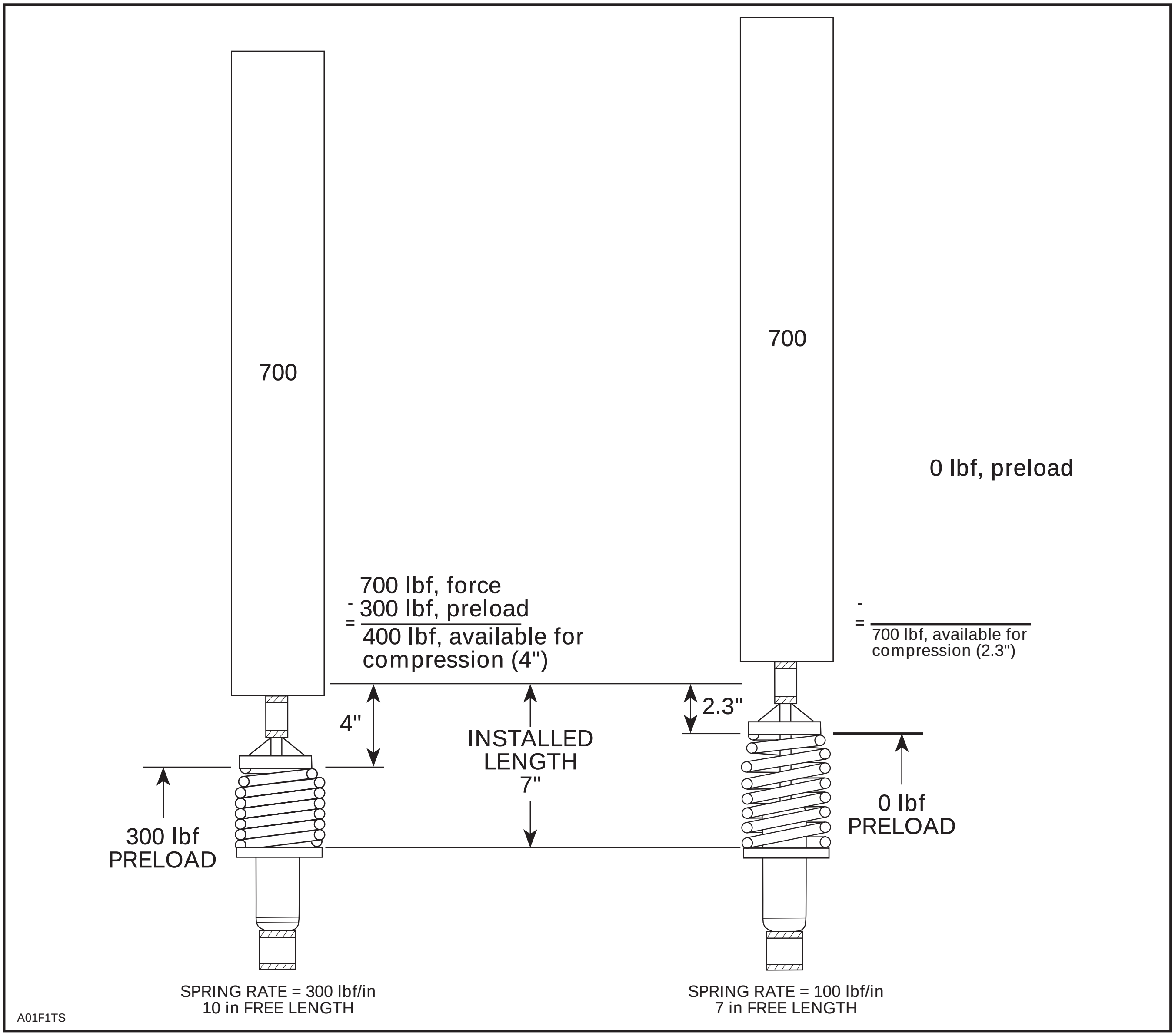
At 300 pounds applied force the 1st spring will not yet move and the 2nd spring will compress 1 inch (following illustration).



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).



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

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

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

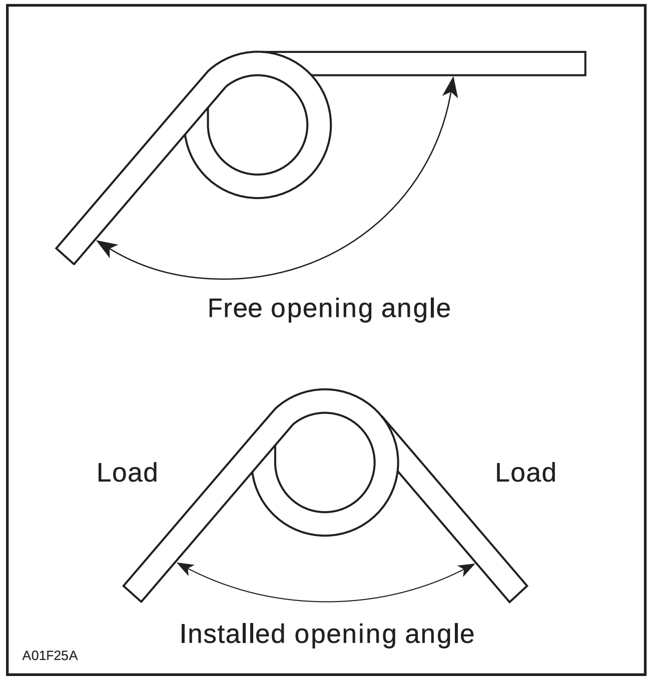
$$\frac{100 \times 150}{100 + 150} = \frac{1500}{250} = 60$$

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.ra

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:

503 117 100 8.25 mm thick × 46.8 mm I.D.

503 162 100 15.0 mm thick × 47.8 mm I.D.

This is divided into 2 main sections.

Section 1, Spring Applications

It is a quick reference chart which provides authorized spring application for each 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

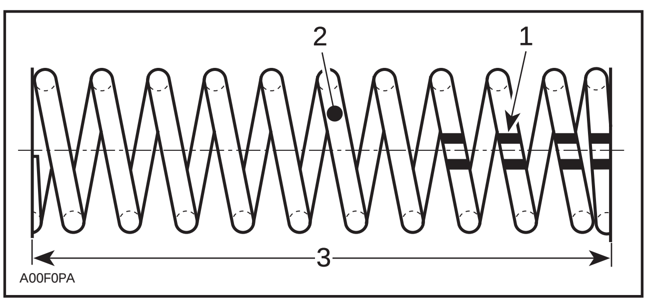
Refers to spring specifications.

The informations supersede all informations previously published.

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

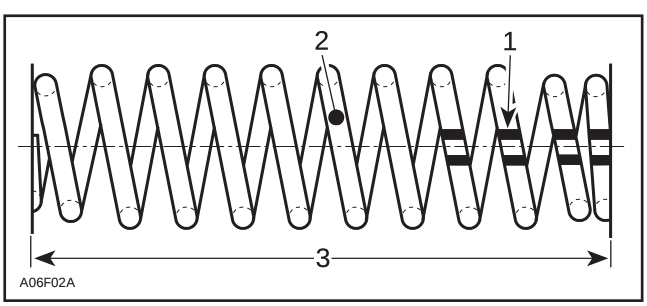
COIL SPRINGS (compression)

Type R (straight on both ends)



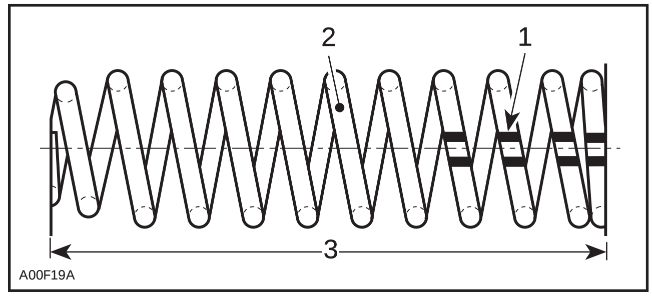
1. *Color code stripes*
2. *Wire diameter*
3. *Free length*

Type T (barrel shape on both ends)



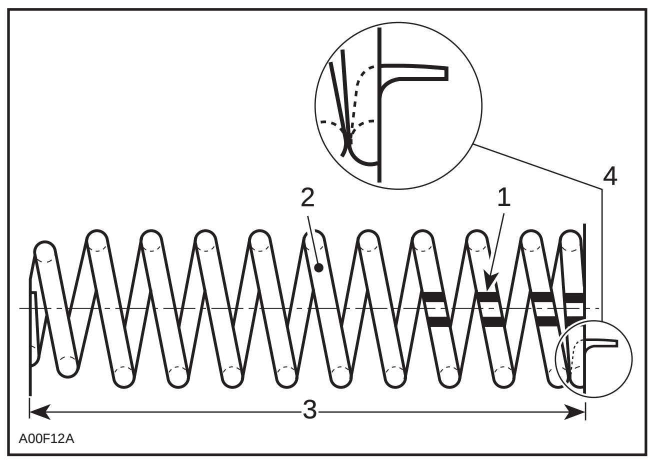
1. *Color code stripes*
2. *Wire diameter*
3. *Free length*

Type S (barrel shape on one end)



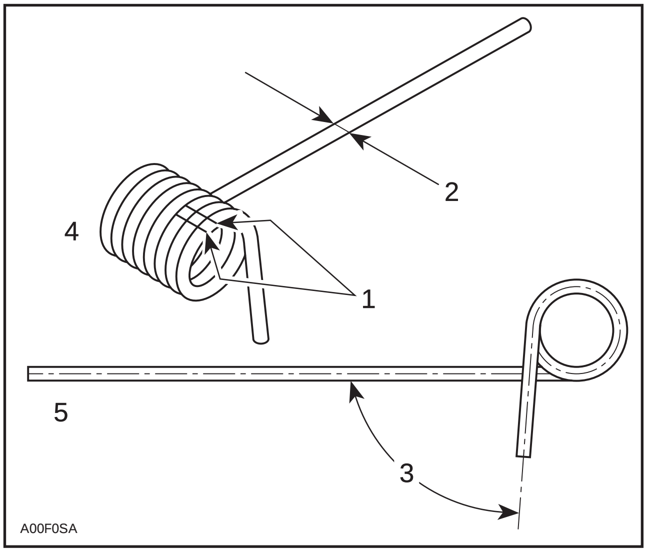
1. *Color code stripes*
2. *Wire diameter*
3. *Free length*

Type U (barrel shape on one end with positioning tab at the other end)



1. *Color code stripes*
2. *Wire diameter*
3. *Free length*
4. *Positioning tab*

TORSION SPRINGS

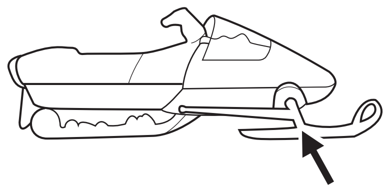


1. Color code stripes
2. Wire diameter
3. Opening angle (°)
4. Left hand (LH)
5. Right hand (RH)

SECTION 1

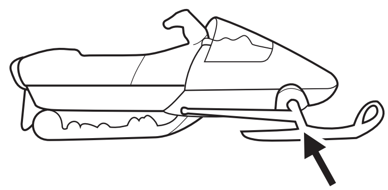
SPRING APPLICATIONS

1998 FRONT SPRINGS 1998



MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
MACH Z	Not Applicable	415 079 300	505 070 144
MACH Z LT	Not Applicable	415 079 400	505 070 146
MACH Z LT SV TRACK	Not Applicable	415 079 400	505 070 146
MACH 1	Not Applicable	415 079 500	505 070 144
FORMULA III 700	Not Applicable	415 079 400	505 070 146
FORMULA III 600	Not Applicable	415 079 300	505 070 144
FORMULA III 600 LT	Not Applicable	415 079 400	505 070 146
FORMULA Z 670	414 956 300	415 0759 00	415 039 700
FORMULA Z 583	414 956 300	415 035 500	415 039 700
FORMULA 583 DE LUXE	414 956 300	415 035 500	415 039 700
FORMULA 500 DE LUXE	414 956 300	414 976 100	415 039 700
FORMULA 500	414 956 300	414 976 100	415 039 700
FORMULA SL	414 956 300	414 976 100	415 039 700
FORMULA S	414 956 300	414 976 100	415 039 700
FORMULA S ELECTRIC	414 956 300	414 976 100	415 039 700
MX Z 670	414 974 400	415 076 000	414 976 100
MX Z 583	414 974 400	415 076 000	414 976 100
MX Z 500	414 974 400	415 076 000	414 976 100
MX Z 440 LC	414 956 300	415 108 100	415 039 700
MX Z 440 F	414 956 300	415 075 900	415 039 700
SUMMIT 670	414 916 800	415 083 700	415 039 600
SUMMIT 583	414 916 800	415 083 700	415 039 600
SUMMIT 500	414 916 800	415 083 700	415 039 600
GRAND TOURING SE	Not Applicable	415 079 700	505 070 146
GRAND TOURING 700	Not Applicable	415 079 600	505 070 146

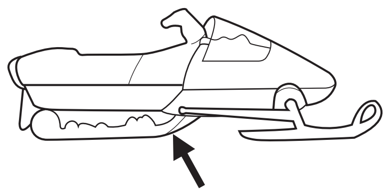
1998	FRONT SPRINGS		1998



MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
GRAND TOURING 583	414 956 300	415 075 800	415 039 700
GRAND TOURING 500	414 956 300	415 075 800	415 039 700
TOURING SLE	414 956 300	415 035 900	415 039 700
TOURING LE	414 956 300	415 035 900	415 039 700
TOURING E	414 956 300	415 035 900	415 039 700
SKANDIC 500	414 859 300	414 955 800	414 968 600
SKANDIC 380	414 859 300	414 955 800	414 968 600
TUNDRA II LT	Not Applicable	414 803 000	415 095 200
TUNDRA R	414 803 000	415 095 200	Not Applicable

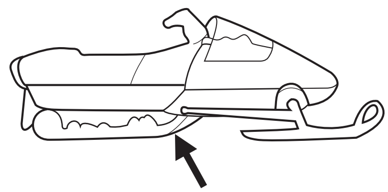
.

1998 CENTER SPRINGS 1998



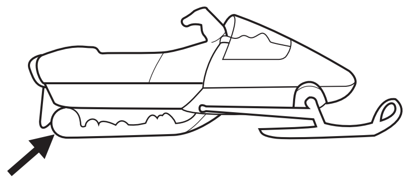
MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
MACH Z	415 070 400	415 103 600	415 057 500
MACH Z LT	415 057 500	415 057 600	415 070 700
MACH Z LT SV TRACK	415 057 500	415 057 600	415 070 700
MACH 1	415 070 400	415 103 600	415 057 500
FORMULA III 700	415 070 400	415 103 600	415 057 500
FORMULA III 600	415 070 400	415 103 600	415 057 500
FORMULA III 600 LT	415 057 500	415 057 600	415 070 700
FORMULA Z 670	Not Applicable	Not Applicable	Not Applicable
FORMULA Z 583	414 974 400	415 070 400	415 103 600
FORMULA 583 DE LUXE	414 974 400	415 070 400	415 103 600
FORMULA 500 DE LUXE	414 859 300	415 070 100	415 070 500
FORMULA 500	414 859 300	415 070 100	415 070 500
FORMULA SL	414 974 400	415 069 900	414 771 300
FORMULA S	414 974 400	415 069 900	414 771 300
FORMULA S ELECTRIC	414 974 400	415 069 900	414 771 300
MX Z 670	414 974 400	415 070 300	414 976 100
MX Z 583	414 974 400	415 070 300	414 976 100
MX Z 500	414 974 400	415 070 300	414 976 100
MX Z 440 LC	Not Applicable	415 090 600 415 090 500	Not Applicable
MX Z 440 F	414 859 300	415 070 100	415 070 500
SUMMIT 670	415 070 100	415 070 500	415 07 000
SUMMIT 583	415 070 100	415 070 500	415 071 000
SUMMIT 500	415 070 100	415 070 500	415 071 000
GRAND TOURING SE	415 057 500	415 057 600	415 070 700
GRAND TOURING 700	415 057 500	415 057 600	415 070 700
GRAND TOURING 583	414 976 100	415 070 600	415 057 600
GRAND TOURING 500	414 976 100	415 070 600	415 057 600

1998	CENTER SPRINGS		1998



MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
TOURING SLE	415 070 100	415 070 500	415 071 000
TOURING LE	414 974 400	415 069 900	414 771 300
TOURING E	414 974 400	415 069 900	414 771 300
SKANDIC 500	414 974 400	415 069 900	414 771 300
SKANDIC 380	414 974 400	415 069 900	414 771 300
TUNDRA II LT	Not Applicable	414 880 500 LH 414 880 400 RH	Not Applicable
TUNDRA R	Not Applicable	414 880 500 LH 414 880 400 RH	Not Applicable

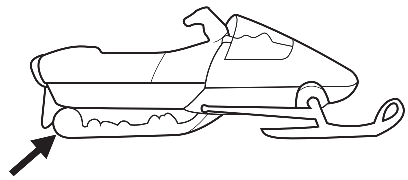
1998 REAR SPRINGS 1998



MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
MACH Z	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
MACH Z LT	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
MACH Z LT SV TRACK	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
MACH 1	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
FORMULA III 700	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
FORMULA III 600	415 010 600 LH 414 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
FORMULA III 600 LT	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
FORMULA Z 670	Not Applicable	415 0903/0 400 LH 415 0903/0 400 RH	415 110 400 LH 415 110 400 RH
FORMULA Z 583	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
FORMULA 583 DE LUXE	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
FORMULA 500 DE LUXE	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH
FORMULA 500	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH
FORMULA SL	Not Applicable	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH
FORMULA S	Not Applicable	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH
FORMULA S ELECTRIC	Not Applicable	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH
MX Z 670	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH
MX Z 583	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH

LH= Left Hand RH=Right Hand

1998 REAR SPRINGS 1998



MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
MX Z 500	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH
MX Z 440 LC	414 943 600 LH 414 943 500 RH	503 188 200 LH 503 188100 RH	414 944 300 LH 414 944 200 RH
MX Z 440 F	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH
SUMMIT 670	Not Applicable	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH
SUMMIT 583	Not Applicable	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH
SUMMIT 500	Not Applicable	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH
GRAND TOURING SE	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
GRAND TOURING 700	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH	Not Applicable
GRAND TOURING 583	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
GRAND TOURING 500	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
TOURING SLE	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
TOURING LE	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
TOURING E	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
SKANDIC 500	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
SKANDIC 380	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
TUNDRA II LT	Not Applicable	414 880 200 LH 414 880 300 RH	Not Applicable
TUNDRA R	Not Applicable	414 880 200 LH 414 880 300 RH	Not Applicable

LH= Left Hand RH=Right Hand

SECTION 2

SPRING SPECIFICATIONS

Coil Springs Specifications 1998

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
414 771 300	R	135	272.5	8.41	BK/BK	SAFARI RED
414 782 300	R	225	165	8.41	BK	SAFARI RED
414 788 200	R	150	272.5	8.41	BK/YL	SAFARI RED
414 789 400	R	135	272.5	8.41	BK/BK	AQUA BLUE
414 797 700	R	135	272.5	8.41	BK/BK	FLAME RED
414 797 800	R	135	272.5	8.41	BK/BK	PEARL BLUE
414 797 900	R	135	272.5	8.41	BK/BK	VIOLET
414 803 000	R	65	408	6.17	BL/OR	BLACK
414 808 800	R	120	272.5	7.77	BK/OR	SAFARI RED
414 809 300	R	160	213.1	7.77	WH	BLACK
414 809 500	R	150 ± 5	256.8	7.92	BK	YELLOW
414 810 100	R	125 ± 5	256.8	7.49	WH	YELLOW
414 859 300	R	90 ± 7	239	7.14	BK/WH	YELLOW
414 861 600	R	135	272.5	8.41	BK/BK	YELLOW
414 869 000	R	125 ± 5	256.8	7.49	WH	SAFARI RED
414 871 600	R	150 ± 5	256.8	7.92	WH	VIOLET
414 877 800	R	160 ± 7	223.1	7.92	WH/WH	BLACK
414 891 000	R	100 ± 7	260	7.14	WH/BK	SAFARI RED
414 893 800	R	185 ± 7	213	8.41	GN/GN	YELLOW
414 895 100	R	100	255	7.14	PI/GD	BLACK
414 916 800	R	90 ± 7	239	7.14	RD	FIREFLY GREEN
414 928 100	R	110	256.8	7.77	GD/BK	SAFARI RED
414 928 600	R	100 ± 7	260	7.14	GD	RASPBERRY

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

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
414 929 300	R	110	256.8	7.77	BK/RD	PEARL BLUE
414 929 500	R	100 ± 7	260	7.14	RD/YL	PEARL BLUE
414 940 200	R	140 ± 7	223	7.77	WH/GN	BLACK
414 955 800	R	100	239	7.14	RD/GN/GN	BLACK
414 955 900	R	125 ± 5	256.8	7.49	BK/RD	NEON GREEN
414 95 6000	R	125 ± 5	256.8	7.49	BL/RD	BLACK
414 956 100	R	125 ± 5	256.8	7.49	BL/BL/BL	VIPER RED
414 956 200	R	115	242	7.77	PI/BL	BLACK
414 956 300	R	100	265	7.14	PI/WH/BL	YELLOW
414 956 400	R	100 ± 7	260	7.14	RD/YL/BL	ROYAL VIOLET
414 956 500	R	100 ± 7	260	7.14	BL/YL/GN	VIPER RED
414 956 800	R	100 ± 7	260	7.14	RD/YL	NEON GREEN
414 968 600	R	125	235	7.49	RD	NEON GREEN
414 974 400	R	90	265	7.14	GN/OR	BLACK
414 974 500	R	115	265	7.49	OR/WH	BLACK
414 976 000	R	135	242	8.25	PI/GN	BLACK
414 976 100	R	125	262	7.92	PI/YL	VIPER RED
415 012 00	R	115	260	7.92	PI/YL	BLACK
415 013 700	R	200	230	8.71	PI/OR/YL	BLACK
415 013 800	R	150	264	7.77	BK/PI/WH	NEON GREEN
415 013900	R	150	264	7.77	PI/WH/YL	ROYAL VIOLET
415 014 200	R	150	264	7.77	GN/OR/BL	PEARL BLUE
415 014 500	R	150	264	7.77	BK/WH/OR	VIPER RED
415 020 600	R	125	203.2	7.77	4 Green lines	BLACK
415 020 700	R	150	203.2	7.92	4 Red lines	BLACK
415 020 800	R	70	152	5.73	4 Blue lines	BLACK
415 020 900	R	150	190.5	8.29	4 Pink lines	BLACK
415 035 500	R	125	262	7.92	SI/GN	YELLOW

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

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
415 035 600	R	125	235	7.49	OR	FRENCH BLUE
415 035 700	R	125	262	7.92	SI/OR	JAY BLUE
415 035 800	R	125	262	7.92	SI/PI	FIR GREEN
415 035 900	R	125	262	7.92	YL	BLACK
415 038 500	R	100	265	7.14	SI/GD	VIPER RED
415 039 600	R	150	235	8.41	GN	BLACK
415 039 700	R	150	258	8.71	PI	BLACK
415 039 800	R	140	257	8.71	SI	BLACK
415 039 900	R	150	238	8.71	SI/WH	BLACK
415 040 000	R	130	250	8.25	SI/SI	BLACK
415 040 100	R	215	218	9.19	OR/PI	BLACK
415 057 500	R	160	264	8.71	RD/GD	BLACK
415 058 200	R	115	270	7.92	GN/GD	BLACK
415 069 600	R	300	170	9.50	YL/BK/YL	BLACK
415 075 800	R	125	262	7.92	PI/RD/BK	FRENCH BLUE
415 075 900	R	125	262	7.92	BL/RD/BK	YELLOW
415 076 000	R	100	265	7.14	RD/RD/BK	YELLOW
415 083 700	R	125	235	7.49	OR/RD/BK	YELLOW
415 090 300	R	376	76	8.25	GD/RD/YL	BLACK
415 090 500	R	293	45	6.17	YL/BL/YL	BLACK
415 095 200	R	75	408	6.17	BL/BL/YL	BLACK
503 100 700	R	65	290	6.35	BL/YL	BLACK
415 090 400	S	359	215	10.60	WH/RD/YL	BLACK
415 090 600	S	220	210	9.19	RD/BL/YL	BLACK
415 110 400	S	400	215	11.10	YL/OR/YL	BLACK
414 809 100	T	125 ± 5	274	7.92	GD	YELLOW
414 815 500	T	135	259	7.77	BK/WH	VIOLET
414 852 800	T	100 ± 7	279	7.92	RD	YELLOW

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

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
414 871 300	T	125 ± 5	274	7.92	GD	SAFARI RED
414 871 500	T	125 ± 5	274	7.92	GD	VIOLET
414 894 100	T	112 ± 7	279.4	8.41	BK/GN	YELLOW
414 916 900	T	100 ± 7	279	7.92	BK/WH	FIREFLY GREEN
414 925 400	T	100 ± 7	279	7.92	WH/BK	SAFARI RED
414 926 000	T	100 ± 7	279	7.49	BK	RASPBERRY
414 926 900	T	110	279.4	7.77	GN/YL	SAFARI RED
414 927 100	T	110	279.4	7.77	BK/YL	PEARL BLUE
414 927 500	T	100 ± 7	279	7.92	RD/WH	PEARL BLUE
414 988 600	T	100 ± 7	279	7.49	PI/PI	BLACK
414 998 600	T	100 ± 7	279	7.49	BK/PI	SAFARI RED
415 006 900	T	150 ± 7	272.5	8.41	BK/YL	FIREFLY GREEN
415 007 000	T	135 ± 7	272.5	8.41	BK/BK	FIREFLY GREEN
415 014 300	T	150	264	7.77	GN/OR/PI	CAN-AM RED
415 057 500	T	160	264	8.71	RD/GD	BLACK
415 057 600	T	180	260	9.52	BL/GD	BLACK
415 069 900	T	115	265	7.49	SI/YL/YL	BLACK
415 070 000	T	135	242	8.25	WH/YL/YL	BLACK
415 070100	T	115	242	7.92	GD/YL/YL	BLACK
415 070 200	T	115	270	7.92	PI/YL/YL	BLACK
415 070 300	T	100	264	7.49	OR/YL/YL	BLACK
415 070 400	T	115	270	8.25	GN/YL/YL	BLACK
415 070 500	T	135	242	8.41	BL/YL/YL	BLACK
415 070 600	T	160	264	9.19	RD/YL/YL	BLACK
415 070 700	T	200	263	9.52	YL/YL/YL	BLACK
415 071 000	T	150	242	8.71	SI/RD/YL	BLACK
415 079 300	T	85	290	7.77	RD/BL/BK	YELLOW
415 079 400	T	85	315	8.25	RD/GN/BK	YELLOW

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

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
415 079 500	T	85	290	7.77	GN/RD/YL	VIPER RED
415 079 600	T	85	315	8.25	OR/RD/YL	FRENCH BLUE
415 079 700	T	85	315	8.25	PI/YL/RD	PLATINUM
415 103 600	T	135	264	8.25	GN/GN/YL	BLACK
503 127 200	T	170	258	8.71	BL/GN	BLACK
503 135 400	T	250	300	10.31	RD/OR	BLACK
505 070 144	T	100	290	8.25	RD/BK/RD	YELLOW
505 070 146	T	100	315	8.71	RD/RD/RD	YELLOW
415 108 100	U	125	260	8.25	BK/RD/BK	YELLOW

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

Torsion Springs Specification 1998

P/N	WIRE DIAMETER (mm)	OPENING ANGLE ±7°	COLOR CODE	COLOR OF SPRING
414 866 300 LH 414 866 200 RH	10.3	85°	YL	BLACK
414 880 200 LH 414 880 300 RH	9.5	100°	Not Applicable	BLACK
414 880 500 LH 414 880 400 RH	10.3	12°	Not Applicable	BLACK
414 943 600 LH 414 943 500 RH	10.6	90°	WH	BLACK
414 944 300 LH 414 944 200 RH	11.11	90°	GN	BLACK
415 010 600 LH 415 010 500 RH	10.6	80°	RD	BLACK
415 060 800 LH 415 060 700 RH	11.11	80°	BL	BLACK
415 069 400 LH 415 069 300 RH	11.11	100°	OR	BLACK
486 078 500 LH 486 078 600 RH	10.3	135°	RD/YL	BLACK
486 071 400 LH 486 071 300 RH	10.3	150°	WH/WH	BLACK
503 188 200 LH 503 188 100 RH	11.11	100°	BL/YL	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

This is divided into 2 main sections.

Section 1: Spring Applications

It is a quick reference chart which provides authorized spring application for each 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.

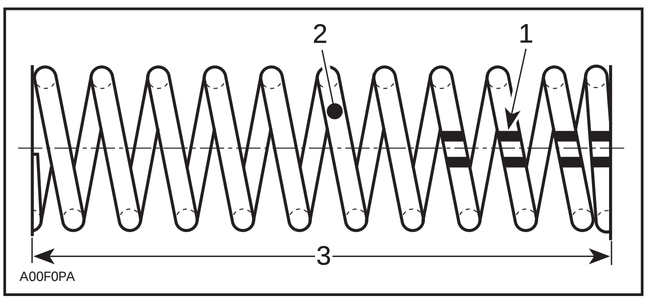
The informations in this bulletin supersede all informations previously published.

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)

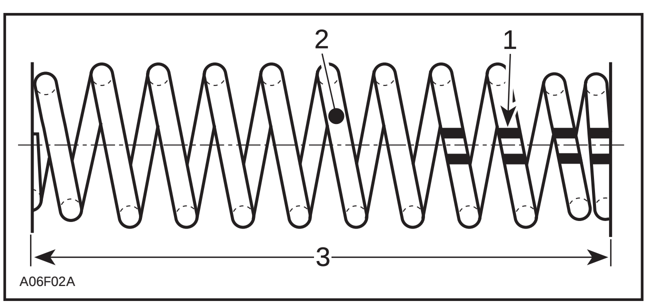
(Single Spring Rate)



1. *Color code stripes*
2. *Wire diameter*
3. *Free length*

Type T (barrel shape on both ends)

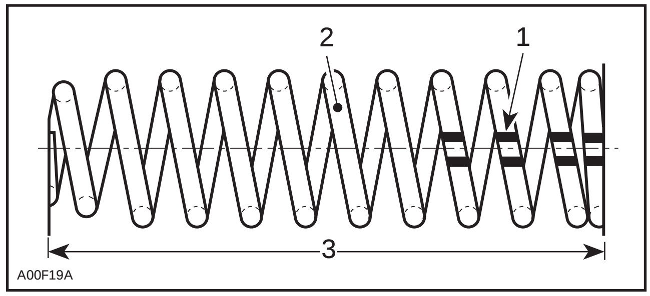
(Single Spring Rate)



1. *Color code stripes*
2. *Wire diameter*
3. *Free length*

Type S (barrel shape on one end)

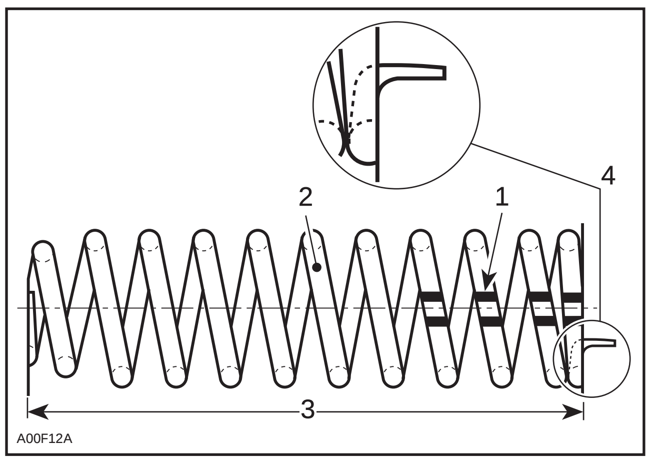
(Single Spring Rate)



1. *Color code stripes*
2. *Wire diameter*
3. *Free length*

Type U (barrel shape on one end with positioning tab at the other end)

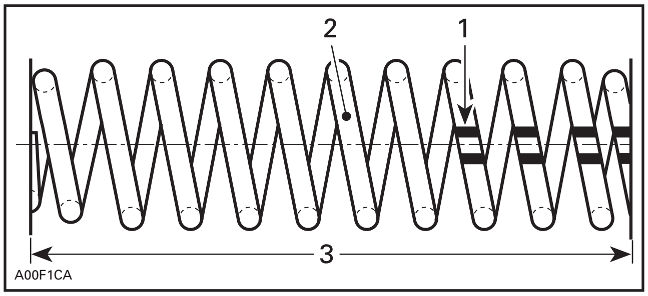
(Single Spring Rate)



1. *Color code stripes*
2. *Wire diameter*
3. *Free length*
4. *Positioning tab*

Type 2
(barrel shape on 1 to 1-1/2 active coils on both ends)

(Dual Spring Rate)

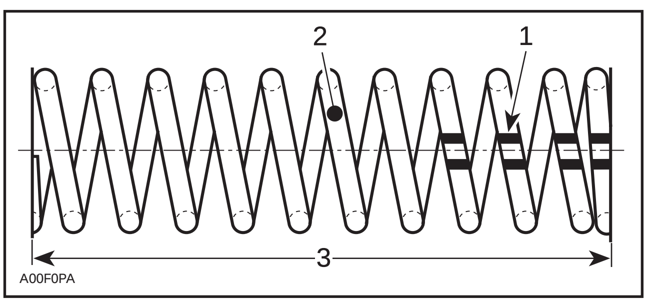


1. *Color code stripes*
2. *Wire diameter*
3. *Free length*

COIL SPRINGS (compression)

Type R
(straight on both ends)

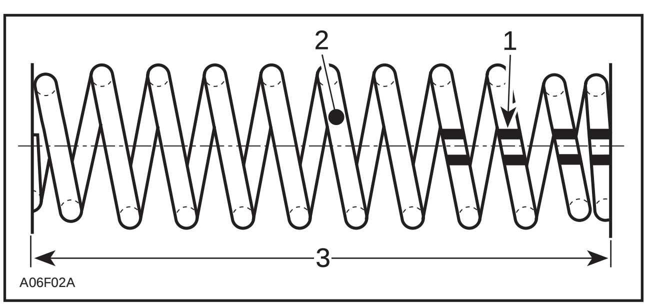
(Single Spring Rate)



1. *Color code stripes*
2. *Wire diameter*
3. *Free length*

Type T
(barrel shape on both ends)

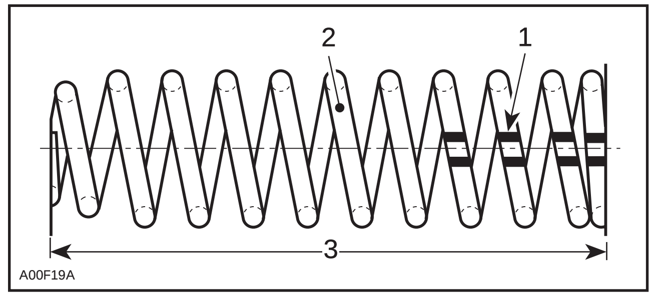
(Single Spring Rate)



1. *Color code stripes*
2. *Wire diameter*
3. *Free length*

Type S
(barrel shape on one end)

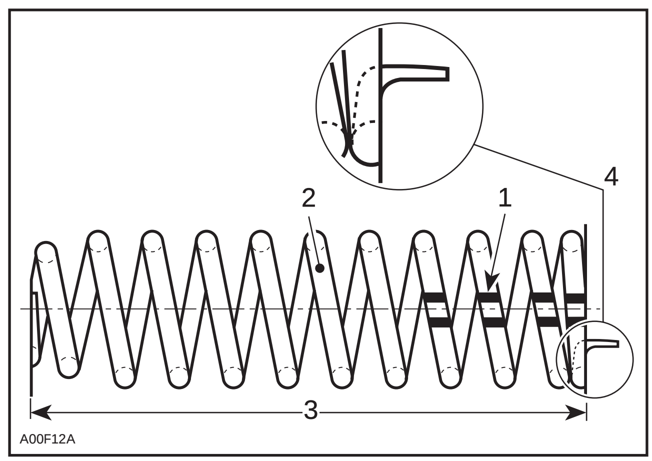
(Single Spring Rate)



1. *Color code stripes*
2. *Wire diameter*
3. *Free length*

Type U
(barrel shape on one end with positioning tab at the other end)

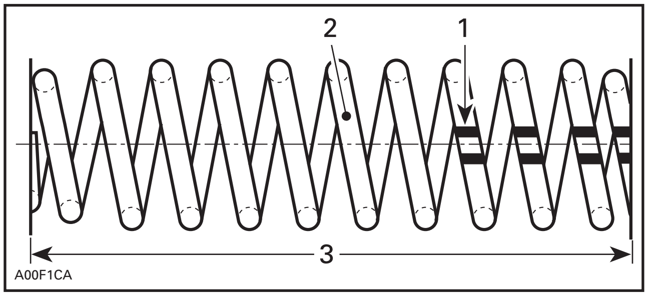
(Single Spring Rate)



1. *Color code stripes*
2. *Wire diameter*
3. *Free length*
4. *Positioning tab*

Type 2
(barrel shape on 1 to 1-1/2 active coils on both ends)

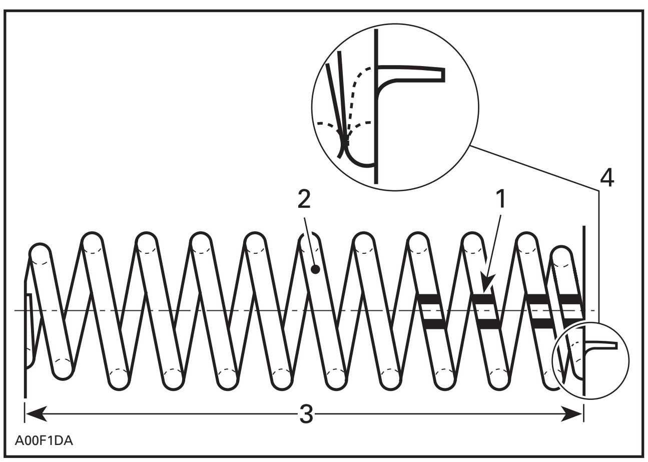
(Dual Spring Rate)



1. *Color code stripes*
2. *Wire diameter*
3. *Free length*

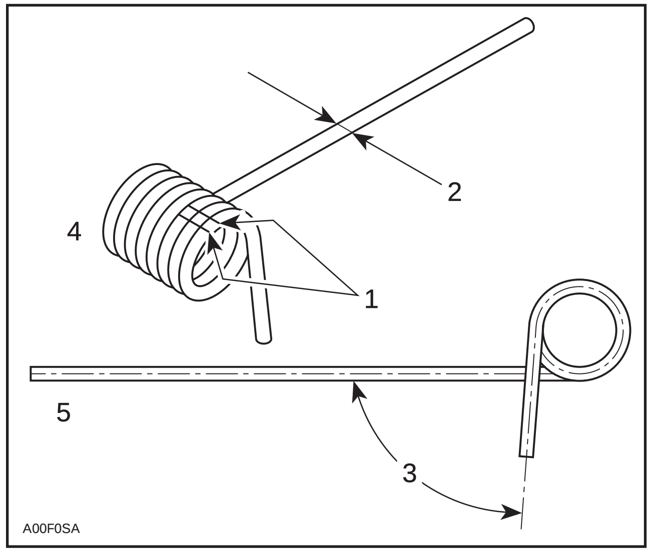
Type 4
(barrel shape on 1 to 1-1/2 active coils on both ends with positioning tab at the color code coils end)

(Dual Spring Rate)



1. *Color code stripes*
2. *Wire diameter*
3. *Free length*
4. *Positioning tab*

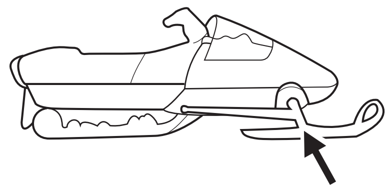
TORSION SPRINGS



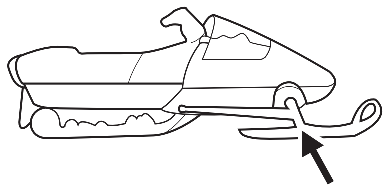
1. *Color code stripes*
2. *Wire diameter*
3. *Opening angle (°)*
4. *Left hand (LH)*
5. *Right hand (RH)*

SECTION 1

SPRING APPLICATIONS

1999	FRONT SPRINGS		1999
			
MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
MACH Z	414 956 300	415 075 900	415 039 700
MACH Z LT	Not Applicable	505 070 153	505 070 298
MACH 1	414 956 300	414 976 100	415 039 700
FORMULA III 800	Not Applicable	505 070 153	505 070 298
FORMULA III 700	Not Applicable	505 070 153	505 070 298
FORMULA III 600	Not Applicable	415 079 300	505 070 144
FORMULA Z 670	Not Applicable	505 070 240	415 075 900
FORMULA Z 583	414 956 300	415 075 900	415 039 700
FORMULA DE LUXE 583	414 956 300	415 075 900	415 039 700
FORMULA DE LUXE 500	414 956 300	415 075 900	415 039 700
FORMULA Z 500	414 956 300	415 075 900	415 039 700
FORMULA SL	414 956 300	415 075 900	415 039 700
FORMULA SL DE LUXE	414 956 300	415 075 900	415 039 700
FORMULA S	414 956 300	415 075 900	415 039 700
FORMULA S DE LUXE	414 956 300	415 075 900	415 039 700
FORMULA DE LUXE 670	414 956 300	415 075 900	415 039 700
MX Z 670	505 070 302	505 070 233	505 070 300
MX Z 600	Not Applicable	505 070 181	Not Applicable
MX Z 500	505 070 302	505 070 233	505 070 300
MX Z 440 F	414 956 300	415 075 900	415 039 700
SUMMIT X 670	414 916 800	415 083 700	415 039 600
SUMMIT 600	Not Applicable	505 070 020	505 070 305
SUMMIT 500	414 916 800	415 083 700	415 039 600
GRAND TOURING SE (Can/US)	Not Applicable	505 070 092	505 070 298

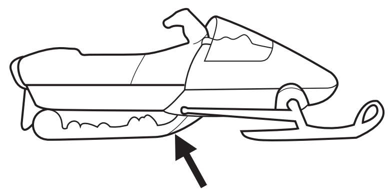
1999	FRONT SPRINGS		1999



MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
GRAND TOURING SE (Eur)	Not Applicable	505 070 093	505 070 144
GRAND TOURING 700	Not Applicable	505 070 091	505 070 298
GRAND TOURING 583	414 956 300	505 070 089	415 039 700
GRAND TOURING 500	414 956 300	505 070 089	415 039 700
TOURING SLE	414 956 300	415 035 900	415 039 700
TOURING LE	414 956 300	415 035 900	415 039 700
TOURING E	414 956 300	415 035 900	415 039 700
SKANDIC 500	414 859 300	414 955 800	414 968 600
SKANDIC 380	414 859 300	414 955 800	414 968 600
TUNDRA	414 803 000	415 095 200	Not Applicable
TUNDRA R	Not Applicable	505 070 130	Not Applicable

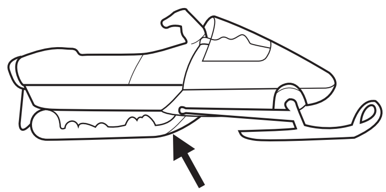
.

1999 CENTER SPRINGS 1999



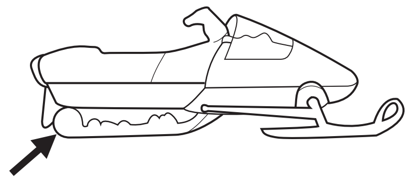
MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
MACH Z	415 070 400	415 090 500 415 090 600	415 103 600
MACH Z LT	415 057 500	415 057 600	415 070 700
MACH 1	415 070 400	415 090 500 415 090 600	415 103 600
FORMULA III 800	415 070 400	415 103 600	415 057 500
FORMULA III 700	415 070 400	415 103 600	415 057 500
FORMULA III 600	415 070 400	415 103 600	415 057 500
FORMULA Z 670	Not Applicable	415 090 400 415 090 300	415 110 400 415 090 300
FORMULA Z 583	414 974 400	415 070 400	415 103 600
FORMULA DE LUXE 583	414 974 400	415 070 400	415 103 600
FORMULA DE LUXE 500	414 974 400	415 070 400	415 103 600
FORMULA Z 500	414 974 400	415 070 400	415 103 600
FORMULA SL	414 974 400	415 069 900	414 771 300
FORMULA SL DE LUXE	414 859 300	415 070 100	415 070 500
FORMULA S	414 974 400	415 069 900	414 771 300
FORMULA S DE LUXE	414 974 400	415 069 900	414 771 300
FORMULA DE LUXE 670	Not Applicable	415 090 400 415 090 300	415 110 400 415 090 300
MX Z 670	415 070 400	415 103 600	415 057 500
MX Z 600	415 103 600	415 057 500	415 057 600
MX Z 500	415 070 400	415 103 600	415 057 500
MX Z 440 F	414 859 300	415 070 100	415 070 500
SUMMIT X 670	414 859 300	415 070 100	415 070 500
SUMMIT 600	414 859 300	415 070 100	415 070 500
SUMMIT 500	415 070 100	415 070 500	415 071000
GRAND TOURING SE	415 057 500	415 057 600	415 070 700
GRAND TOURING 700	415 057 500	415 057 600	415 070 700

1999	CENTER SPRINGS		1999



MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
GRAND TOURING 583	415 035 900	415 070 600	415 057 600
GRAND TOURING 500	415 035 900	415 070 600	415 057 600
TOURING SLE	415 070 100	415 070 500	415 071000
TOURING LE	414 974 400	415 069 900	414 771 300
TOURING E	414 974 400	415 069 900	414 771 300
SKANDIC 500	414 974 400	503 189000	414 771 300
SKANDIC 380	414 974 400	503 189000	414 771 300
TUNDRA	Not Applicable	414 880 500 LH 414 880 400 RH	Not Applicable
TUNDRA R	Not Applicable	414 880 500 LH 414 880 400 RH	Not Applicable

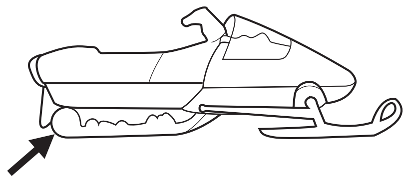
1999 REAR SPRINGS 1999



MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
MACH Z	415 010 600 LH 415 010 500 RH	503 189 242 LH 503 189 241 RH	414 944 300 LH 414 944 200 RH
MACH Z LT (Can/US)	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
MACH Z LT (Eur)	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH	Not Applicable
MACH 1	415 010 600 LH 415 010 500 RH	503 189 242 LH 503 189 241 RH	414 944 300 LH 414 944 200 RH
FORMULA III 800	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
FORMULA III 700	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
FORMULA III 600	415 010 600 LH 414 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
FORMULA Z 500 (Can/US)	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
FORMULA Z 500 (Eur)	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
FORMULA Z 583	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
FORMULA DE LUXE 583	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
FORMULA DE LUXE 500 LC (Can/US)	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
FORMULA DE LUXE 500 LC (Eur)	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
FORMULA SL (Can/US)	Not Applicable	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH
FORMULA SL DE LUXE (Can/US)	Not Applicable	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH
FORMULA SL (Eur)	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH

LH = Left Hand RH = Right Hand

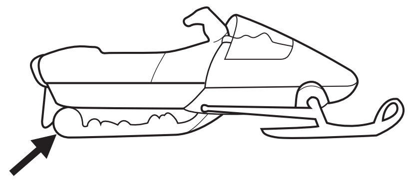
1999	REAR SPRINGS		1999



MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
FORMULA S (Can/US)	Not Applicable	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH
FORMULA S DE LUXE (Can/US)	Not Applicable	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH
FORMULA S (Eur)	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
MX Z 670	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH
MX Z 600	415 010 600 LH 415 010 500 RH	503 188 200 LH 503 188 100 RH	414 944 300 LH 414 944 200 RH
MX Z 500	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH
MX Z 440 LC	to be determined	503 189 083 LH 503 189 080 RH	to be determined
MX Z 440 F (Can/US)	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH
MX Z 440 F (Eur)	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
SUMMIT X 670	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH
SUMMIT 600	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH
SUMMIT 500 (Can/US)	Not Applicable	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH
SUMMIT 500 (Eur)	414 866 300 LH 414 866 200 RH	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH
GRAND TOURING SE	414 943 600 LH 414 943 500 RH	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH
GRAND TOURING 700	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH	Not Applicable
GRAND TOURING 583	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH

LH = Left Hand RH = Right Hand

1999	REAR SPRINGS		1999



MODEL	(P/N) SOFTER SPRING	(P/N) STANDARD	(P/N) HARDER SPRING
GRAND TOURING 500	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
TOURING SLE	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
TOURING LE	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
TOURING E	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
SKANDIC 500	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
SKANDIC 380	415 010 600 LH 415 010 500 RH	414 944 300 LH 414 944 200 RH	415 060 800 LH 415 060 700 RH
TUNDRA	Not Applicable	414 880 200 LH 414 880 300 RH	503 189 252 LH 503 189 251 RH
TUNDRA R	Not Applicable	414 880 200 LH 414 880 300 RH	503 189 252 LH 503 189 251 RH

LH = Left Hand RH = Right Hand

SECTION 2

SPRING SPECIFICATIONS

Coil Springs Specifications 1999

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
414 771 300	R	135	272.5	8.41	BK/BK	SAFARI RED
414 782 300	R	225	165	8.41	BK	SAFARI RED
414 788 200	R	150	272.5	8.41	BK/YL	SAFARI RED
414 789 400	R	135	272.5	8.41	BK/BK	AQUA BLUE
414 797 700	R	135	272.5	8.41	BK/BK	FLAME RED
414 797 800	R	135	272.5	8.41	BK/BK	PEARL BLUE
414 797 900	R	135	272.5	8.41	BK/BK	VIOLET
414 803 000	R	65	408	6.17	BL/OR	BLACK
414 808 800	R	120	272.5	7.77	BK/OR	SAFARI RED
414 809 300	R	160	213.1	7.77	WH	BLACK
414 809 500	R	150 ± 5	256.8	7.92	BK	YELLOW
414 810 100	R	125 ± 5	256.8	7.49	WH	YELLOW
414 859 300	R	90 ± 7	239	7.14	BK/WH	YELLOW
414 861 600	R	135	272.5	8.41	BK/BK	YELLOW
414 869000	R	125 ± 5	256.8	7.49	WH	SAFARI RED
414 871 600	R	150 ± 5	256.8	7.92	WH	VIOLET
414 877 800	R	160 ± 7	223.1	7.92	WH/WH	BLACK
414 891 000	R	100 ± 7	260	7.14	WH/BK	SAFARI RED
414 893 800	R	185 ± 7	213	8.41	GN/GN	YELLOW
414 895 100	R	100	255	7.14	PI/GD	BLACK
414 916 800	R	90 ± 7	239	7.14	RD	FIREFLY GREEN
414 928 100	R	110	256.8	7.77	GD/BK	SAFARI RED
414 928 600	R	100 ± 7	260	7.14	GD	RASPBERRY
414 929 300	R	110	256.8	7.77	BK/RD	PEARL BLUE
414 929 500	R	100 ± 7	260	7.14	RD/YL	PEARL BLUE

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

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
414 940 200	R	140 ± 7	223	7.77	WH/GN	BLACK
414 955 800	R	100	239	7.14	RD/GN/GN	BLACK
414 955 900	R	125 ± 5	256.8	7.49	BK/RD	NEON GREEN
414 956000	R	125 ± 5	256.8	7.49	BL/RD	BLACK
414 956 100	R	125 ± 5	256.8	7.49	BL/BL/BL	VIPER RED
414 956 200	R	115	242	7.77	PI/BL	BLACK
414 956 300	R	100	265	7.14	PI/WH/BL	YELLOW
414 956 400	R	100 ± 7	260	7.14	RD/YL/BL	ROYAL VIOLET
414 956 500	R	100 ± 7	260	7.14	BL/YL/GN	VIPER RED
414 956 800	R	100 ± 7	260	7.14	RD/YL	NEON GREEN
414 968 600	R	125	235	7.49	RD	NEON GREEN
414 974 400	R	90	265	7.14	GN/OR	BLACK
414 974 500	R	115	265	7.49	OR/WH	BLACK
414 976000	R	135	242	8.25	PI/GN	BLACK
414 976 100	R	125	262	7.92	PI/YL	VIPER RED
415 012 900	R	115	260	7.92	PI/YL	BLACK
415 016 700	R	200	230	8.71	PI/OR/YL	BLACK
415 013 800	R	150	264	7.77	BK/PI/WH	NEON GREEN
415 013 900	R	150	264	7.77	PI/WH/YL	ROYAL VIOLET
415 014 200	R	150	264	7.77	GN/OR/BL	PEARL BLUE
415 014 500	R	150	264	7.77	BK/WH/OR	VIPER RED
415 020 600	R	125	203.2	7.77	4 Green lines	BLACK
415 020 700	R	150	203.2	7.92	4 Red lines	BLACK
415 020 800	R	70	152	5.73	4 Blue lines	BLACK
415 020 900	R	150	190.5	8.29	4 Pink lines	BLACK
415 035 500	R	125	262	7.92	SI/GN	YELLOW
415 035 600	R	125	235	7.49	OR	FRENCH BLUE
415 035 700	R	125	262	7.92	SI/OR	JAY BLUE
415 035 800	R	125	262	7.92	SI/PI	FIR GREEN
415 035 900	R	125	262	7.92	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

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
415 038 500	R	100	265	7.14	SI/GD	VIPER RED
415 039 600	R	150	235	8.41	GN	BLACK
415 039 700	R	150	258	8.71	PI	BLACK
415 039 800	R	140	257	8.71	SI	BLACK
415 039 900	R	150	238	8.71	SI/WH	BLACK
415 040 000	R	130	250	8.25	SI/SI	BLACK
415 040 100	R	215	218	9.19	OR/PI	BLACK
415 057 500	R	160	264	8.71	RD/GD	BLACK
415 058 200	R	115	270	7.92	GN/GD	BLACK
415 069 600	R	300	170	9.50	YL/BK/YL	BLACK
415 075 800	R	125	262	7.92	PI/RD/BK	FRENCH BLUE
415 075 900	R	125	262	7.92	BL/RD/BK	YELLOW
415 076 000	R	100	265	7.14	RD/RD/BK	YELLOW
415 083 700	R	125	235	7.49	OR/RD/BK	YELLOW
415 090 300	R	376	76	8.25	GD/RD/YL	BLACK
415 090 500	R	293	45	6.17	YL/BL/YL	BLACK
415 095 200	R	75	408	6.17	BL/BL/YL	BLACK
503 100 700	R	65	290	6.35	BL/YL	BLACK
505 070 089	R	125	262	7.92	GN/BK/BK	GOLDEN WHEAT
505 070 130	R	75	408	6.17	YL/PI/YL	BLACK
415 090 400	S	359	215	10.60	WH/RD/YL	BLACK
415 090 600	S	220	210	9.19	RD/BL/YL	BLACK
415 110 400	S	400	215	11.10	YL/OR/YL	BLACK
414 809 100	T	125 ± 5	274	7.92	GD	YELLOW
414 815 500	T	135	259	7.77	BK/WH	VIOLET
414 852 800	T	100 ± 7	279	7.92	RD	YELLOW
414 871 300	T	125 ± 5	274	7.92	GD	SAFARI RED
414 871 500	T	125 ± 5	274	7.92	GD	VIOLET
414 894 100	T	112 ± 7	279.4	8.41	BK/GN	YELLOW
414 916 900	T	100 ± 7	279	7.92	BK/WH	FIREFLY GREEN

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

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
414 925 400	T	100 ± 7	279	7.92	WH/BK	SAFARI RED
414 926000	T	100 ± 7	279	7.49	BK	RASPBERRY
414 926 900	T	110	279.4	7.77	GN/YL	SAFARI RED
414 927 100	T	110	279.4	7.77	BK/YL	PEARL BLUE
414 927 500	T	100 ± 7	279	7.92	RD/WH	PEARL BLUE
414 988 600	T	100 ± 7	279	7.49	PI/PI	BLACK
414 998 600	T	100 ± 7	279	7.49	BK/PI	SAFARI RED
415 006 900	T	150 ± 7	272.5	8.41	BK/YL	FIREFLY GREEN
415 007 000	T	135 ± 7	272.5	8.41	BK/BK	FIREFLY GREEN
415 014 300	T	150	264	7.77	GN/OR/PI	CAN-AM RED
415 057 500	T	160	264	8.71	RD/GD	BLACK
415 057 600	T	180	260	9.52	BL/GD	BLACK
415 069 900	T	115	265	7.49	SI/YL/YL	BLACK
415 070 000	T	135	242	8.25	WH/YL/YL	BLACK
415 070 100	T	115	242	7.92	GD/YL/YL	BLACK
415 070 200	T	115	270	7.92	PI/YL/YL	BLACK
415 070 300	T	100	264	7.49	OR/YL/YL	BLACK
415 070 400	T	115	270	8.25	GN/YL/YL	BLACK
415 070 500	T	135	242	8.41	BL/YL/YL	BLACK
415 070 600	T	160	264	9.19	RD/YL/YL	BLACK
415 070 700	T	200	263	9.52	YL/YL/YL	BLACK
415 071 000	T	150	242	8.71	SI/RD/YL	BLACK
415 079 300	T	85	290	7.77	RD/BL/BK	YELLOW
415 079 400	T	85	315	8.25	RD/GN/BK	YELLOW
415 079 500	T	85	290	7.77	GN/RD/YL	VIPER RED
415 079 600	T	85	315	8.25	OR/RD/YL	FRENCH BLUE
415 079 700	T	85	315	8.25	PI/YL/RD	PLATINUM
415 103 600	T	135	264	8.25	GN/GN/YL	BLACK
503 127 200	T	170	258	8.71	BL/GN	BLACK
503 135 400	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

P/N	TYPE	SPRING RATE (lbs/in) ± 10	FREE LENGTH (mm) ± 3	WIRE DIAMETER (mm) ± .05	COLOR CODE STRIPES	COLOR OF SPRING
503 189 000	T	115	265	7.92	YL/GD/YL	BLACK
505 070 020	T	90	250	7.77	BK/OR/BK	YELLOW
505 070 093	T	85	290	7.77	BK/GN/BK	GRAND CANYON RED
505 070 144	T	100	290	8.25	RD/BK/RD	YELLOW
505 070 146	T	100	315	8.71	RD/RD/RD	YELLOW
505 070 240	T	90	265	7.49	RD/PI/BK	YELLOW
505 070 305	T	105	250	8.25	RD/OR/BK	YELLOW
415 108 100	U	125	260	8.25	BK/RD/BK	YELLOW
505 070 233	U	125	262	7.92	PI/BL/BK	YELLOW
505 070 300	U	150	258	8.71	GN/PI/BK	YELLOW
505 070 302	U	100	265	7.14	OR/PI/BK	YELLOW
505 070 091	2	65-95	340	8.25	BK/BL/BK	GOLDEN WHEAT
505 070 092	2	65-95	340	8.25	BK/YL/BK	GRAND CANYON RED
505 070 153	2	65-95	340	8.25	GN/GN/BK	YELLOW
505 070 298	2	70-100	340	8.25	BL/PI/BK	YELLOW
505 070 181	4	55-85	320	7.77	PI/BK/BK	YELLOW

SPRING COLOR CODES
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Torsion Springs Specification 1998

P/N	WIRE DIAMETER (mm)	OPENING ANGLE ±7°	COLOR CODE	COLOR OF SPRING
414 866 300 LH 414 866 200 RH	10.3	85°	YL	BLACK
414 880 200 LH 414 880 300 RH	9.5	100°	Not Applicable	BLACK
414 880 500 LH 414 880 400 RH	10.3	12°	Not Applicable	BLACK
414 943 600 LH 414 943 500 RH	10.6	90°	WH	BLACK
414 944 300 LH 414 944 200 RH	11.11	90°	GN	BLACK
415 010 600 LH 415 010 500 RH	10.6	80°	RD	BLACK
415 060 800 LH 415 060 700 RH	11.11	80°	BL	BLACK
415 069 400 LH 415 069 300 RH	11.11	100°	OR	BLACK
486 078 500 LH 486 078 600 RH	10.3	135°	RD/YL	BLACK
486 071 400 LH 486 071 300 RH	10.3	150°	WH/WH	BLACK
503 188 200 LH 503 188 100 RH	11.11	100°	BL/YL	BLACK
503 189 083 LH 503 189 080 RH	11.5	100°	GD	BLACK
503 189 242 LH 503 189 241 RH	11.11	105°	OR/YL	BLACK
503 189 252 LH 503 189 251 RH	10.3	95°	RD/RD	BLACK

LH = Left Hand RH = Right Hand

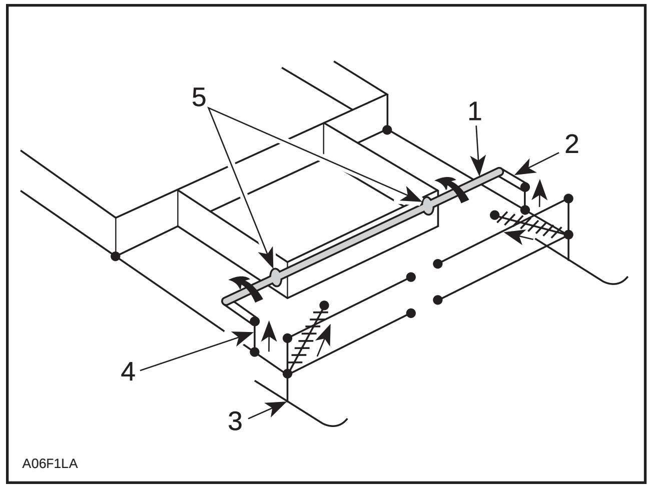
SPRING COLOR CODES
BK = BLACK BL = BLUE GD = GOLD GN = GREEN OR = ORANGE PI = PINK RD = RED SI = SILVER WH = WHITE YL = YELLOW

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.

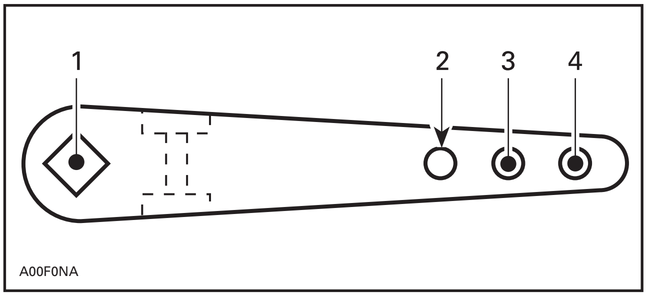
Roll can be reduced by installing stiff springs on the front suspension and/or a lot of preload, but this will cause a harsher ride than necessary. Lowering the center of gravity will also reduce roll but there are practical limits as to how low the center of gravity can go. Most vehicles are equipped with an antiroll bar or **stabilizer** bar. Common terminology will refer to it as a **sway** bar. (It is inaffect 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*

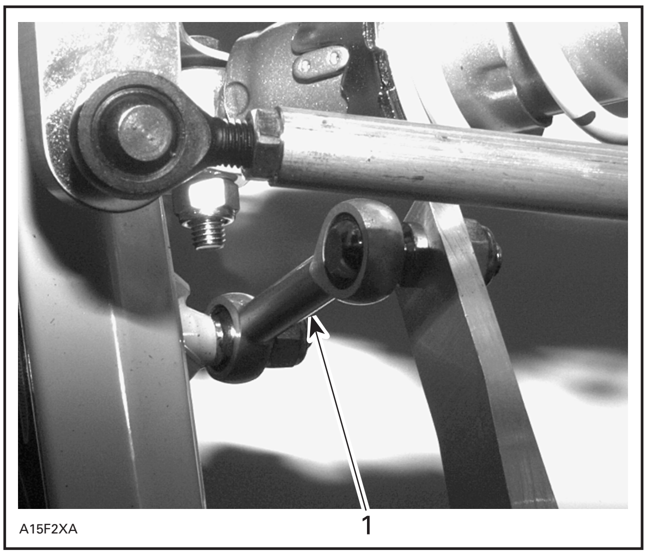
By having a sway bar in the suspension, softer springs can be used to achieve a good ride because the bar will help control roll in a corner. The bar has no affect on ride when traveling straight ahead over bumps that are even from side to side. However, if only one ski encounters a bump, then the bar 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).



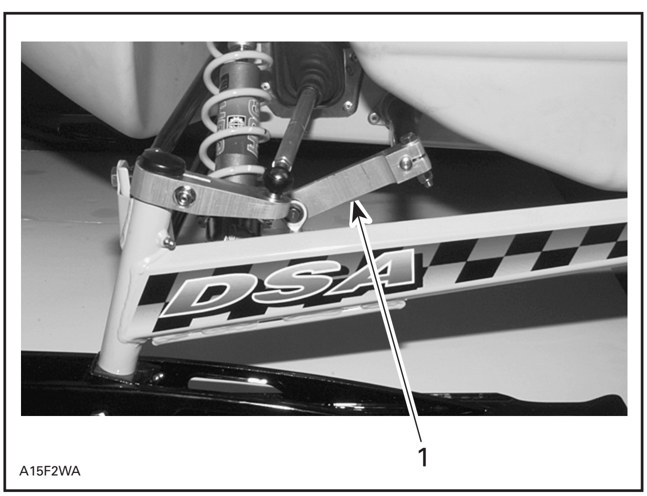
END LEVER
1. *Sway bar*
2. *Stiffer*
3. *Softer*
4. *Softest*

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*

Optional Sway Bars

486 074 000	25.4 mm (1 in tubular)
506 141 100	Lever
486 073 600	15.88 mm (5/8 in) steer
561 723 300	Bushing
506 141 100	Lever
486 073 800	19.05 mm (3/4 in) steer
486 073 900	Bushing

– 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.

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.

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. A quick adjust limitor assembly, (P/N 861 760 200) is available for models equipped with the SC-10 cross country rear suspension. If the adjuster nut is all the way tight and you would more ski pressure, install a shorter limiter strap.

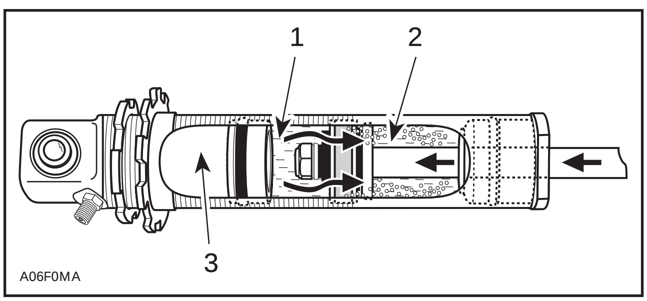
SHOCK ABSORBER

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.

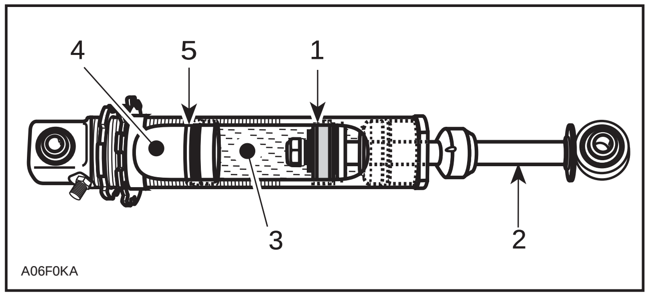
As dampers of the air/oil type are cycled rapidly, a low pressure will be generated on the oil exit side of the valved piston. If the pressure drops too much, a vaporization or aeration of the oil can occur. If this oil aeration is allowed to continue, a loss in damping performance will result. This 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.

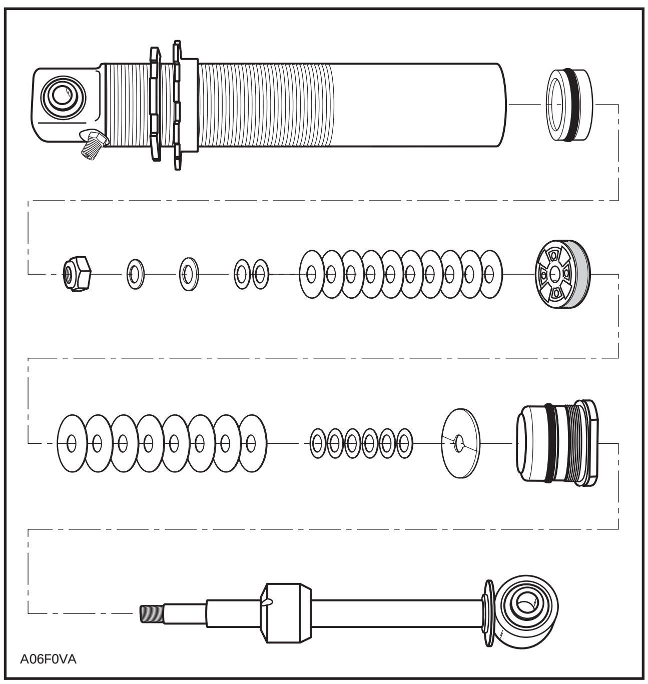


1. *Valved piston*
2. *Damper shaft*
3. *Oil volume*
4. *High pressure gas chamber (300 PSI N_2)*
5. *Floating piston*

HPG, 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.

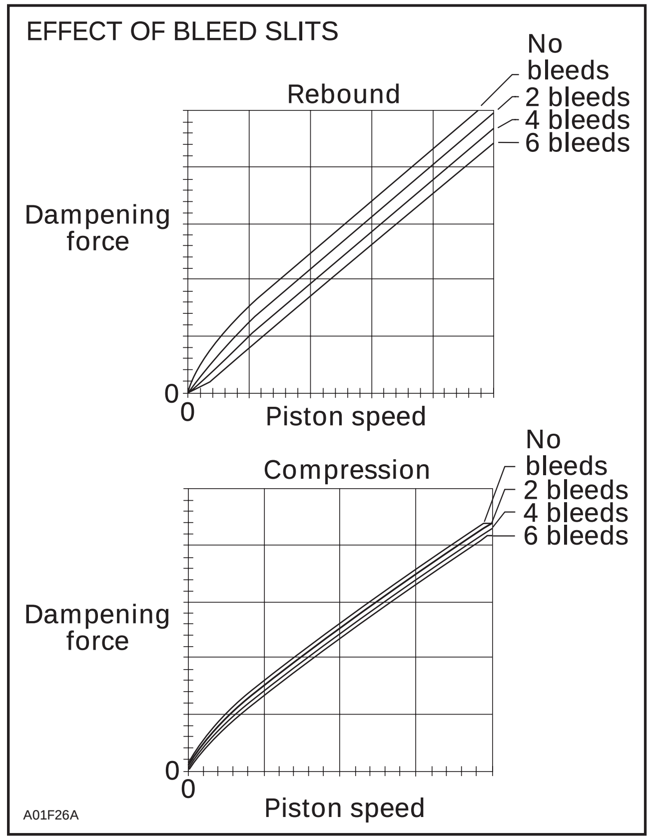


Valving and Dampening

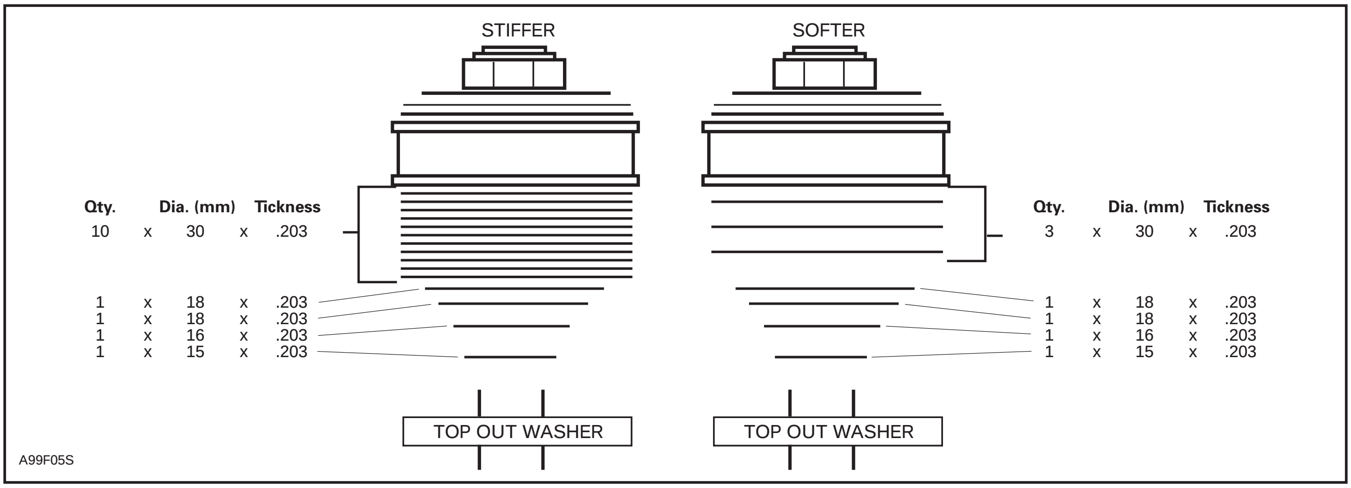
In the HPG shock, the piston passages are covered by a stack of thin metal shims of various thicknesses and diameters. The shims provide dampening by acting as spring loaded valves offering resistance to the oil traveling through the piston. There is a stack of shims on both sides of the piston. One 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 damping 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.



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 × .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 × .152 = 2.4 × .114
1 × .203 = 2.3 × .152
1 × .254 = 2.0 × .203

This means it will take 2.4 × .114 mm shims to have the same dampening as 1 × .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.

Shim Comparator Formula

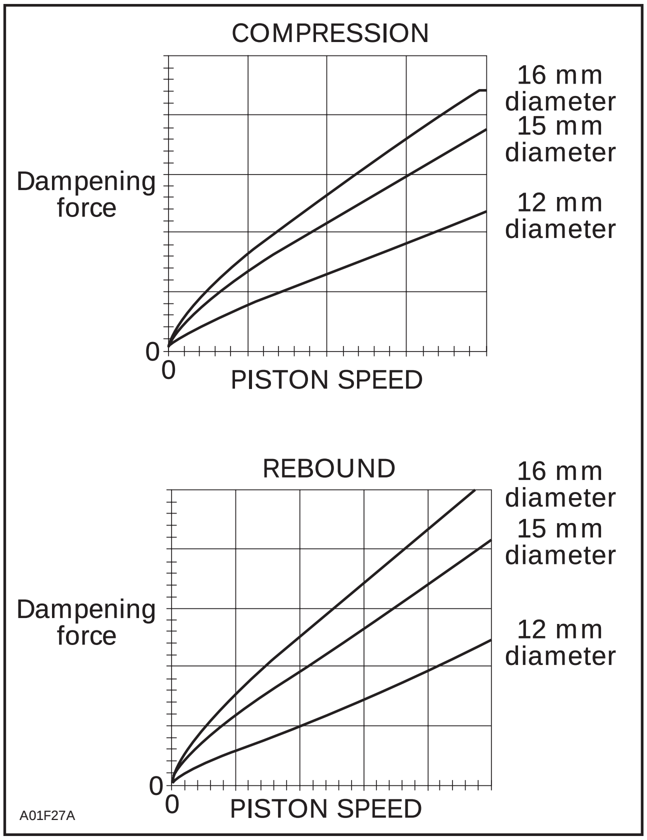
Thickness^3 or cubed.

Example: .152 x .152 x .152

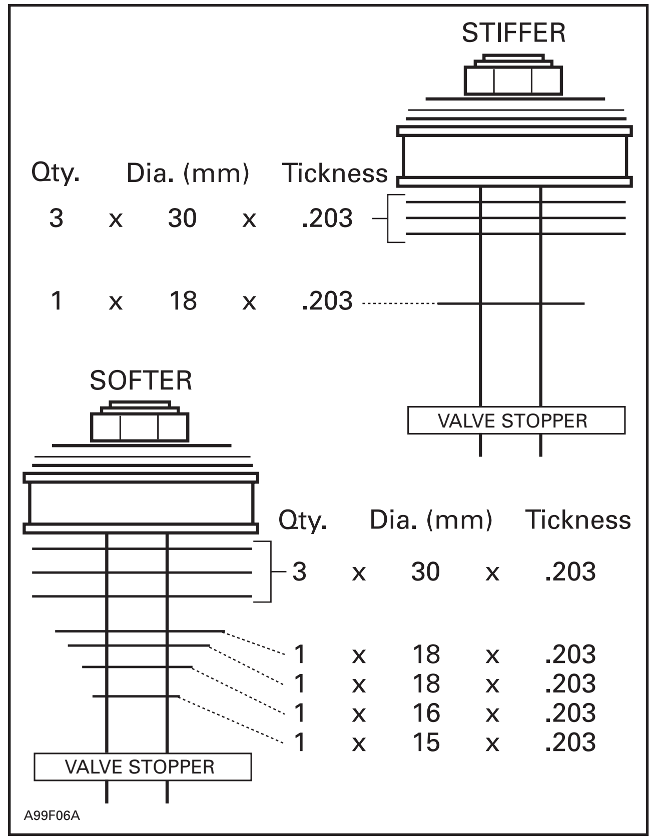
(mm)

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

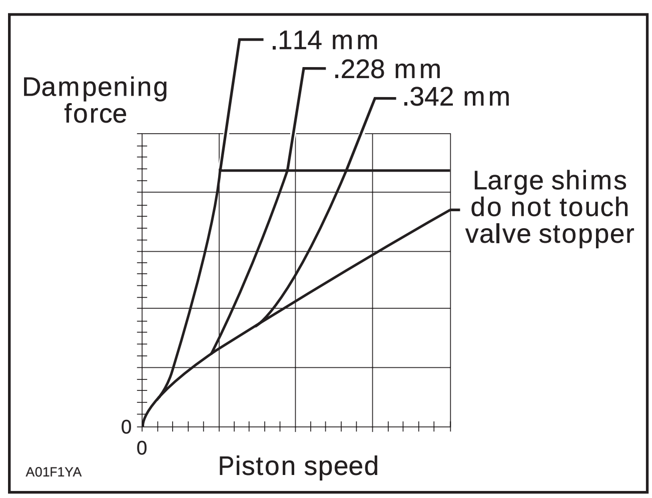
The diameter of the smaller shims that support the large shims will also affect the dampening. A larger support shim gives more support to the large shim thus making it act stiffer. Conversely, a smaller diameter support shim will allow the large shim to bend more easily thus softening the dampening.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



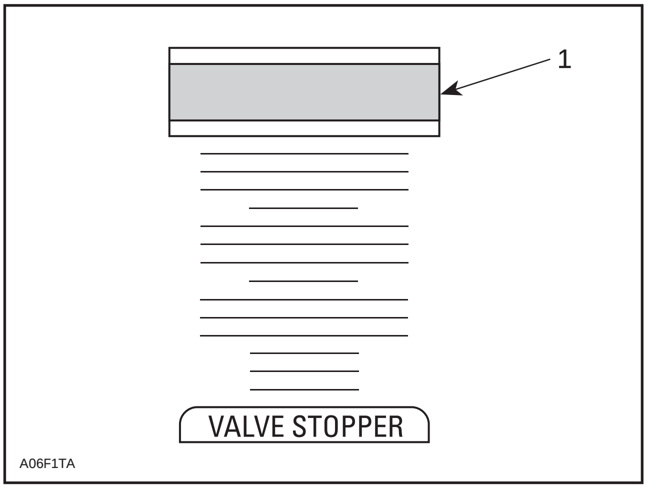
Another method of changing dampening is by controlling the amount of space the stack has to open. This is done by reducing the amount of smaller shims which support the larger shims. The larger shims act the same until they bottom out'' against the valve stopper.



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 damping 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.



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.

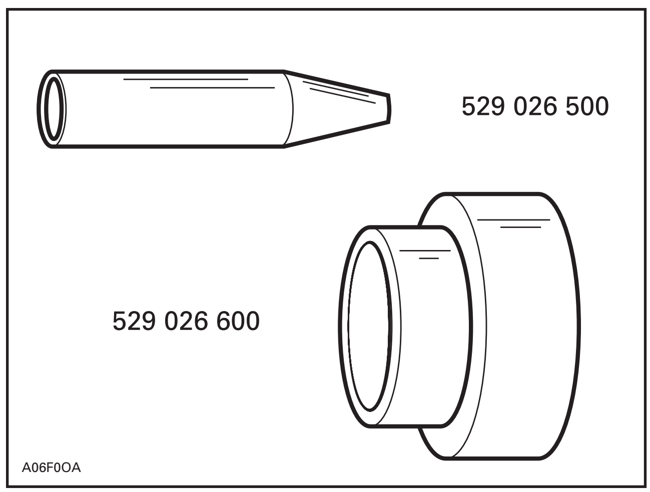
– If the dampening is close to what you want, just add or remove 1 or 2 large shims, from the appropriate side, to fine tune the overall stiffness.

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. Overdampening 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.

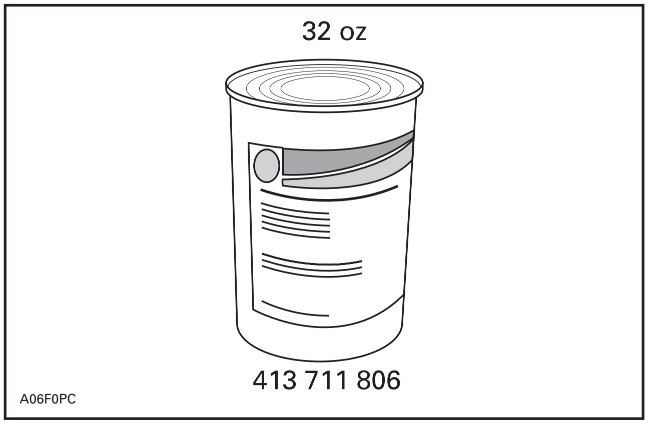
Special Tools

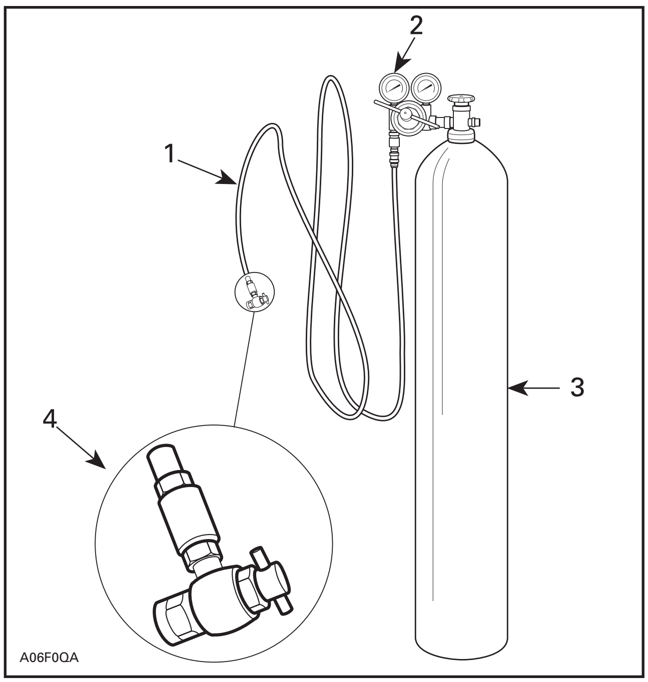
Special tools specific to the HPG T/A shock will be the seal pilot (P/N 529 026 500) and piston guide (P/N 529 026 600) from Bombardier.



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

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 (P/N 529 035 570)*

NOTE: Commercially available through compressed gas dealers.

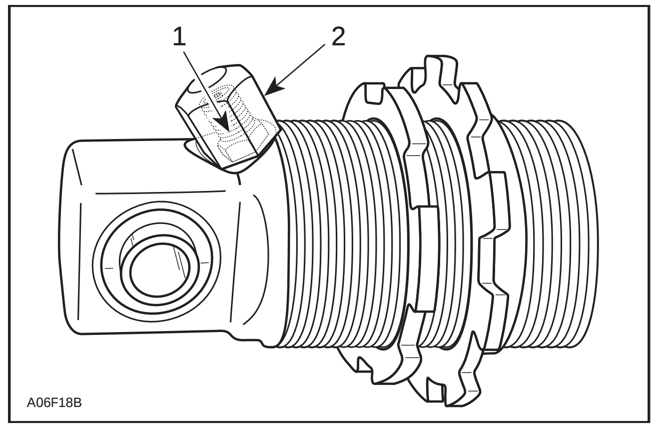
Disassembly and Assembly

Release N_2 (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**

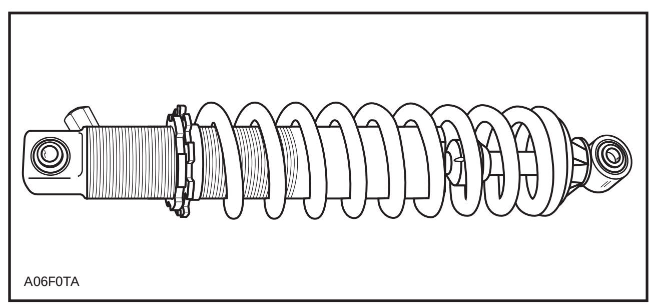
Nitrogen gas is under extreme pressure. Use caution when releasing this gas volume. Protective eye wear should be used.



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

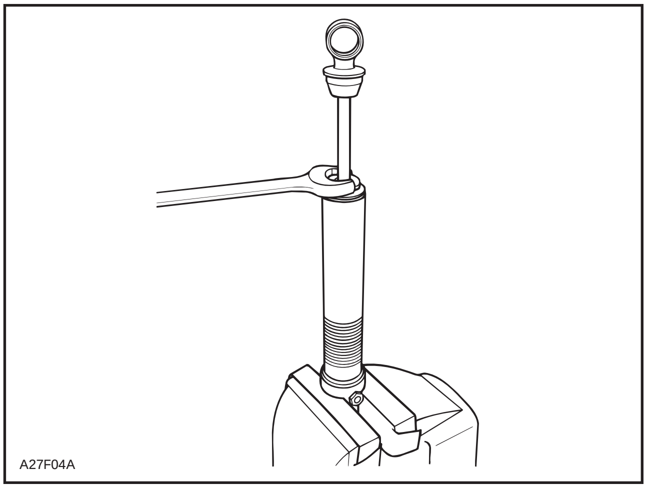
NOTE: Before unscrewing pre-load rings, measure the compressed length of the installed spring and mark position for reinstallation. For factory adjustment refer to the end of this section.

Use tools (P/N 861 743 900) to remove damper spring by unthreading spring pre-load rings, then removing spring retainer or use the spring removal tool (P/N 529 035 504).



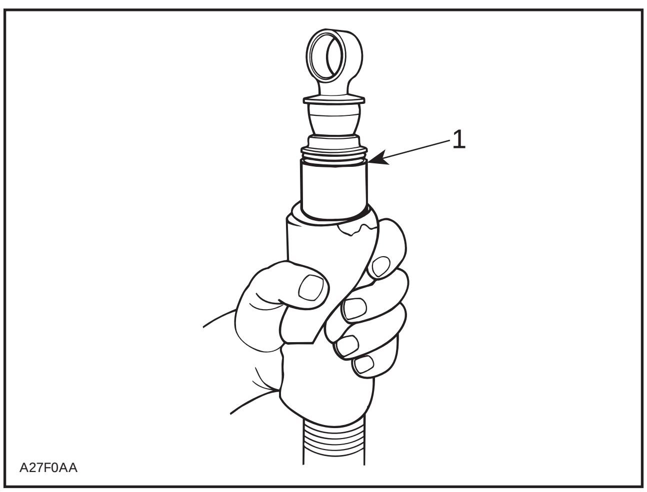
TYPICAL

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.



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

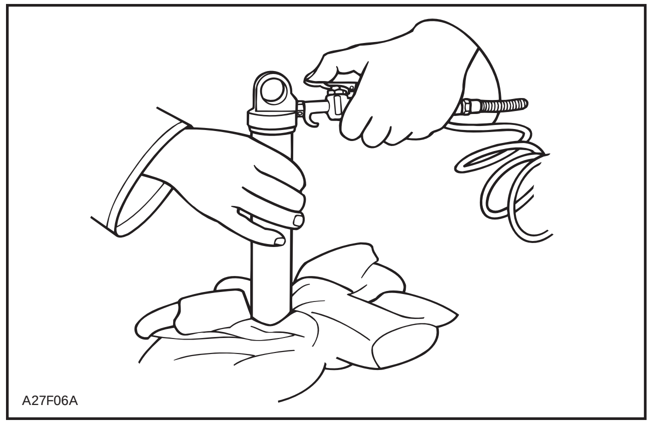
NOTE: Remove damper rod assembly slowly to reduce oil spillage and prevent piston seal damage by damper body threads. Wrap the damper body with a shop cloth to capture possible overflow oil while removing the damper piston.



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

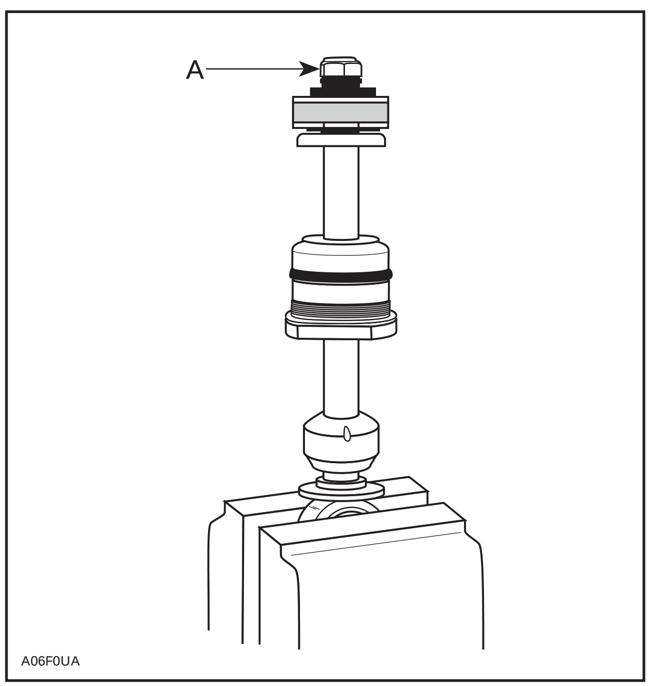
◆ WARNING

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.

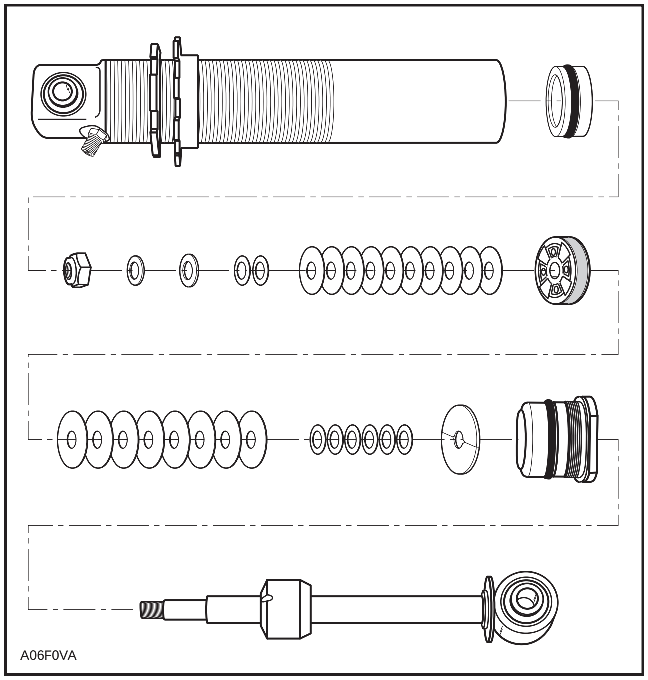
Replace damper body if wear is identified.

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



A. *Remove damper nut*

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.

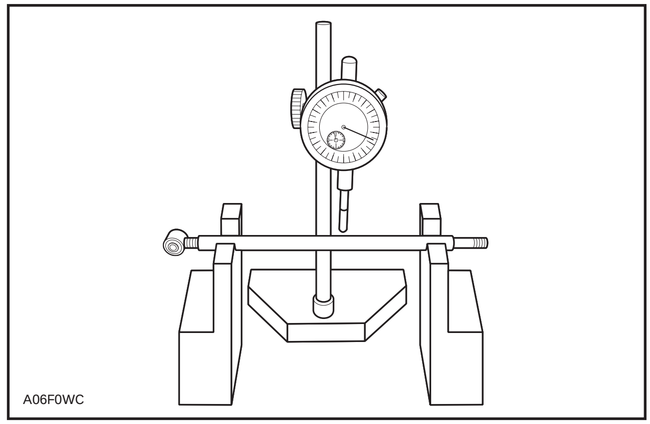
NOTE: If revalving is to be done, it is imperative that you identify the original shim pack (size and number of shims). The seal carrier need not be removed if only revalving is to be done.

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.

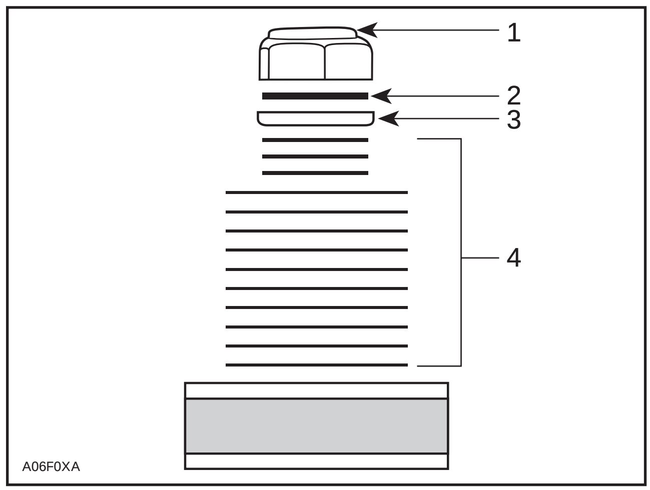
The damper rod is constructed of a plated shaft design. This damper shaft must be inspected for any visible wear on the surface of the damper rod.

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*

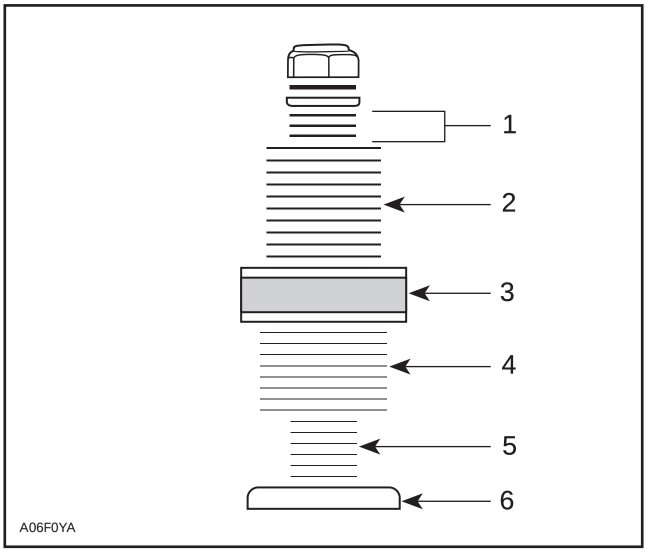
▼ CAUTION

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 414 888 309) 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.

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 5 pistons; 0, 1, 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.

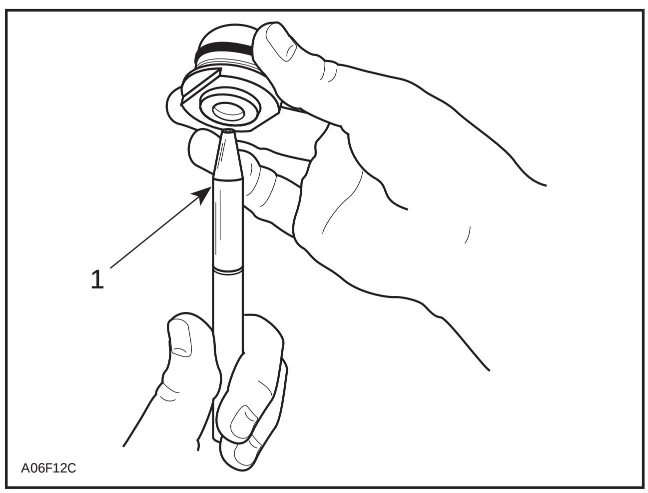
Fewer spacer shims will result in more high speed dampening. A minimum of 0-114 mm (.0045 in) clearance should be allowed between shim stack and compression valve stopper. Use at least one shim of 12 × .114.

If the seal carrier assembly is replaced, use seal pilot (P/N 529 026 500) to guide seal over damper shaft. Lubricate seal carrier guide pilot before use.

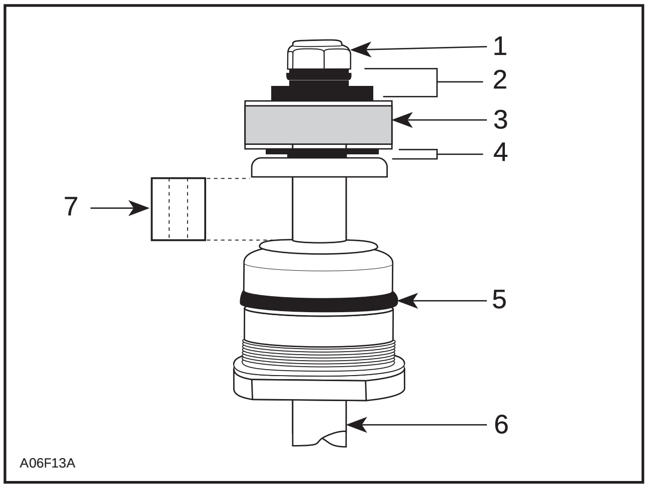
▼ CAUTION

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 529 026 900)*



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 861 744 200)

Kit includes:

2 x 26 mm long spacer

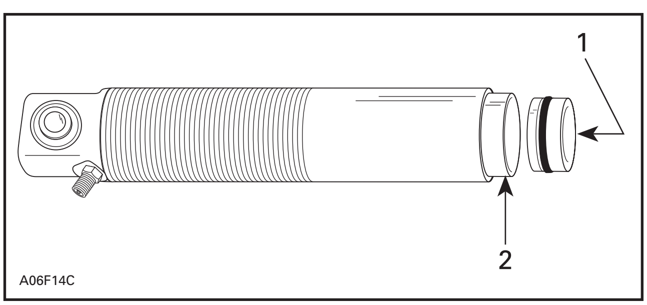
1 x 48 mm long spacer

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 413 703 700) or silicone grease Dow Corning MS4 (P/N 420 897 061) to ease O-ring past damper body threads with floating piston pilot (P/N 529 026 600).

▼ CAUTION

Failure to install IFP correctly could result in shock damage.

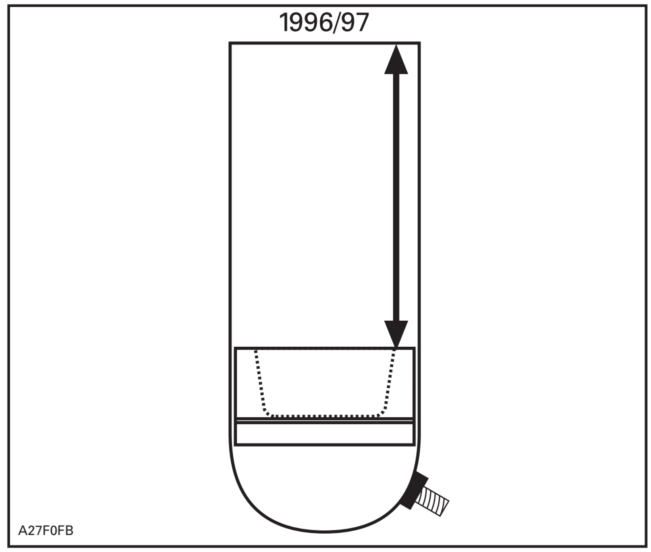


1. Push (slowly) by hand
2. Floating piston guide (P/N 529 026 600)

NOTE: Lubricate inside of piston guide with molykote GN paste (P/N 413 703 700) or MS4 silicone grease (P/N 420 897 061).

Install floating piston to the proper depth.

On all HPG take apart shocks from 1996 on. The floating piston is installed hollow side up.



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.

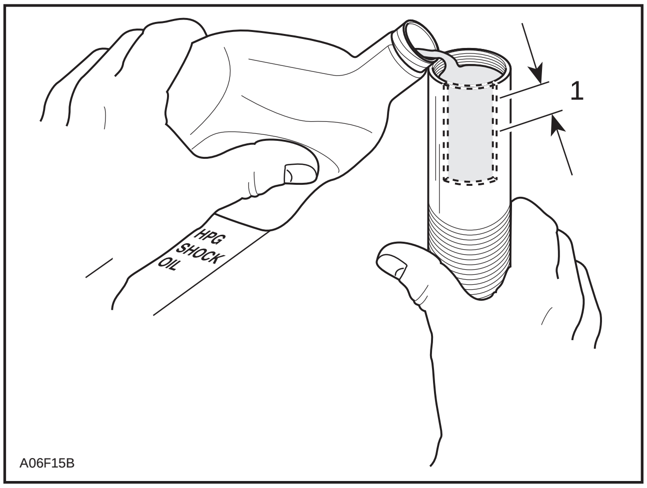
▼ CAUTION

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

◆ WARNING

Always wear protective eye wear whenever using compressed air.

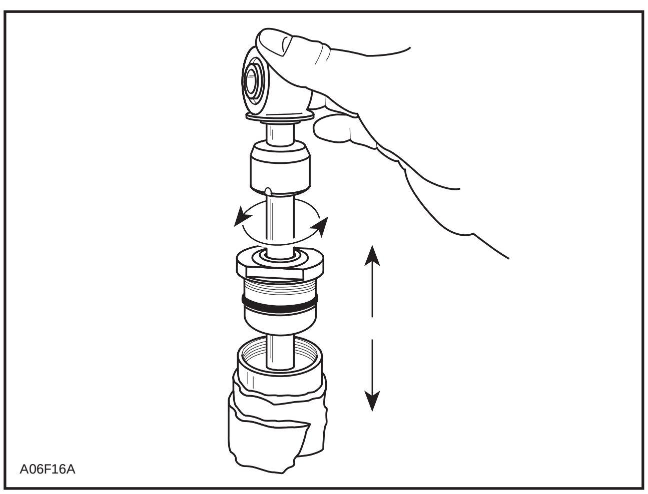
Fill the shock with Bombardier HPG shock oil (P/N 413 711 806) to approximately 10 mm (.393 in), from the base of seal carrier threads.



1. Fill to 10 mm (.393 in)

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.

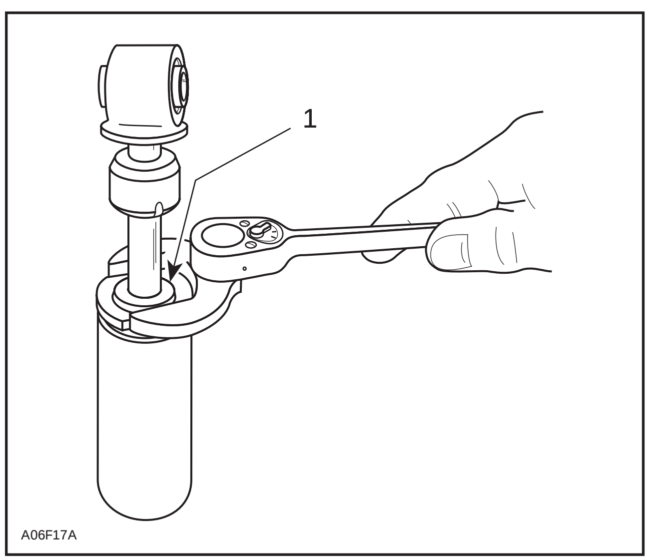
Slight oscillation of damper rod may be required to allow piston to enter damper body bore.

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 submersed piston. Be careful not to drive the shaft any deeper into the oil than is necessary to just cover the shim stack.

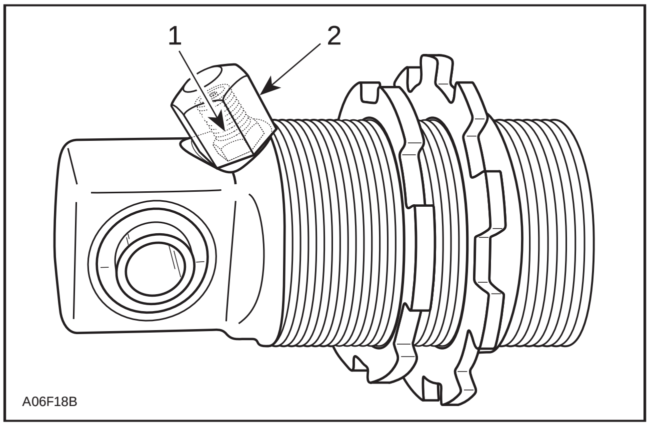
NOTE: Fast installation of the damper rod may displace the floating piston from its original position. This must not occur if the damper is expected to perform as designed.

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 weapage 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)



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 (N_2) 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 (N_2), 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.

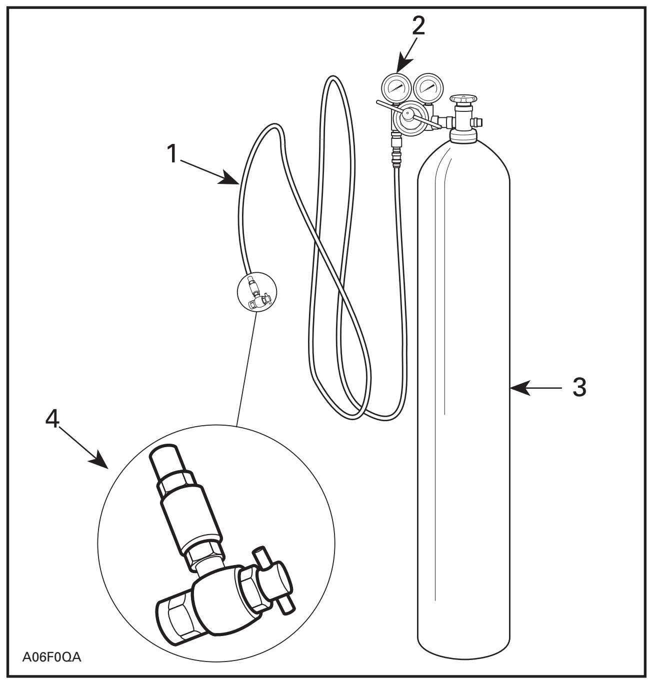
◆ WARNING

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 (P/N 529 035 570)

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.

1997/1998

MX Zx 440 LC

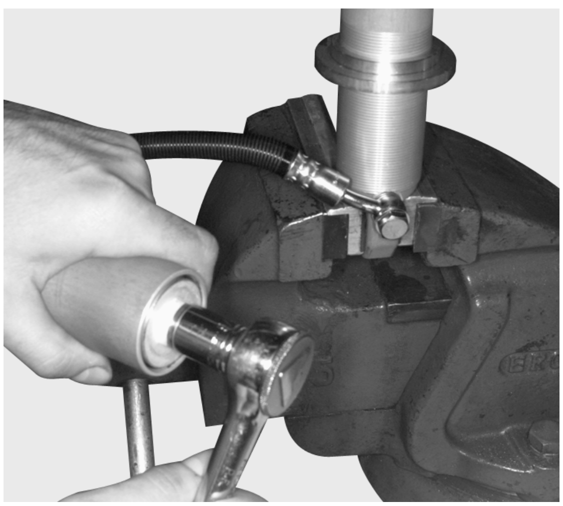
Shock Absorber Servicing

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.



A15F3GA

REMOVE AIR VALVE CAP FROM RESERVOIR

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

A15F3HA

RELEASE PRESSURE FROM RESERVOIR

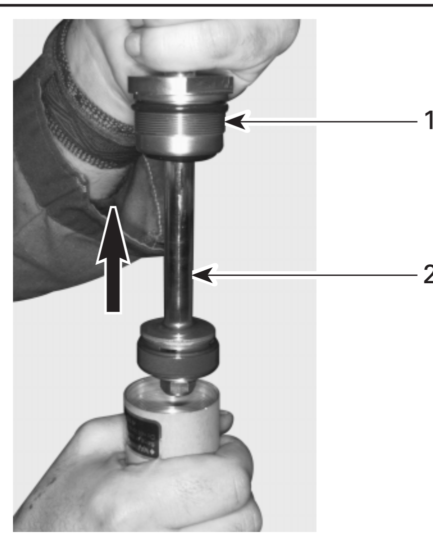
Damper Disassembly

◆ 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.



A15F3IA

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

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

Reservoir Disassembly

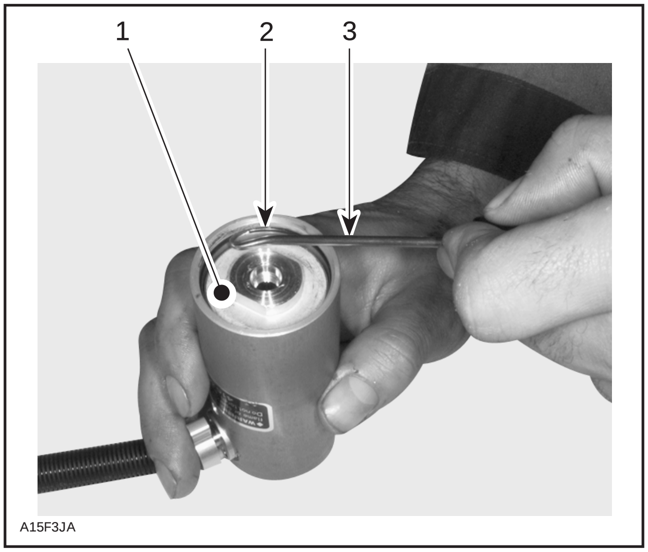
Remove air valve from reservoir cap assembly on the remote reservoir.

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.

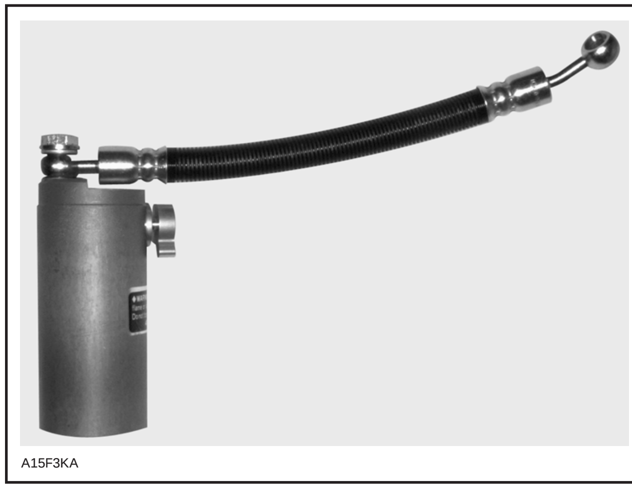


1. *Reservoir cap assembly*
2. *Circlip*
3. *Special tool Snap-on 3ASH*

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

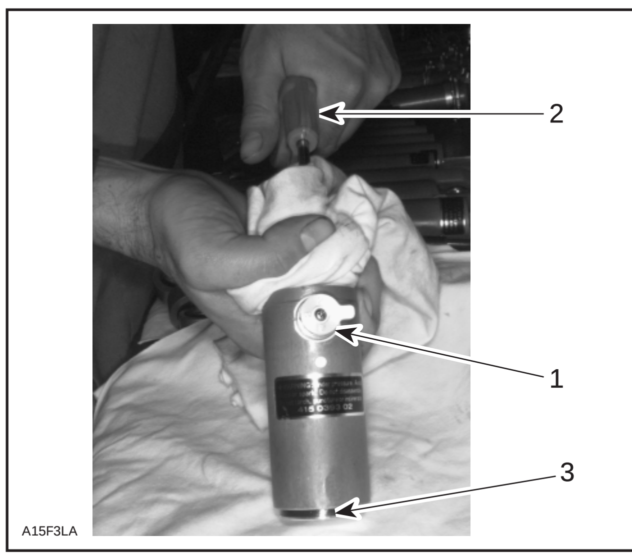
Set reservoir adjustment knob to position 4.

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 415 038 700).

Fill reservoir with 50 mL of Bombardier HPG shock oil (P/N 413 709 400).

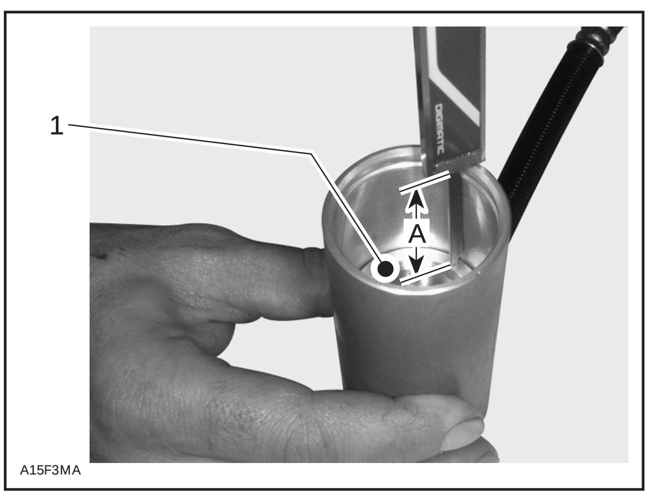
Reinstall floating piston into reservoir body. Concave side of piston must be facing upward. Use oil to ease O-ring pass reservoir body groove.

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 ± 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.

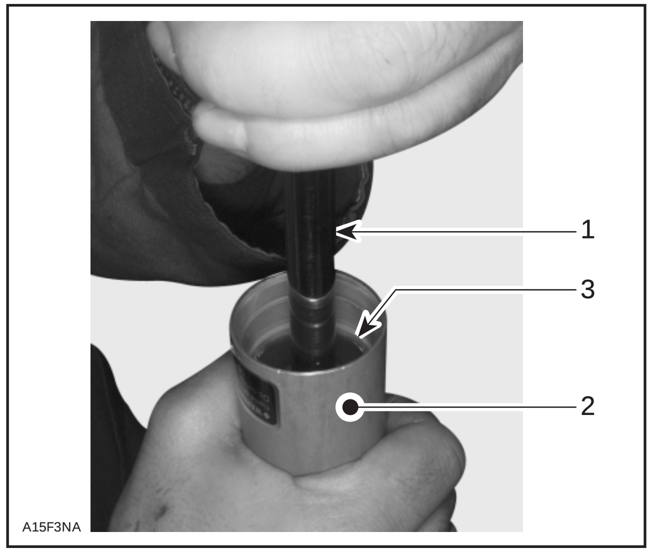


RESERVOIR HAS BEEN REVERSE TO SHOW HOW TO MEASURE

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

Damper Assembly

Replace damper oil with Bombardier HPG shock oil (P/N 413 709 400) 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.

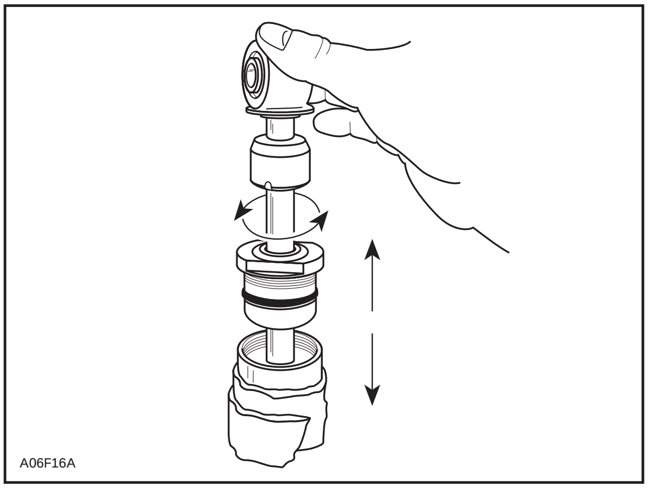
NOTE: Some shock oil may overflow when installing damper rod assembly. Wrap damper with shop cloth to catch possible oil overflow.

▼ 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.



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 ± 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

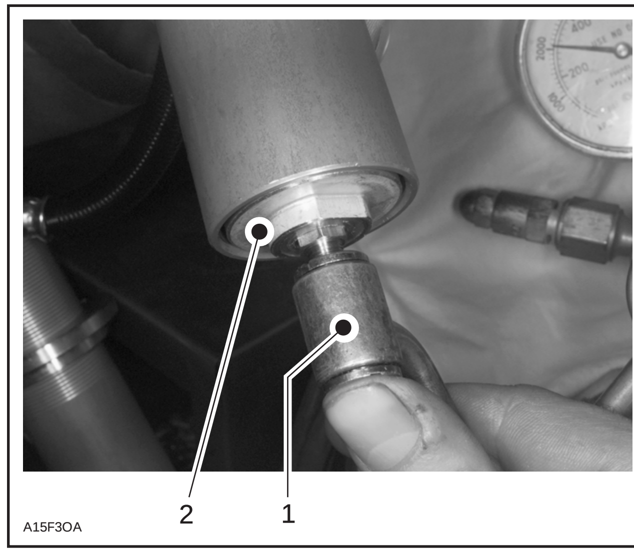
NOTE: If all previous procedures have been properly performed, **final floating piston position must be 40 ± 2 mm (1-9/16 ± 5/64 in)**. Final floating piston position must be measured after damper seal carrier assembly has been completely threaded.

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.



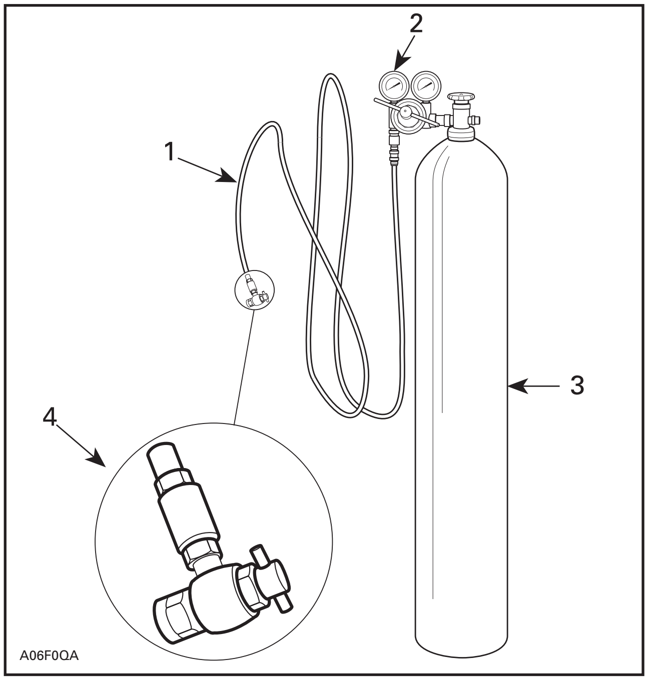
1. Valve tip (Nitrogen)
2. Reservoir cap assembly

▼ 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.

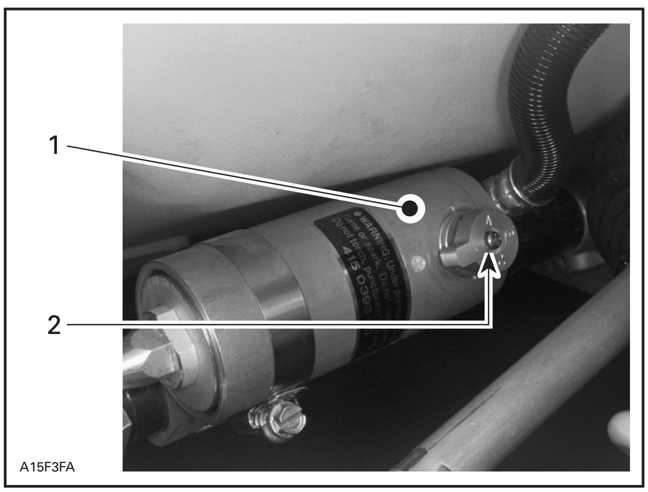
Damper gas pressure can be confirmed by using a pressure gauge available through your local industrial gas supplier.



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 (P/N 529 035 570)

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)

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
415 082 200	MX Z - Front
415 082 300	MX Z - Center
415 082 400	MX Z - Rear
415 086 400	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
415 082 200	1998 MX Z	145.5 mm (Front)
415 082 300	1998 MX Z	133.5 mm (Center)
415 082 400	1998 MX Z	174.5 mm (Rear)
415 086 400	1998 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.

HPG T/A Shock Spare Parts

SHIMS

P/N	SIZE (mm)	MOQ (minimum order quantity)
415 039 100	30 × .254	5
414 888 318	30 × .203	15
414 888 319	30 × .152	1
414 888 20	28 × .203	5
414 888 321	28 × .152	5
415 039 000	26 × .254	5
414 888 322	26 × .203	5
414 888 323	26 × .152	50
414 888 324	22 × .203	5
414 888 325	22 × .152	5
414 888 326	20 × .203	5
414 888 327	20 × .152	5
414 888 328	20 × .144	5
414 888 329	18 × .203	5
414 888 330	18 × .152	5
414 888 331	16 × .254	10
414 888 332	16 × .203	10
414 888 333	16 × .152	10
415 038 900	16 × .114	10
414 888 334	15 × .254	10
414 888 335	15 × .203	10
414 888 336	15 × .152	10
414 888 337	15 × .114	10
414 888 338	12 × .203	10
414 888 339	12 × .152	10
415 038 800	12 × .114	10
414 888 340	21 × .114	10
414 888 341	24 × .114	10

PISTONS

P/N	SIZE	MOQ (minimum order quantity)
414 888 304	0 slit	1
414 888 305	2 slits	2
414 888 306	4 slits	1
414 888 307	6 slits	1
415 127 408	1 slit	

1999 MX Zx

REAR SHOCK SHIMS

P/N	SIZE (mm)	MOQ (minimum order quantity)
503 189 011	22 × .114	
503 189 012	22 × .152	
503 189 013	22 × .203	
503 189 014	22 × .254	
503 189 015	22 × .305	
503 189 016	24 × .114	
503 189 017	24 × .152	
503 189 018	24 × .203	
503 189 019	24 × .254	
503 189 020	24 × .305	
503 189 021	26 × .114	
503 189 022	26 × .152	
503 189 023	26 × .203	
503 189 024	26 × .254	
503 189 025	26 × .305	
503 189 026	28 × .114	
503 189 027	28 × .152	
503 189 028	28 × .203	
503 189 029	28 × .254	
503 189 030	28 × .305	
503 189 031	30 × .114	
503 189 032	30 × .152	
503 189 033	30 × .203	
503 189 034	30 × .254	
503 189 035	30 × .305	
503 189 036	36 × .152	
503 189 037	36 × .203	
503 189 038	36 × .254	
503 189 039	40 x 114	
503 189 040	40 x 203	
503 189 041	40 x 254	

Miscellaneous

P/N	DESCRIPTION
414 956 600	96/97 MX Z T/A front damper unit
414 953 900	96/97 MX Z T/A center damper unit
414 954 000	96/97 MX Z T/A rear damper unit
415 039 300	97 MX Zx T/A front damper unit R.H.
415 039 302	97 MX Zx T/A front damper unit L.H.
415 953 900	97 MX Zx T/A center damper unit
414 954 000	97 MX Zx T/A rear damper unit
415 114 600	98 MX Zx T/A front damper unit R.H.
415 114 602	98 MX Zx T/A front damper unit L.H.
415 106 700	98 MX Zx T/A center damper unit
415 106 800	98 MX Zx T/A rear damper unit
415 082 200	98 MX Z front damper unit T/A
415 082 300	98 MX Z center damper unit T/A
415 082 400	98 MX Z rear damper unit T/A
415 086 400	98 Summit x rear damper unit T/A
505 070 128	99 MX Zx front damper unit R.H. T/A
505 070 127	99 MX Zx front damper unit L.H. T/A
503 189 078	99 MX Zx center damper unit T/A
503 189 079	99 MX Zx rear damper unit T/A
505 070 180	99 MX Z 500/670 HO front damper unit T/A
503 188 916	99 MX Z 500/670 HO center damper unit T/A
503 188 915	99 MX Z 500/670 HO rear damper unit T/A
505 070 186	99 MX Z 600 front damper unit T/A
503 188 913	99 MX Z 600 center damper unit T/A
503 188 912	99 MX Z 600 rear damper unit T/A
503 188 917	99 Summit x rear damper unit T/A

P/N	DESCRIPTION
414 862 102	Cylinder body without bearing front
414 861 902	Cylinder rod without bearing front
414 861 502	Cylinder rod without bearing center
414 862 103	Cylinder rod without bearing rear
414 925 702	Cylinder body without bearing center
414 861 503	Cylinder body without bearing rear
414 562 900	Spherical bearing
371 905 000	Circlip
414 888 300	Seal carrier assembly with O-ring
414 888 301	O-ring for seal carrier
414 888 302	Rubber cushion
414 888 303	Compression valve stopper D33 x T4
414 888 308	Rebound valve stopper D17 x T2
414 888 309	Washer
414 888 310	Piston nut with spring lock
414 888 311	Floating piston with O-ring for 1994/95 HPG
415 038 700	Floating piston with O-ring for 1996 HPG
414 888 312	O-ring for floating piston for all 1994/95/96 models
414 888 313	Gas valve cap ass'y with rubber
414 888 314	Gas valve ass'y with O-ring
414 888 315	O-ring for gas valve
414 888 316	Threaded spring collar
414 762 500	Threaded jam collar
414 956 600	Optional MVA shaft for C7 rear shocks
414 888 317	Spring stopper for MVA use
414 956 600	96 MX Z T/A Front damper unit
414 953 900	96/97 MX Z T/A Center damper unit
414 954 000	96/97 MX Z T/A Rear damper unit
415 039 300	97 MX Zx T/A Front damper unit RH
415 039 302	97 MX Zx T/A Front damper unit LH
415 953 900	97 MX Zx T/A Center damper unit
414 954 000	97 MX Zx T/A Rear damper unit

Shock Calibration

MODEL	FRONT/SKI SHOCK	CENTER SHOCK	REAR SHOCK
1997 MX Z 440			
— Compression	8 x 30 x .152	10 x 30 x .203	7 x 30 x .203
	2 x 15 x .114	3 x 16 x .203	3 x 15 x .203
	4 slit piston	4 slit piston	2 slit piston
— Rebound	1 x 12 x .203	1 x 12 x .203	1 x 15 x .203
	5 x 26 x .203	8 x 26 x .152	10 x 26 x .152
	IFP 151 mm	IFP 141 mm	IFP 190 mm
1998 MX Z 583 & 670			
— Compression	8 x 30 x .152	10 x 30 x .203	7 x 30 x .203
	2 x 15 x .114	3 x 16 x .203	3 x 15 x .203
	4 slit piston	4 slit piston	2 slit piston
— Rebound	5 x 26 x .203	8 x 26 x .152	10 x 26 x .152
	1 x 12 x .203	1 x 12 x .203	1 x 15 x .203
	IFP 144.5 mm	IFP 133.5 mm	IFP 174.5 mm
1998 SUMMIT x			
— Compression			8 x 30 x .152
			3 x 15 x .203
			6 slit piston
— Rebound			8 x 26 x .152
			1 x 12 x .203
			IFP 201 mm
1997 MX Zx			
— Compression	3 x 30 x .203	10 x 30 x .203	3 x 30 x .203
	1 x 12 x .114	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
	6 slit piston	4 slit piston	2 slit piston
— Rebound	9 x 26 x .203	8 x 26 x .152	9 x 26 x .203
	1 x 15 x .203	1 x 12 x .203	1 x 15 x .203
	IFP 40 mm	IFP 141 mm	IFP 190 mm

MODEL	FRONT/SKI SHOCK	CENTER SHOCK	REAR SHOCK
1998 MX Zx			
— Compression	5 x 30 x .203	5 x 30 x .203	5 x 30 x .203
	1 x 15 x .152	1 x 15 x .152	1 x 15 x .152
	2 x 30 x .254	3 x 30 x .254	3 x 30 x .254
	1 x 24 x .152	2 x 28 x .203	1 x 21 x .114
	1 x 20 x .114	1 x 22 x .152	5 x 30 x .254
	1 x 16 x .114	1 x 18 x .152	2 x 28 x .203
		1 x 16 x .114	1 x 26 x .203
			1 x 24 x .152
			1 x 21 x .114
	6 slit piston	4 slit piston	1 slit piston
— Rebound	6 x 26 x .254	7 x 26 x .254	6 x 26 x .203
	1 x 15 x .203	1 x 20 x .203	1 x 16 x .152
		1 x 15 x .152	6 x 26 x .254
			1 x 22 x .203
			1 x 15 x .114
	IFP 40 mm	IFP 141 mm	IFP 176 mm
1999 MX Zx			
— Compression	3 x 30 x .152	3 x 30 x .203	3 x 40 x .203
	1 x 15 x .152	1 x 16 x .152	1 x 24 x .203
	7 x 30 x .152	4 x 30 x .254	4 x 40 x .254
	1 x 24 x .114	1 x 26 x .203	1 x 36 x .203
	1 x 16 x .114	1 x 24 x .114	1 x 30 x .254
		1 x 21 x .114	1 x 26 x .152
	6 slit piston	4 slit piston	2.0 mm slit piston
— Rebound	10 x 26 x .152	1 x 26 x .152	9 x 36 x .254
	1 x 15 x .203	1 x 21 x .114	1 x 24 x .203
		7 x 26 x .254	
		1 x 15 x .152	
	IFP 54 mm	IFP 134.5 mm	IFP 187 mm

MODEL	FRONT/SKI SHOCK	CENTER SHOCK	REAR SHOCK
1999 MX Z 500/670			
— Compression	8 x 30 x .152	10 x 30 x .203	7 x 30 x .203
	2 x 15 x .114	3 x 16 x .203	3 x 15 x .203
	4 slit piston	4 slit piston	2 slit piston
— Rebound	5 x 26 x .203	8 x 26 x .152	10 x 26 x .152
	1 x 12 x .203	1 x 12 x .203	1 x 15 x .203
	IFP 149 mm	IFP 144 mm	IFP 184 mm
1999 MX Z 600			
— Compression	7 x 30 x .152	4 x 30 x .203	12 x 30 x .152
	3 x 15 x .203	3 x 16 x .203	3 x 15 x .203
	2 slit piston	4 slit piston	2 slit piston
— Rebound	8 x 26 x .152	4 x 26 x .152	8 x 26 x .203
	1 x 12 x .203	1 x 12 x .203	1 x 12 x .203
	IFP 172 mm	IFP 138 mm	IFP 169 mm
1999 SUMMIT x			
— Compression			2 x 30 x .152
			1 x 12 x .254
			2 x 26 x .203
			3 x 12 x .203
			6 slit piston
— Rebound			12 x 26 x .203
			1 x 12 x .203
			IFP 204 mm

SHOCK CALIBRATION WORK SHEET

MODEL: ______________________________ DATE: ____________________

RIDING CONDITIONS: ____

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

NOTES: ____

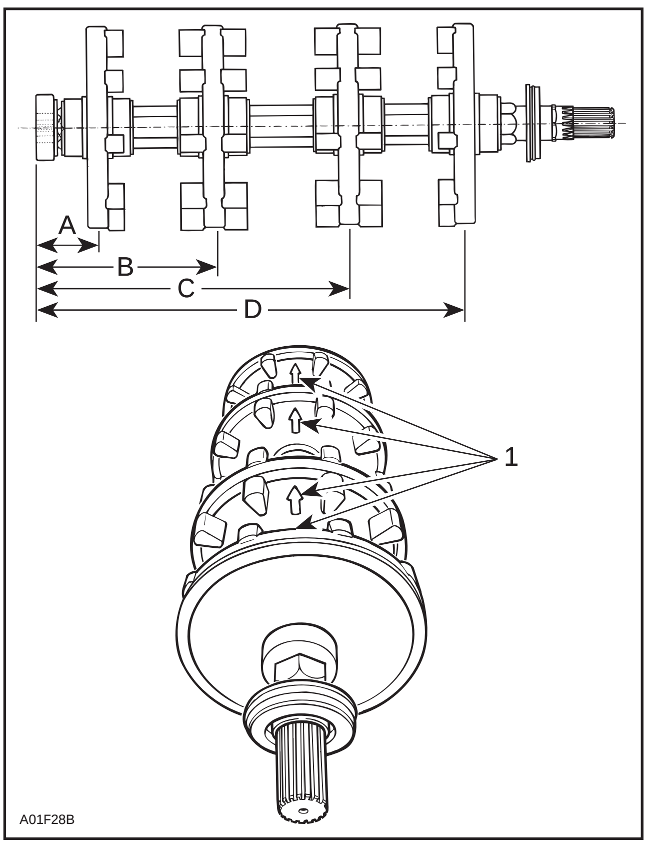
CHASSIS SET-UP

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)
B. 159.3 mm (6-17/64 in)
C. 282.3 mm (11-7/64 in)
D. 375.8 mm (14-51/64 in)

1995/1999 All S-Series DSA
1993/1997 All F-Series DSA

Use a press or special tool (P/N 861 725 700) 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.

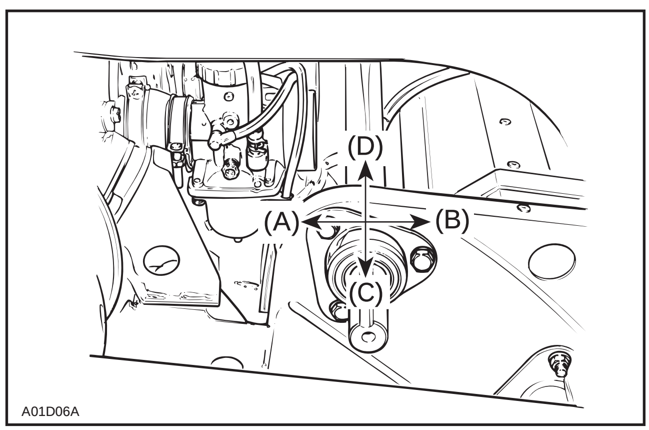
▼ CAUTION

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.

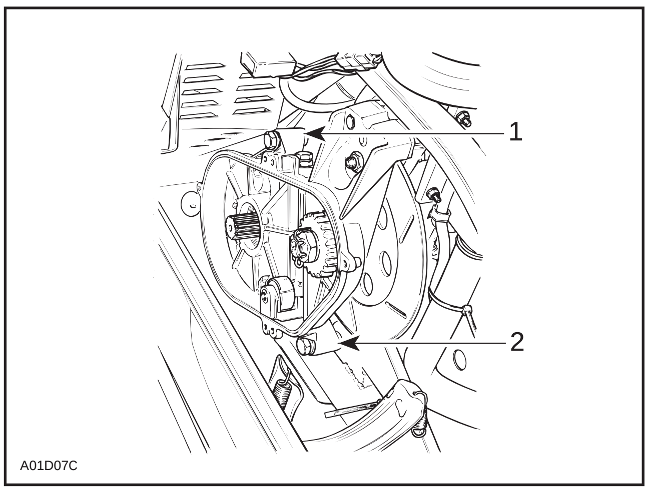
With both left shaft ends free, you can see if the shafts are centered in their bearing mount holes.



TYPICAL

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.

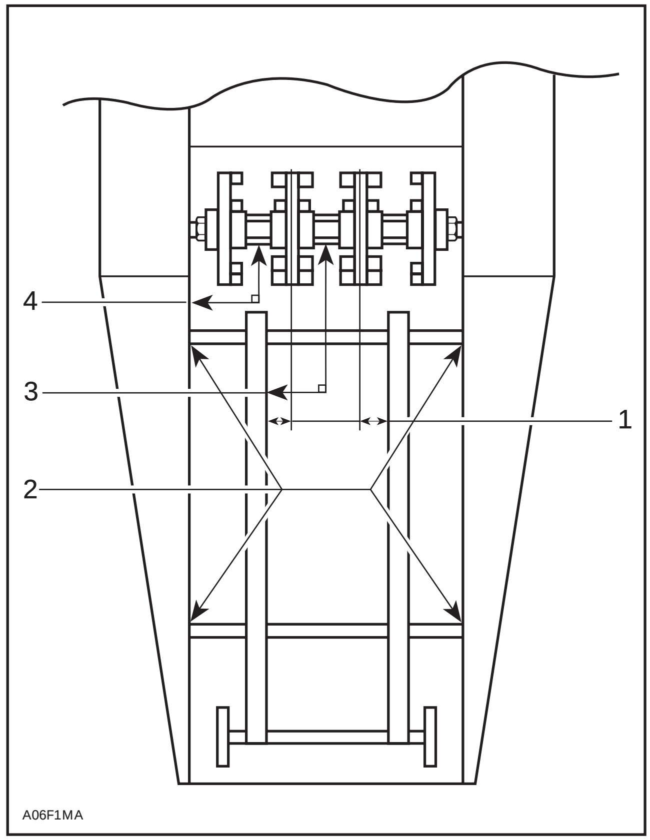
Now, reinstall the left end bearing housing. Using a large carpenters square, check to see that the drive axle is square (90°) with the tunnel. If not, slot the left end bearing housing holes and reshim the chaincase to square up the drive axle and the countershaft.



TYPICAL

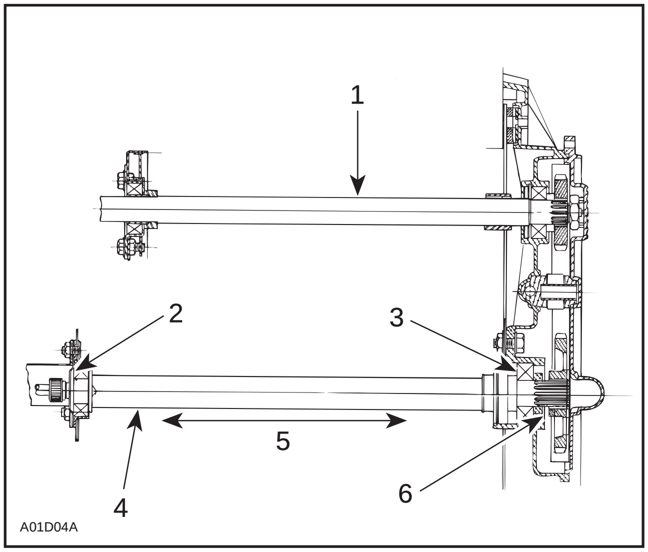
1. *Shim location*
2. *Shim location*

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.



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).

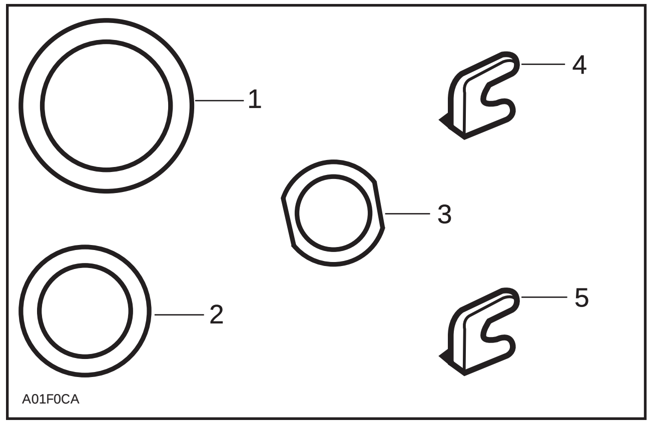


TOP VIEW
1. *Countershaft*
2. *Shim position on end bearing housing side*
3. *Shim position on chaincase side*
4. *Drive axle*
5. *Axial play*
6. *Shim between sprocket and spacer*

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.



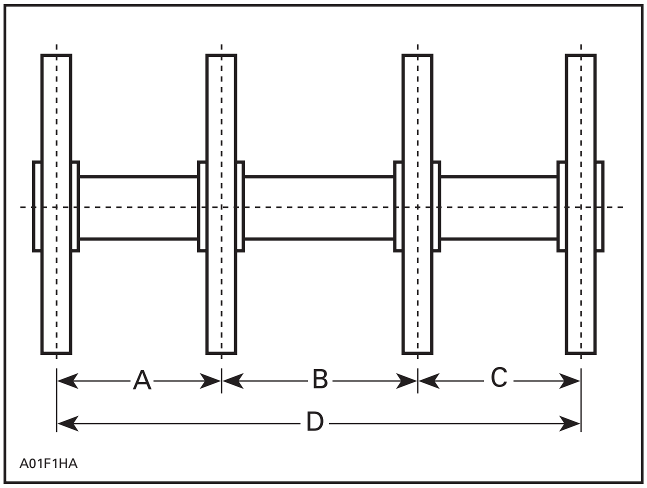
1. *P/N 501 020 500*
   Shim, Drive Axle End Bearing Housing 1.6 mm (.063 in) Thick
2. *P/N 414 605 300*
   Shim, Drive Axle Chaincase Side 1.6 mm (.063 in) Thick
3. *P/N 506 041 400*
   Shim, Drive Axle Chaincase Side 1.6 mm (.063 in) Thick
4. *P/N 504 030 700*
   Shim, Chaincase Perpendicularity 1 mm (.040 in) Thick
5. *P/N 504 039 800*
   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.

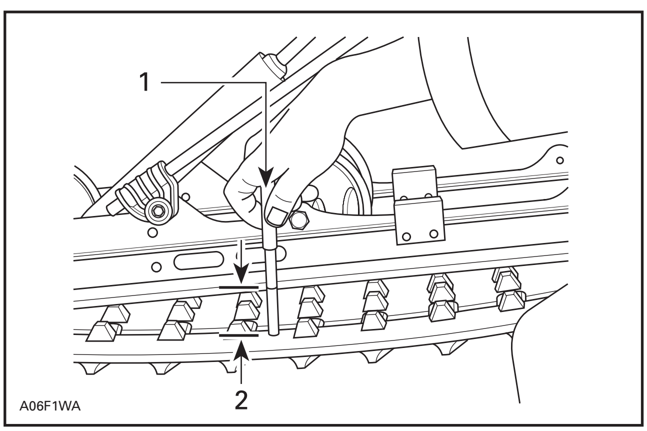


A. 101.5 mm (3-63/64 in)
B. 123 mm (4-27/32 in)
C. 101.5 mm (3-63/64 in)
D. 326 mm (12.83 in)

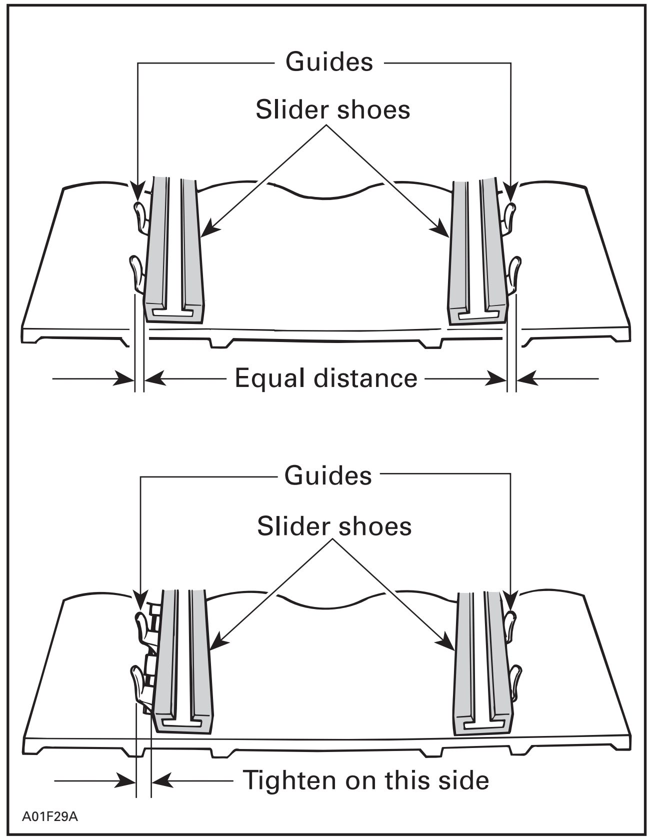
When you have reinstalled the track and suspension, make certain that all bolts attaching the suspension to the chassis are installed with high strength threadlocker (Loctite 271), and that bolts are properly torqued.

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 413 706 100).

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.

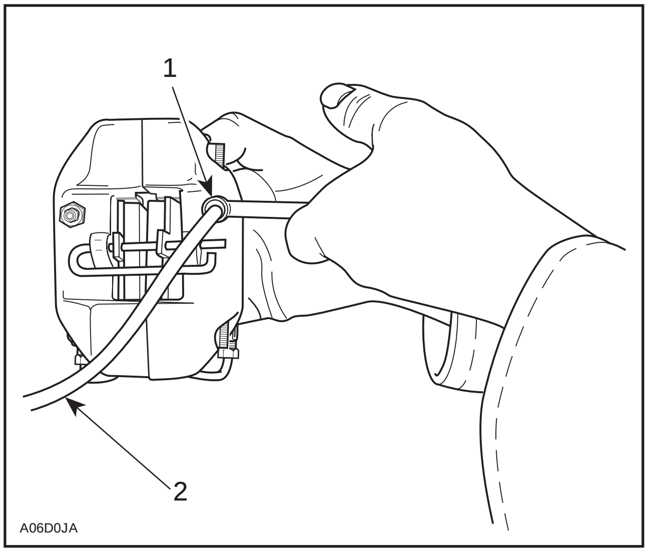


TYPICAL
1. 7.3 kg (16 lb)
2. Deflection



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 baloon 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 time brake lever and while holding brade 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 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.

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 861 744 200) 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).

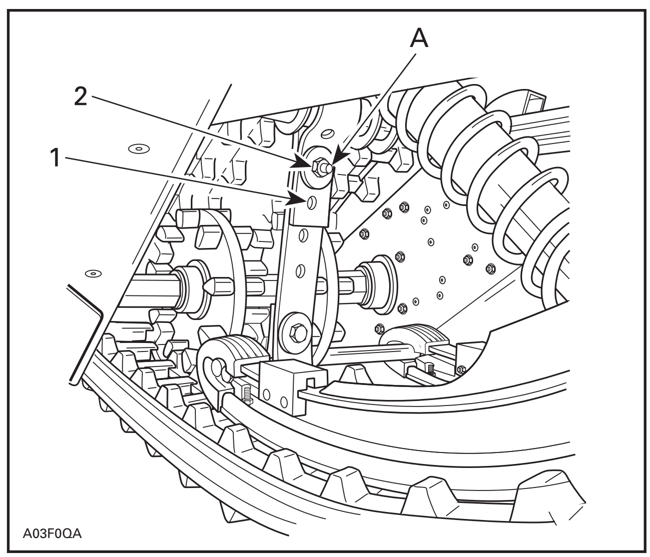
The threaded adjusters can be loosened to provide the desired amount of spring preload.

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 486 078 500) and (P/N 486 078 600). Install bushings (P/N 572 086 100).

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 486 078 500) and (P/N 486 078 600). Install bushings (P/N 572 086 100).



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 414 955 300) is available for the vehicles with the strap and bolt style.

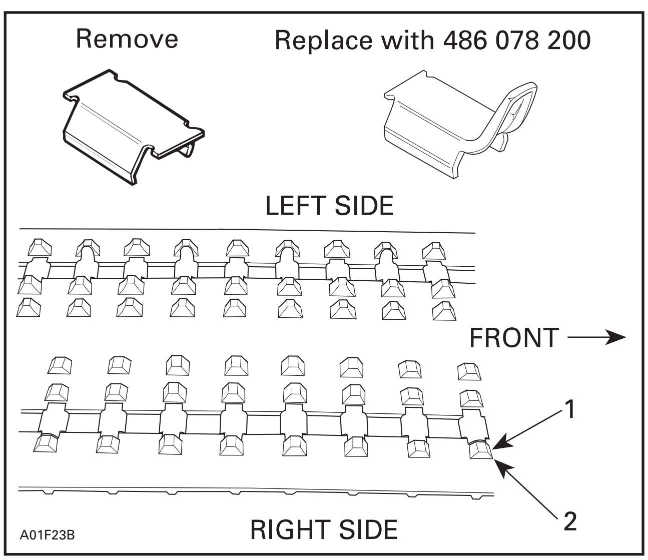
Quick Adjust Limiters may also be used. The (P/N 861 760 200) is for the 1997 MX Zx and 1997/98 MX Z 440/500/583/670. Use (P/N 486 078 100) for the 1997 MX Z 440F and (P/N 861 765 500) for the 1998 MX Zx. The Quick Adjust Limiter will allow you to shorten or lengthen the length of the limiter straps 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 486 078 200) 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 486 078 200

NOTE: When installing taller track guides or studs part (P/N 572 086 100), 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 encounted, 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.

P/N 529 028 700 Guide clip remover.

P/N 529 008 500 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.

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.

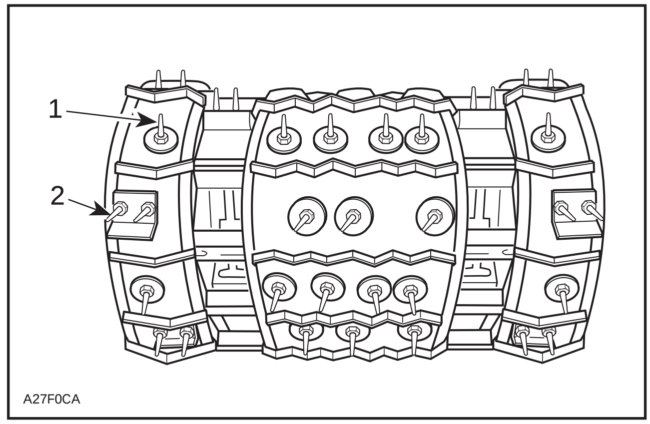
Hooker plates are welded to the track cleats and place the studs directly beneath the slider shoes for maximum pressure. The hooker setup is very hard on tracks, particularly the fiberglass reinforcing rods.

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.

▼ CAUTION

Check condition of heat exchanger after every race.

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.

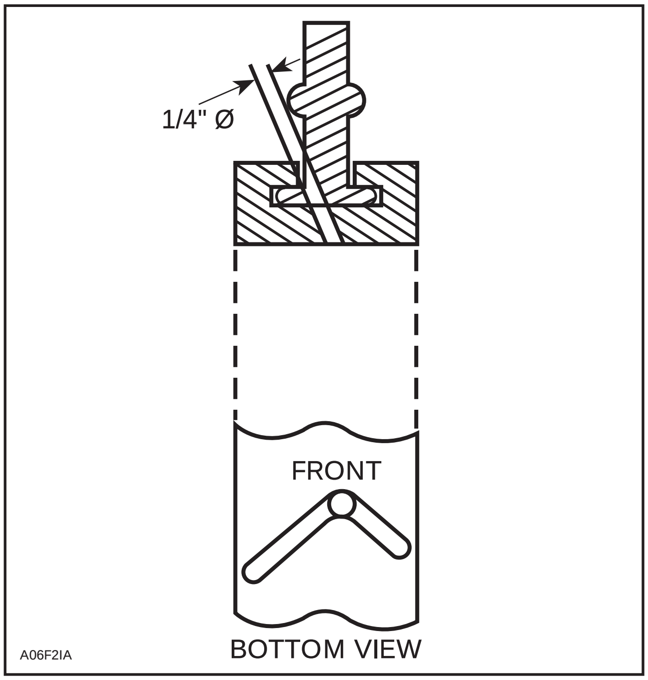
The 2 front nozzles should be located on each runner where the track just begins to touch the slider shoe. Drill a 1/4 inch diameter hole on the inner side of each runner down through the runner and slider shoe. Using red or green Loctite, insert a 1/4 inch diameter by 1-1/2 inch long roll pin in each 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	403 800 400
Impulse hose	1	414 286 700 (10 ft)
Hose clamp (1/4″ D)	4	408 801 100
Fuel line (1/4″ D)	1	414 834 000 (25 ft roll)
Tee (1/4 × 1/4 × 1/4)	3	414 155 300
Spring clamp (for fuel line)	@	414 554 800
Shutoff valve	1	414 539 000
Lube tank (1 to 1-1/2 gallon)	1	N.A.
Roll pin (1/4″ dia. × 1-1/2″)	4	N.A.
Locking tie	@	414 115 200 (package of 25)

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



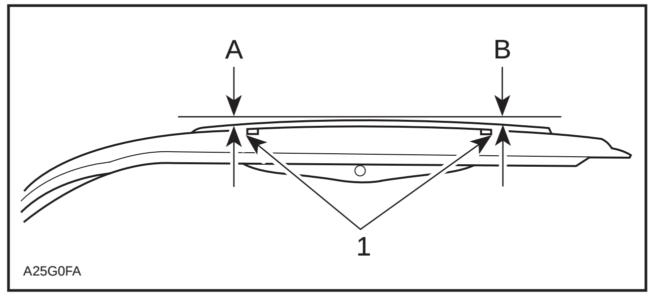
NOTE: Before installing a lubrication system check with your sanctioning body or race organization. In some cases, use of this system and/or certain lubricants is not allowed.

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 860 600 200).

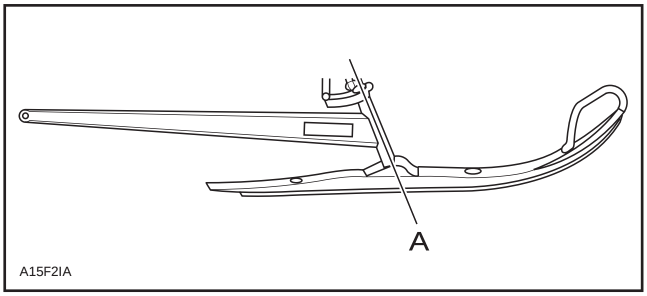
Plastic skis or liners are good for a 2 MPH increase in speed in most snow conditions, more in sticky snow conditions.

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.



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

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

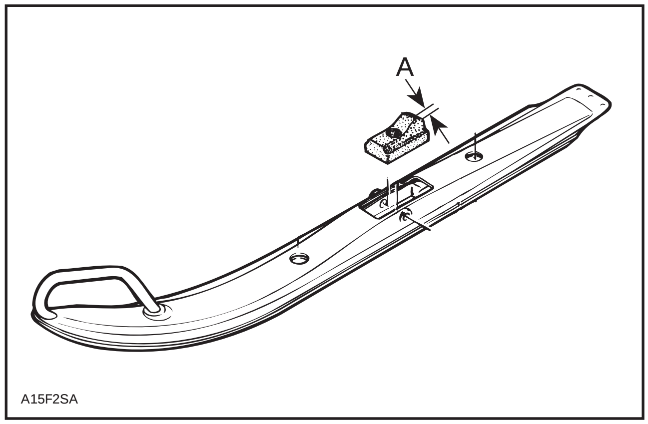
Once you have determined how much carbide you will be using, make up at least one more set. Sharp carbides dig! They must be sharp enough that when you drag your thumb nail over them, they will scrape off some of the nail. To keep your carbide runners is this condition, you must sharpen them every 5 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.

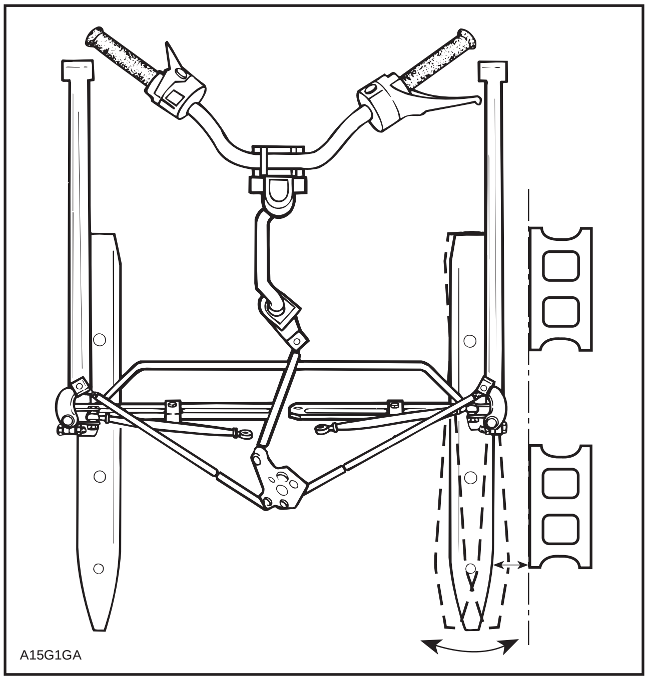


A. 3 mm (1/8 in)

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.



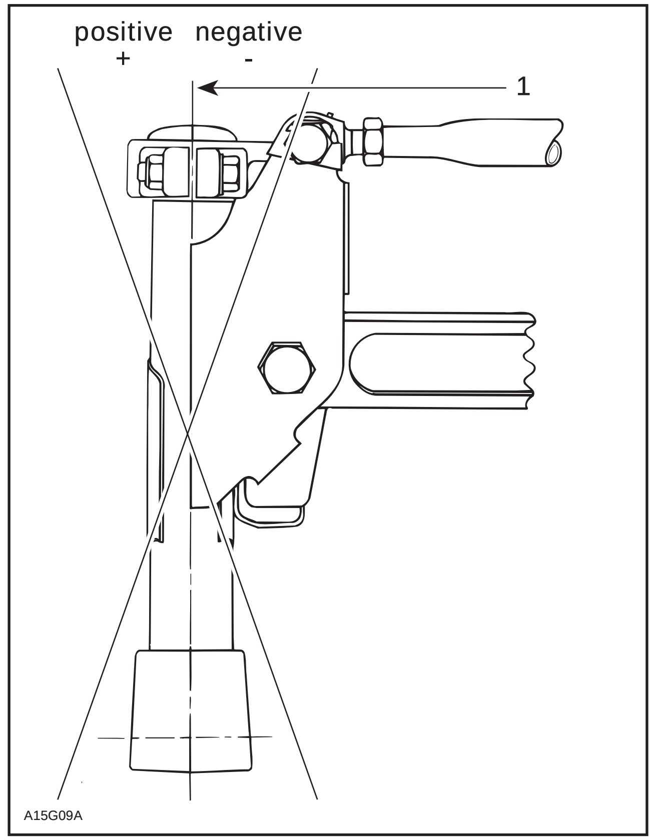
Lift the ski up to its upper travel limit. Using a measuring tape, measure the distances from the front and rear edges of the ski to the concrete block reference. The front and rear measurements must be equal or no more than 1.6 mm (1/16 in) difference if the bump steer adjustment is correct.

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.

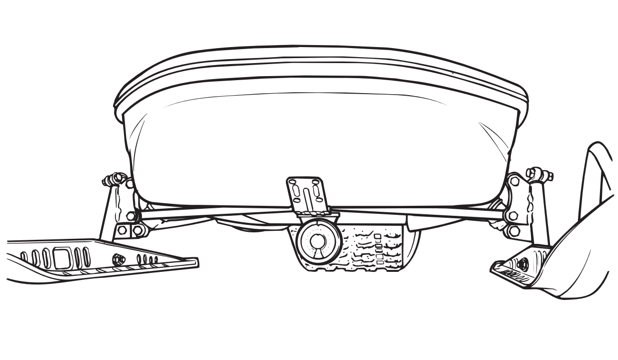
Camber angle is measured using an angle finder available from most tool supply stores.

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

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.



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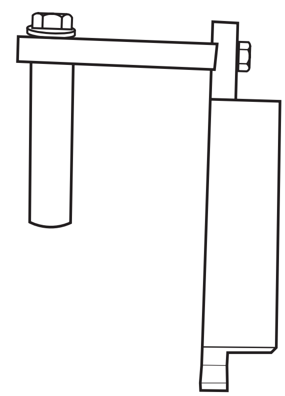
– Remove the black plastic cap from the spindle.
– Insert camber angle tool (P/N 529 021 600) into the spindle.
– Place an Angle Finder squarely on the Camber angle tool.
– Loosen the lock nuts on the upper radius rods.

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 529 021 600)

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

Suggestion: K-D tool no. 2968



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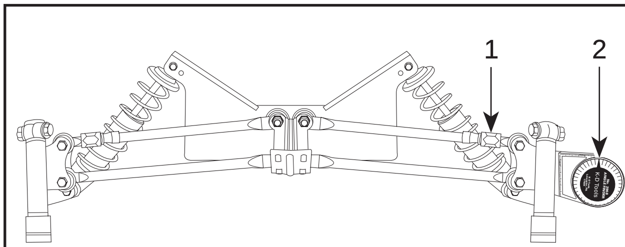
APPLICATION

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.



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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.

SKI TOE OUT

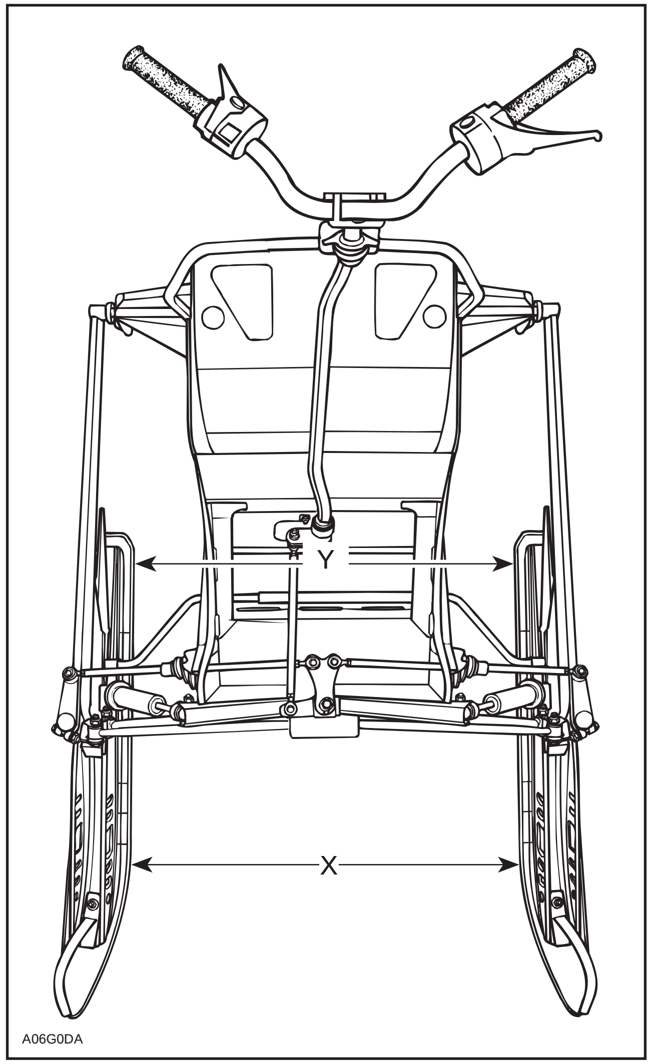
Most oval racers use modified handlebars with loops or angles on the left end. Often a driver prefers a handlebar position that is not horizontal when the skis are in their straight ahead position. This allows a more comfortable driving position when in a corner. Whatever handlebar you prefer should 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 ± 3 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.
3. General handling problems.
   a. Machine darts from side to side on straightaway.
   – 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 in to 2 in (25 mm to 50 mm) less than the fully extended dimension.
– If the vehicle settles more than 2 in (50 mm), increase the rear spring preload.
– If the vehicle settles less than 1 in (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 preload 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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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

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

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.

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.

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

YEAR	P/N
1996	
Vol. 1	484 062 800 Élan, Tundra II LT, Touring E/E LT/LE/SLE Formula S/SL, Skandic 380/500
Vol. 2	484 062 801 Grand Touring 500/580/SE Formula SLS/STX/STX LT(2) Summit 500, Mach 1
Vol. 3	484 062 802 MX Z 440/583 Formula Z/SS/III/III LT Summit 583/670 Mach Z/Z LT Skandic WT
1997	
Vol. 1	484 064 700 Tundra II LT, Touring E/E LT/LE/SLE Formula S/SL, Skandic 380/500
Vol. 2	484 064 701 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	484 064 702 Formula III/III LT Mach 1, Mach Z/Z LT

YEAR	P/N
1998	
Vol. 1	484 068 000 Tundra II LT, Touring E/E, Formula S/S Electric/SL, Skandic 380/500
Vol. 2	484 068 200 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	484 068 400 Grand Touring 700/SE, Mach 1/1 R/Z/Z R/ZLT/Z LTR Formula III 600/600 R/600 LT/ 700/700 R
1999	
Vol. 1	484 200 001 Tundra R, Skandic 380/500 Touring E/LE/SLE Formula S/SL Formula Deluxe 380/500
Vol. 2	484 200 003 Grand Touring Summit 500/670 X MX Z 440/500/670 HO Formula Z 500/Deluxe 500 LC/Z 583/ Deluxe 583/Z 670/Deluxe 670
Vol. 3	484 200 005 Grand Touring 700 SE Formula III 600/700/800 Mach 1/1R Mach Z/Z M.H. R/Z LT/Z LTR

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.
TDC	Top Dead Center: The position of the piston when it reaches the upper limit of its travel inside the cylinder. BTDC: Before Top Dead Center ATDC: After Top Dead Center.
BDC	Bottom Dead Center: The position of the piston when it reaches the lower limit of its travel inside the cylinder. BBDC: Before Bottom Dead Center ABDC.: After Bottom Dead Center.
Bore	Diameter of the cylinder.
Stroke	The maximum movement of the piston from BDC to TDC. It is characterized by 180° of crankshaft rotation.
Combustion Chamber	Space between cylinder head and piston dome at TDC.
Displacement	The volume of the cylinder displaced by the piston as it travels from TDC. to BDC. The formula is: $\frac{Bore^2 \times Stroke \times \pi}{4}$ 20 = (π = 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.

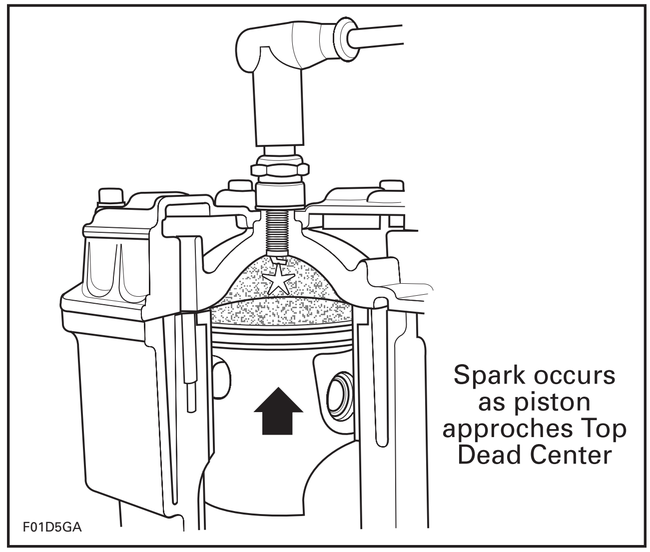
Combustion Process

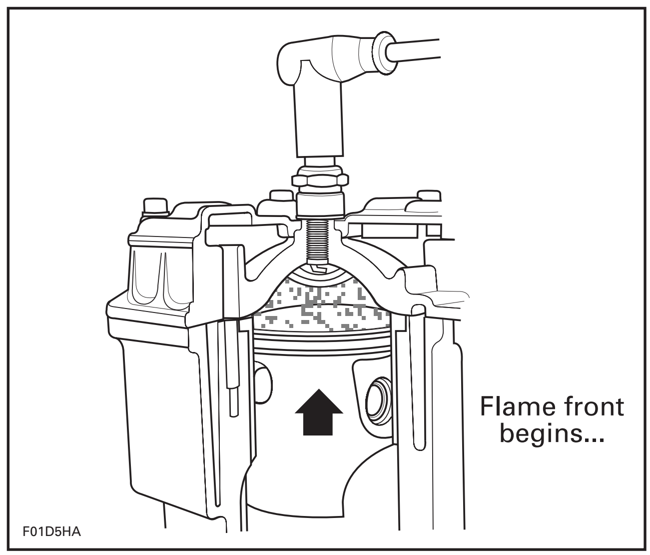
NORMAL COMBUSTION

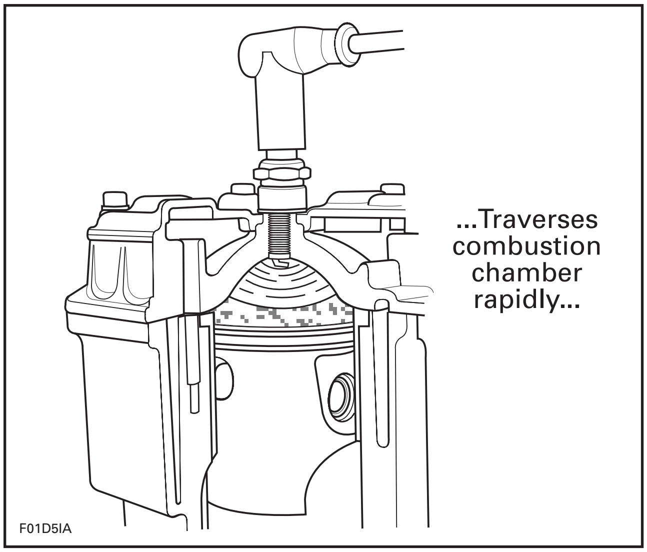
Since the beginning of this study we have spoken of air/fuel mixture combustion rather than explosion. This combustion is a slow then accelerated burning of the mixture within the combustion chamber. Ignition occurs with the firing of the spark plug.

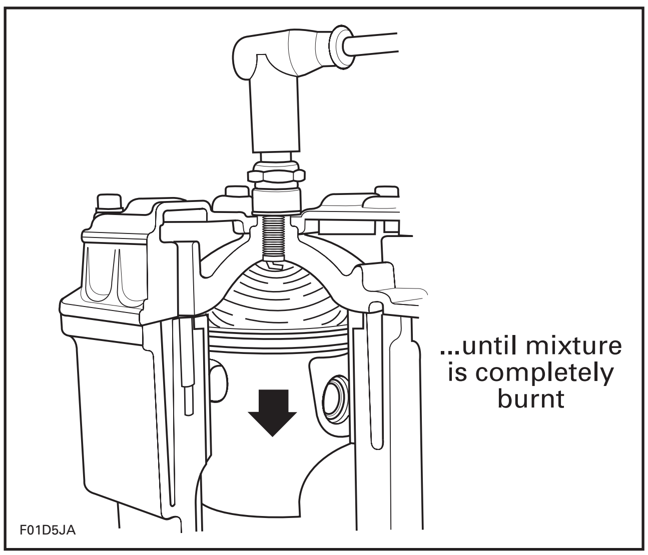
This initial process generates heat and pressure which in turn, is transmitted by conduction to the contiguous portion of the unburned mixture. When this portion has reached the point of self-ignition it starts to burn releasing more pressure and heat.

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.







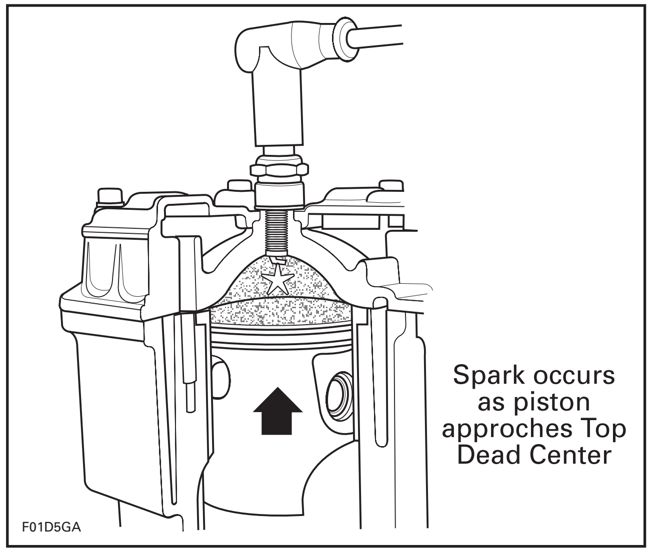


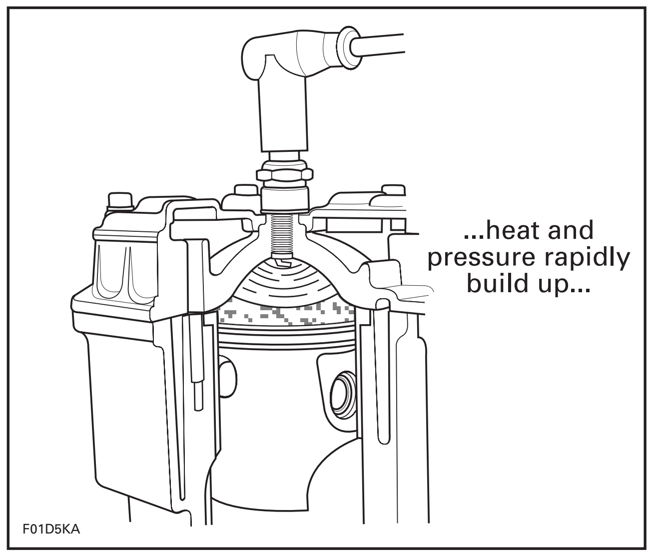
With all operating parameters correct, normal combustion will take place. However, if for some reason the temperature inside the cylinder is increased during combustion, abnormal combustion will occur and lead to serious engine damage.

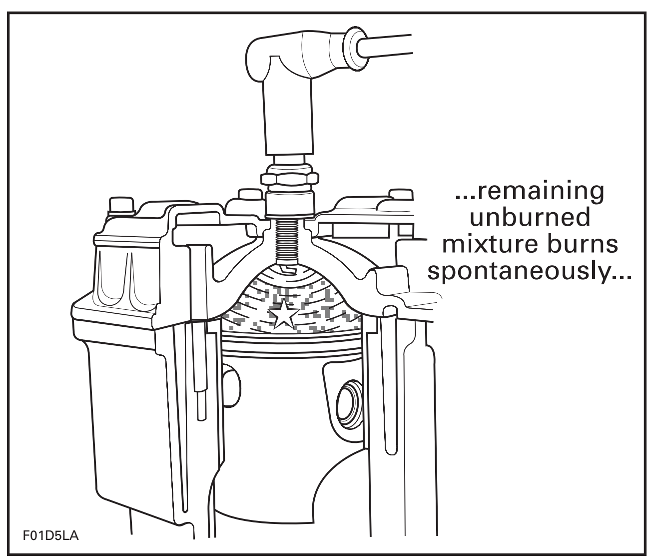
DETONATION

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.



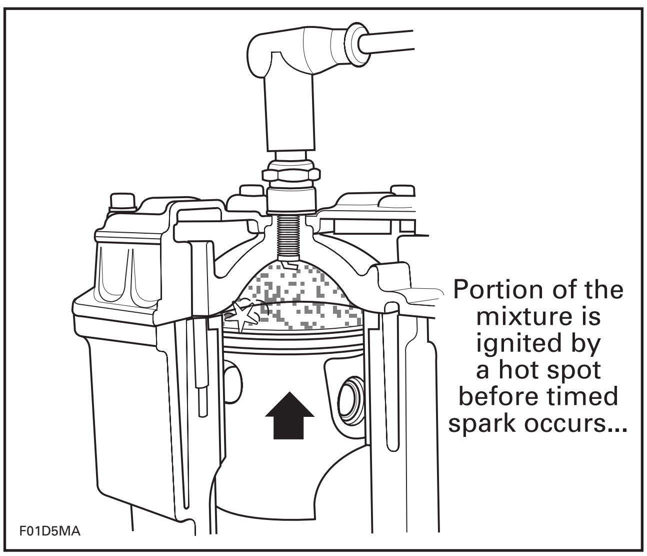


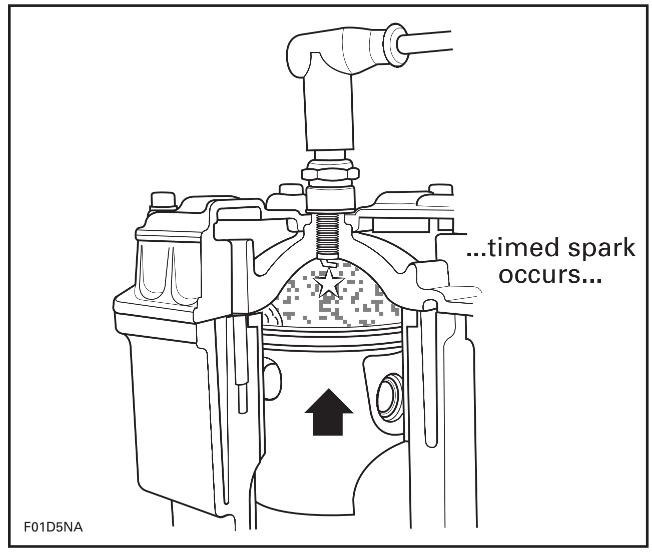


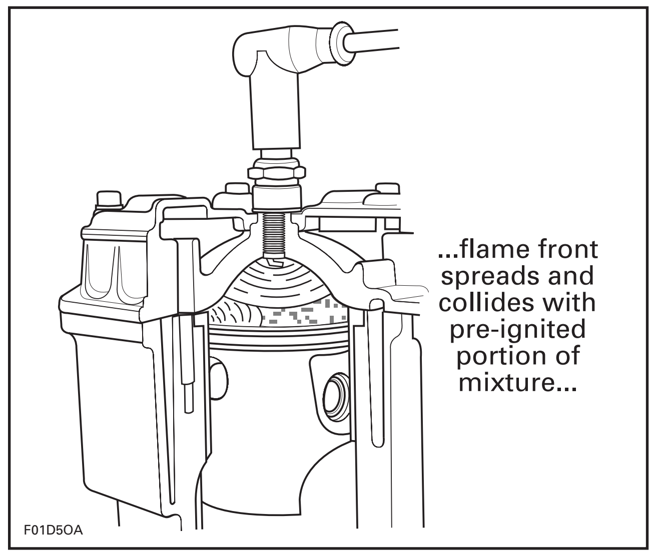
These shock waves can sometimes be heard as pinging. While these shock waves can be detrimental to the mechanical integrity of the engine, it is the excessive heat that causes most problems in 2-strokes. The piston may expand excessively causing a seizure or the piston may melt. The melting will occur 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.

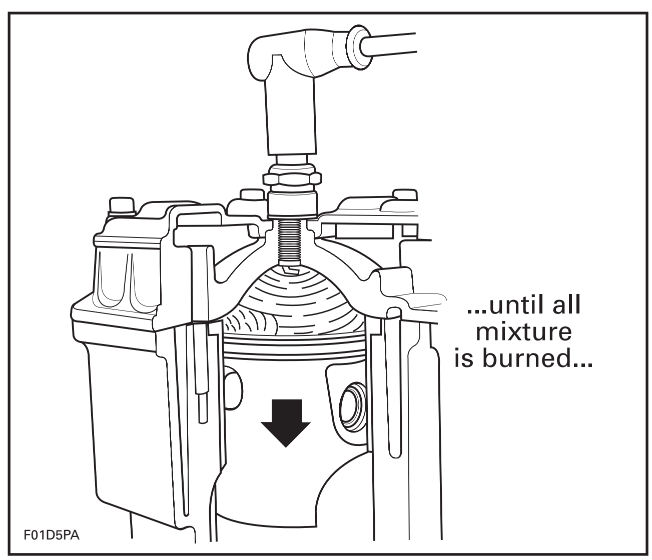
PRE-IGNITION

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.









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

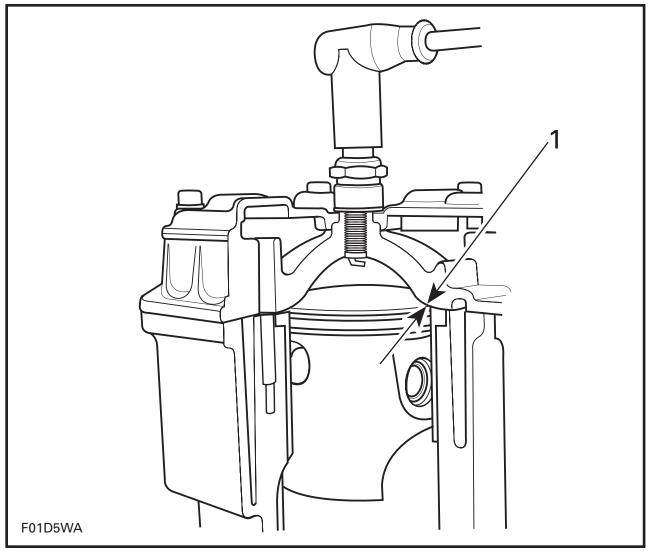
General overheating

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.

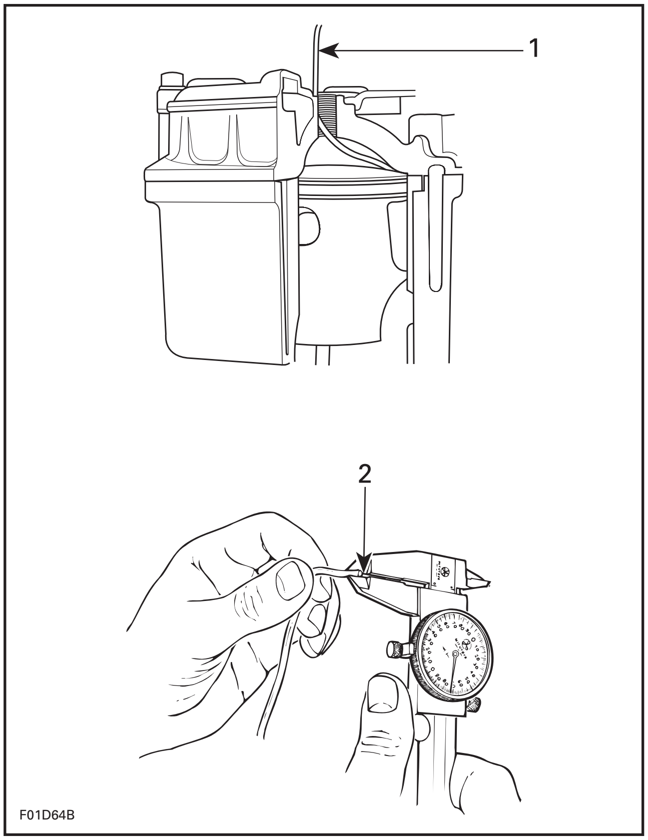


1. *Squish area 1.27 – 1.78 mm (.050 – .070 in)*

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 TDC, 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

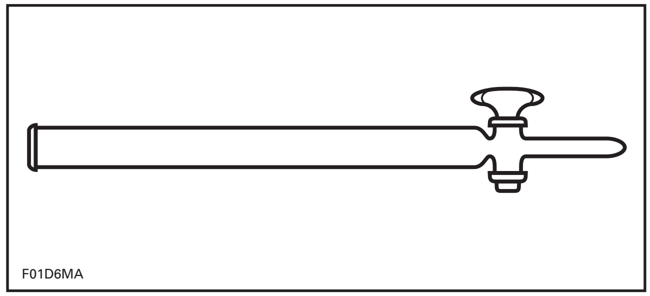
Measuring a Compression Ratio

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

Remove one spark plug and place piston at TDC.

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

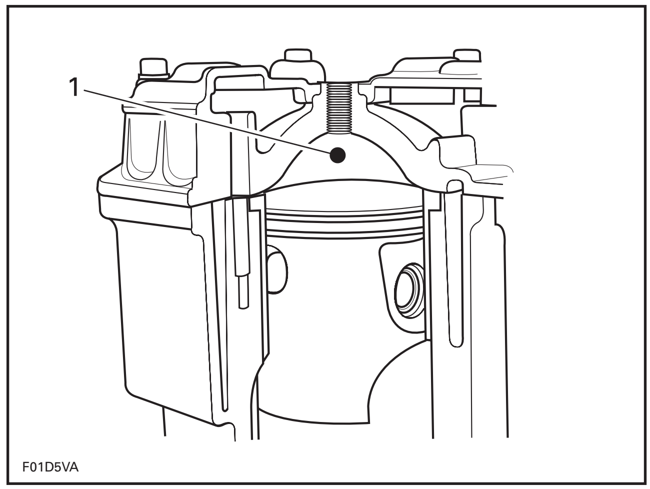
NOTE: Suggested burette, Canlab no. 8-000/T, or equivalent.



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.

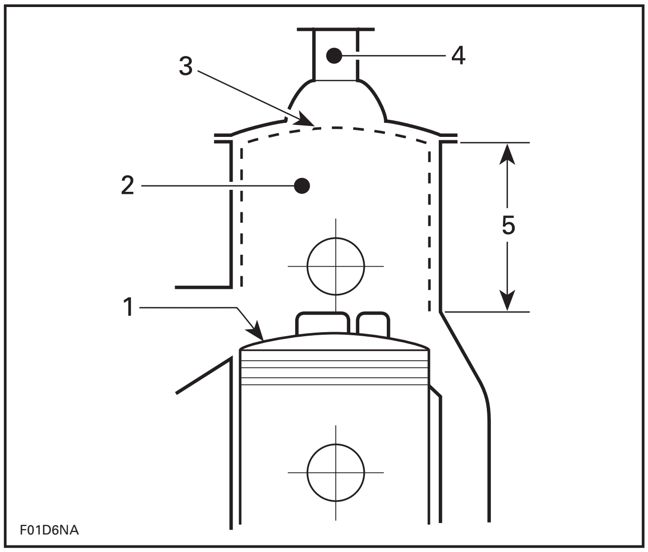
$$C.R. = \frac{V_1 + V_2}{V_2}$$

Where:

C.R. = compression ratio: 1

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

V_2 = minimum combustion chamber volume



1. BDC
2. V_1
3. TDC
4. V_2
5. Stroke

EXAMPLE:

$\pi = 3.14$
B = Bore diameter (cm) = 7.2 (= 72 mm)
S = Stroke (cm) = 6.1 (= 61 mm)
V_2 = 21.5 cc

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

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

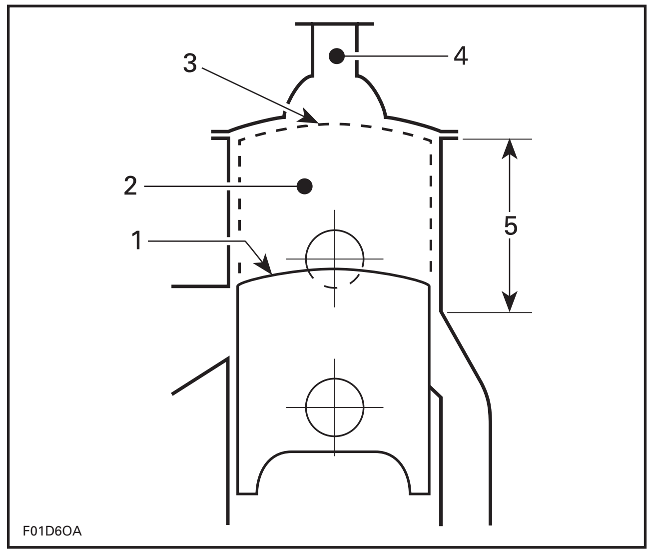
$$C.C.R. = \frac{V_3 + V_2}{V_2}$$

Where:

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

V_3 = volume of a cylinder with piston just 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. TDC
4. V_2
5. Portion of stroke

EXAMPLE:

$\pi = 3.14$
B = Bore diameter (cm) = 7.2 (= 72 mm)
S_1 = Portion of stroke (cm) = 3.1 (= 31 mm)
V_2 = 21.5 cc

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

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

π = 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")

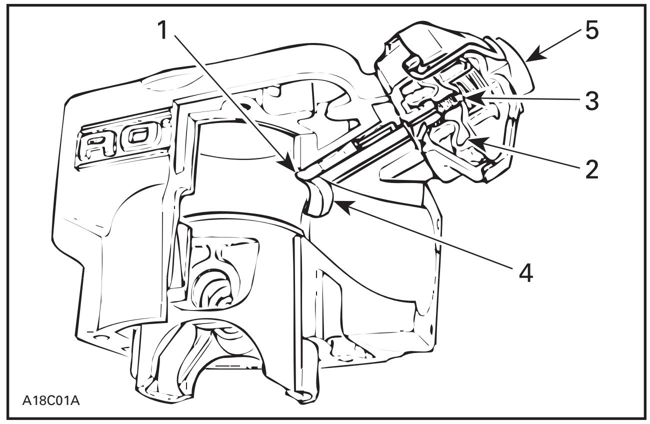
OPERATION OF THE RAVE VALVE (RAVE = ROTAX ADJUSTABLE VARIABLE EXHAUST)

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.



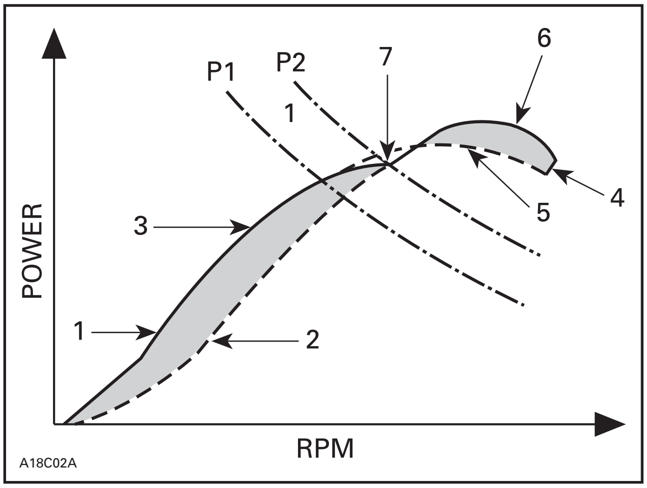
1. Guillotine
2. Diaphragm
3. Return spring
4. Exhaust port
5. Red plastic adjustment knob

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

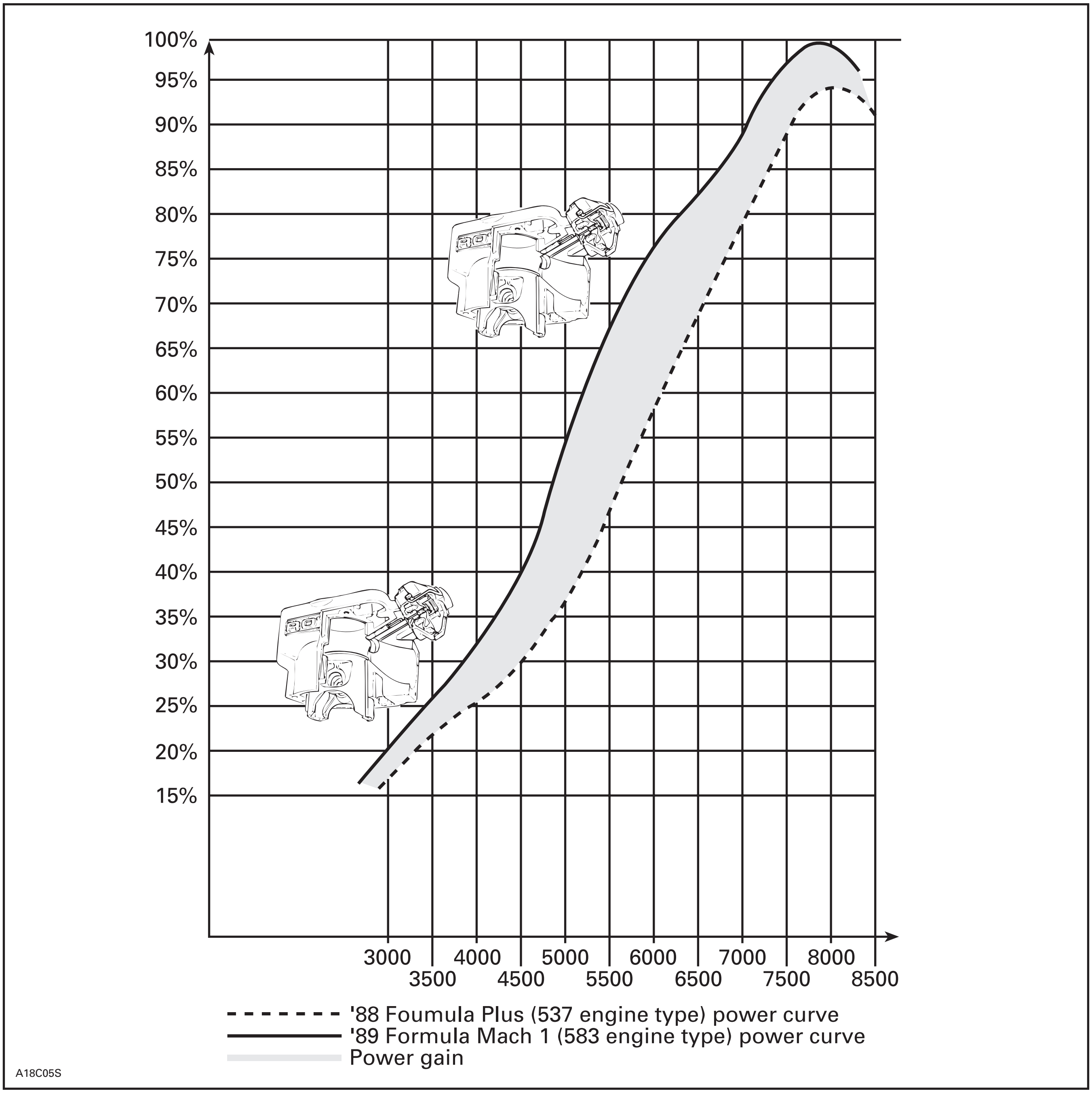
The RAVE valve does not allow an engine to make higher peak horsepower than an engine not so equipped, it can make moving the peak higher practical because of its effect on the rest of the power curve. Item 2 in following illustration is the power curve of an engine with the RAVE valve held fully open 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).



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.

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 LENGTH
1997	809	420 239 944	48.5 mm x D.9
	699	420 239 944	48.5 mm x D.9
	670	420 239 948	38.0 mm x D1.0
	599	420 239 944	48.5 mm x D.9
	583	420 239 948	38.5 mm x D1.0
	454	420 239 945	48.5 mm x D1.0
	454 MX Zx	420 239 945	48.5 mm x D1.0
Optional		420 239 942	42.5 mm x D.8
		420 239 944	48.5 mm x D.9
1998	809	420 239 944	48.5 mm x D.9
	699	420 239 944	48.5 mm x D.9
	670	420 239 948	38.0 mm x D1.0
	599	420 239 940	48.5 mm x D.8
	583	420 239 948	38.0 mm x D1.0
	494	420 239 946	42.0 mm x D1.0
	454	420 229 945	48.5 mm x D1.0
	699 S.P.	420 239 945	48.5 mm x D1.0
1999	809	420 239 941	52.5 mm x D.8
	809 SP	420 239 945	48.5 mm x D.8
	699	420 239 944	48.5 mm x D.9
	699 SP	420 239 945	48.5 mm x D.8
	670	420 239 941	52.5 mm x D.8
	599	420 239 940	48.5 mm x D.8
	593	420 239 946	42.0 mm x D1.0
	583	420 239 948	38.0 mm x D1.0
	494	420 239 944	48.5 mm x D.9

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 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.

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 861 725 800) 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 861 725 600), 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 861 725 600) to check the RAVE valve operation, install a gauge with a range of 0-200 inches of water (P/N 529 010 400) 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° BTDC and closing the port at about 60° ATDC) 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.

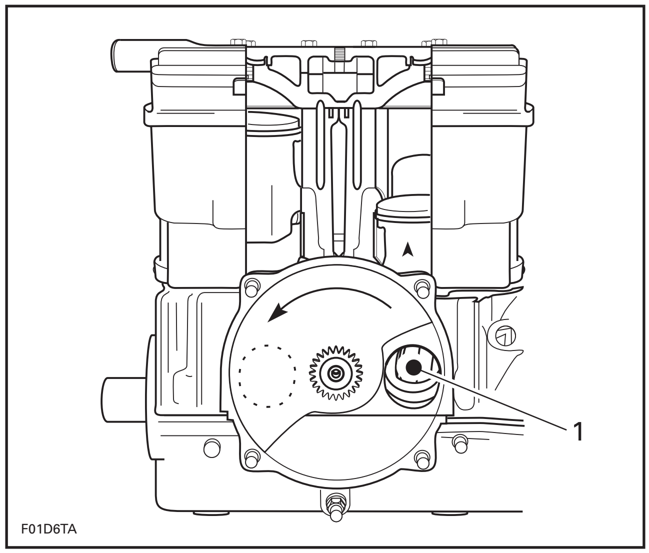
Basically, the rotary valve engine performs the same operation as the ordinary two-stroke engine. The only difference being the location and operation of intake.

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

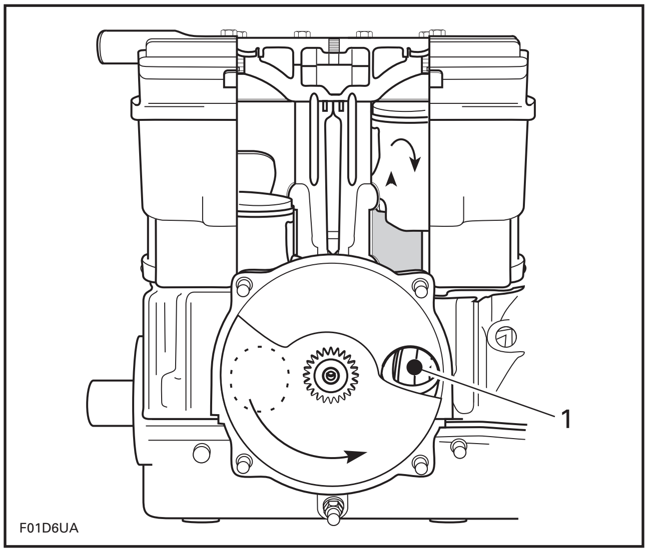


1. Fresh charge from carburetor

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).

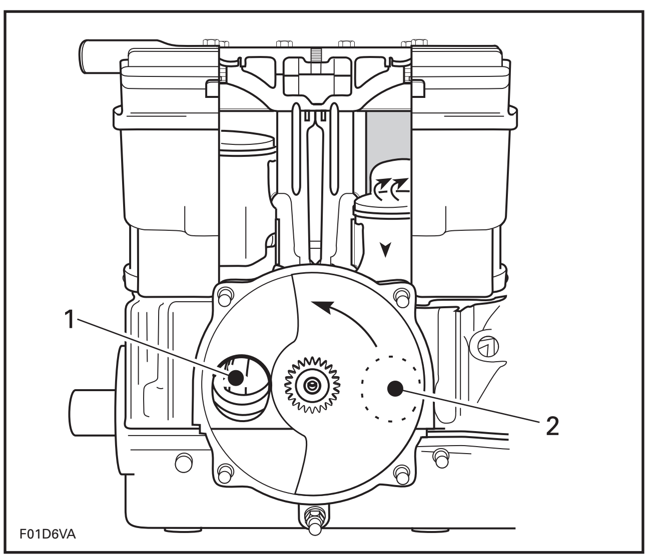
Ignition and Combustion



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.

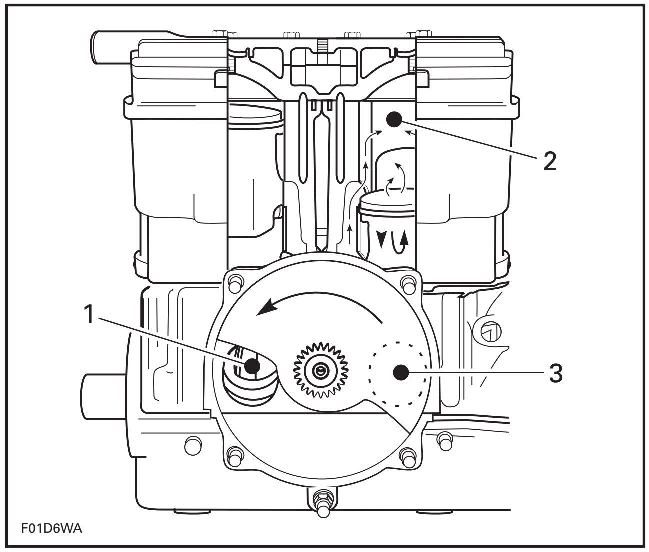
Exhaust and Primary Compression



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

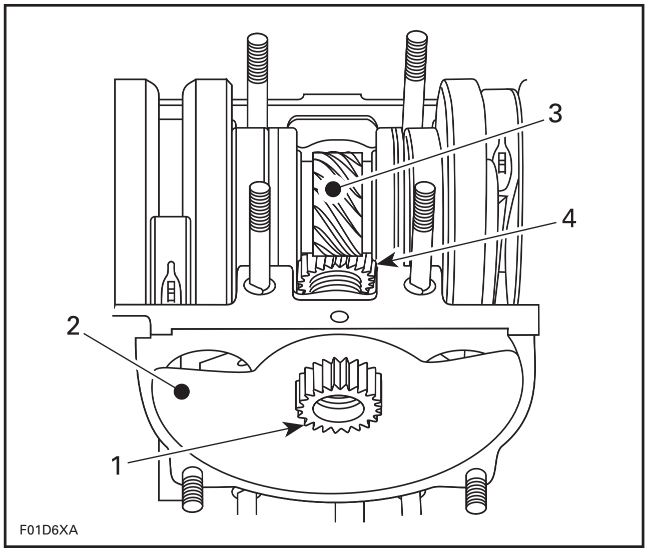


1. *Fresh charge for the other cylinder*
2. *Fresh charge*
3. *Intake port covered*

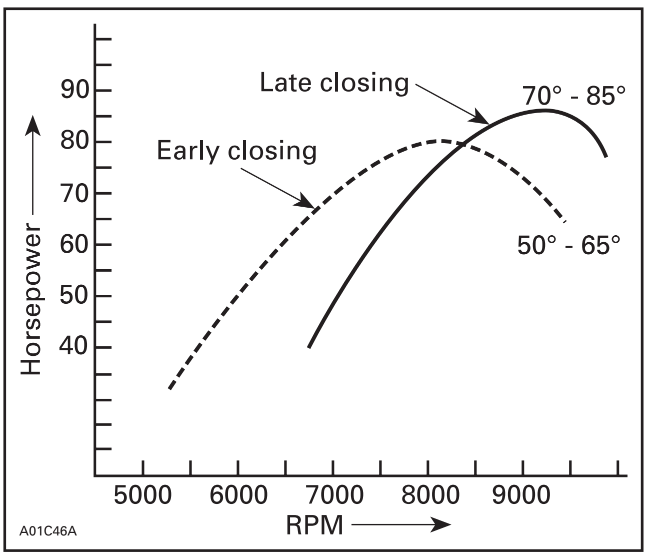
Near the bottom of the downward stroke, the transfer ports are uncovered by the piston, and the compressed air/fuel mixture in the crankcase rushes into the combustion chamber. Piston dome and combustion chamber configuration and muffler back pressures prevent fresh charge (air/fuel mixture) from escaping 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° BTDC	140° BTDC
Closing	75° ATDC	55° ATDC

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.

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	420 924 205	140°	56°
	345	420 924 205	140°	56°
1976	245,345	420 924 205	140°	56°
	245, 345 (competition)	420 924 220	140°	70°
1977	345	420 924 200	127°	48°
	354	420 924 220	132°	50°
	444	420 924 205	140°	50°
	454	420 924 207	130°	80°
1978	345	420 924 200	127°	48°
	345 (cross country)	420 924 202	128°	37°
	354	420 924 200	132°	50°
	444	420 924 205	140°	50°
	254 (super stock)	420 924 207	137°	60°
	354 (super stock)	420 924 207	129°	73°
	454 (super stock)	420 924 207	135°	75°
1979	354	420 924 200	132°	52°
	444	420 924 205	140°	50°
	254 (super stock)	420 924 207	137°	65°
	354 (super stock)	420 924 207	132°	70°
	454 (super stock)	420 924 207	140°	70°
1980	354	420 924 200	132°	52°
	454	420 924 207	137°	65°
	464	420 924 205	150°	49°

ENGINE TYPES		VALVE P/N	TIMING	
			opening	closing
1981	354	420 924 200	132°	52°
	454	420 924 207	137°	65°
	464 (Everest LC)	420 924 205	150°	49°
	464 (Elite)	420 924 200	125°	60°
1982	454	420 924 207	130°	50°
	464 (Everest LC)	420 924 205	150°	49°
	464 (Elite)	420 924 200	125°	60°
1983	464 (Everest LC)	420 924 205	150°	49°
	534	420 924 207	140°	61°
1984	354 (Competition)	420 924 207	130°	73°
	462	420 924 205	140°	51°
	465 (Competition)	420 924 205	150°	49°
	534	420 924 207	140°	61°
1985	354 (Competition)	420 924 207	130°	73°
	462	420 924 200	132°	52°
	537	420 924 200	132°	52°
1986	467	420 924 200	132°	52°
	532	420 924 200	132°	52°
	537	420 924 200	132°	52°
1987	354 (Competition)	420 924 207	130°	73°
	467	420 924 200	132°	52°
	537	420 924 200	132°	52°
1988	354 (Competition)	420 924 207	140°	69°
	467	420 924 200	132°	52°
	537	420 924 200	132°	52°
1989	354 (Competition)	420 924 207	140°	69°
	467	420 924 200	132°	52°
	536	420 924 202	117°	52°
	583	420 924 209	140°	68°
1990	354 (Competition)	420 924 207	140	69°
	467	420 924 200	132°	52°
	536	420 924 202	117°	52°
	536 (Formula PLUS 500)	420 924 207	134°	69°
	583	420 924 209	140°	68°

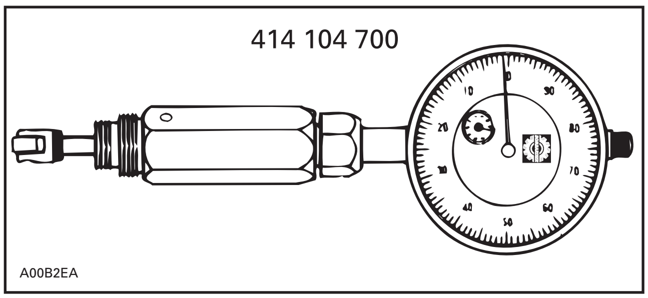
ENGINE TYPES		VALVE P/N	TIMING	
			opening	closing
1991	354 (Competition)	420 924 207	140°	69°
	467	420 924 200	132°	52°
	467 (Formula MX X)	420 924 209	143°	66°
	536	420 924 508	137°	61°
	536 (Formula PLUS X)	420 924 207	134°	69°
	643	420 924 500	144°	72°
	643 (Formula MACH 1 X)	420 924 501	146°	75°
1992	354 (Competition)	420 924 207	140°	69°
	467	420 924 504	132°	52°
	582	420 924 508	129.5°	69.5°
	583 (Formula PLUS X)	420 924 502	141.5°	69.5°
	643	420 924 500	144°	72°
	670 (Mach 1 X)	420 924 501	146°	75°
1993	354 (Competition)	420 924 207	140°	69°
	467	420 924 504	132°	52°
	582	420 924 508	129.5°	69.5°
	583 (Plus X)	420 924 502	141.5°	69.5°
	670	420 924 500	144°	72°
1994	354 (Competition)	420 924 207	140°	69°
	467	420 924 504	132°	52°
	467 (MX Zx)	420 924 502	145°	65°
	582	420 924 509	134°	65°
	583	420 924 509	134°	65°
	670	420 924 500	144°	72°
1995	454	420 924 502	146.8°	65.3°
	467	420 924 504	132°	52°
	582	420 924 509	129.5°	69.5°
	583 (Summit)	420 924 509	134°	65°
	583 (STX, FZ)	420 924 502	140°	71°
	670 (Summit, SS)	420 924 500	144°	72°
	670 (Mach 1)	420 924 501	145°	76°
1996	MX Z 440	420 924 502	145°	64°
	Summit 500 Formula SLS Touring 500 Summit 580	420 924 509	134°	63°

ENGINE TYPES		VALVE P/N	TIMING	
			opening	closing
1996	Formula Z Formula STX Formula STX LT	420 924 502	140°	71°
	MX Z 583	420 924 502	139°	70°
	Formula SS GT 670 SE	420 924 500	145°	71°
	Mach 1	420 924 501	145°	76°
	Summit 670	420 924 500	140°	71°
1997	454 MX Z	420 924 502	146°	65°
	494	420 924 509	135°	64°
	Formula 583	420 924 502	140°	71°
	MX Z 583	420 924 502	140°	71°
	Formula Z	420 924 502	140°	71°
	Summit 583	420 924 509	135°	64°
	MX Z 670	420 924 500	145°	71°
	Summit 670	420 924 500	145°	71°
	454 MX Z x	420 924 502	146°	65°
1998	454 MX Zx	420 924 502	146°	65°
	494 MX Z 500	420 924 502	146°	65°
	494 (Formula 500)	420 924 509	135°	64°
	583 MX Z	420 924 502	140°	71°
	583 (Formula Z)	420 924 502	140°	71°
	494 Summit	420 924 509	135°	64°
	583 Summit	420 924 509	135°	64°
	670 Summit	420 924 500	145°	71°
	670 Summit x	420 924 500	145°	71°
	670 (Formula Z)	420 924 500	145°	71°
	670 MX Z	420 924 500	145°	71°
1999	670 MX Z HO	420 924 500	144°	70°
	670 Summit x	420 924 500	144°	70°
	670 Formula Z	420 924 500	144°	70°
	583 Formula Z	420 924 502	140°	71°
	583 Formula Deluxe	420 924 502	140°	71°
	494 MX Z 500	420 924 509	134°	63°
	494 Summit 500	420 924 509	134°	63°
	494 Formula Z	420 924 509	134°	63°
	494 Formula 500 LC	420 924 509	134°	63°

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°)	

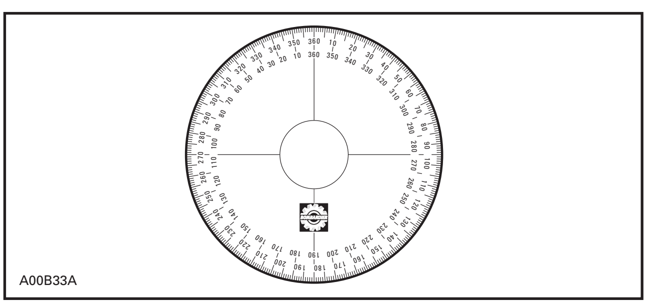
On all engines, use TDC gauge (P/N 414 104 700).



DIAL INDICATOR (P/N 414 104 700)

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 414 352 900) 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.



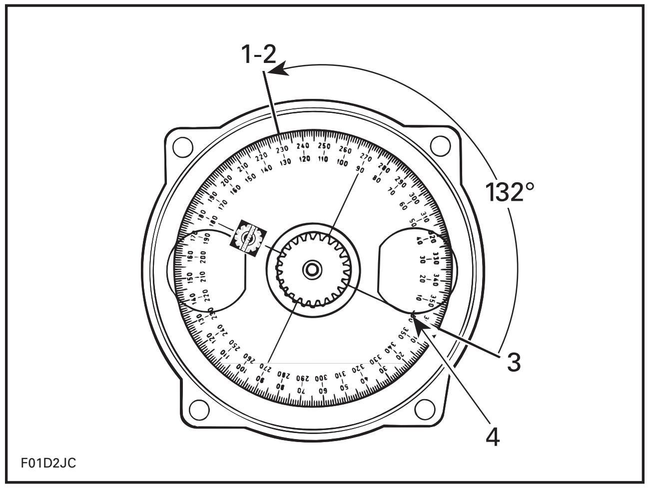
For the following instructions, let's use these specifications as an example:

OPENING: 132° BTDC

CLOSING: 52° BTDC

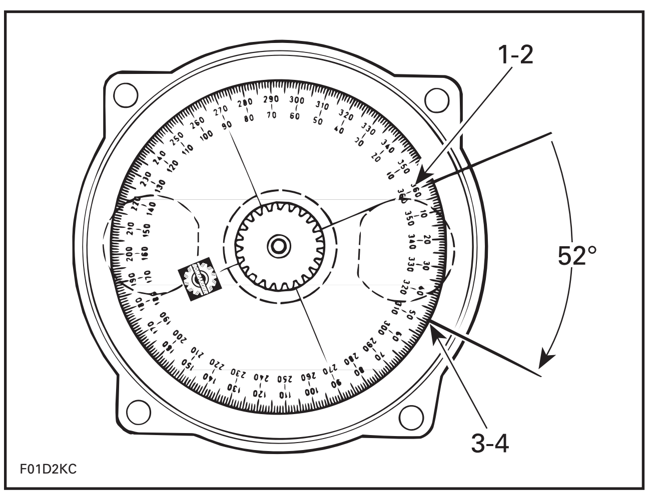
Proceed as follows:

– 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.



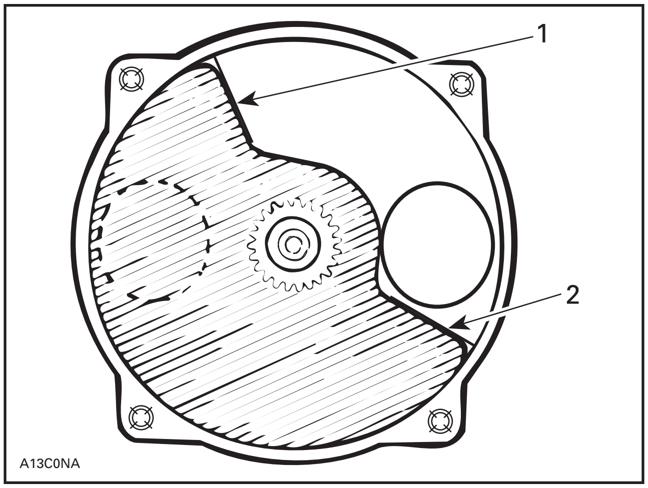
1. *Find 132° on degree wheel and mark here*
2. *Opening mark*
3. *Bottom of MAGneto inlet port*
4. *Align 360° line of degree wheel here*

– 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.

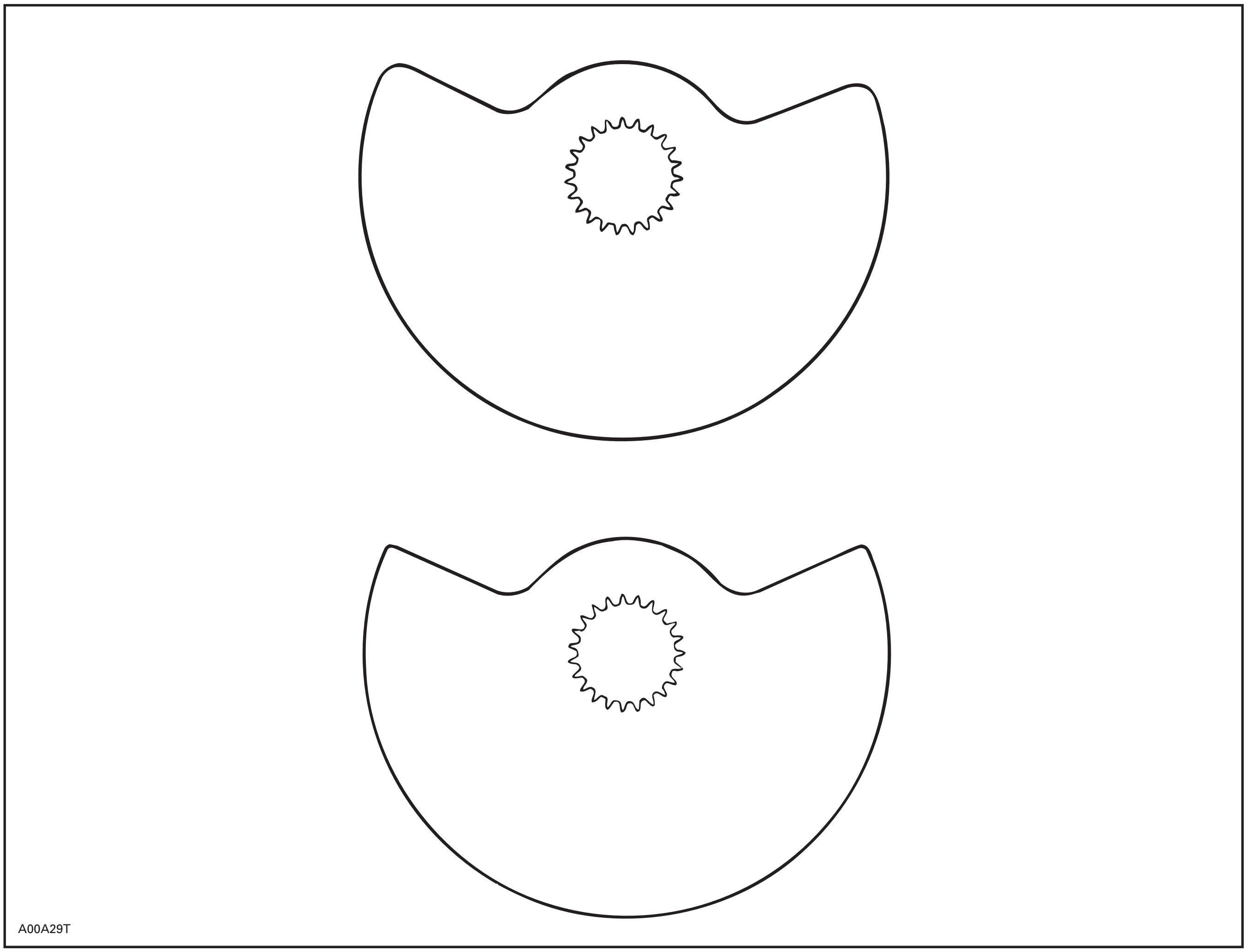


MAGNETO SIDE PISTON MUST BE A TDC

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.



NOTE: Bombardier Recreational Products/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).

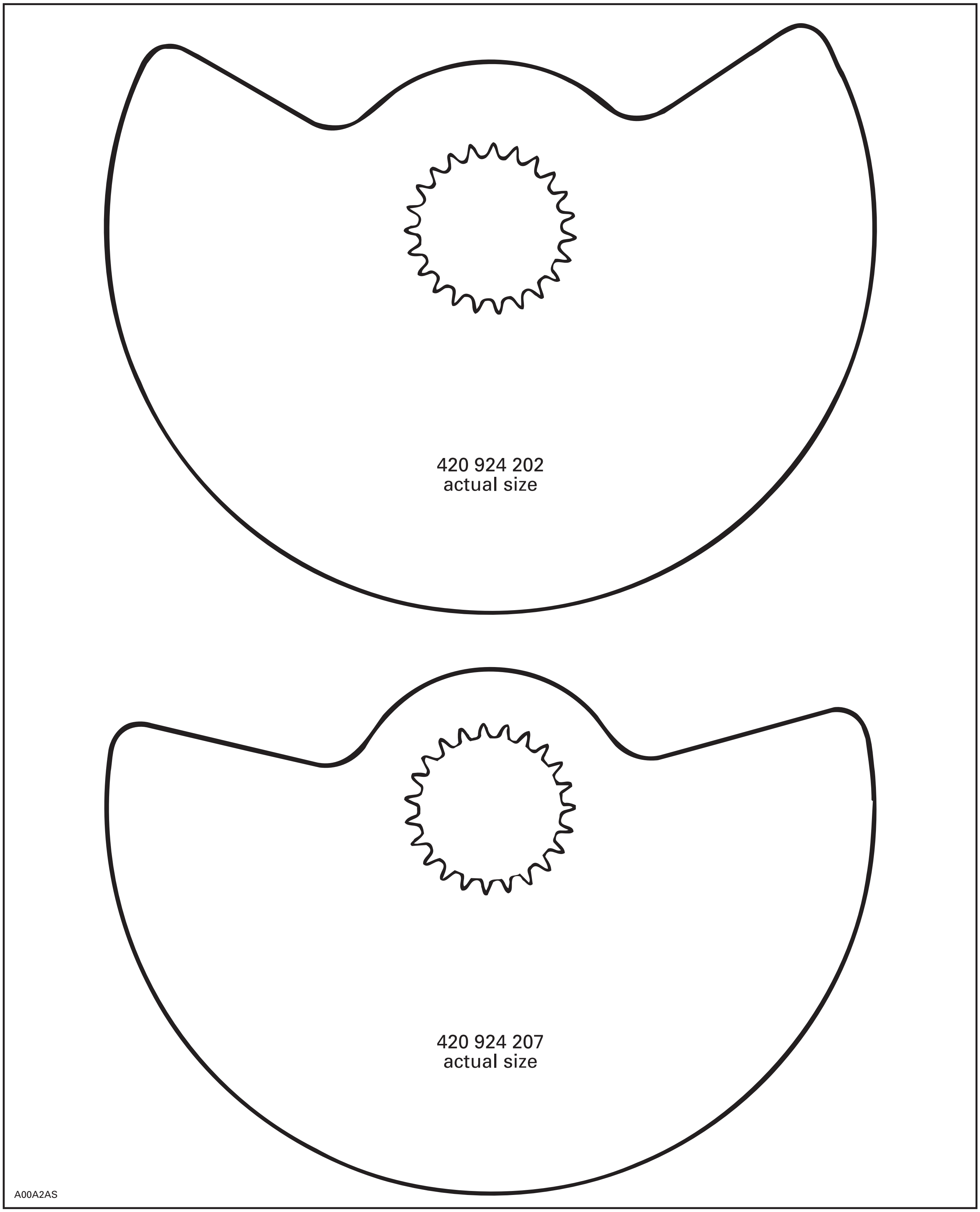
This change is for reliability and does not affect performance in any fashion. The valves are interchangeable, but do carry different part numbers.

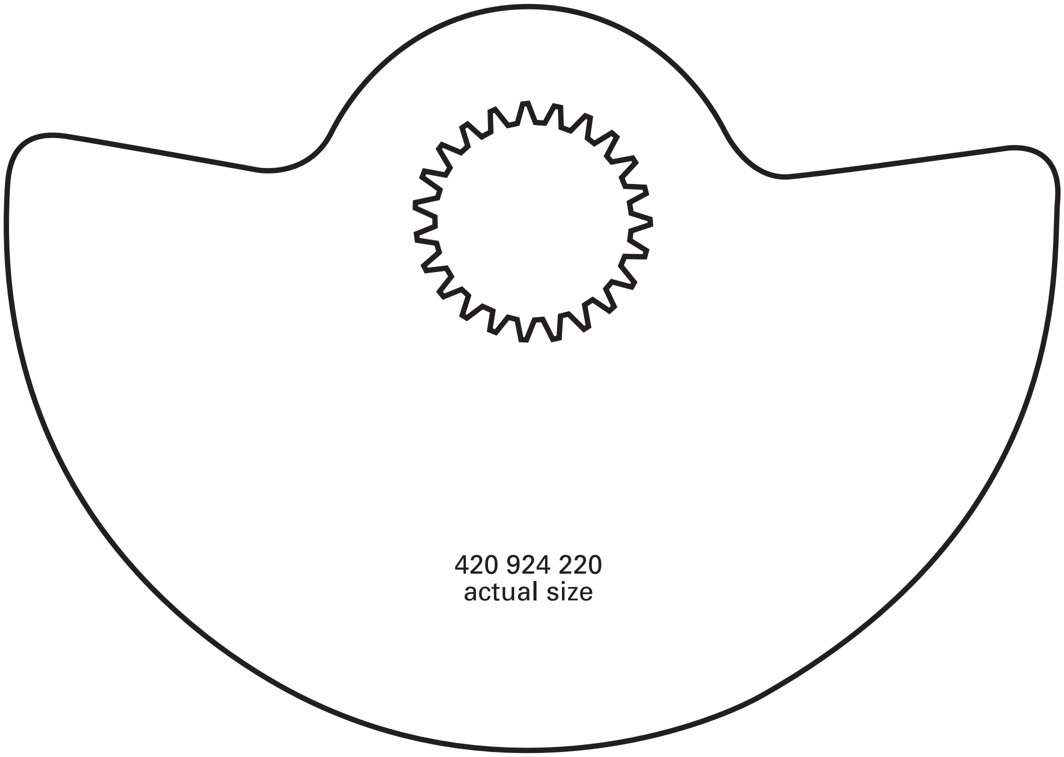
420 924 200 subs to 420 924 504

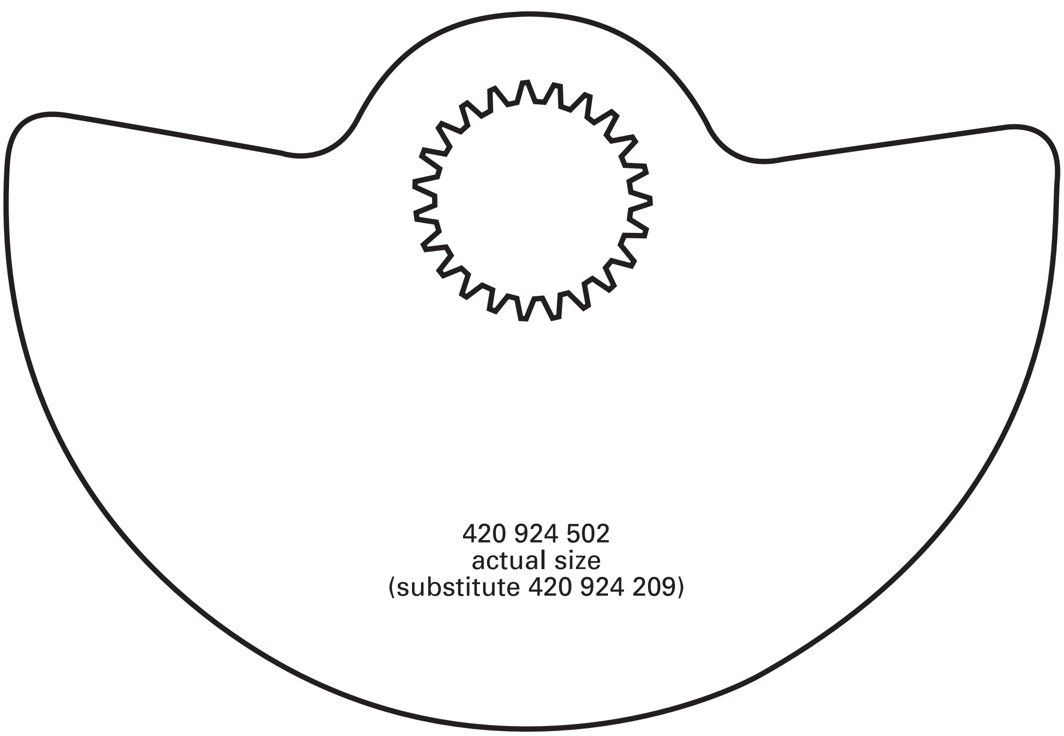
420 924 205 subs to 420 924 508

420 924 209 subs to 420 924 502

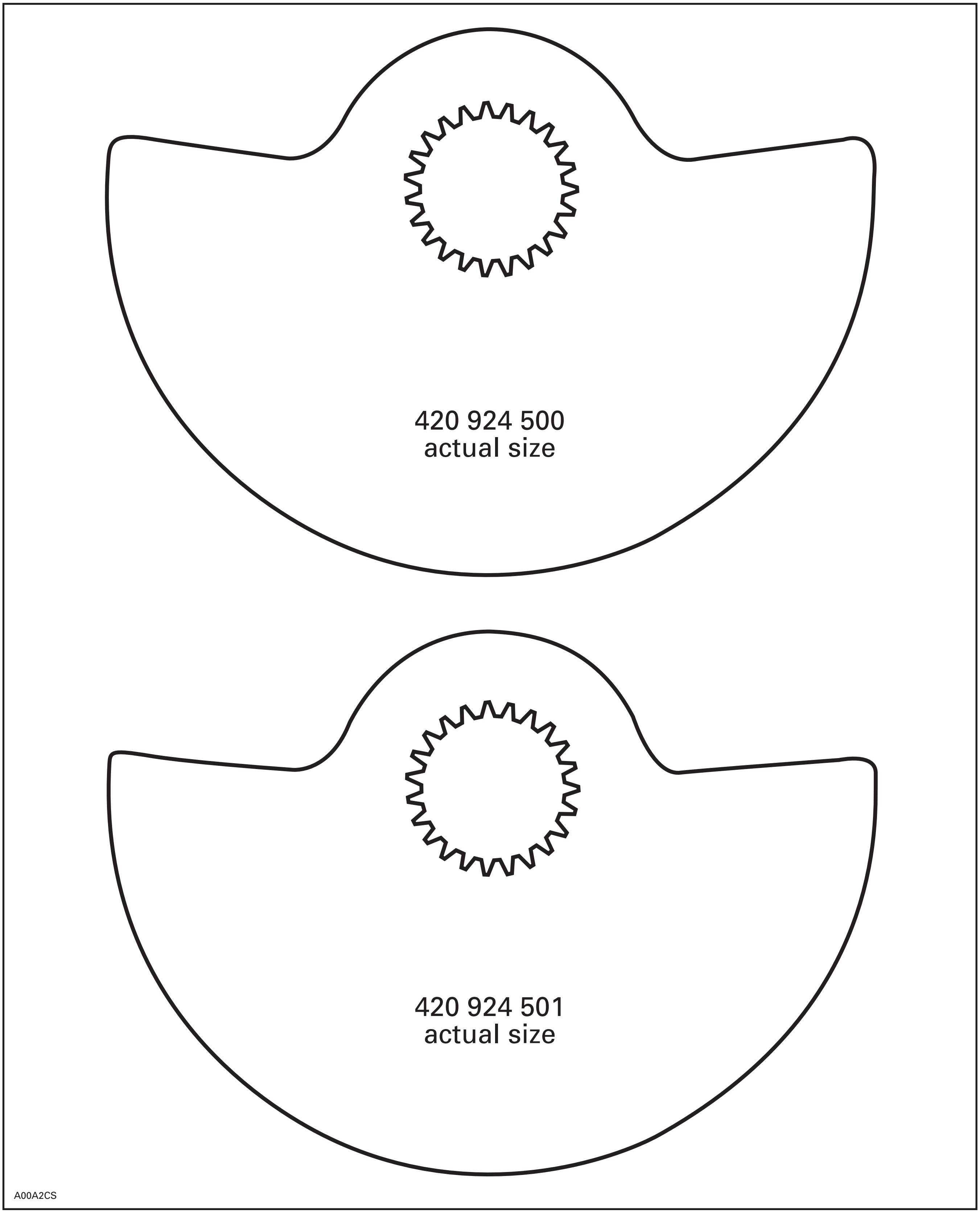
Refer to next page.

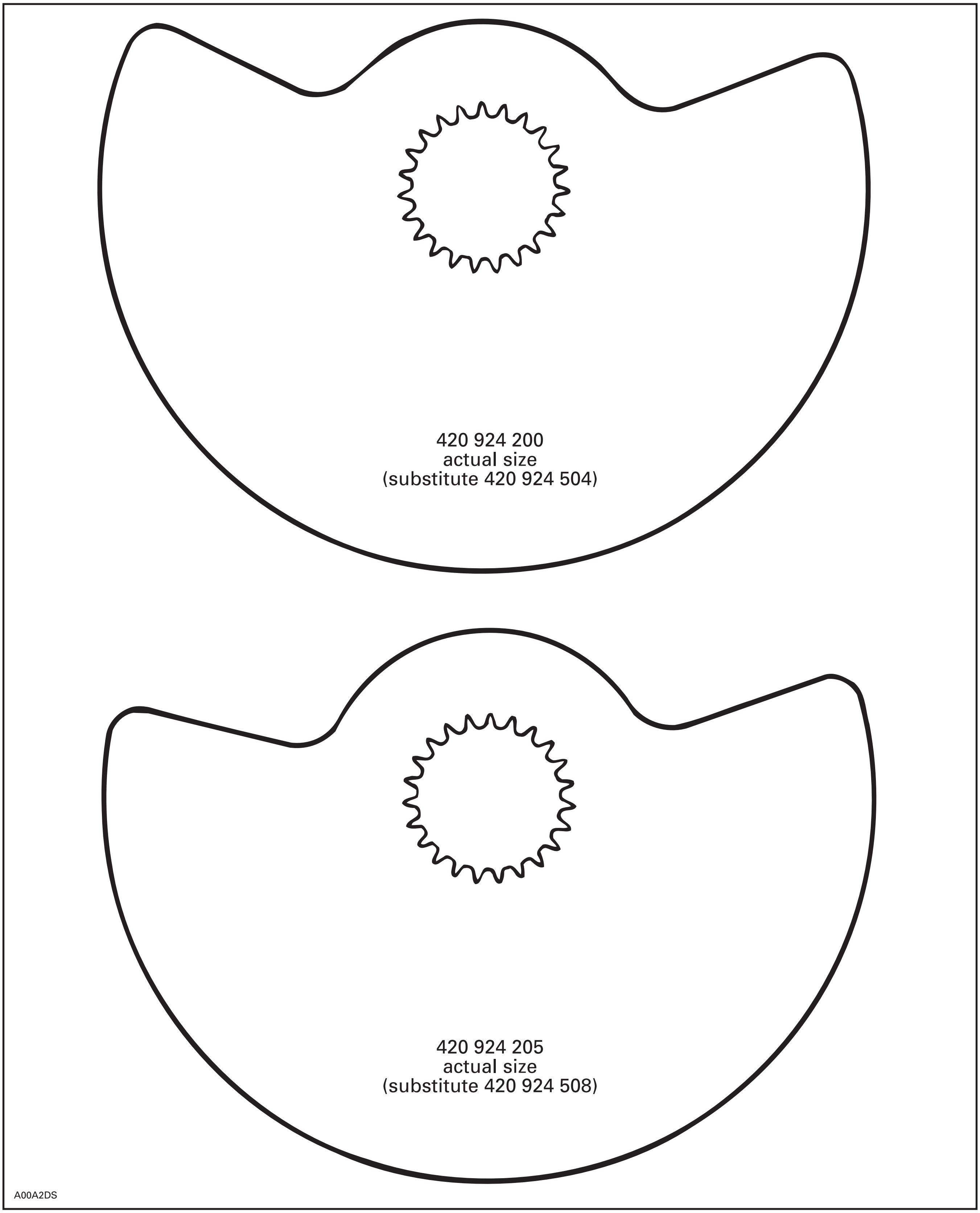

420 924 202
actual size
420 924 207
actual size
A00A2AS

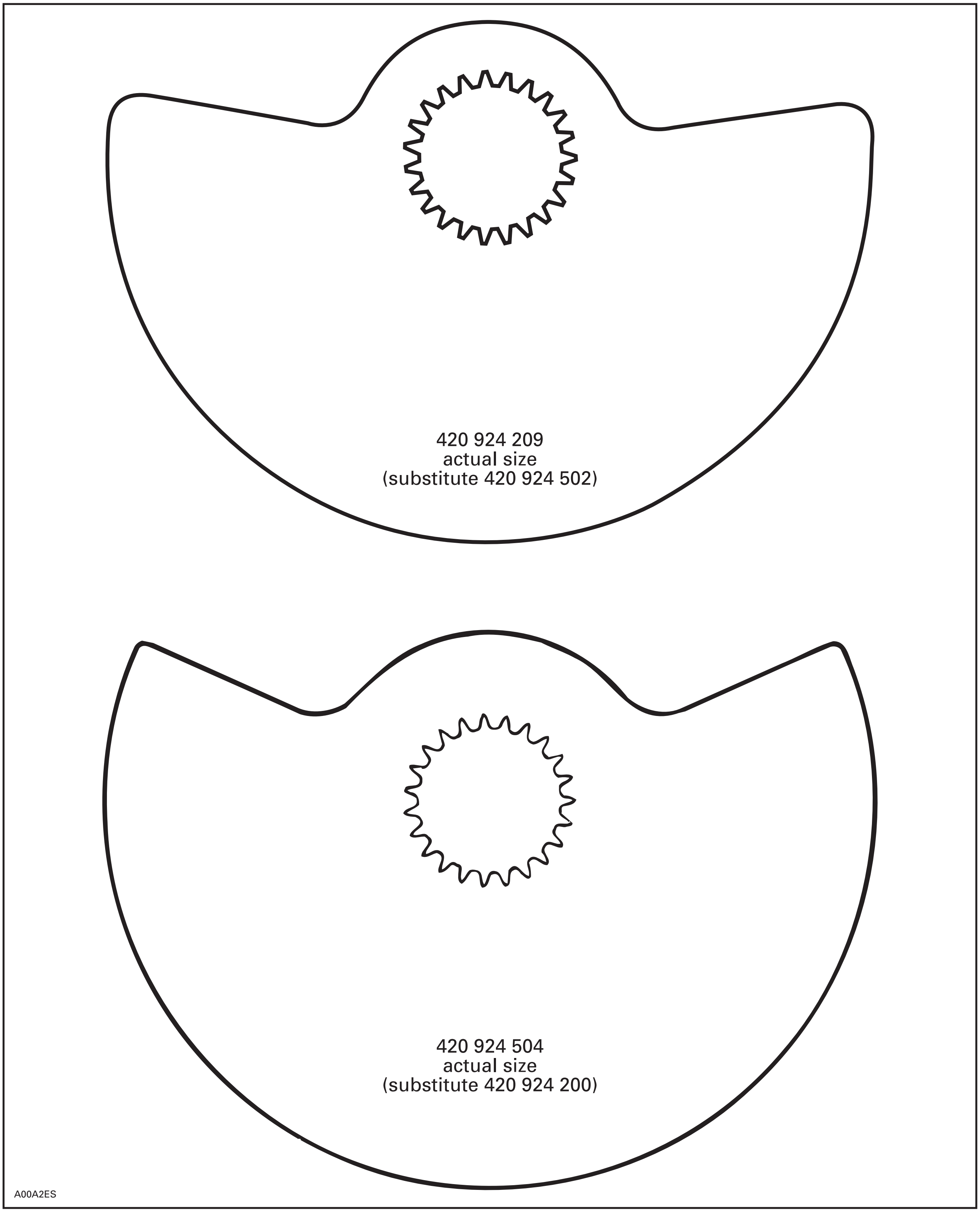

420 924 220
actual size

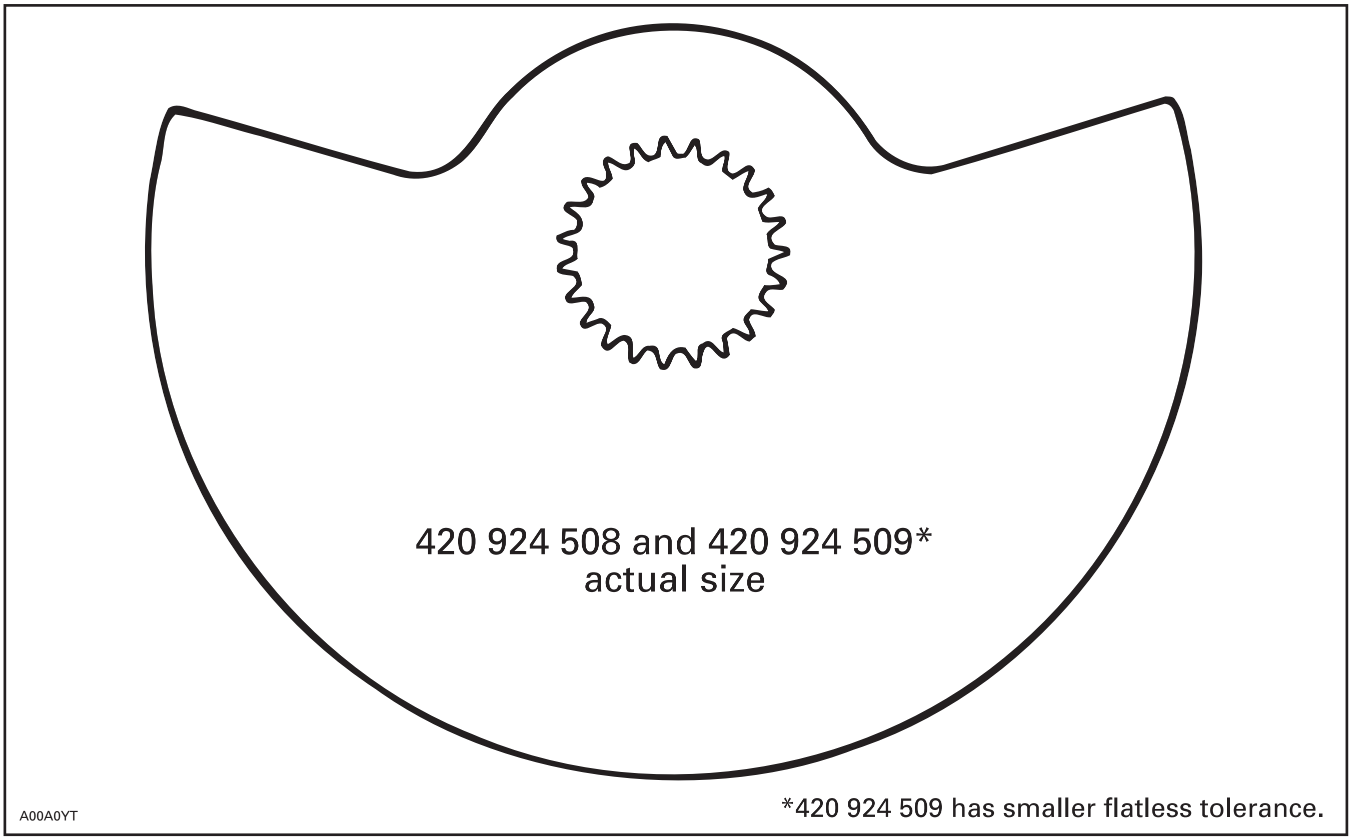

420 924 502
actual size
(substitute 420 924 209)

A00A2BS


420 924 500
actual size
420 924 501
actual size
A00A2CS


420 924 200
actual size
(substitute 420 924 504)
420 924 205
actual size
(substitute 420 924 508)
A00A2DS


420 924 209
actual size
(substitute 420 924 502)
420 924 504
actual size
(substitute 420 924 200)
A00A2ES



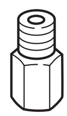
1997 AND 1998 BASE GASKETS		
809	P/N 420 931 620	0.3 mm
	P/N 420 931 621	0.4 mm
	P/N 420 931 622	0.6 mm
699	P/N 420 931 570	0.3 mm
	P/N 420 931 571	0.4 mm
	P/N 420 931 572	0.6 mm
670	P/N 420 931 230	0.3 mm
	P/N 420 931 231	0.4 mm
	P/N 420 931 233	0.5 mm
	P/N 420 931 232	0.6 mm
	P/N 420 931 234	0.8 mm
599	P/N 420 931 310	0.4 mm
	P/N 420 931 311	0.6 mm
	P/N 420 931 312	0.3 mm
583	P/N 420 931 185	0.3 mm
503	P/N 420 831 858	0.5 mm
494	P/N 420 931 361	0.4 mm

1997 AND 1998 BASE GASKETS		
454	P/N 420 931 360	0.3 mm
	P/N 420 931 361	0.4 mm
	P/N 420 931 362	0.6 mm
	P/N 420 931 363	0.5 mm
	P/N 420 931 364	0.8 mm
443	P/N 420 850 105	0.4 mm
377	P/N 420 850 105	0.4 mm
1999 BASE GASKETS		
377	P/N 420 931 781	0.4 mm
443	P/N 420 931 782	0.6 mm
	P/N 420 931 781	0.4 mm
	P/N 420 931 780	0.3 mm
503	P/N 420 831 858	0.5 mm
494	P/N 420 931 361	0.4 mm
593	P/N 420 931 580	0.3 mm
	P/N 420 931 581	0.4 mm
	P/N 420 931 582	0.6 mm
599	P/N 420 931 310	0.4 mm
	P/N 420 931 311	0.6 mm
	P/N 420 931 312	0.3 mm
670	P/N 420 931 234	0.8 mm
	P/N 420 931 236	0.7 mm
	P/N 420 931 232	0.6 mm
	P/N 420 931 233	0.5 mm
	P/N 420 931 231	0.4 mm
	P/N 420 931 230	0.3 mm
699	P/N 420 931 570	0.3 mm
	P/N 420 931 571	0.4 mm
	P/N 420 931 572	0.6 mm
809	P/N 420 931 620	0.3 mm
	P/N 420 931 621	0.4 mm
	P/N 420 931 622	0.6 mm

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):

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

▼ CAUTION

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

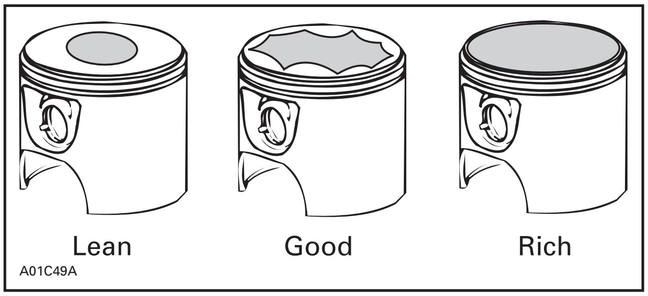
This table is more than adequate for stock engines. Two-stroke engines with high specific outputs that are heavily modified (twin pipes, high compression, large carburetors, etc.) and performing at high RPM are very sensitive to air density changes. The following is a very accurate formula for correcting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

A01C48A

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)

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

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) = 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

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

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.

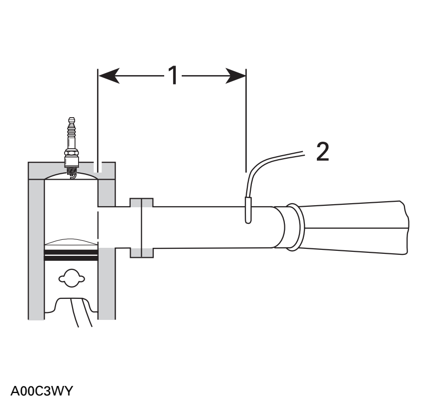
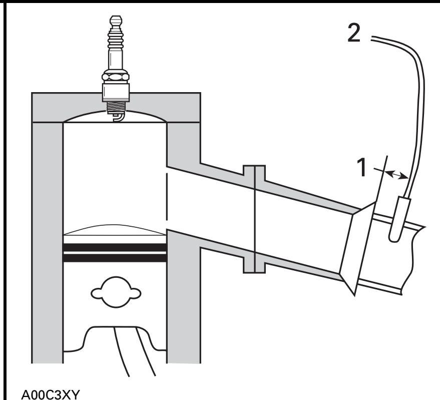
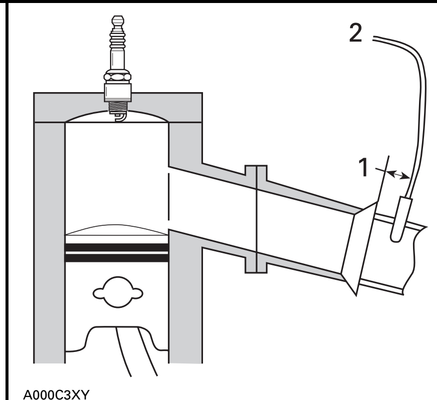
Example: 300 x 115 = 345

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.

Exhaust Gas Temperature Probe Location

TWO CYLINDERS SINGLE PIPE	THREE CYLINDERS TRHEE PIPES	TWO CYLINDERS TWO PIPES
		
DETONATION = 720°C (1330°F)	DETONATION = 700°C (1290°F)	DETONATION = 700°C (1290°F)
	NORMAL = 650 TO 675°C (1200 TO 1250°F)	

1. 100 mm from piston
2. Probe

1. 80 mm
2. Probe

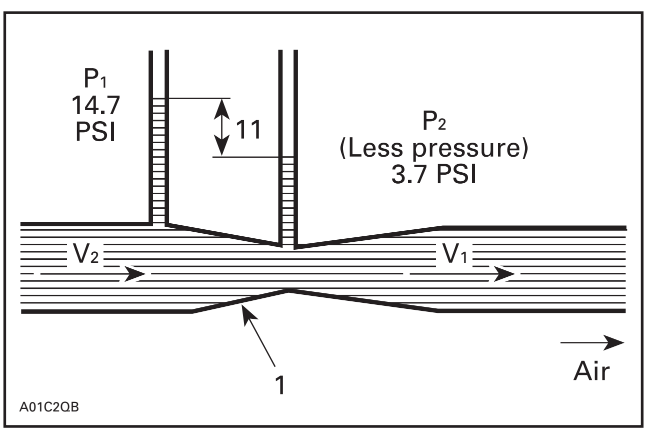
1. 35 mm
2. Probe

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).

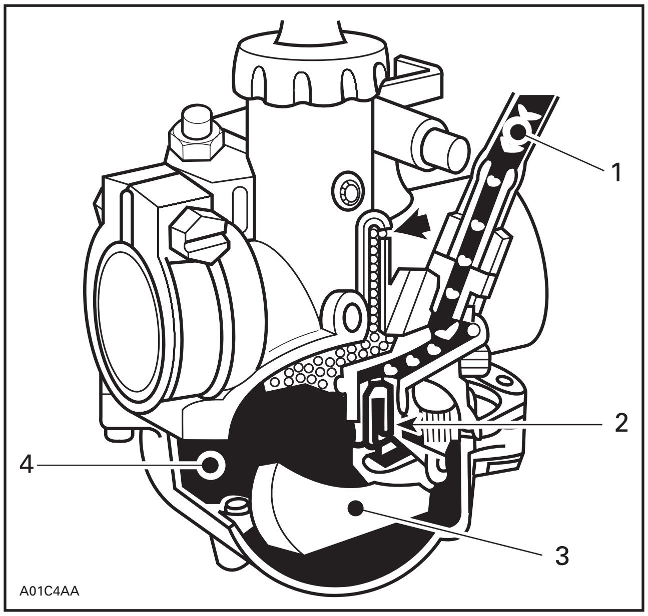


1. Venturi

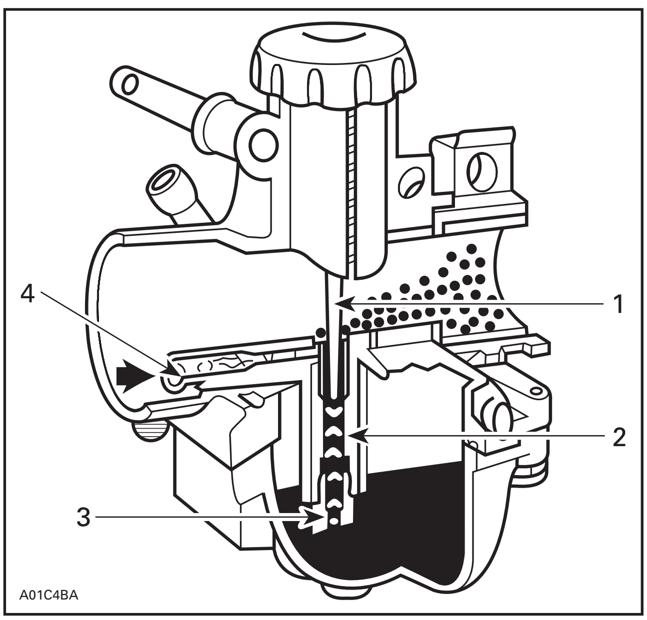
Air entering the bell of the carburetor has a speed of V1 and pressure of P1. As the air is forced into the smaller diameter of the venturi, speed increases (V2) but pressure drops (P2).

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.



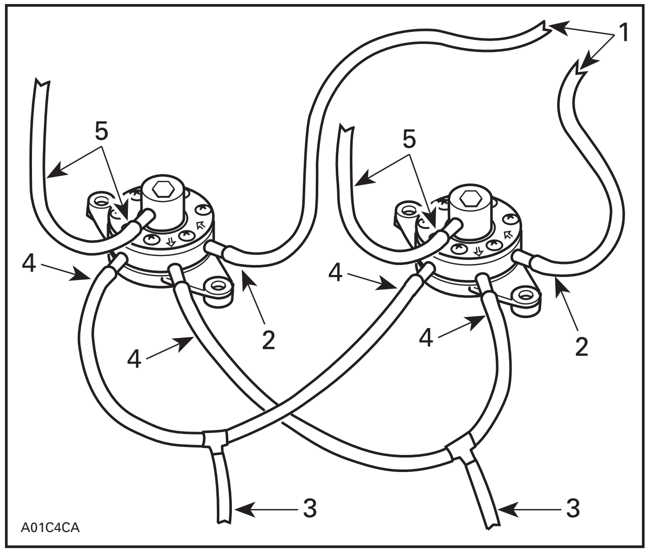
1. *Float bowl*
2. *Needle valve*
3. *Float*
4. *Fuel inlet*



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.

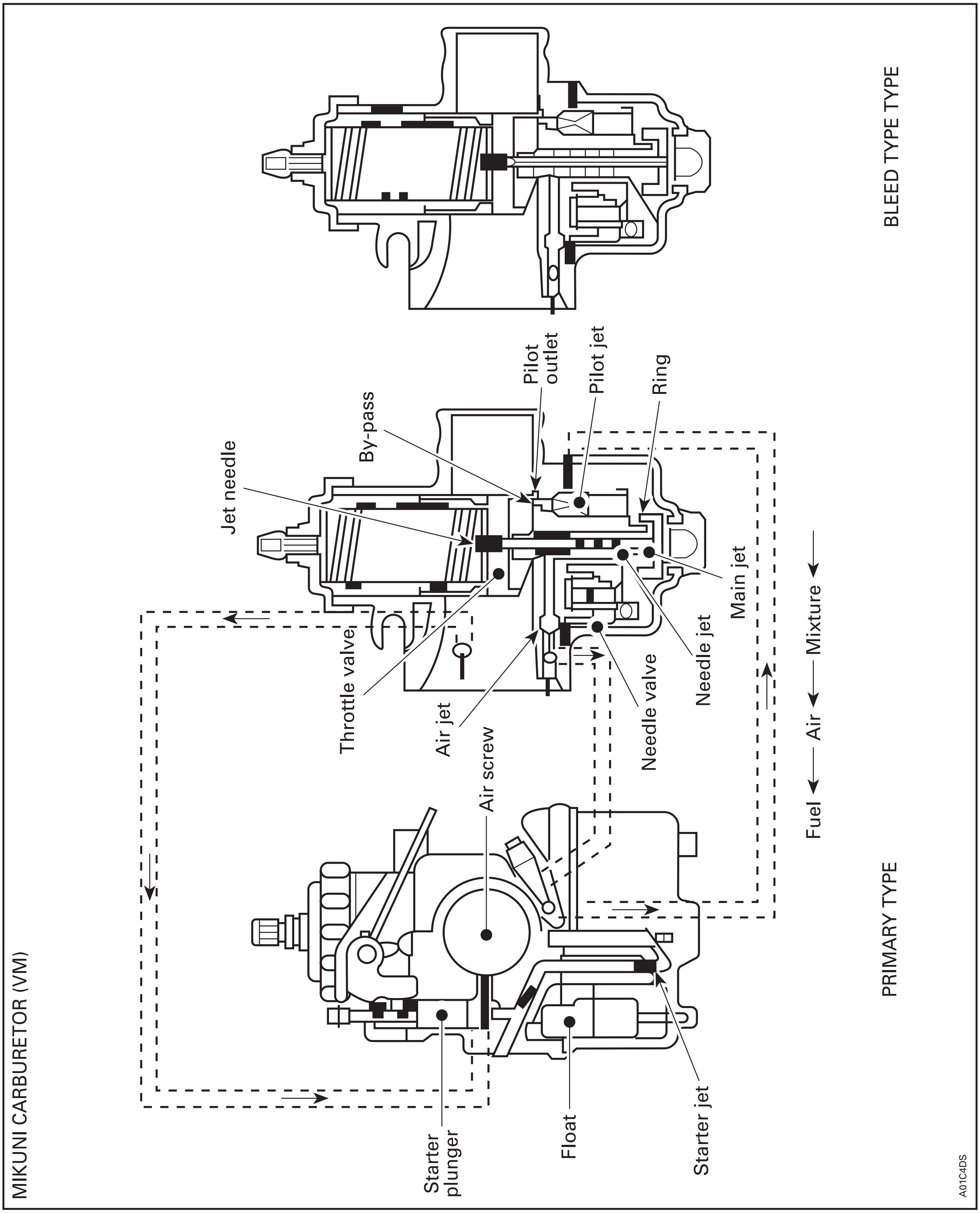
LARGE FUEL PUMP PARTS

70 Liter/hour fuel pump	P/N 403 901 200
Filter, in-tank	P/N 414 872 100
Fuel line, in-tank	P/N 414 943 700
Grommet, tank	P/N 570 273 900
Connector, tank	P/N 141 872 700
Fuel line, tank to shut off valve	P/N 414 939 900
Shut off valve	P/N 414 872 200
Fuel line, valve to pump	P/N 414 931 400 (roll)
Clamp, fuel line	P/N 414 655 700

MIKUNI CARBURETORS

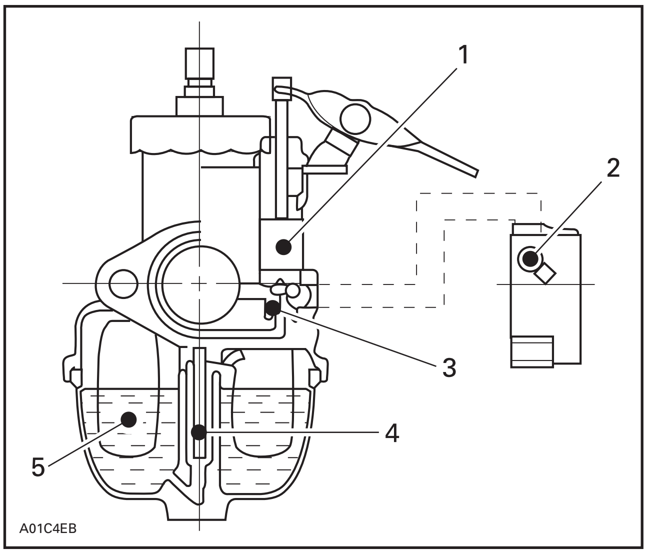
Snowmobile engines are operated under a wide range of conditions, from idling with the throttle valve remaining almost closed to the full load (the maximum output) with the throttle valve fully opened. In order to meet the requirements for the proper mixture ratio under these varying conditions, a low-speed 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.


MIKUNI CARBURETOR (VM)
BLEED TYPE TYPE
PRIMARY TYPE
Jet needle
By-pass
Pilot outlet
Pilot jet
Ring
Main jet
Needle jet
Needle valve
Air jet
Throttle valve
Air screw
Starter plunger
Float
Starter jet
Fuel
Air
Mixture
A01C4DS

Starting Device (Enrichener)

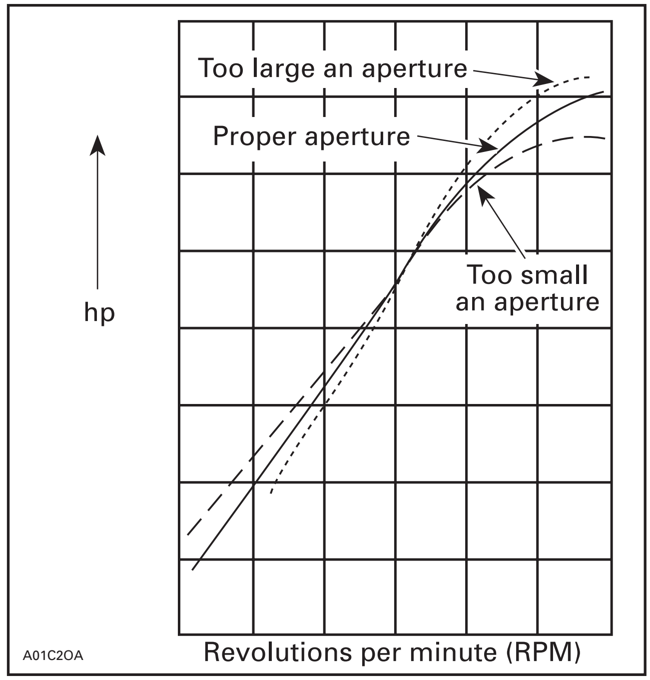
Instead of a choke, the enrichener system is used on some Mikuni carburetors. In the starter type, fuel and air for starting the engine are metered with entirely independent jets. The fuel metered in the starter jet is mixed with air and is broken into tiny particles inside the emulsion tube. The mixture 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 mm (.39 in) to 44 mm (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.

Checking and Adjusting Float System

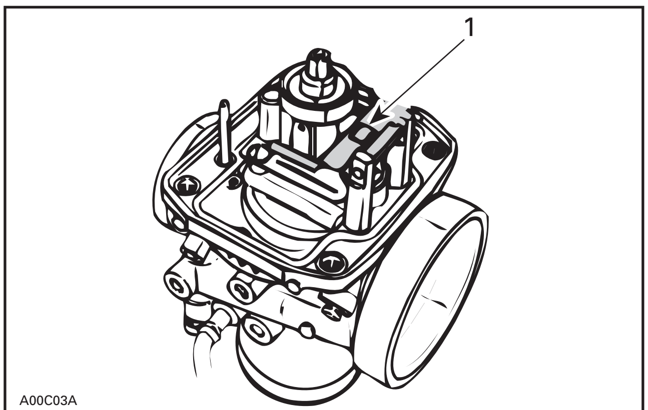
1. Invert the carburetor and check the alignment between the float arm and the base of the carburetor. The float arm should be parallel to the base.
2. Bend the actuating tab as required to make the float arm parallel to the base. Be careful not to bend the float arm.

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.

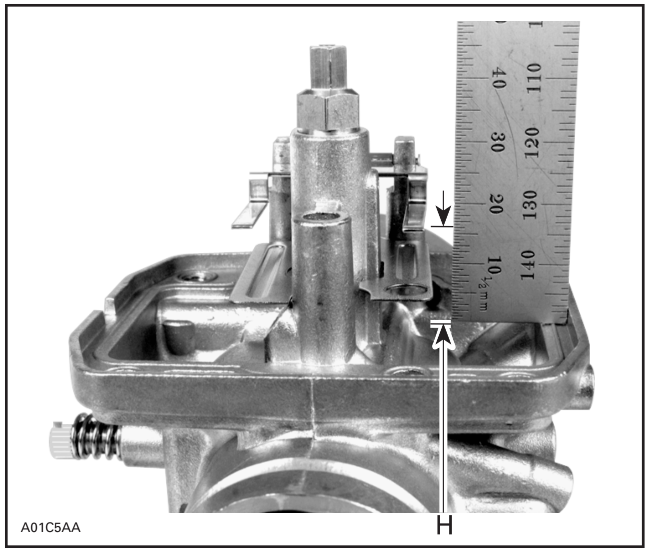
NOTE: Mikuni carburetors used on snowmobiles with fuel pumps require a smaller inlet needle valve (usually 1.5 or 2.0) than carburetors used in gravity feed applications (3.0).

To Adjust Height H

– Bend the contact tab of float arm until the specified height is reached.



1. Contact tab



TYPICAL
H. 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 H ± 1 mm	(± 0.40 in)
1998		
VM 30 VM 34	23.9	(.941)
VM 36 VM 38 VM 40 VM 44 HAC	18.1	(.713)
TM 38	21.0	(.826)
1999		
VM 30 VM 34	23.9	(.941)
VM 36 VM 38 VM 40	18.1	(.713)
VM 40 MX Z & Summit	22.9	(.901)
VM 44 DPM	22.9	(.901)

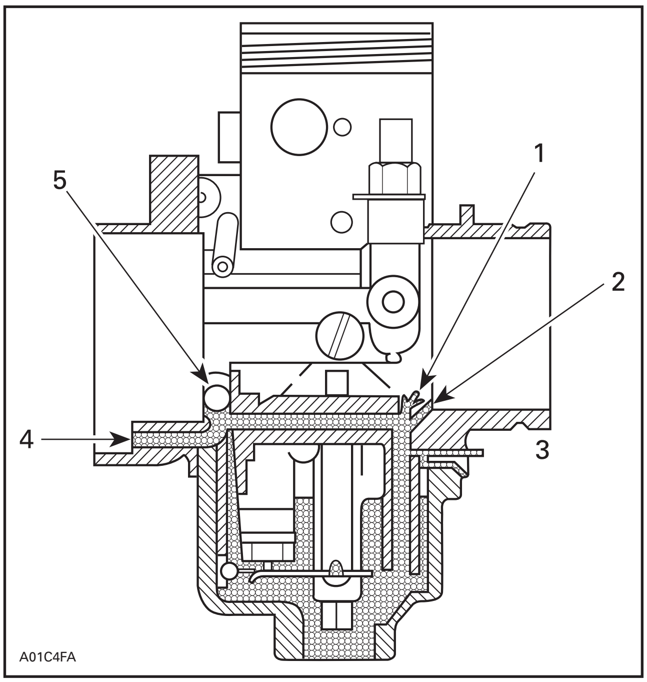
NOTE: To adjust height A — bend the contact tab of float arm until the specified height is reached.

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

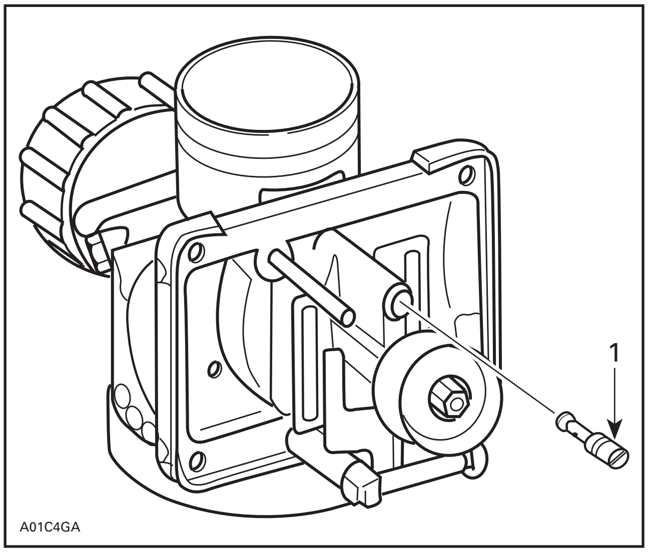


1. Pilot bypass
2. Pilot outlet
3. Pilot jet
4. Air intake
5. Air screw

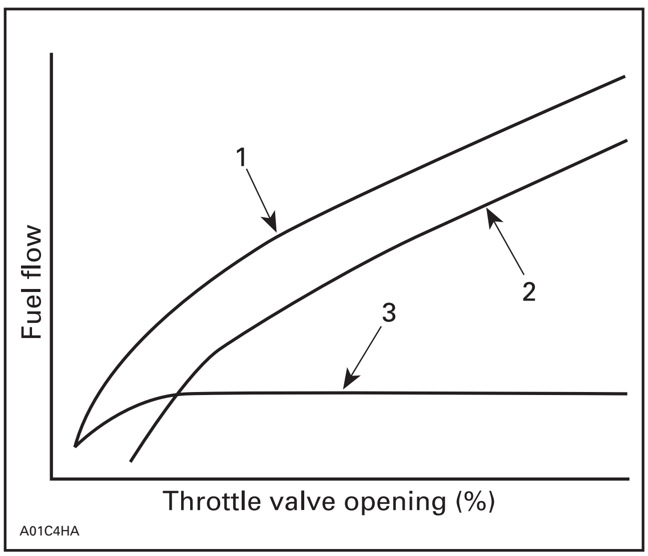
NOTE: This procedure may be performed for single and dual carburetors. Never adjust screws more than 1/4 turn at a time.

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



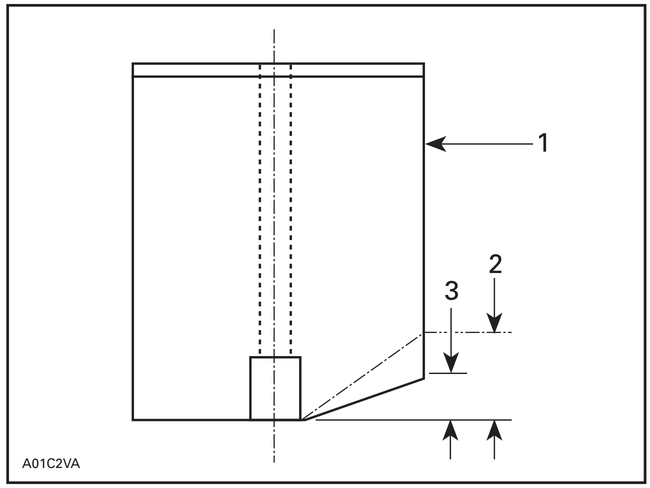
1. Total amount of fuel flow
2. Main fuel system
3. Pilot fuel system

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

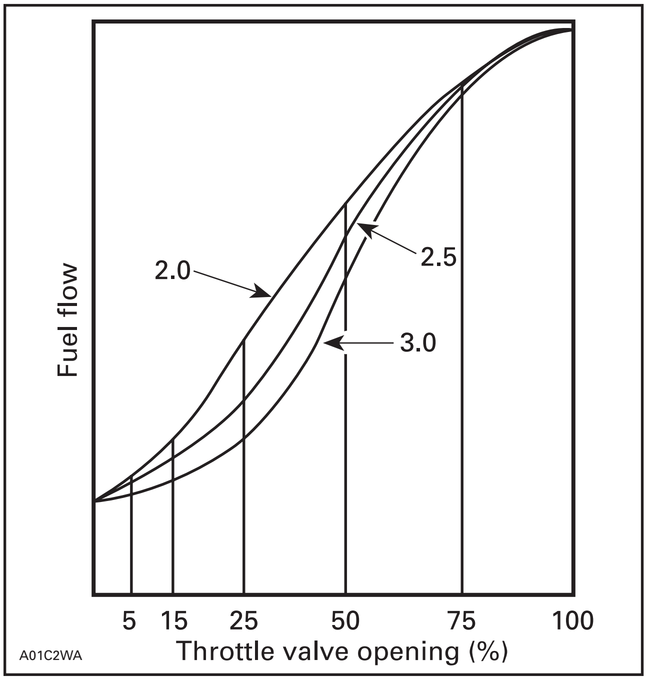
The throttle valve is cut away on the air inlet side to help control the fuel/air mixture at low and intermediate throttle settings. The size of cutaway also affects acceleration.

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



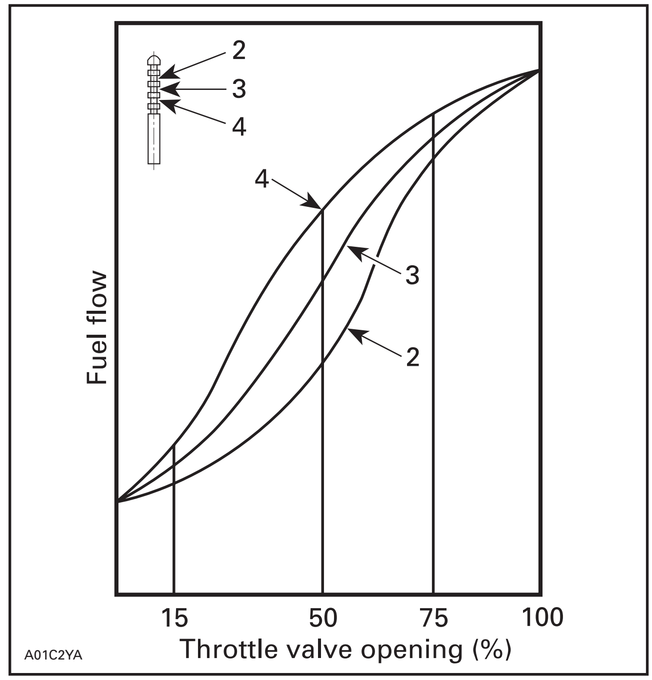
1. Operate engine at low throttle settings, accelerating from idle to 1/4 throttle.
2. If engine bogs during acceleration, there is probably insufficient fuel. Turn in air screw about 1/4 turn at a time. If engine acceleration is improved, after adjusting air screw, the throttle valve cutaway needs to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

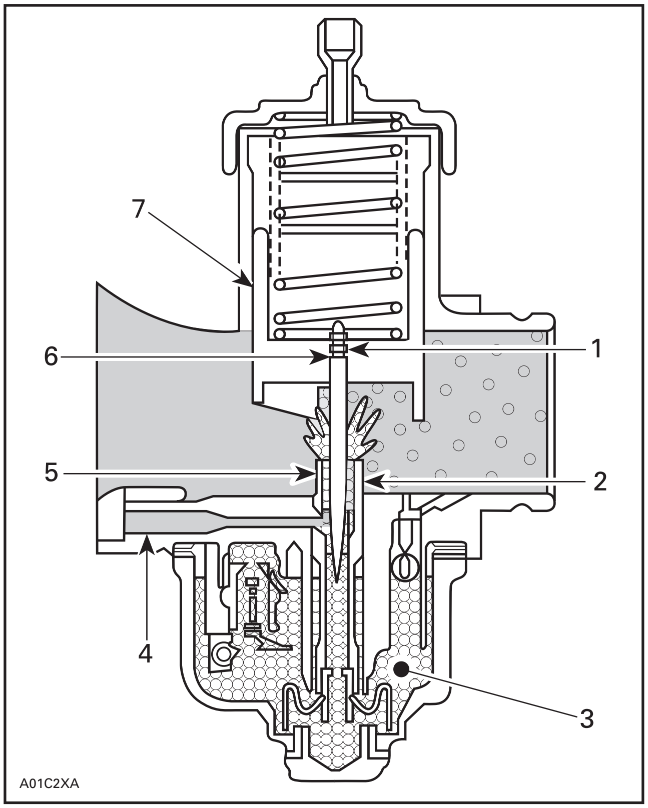
Jet Needle

PRINCIPLES OF OPERATION



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

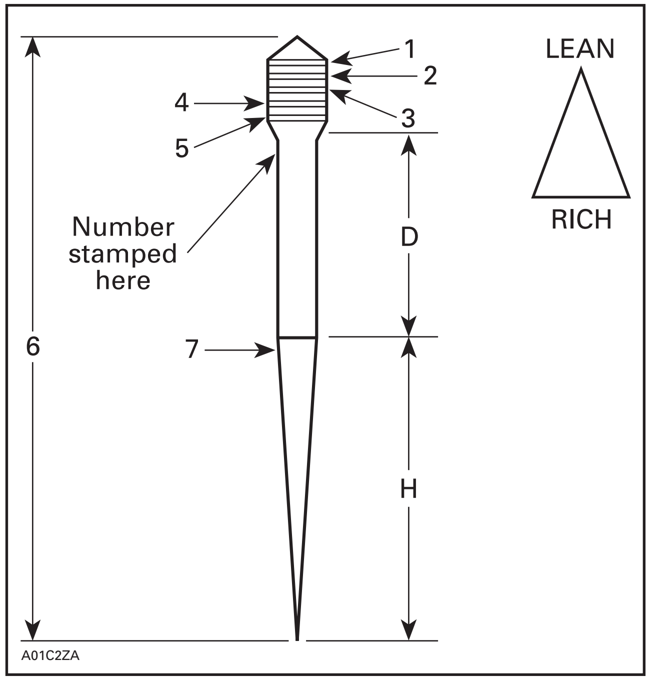
Although the jet needle and needle jet function in the 1/4 to 3/4 throttle range, they also affect the amount of fuel present at wide open throttle. When tuning the jet needle, also check main jet system operation.



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.



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.

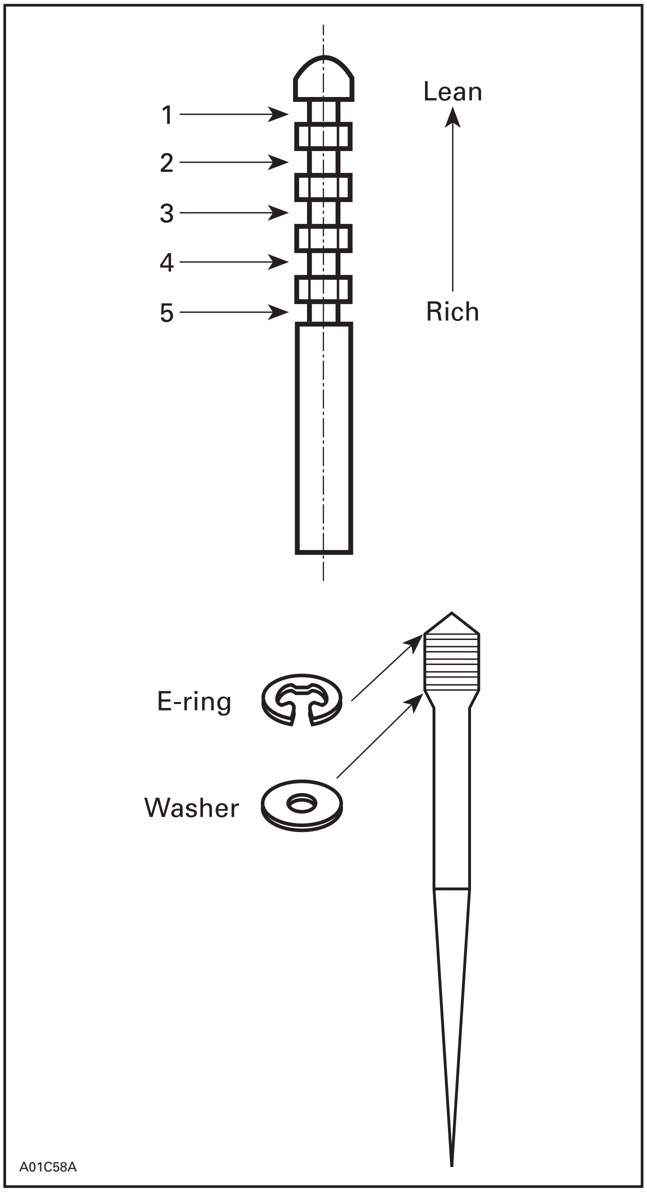
7 - Material, type of coating and start of second taper on needle.

NOTE: Letter designation of the jet needle indicates the angle of taper. Each letter (starting with A is 0.25° greater than preceeding 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



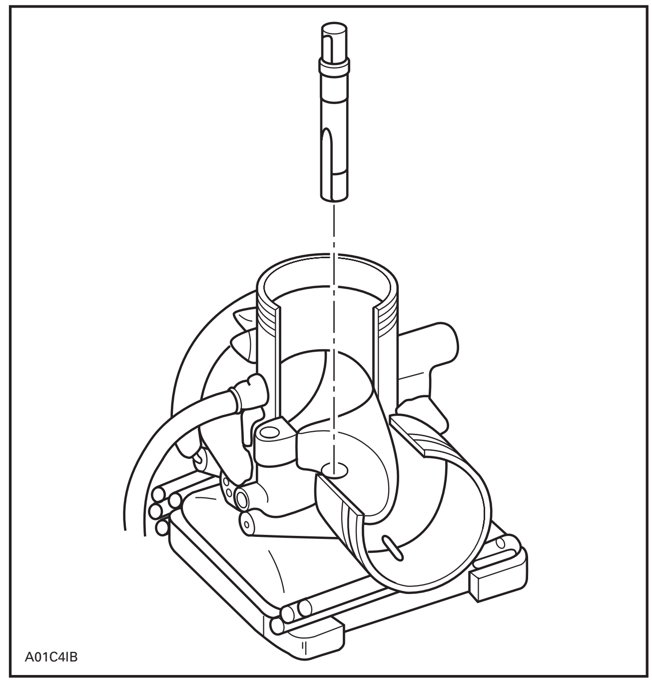
1 to 5 = E-ring position

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.

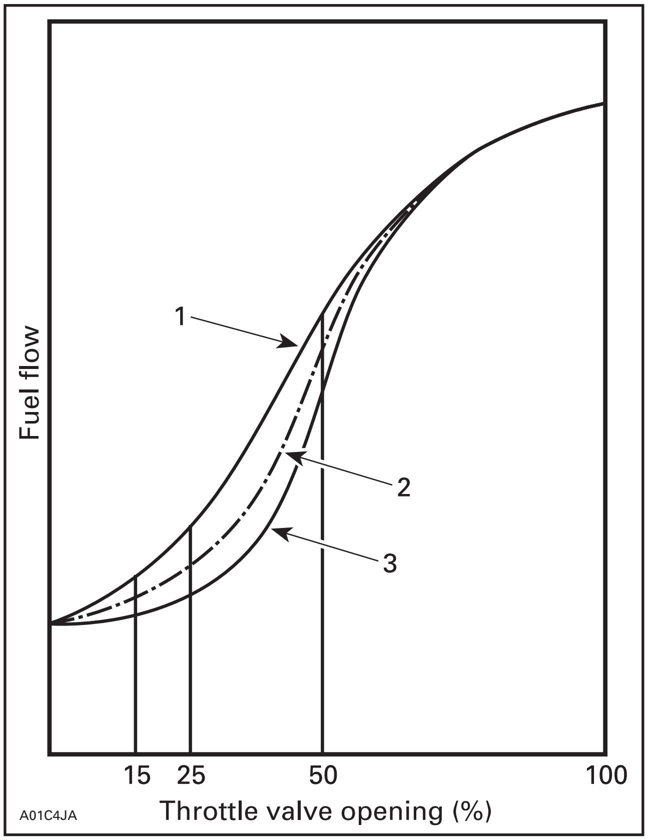
Needle Jet

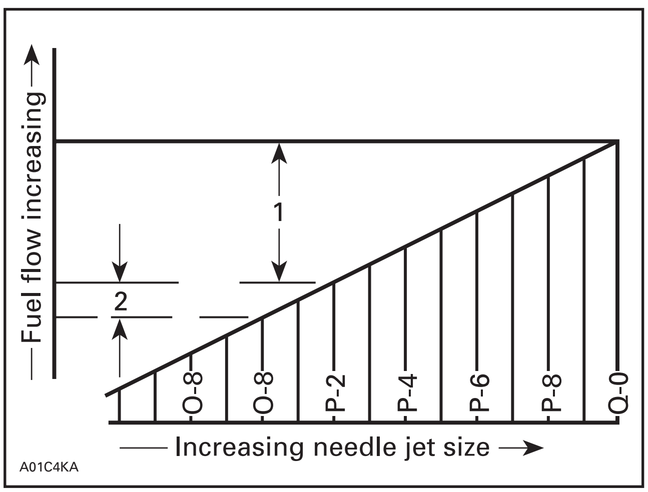
PRINCIPLES OF OPERATION



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.



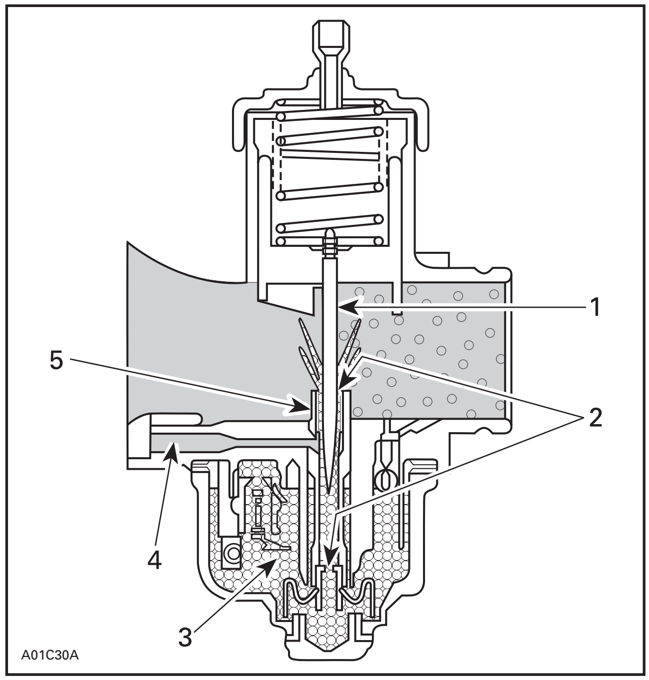


Needle jets are stamped with an alphanumeric code. The letter indicates a major change in fuel flow. P-2, for example, indicates low flow; P-4, greater flow, and so on. The number indicates minor adjustments in fuel flow. The first diagram shows the relationship between the alphanumeric needle jet size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

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



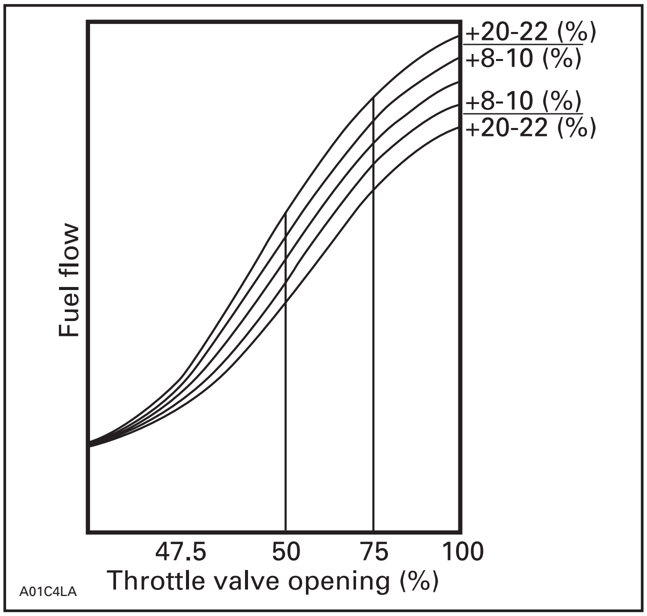
1. *Jet needle*
2. *Metered here*
3. *Fuel*
4. *Air*
5. *Needle jet*

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.

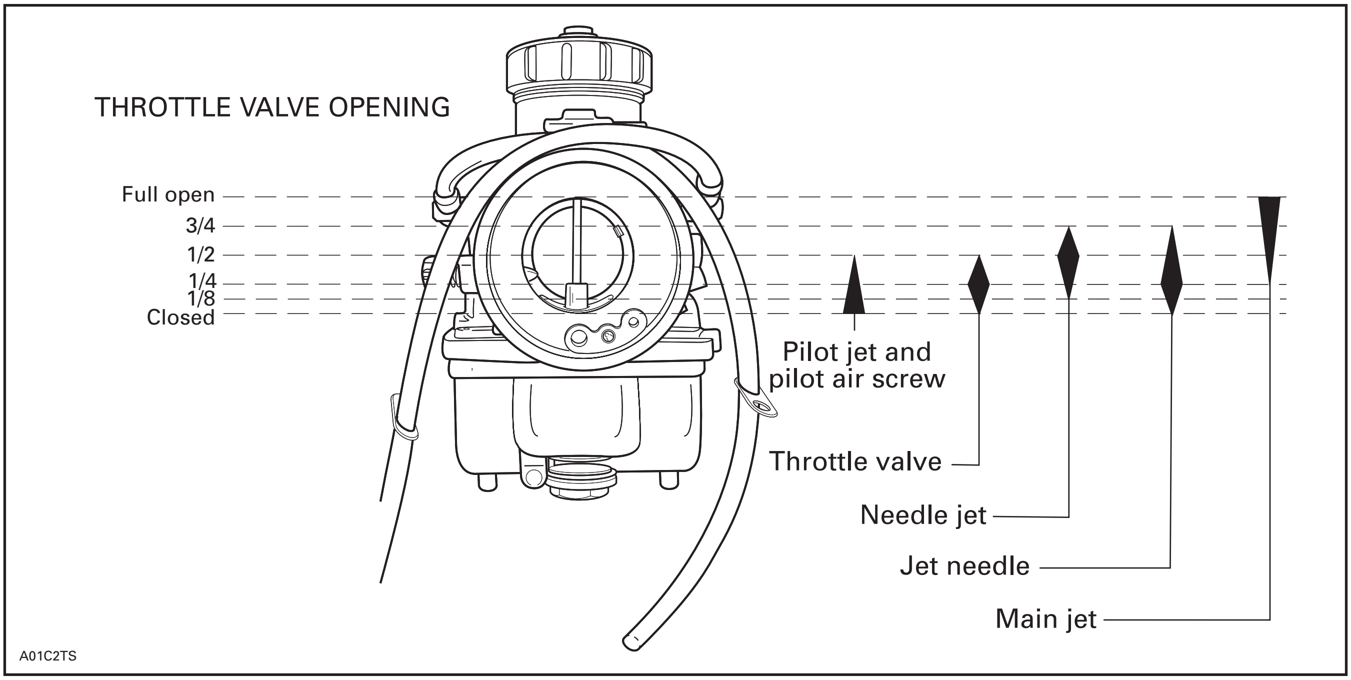
3. If the exhaust manifold or spark plug insulator is dark brown or black, the fuel/air mixture is too rich. Decrease jet size.
4. If the exhaust manifold or spark plug insulator is very light in color, the fuel/air mixture is too lean. Increase jet size.
5. If you cannot determine the color, proceed 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



Revision: 25
Date: 98-07-02

MIKUNI

CARBURETOR CALIBRATION

<< ATTENTION >> The preliminary calibration is for prototype test use only

BOMBARDIER MODELS 1999

ENGINE	MODEL #	MODEL NAME	CARB. #	BBD #	IDLE ±0.2	R.P.M. ±200	M.J.	NEEDLE	C.A.	P.J.	A.S. ± 1/16	V.S.	N.JET	S.J.	FLOAT LEVEL ± 1	STATUS
277	3274	TUNDRA II LT	VM34-529	403 138 501	1.3	1200	190	6DH4-2	2.5	40	1.0	1.5	O-8 (159)	N/A	23.9	Final
277	3272	TUNDRA R	VM34-537	403 138 566	1.5	1650	190	6DH4-2	2.5	40	1.0	1.5	O-8 (159)	N/A	23.9	Final
377	1351	FORMULA S	VM30-195	403 138 540	1.3	1650	140	6DP9-3	2.5	40	1.25	1.5	P-0 (159)	1.2	23.9	Final
377	1365	SKANDIC 380	VM30-196	403 138 563	1.3	1650	140	6DP9-3	2.5	40	1.25	1.5	P-0 (159)	0.9	23.9	Final
	1384	FORMULA DLX 377														Final
	1359	TOURING E														Final
443	1409	MXZ 440	VM34-530 PTO	403 138 543	1.5	1650	205	6DH2-3	2.5	35	[1.5]	1.5	P-0 (159)	1.2	23.9	Final
	1357	TOURING LE	VM34-531 MAG	403 138 544	1.5	1650	195	6DH2-3	2.5	35	[1.5]	1.5	P-0 (159)	1.2	23.9	Final
494	1388	FORMULA Z 500	VM38-408 PTO	403 138 527	1.8	1800	300	6DGY9-2	2.5	50	[2.0]	1.5(V)	Q-3 (480)	N/A	18.1	Final
	1377	FORMULA DLX 500 LC	VM38-409 MAG	403 138 528	1.8	1800	280	6DGY9-2	2.5	50	[2.0]	1.5(V)	Q-3 (480)	`	18.1	Final
494	1367	GT 500	VM38-410 PTO	403 138 517	1.8	1800	300	6DGY9-2	2.5	50	[2.0]	1.5(V)	Q-3 (480)	N/A	18.1	Final
			VM38-411 MAG	403 138 518	1.8	1800	280	6DGY9-2	2.5	50	[2.0]	1.5(V)	Q-3 (480)	N/A	18.1	
494	1412	MXZ 500	VM38-412 PTO	403 138 521	1.8	1800	300	6DGY9-3	2.5	50	[2.5]	1.5(V)	Q-4 (480)	N/A	18.1	Final
			VM38-413 MAG	403 138 522	1.8	1800	280	6DGY9-3	2.5	50	[2.5]	1.5(V)	Q-4 (480)	N/A	18.1	
494	1403	SUMMIT 500	VM38-414 PTO	403 138 519	2.2	1800	350	6DHY48-4	2.5	75	[2,0]	1.5(V)	Q-6 (480)	N/A	18.1	Final
		(HAC)	VM38-415 MAG	403 138 520	2.2	1800	330	6DHY48-4	2.5	75	[2.0]	1.5(V)	Q-6 (480)	N/A	18.1	Final
503	1361	SKANDIC 500	VM34-532 PTO	403 138 541	1.5	1650	180	6DH2-3	2.5	40	[1.875]	1.5	P-0 (159)	0.9	23.9	Final
	1348	FORMULA SL	VM34-533 MAG	403 138 542	1.5	1650	170	6DH2-3	2.5	40	[1.875]	1.5	P-0 (159)	0.9	23.9	Final
	1386	FORMULA DLX 503														Final
	1354	TOURING SLE														Final
583	1380	FORMULA DLX 583	VM38-416 PTO	403 138 511	2.0	1800	270	6DEY4-2	2.5	50	[2.0]	1.5(V)	P-7 (480)	N/A	18.1	Final
	1370	GT 583	VM38-417 MAG	403 138 512	2.0	1800	260	6DEY4-2	2.5	50	[2.0]	1.5(V)	P-7 (480)	N/A	18.1	Final
583	1391	FORMULA Z 583	VM40-105 PTO	403 138 525	2.0	1800	280	7ECY1-3	2.5	60	[2.0]	1.5(V)	AA-2 (224)	N/A	18.1	Final
			VM40-106 MAG	403 138 526	2.0	1800	260	7ECY1-3	2.5	60	[2.0]	1.5(V)	AA-2 (224)	N/A	18.1	Final
599	1396	FORMULA III 600	VM36-190	403 138 550	1.3	1800	270	6DEY2-2	2.5	50	[2.0]	1,5(V)	P-0 (286)	1.5	18.1	Final
593	1336	MXZ 600	VM40-107	403 138 200	1.3	1600	280	XB0101/02-3	2.5	37.5	[1.0]	1,5(V)	Z-9 (224)	0.8	22,9 ***	Final
593	1345	SUMMIT 600	VM40-113	403 138 400	1.3	1600	280	XB0101/02-3	2.5	37.5	[1.0]	1,5(V)	Z-9 (224)	0.8	22,9 ***	Final
670	1382	FORMULA DLX 670	VM40-109 PTO	403 138 513	2.1	1700	310	7EDY1-3	2.5	60	[2.25]	1.5(V)	AA-3 (224)	N/A	18.1	Final
	1394	FORMULA Z 670	VM40-110 MAG	403 138 514	2.1	1700	290	7EDY1-3	2.5	60	[2.25]	1.5(V)	AA-3 (224)	N/A	18.1	Final
670	1415	MXZ 670 (DPM)	VM44-36 PTO	403 138 559	1.9	1700	340	7ECY1-3	2.5	55	[1.75]	1.5(V)	AA-4 (224)	N/A	22,9 ***	Final
			VM44-37 MAG	403 138 560	1.9	1700	310	7ECY1-3	2.5	55	[1.75]	1.5(V)	AA-4 (224)	N/A	22,9 ***	Final
670	1407	SUMMIT X 670 (DPM)	VM44-38 PTO	403 138 545	2.4	1700	350	7ECY1-2	2.5	55	[1.75]	1.5(V)	AA-8 (224)	N/A	22,9 ***	Final
			VM44-39 MAG	403 138 546	2.4	1700	340	7ECY1-2	2.5	55	[1.75]	1.5(V)	AA-8 (224)	N/A	22,9 ***	Final
699	1422	MACH 1	TM38-C224	403 138 557	1.5	1800	290	8AGY1/41-4	2,0	50	[4.0]	1.5(V)	N-7 (327)	1.0	21,0	Final
	1442	MACH 1 R														
699	1401	FORMULA III 700	VM38-420	403 138 551	1.2	1800	290	6DEH5-3	2.5	50	[2.5]	1.5(V)	P-1 (480)	1.5	18.1	Final
699	1373	GT 700 (DPM)	VM38-422	403 138 547	1.2	1800	290	6DEH5-3	2.5	50	[2.5]	1.5(V)	P-1 (480)	1.5	18.1	Final
809	1401	FORMULA III 800	TM38-C228 PTO	403 138 558	1.3	1800	270	8ADY1/41-3	2.0	50	[4.5]	1.5(V)	O-2 (327)	1.5	21.0	Final
			CEN		1.3	1800	290	8ADY1/41-3	2.0	50	[4.5]	1.5(V)	O-2 (327)	1.5	21.0	Final
			MAG		1.3	1800	280	8ADY1/41-3	2.0	50	[4.5]	1.5(V)	O-2 (327)	1.5	21.0	Final
809	1375	GT SE (DPM)	TM38-C232 PTO	403 138 556	1.3	1800	270	8ADY1/41-3	2.0	50	[4.5]	1.5(V)	O-2 (327)	1.0	21.0	Final
			CEN		1.3	1800	290	8ADY1/41-3	2.0	50	[4.5]	1.5(V)	O-2 (327)	1.0	21.0	Final
			MAG		1.3	1800	280	8ADY1/41-3	2.0	50	[4.5]	1.5(V)	O-2 (327)	1.0	21.0	Final
809	1418	MACH Z	TM38-C236	403 138 555	1.3	1800	300	8ADY1/41-3	2.0	50	[4.5]	1.5(V)	O-2 (327)	1.0	21.0	Final
	1439	MACH Z R														
	1420	MACH ZLT														
	1445	MACH ZLT R														

*** With straith float arm
V = VITON TYPE

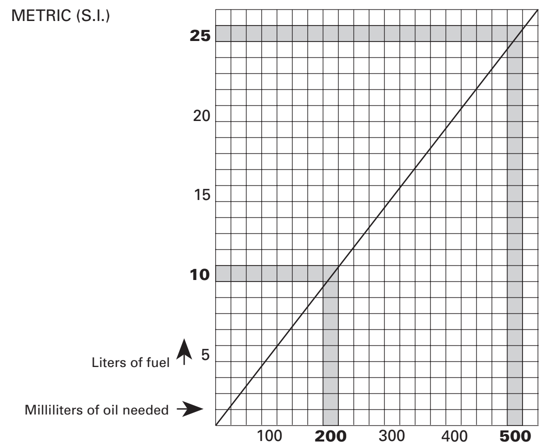
[x.xx] = FINE THREAD (20° , 0.5 mm PITCH)
Color Identification : MAG: Red, CENTER: yellow, PTO : Blue
(No color if carbs. Identical)

FUEL/OIL RATIO CHARTS

50/1

METRIC (S.I.)

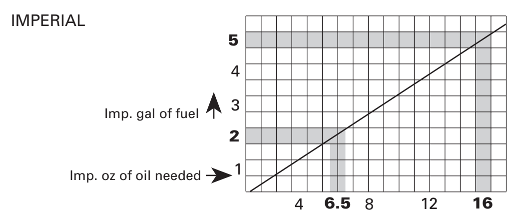
500 mL of oil + **25 L of fuel = 50/1**



IMPERIAL

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

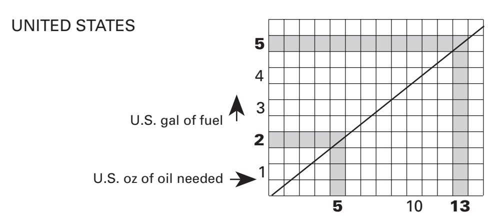
500 mL of oil + **5.5 Imp. gal of fuel = 50/1**



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**

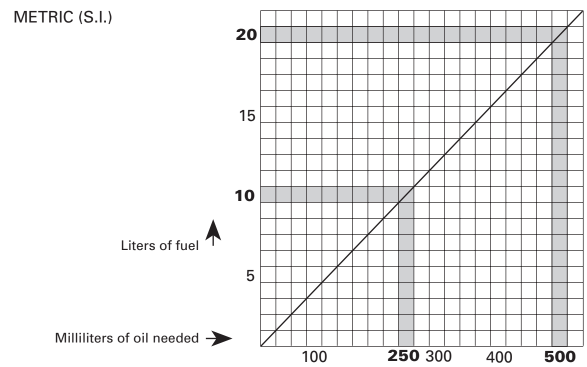


A00A1WJ

40/1

METRIC (S.I.)

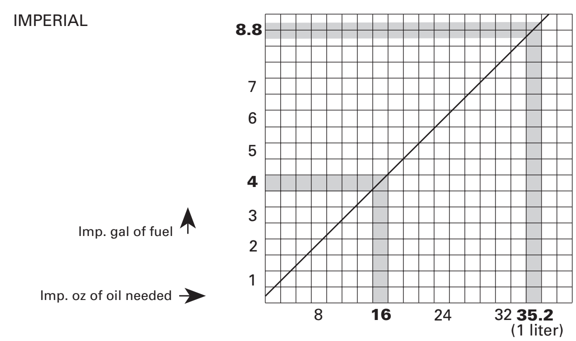
500 mL of oil + **20 L of fuel** = **40/1**



IMPERIAL

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

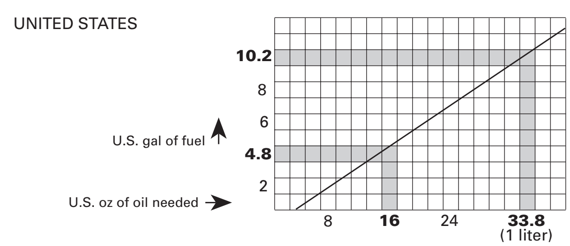
500 mL of oil + **4.8 Imp. gal of fuel** = **40/1**



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**



A00A2WJ

30/1

METRIC (S.I.)

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

IMPERIAL

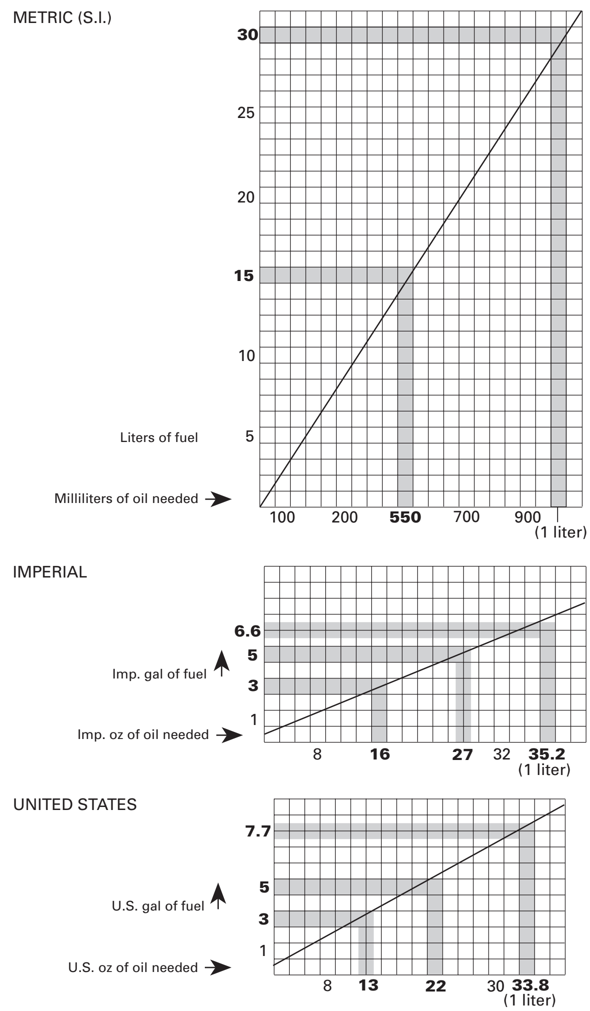
16 oz of oil + **3 Imp. gal of fuel = 30/1**

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**



A00A2XJ

25/1

METRIC (S.I.)

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

IMPERIAL

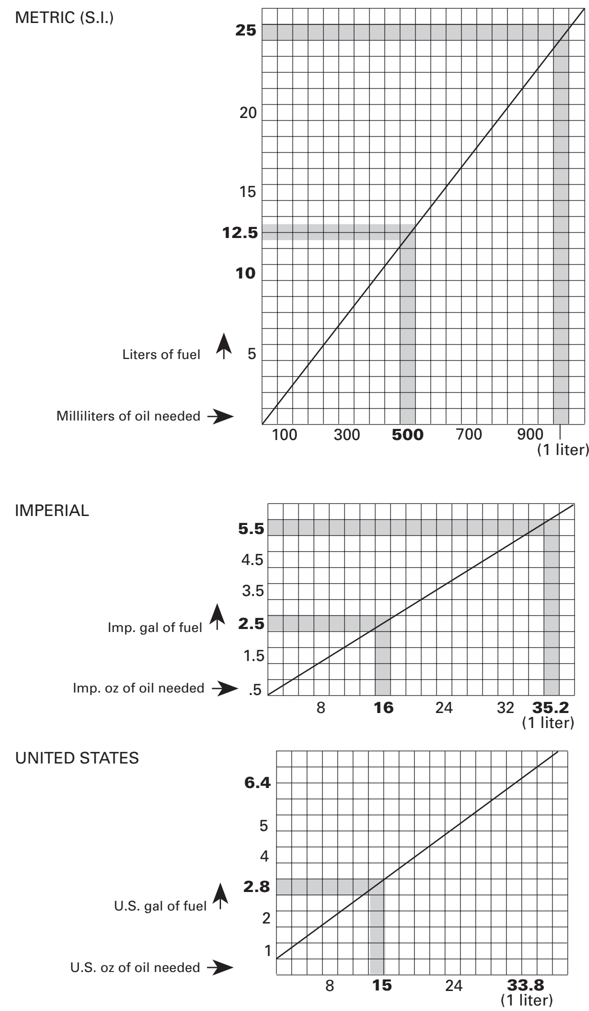
16 oz of oil + **2.5 Imp. gal of fuel = 25/1**

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**

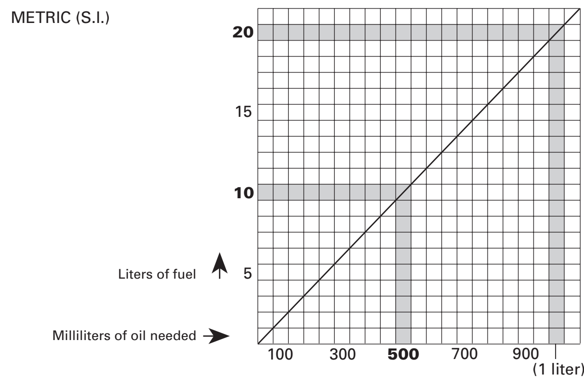


A00A2YJ

20/1

METRIC (S.I.)

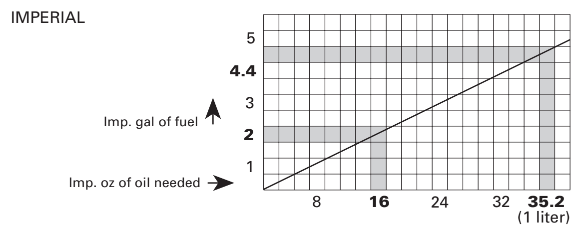
500 mL of oil + **10 L of fuel = 20/1**



IMPERIAL

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

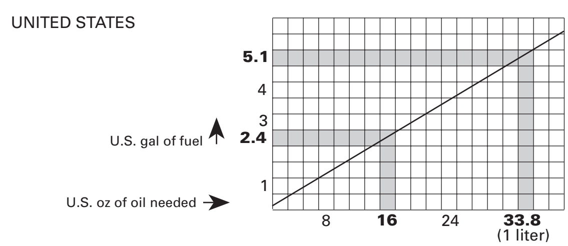
500 mL of oil + **2.2 Imp. gal of fuel = 20/1**



UNITED STATES

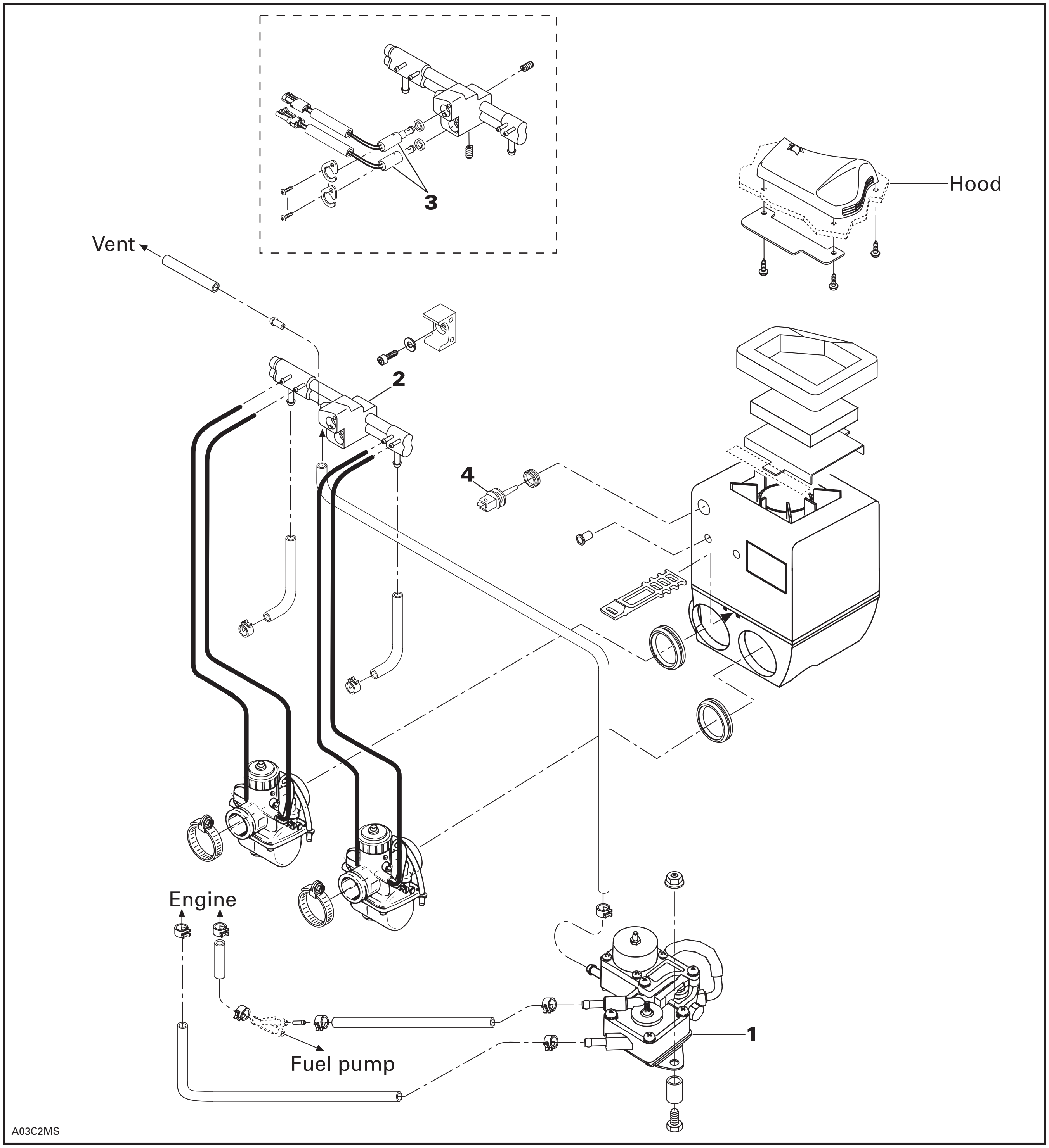
16 oz of oil + **2.4 U.S. gal of fuel = 20/1**

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

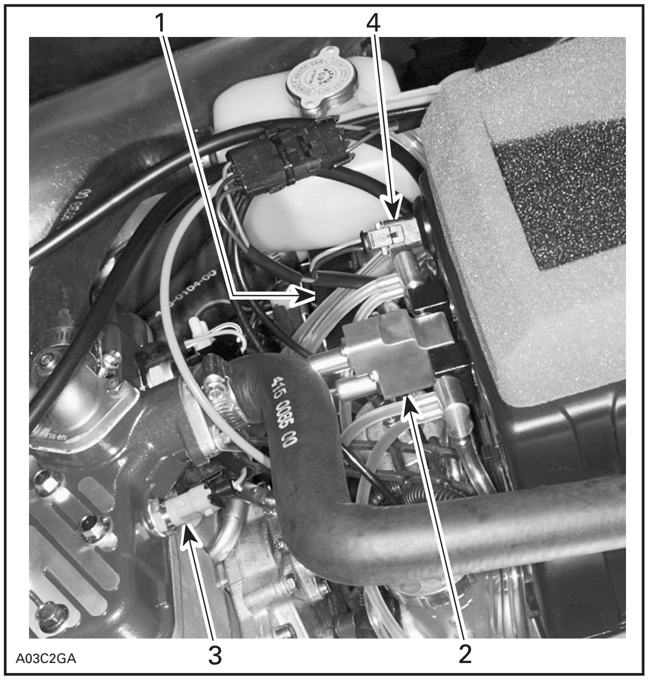


A00A2YJ

DIGITAL PERFORMANCE MANAGEMENT (DPM) SYSTEM



COMPONENT LOCATION



1. *MPEM module*
2. *Manifold*
3. *Engine temperature DPM sensor*
4. *Air temperature DPM sensor*

THEORY AND OPERATION

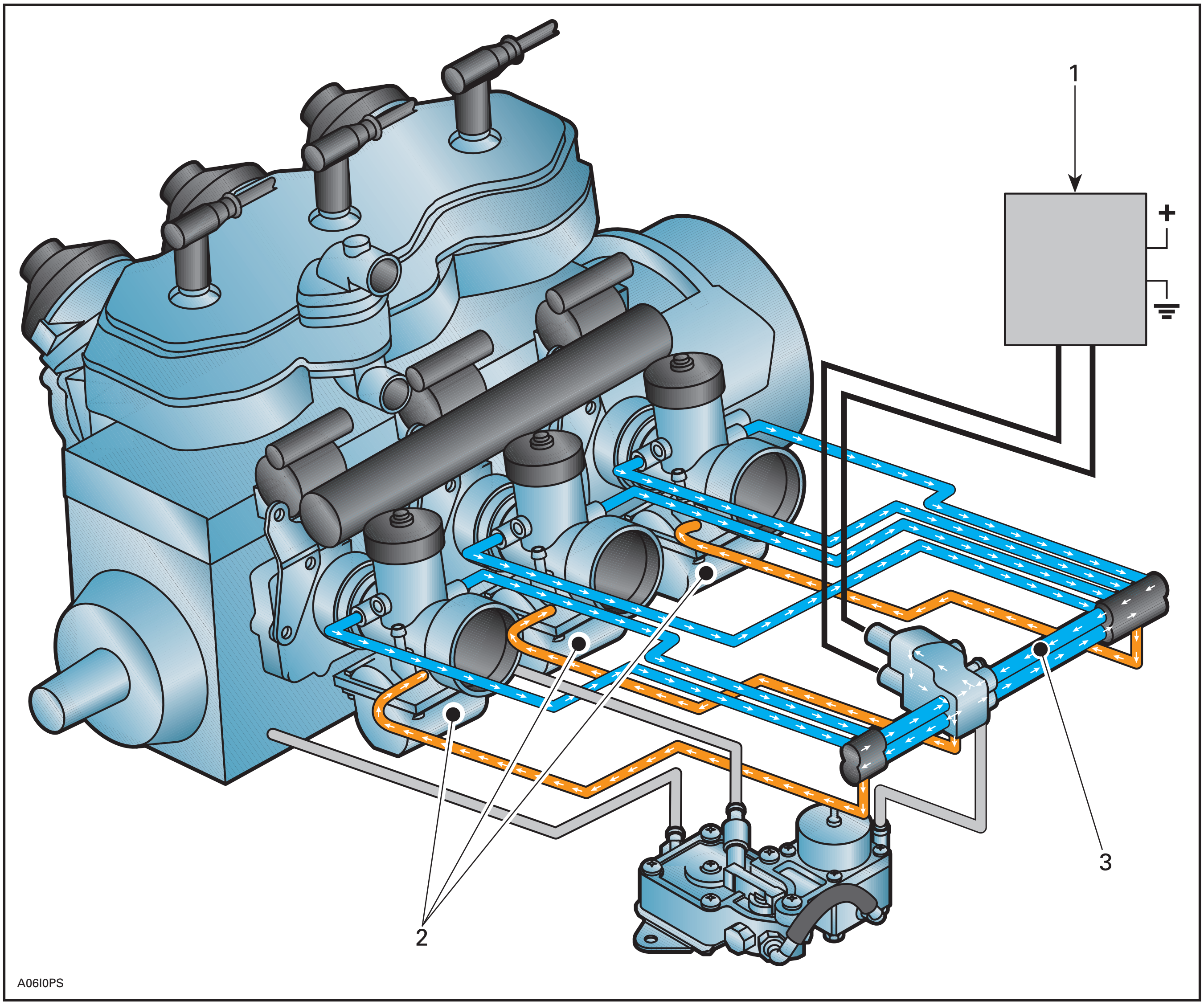
PURPOSE

Calibrate the air/fuel mixture in order to optimize the engine output while reducing fuel consumption.

METHOD

The system makes the pressure vary within the carburetor bowl.

OVERALL SYSTEM OPERATION



3 CYLINDER ENGINE SHOWN — SAME PRINCIPLE FOR 2 CYLINDER ENGINE

1. *MPEM module*
2. *Carburetor bowls*
3. *Distribution gallery (upper tube)*

Introduction

The engine is being started using the manual starter.

The Digital Performance Management (DPM) system increases pressure within all 2 carburetor bowls thus the air/fuel mixture is enriched. This is what we call the enrichment mode.

NOTE: On Summit x 670, use primer to ease cold starting. See STARTING PROCEDURE at the end of this section.

As soon as the spark plug gives off its first spark, the DPM system calculates the enrichment time and rate based on the engine temperature.

Once enrichment mode is completed carburetor bowls return to atmospheric pressure (DPM in standby mode), and the air/fuel mixture is identical to that of carburetors without the DPM system.

Over 3000 RPM, compensation mode is activated but will compensate only if the air temperature exceeds - 20°C (- 4°F) and the air pressure is lower than 1000 mbar.

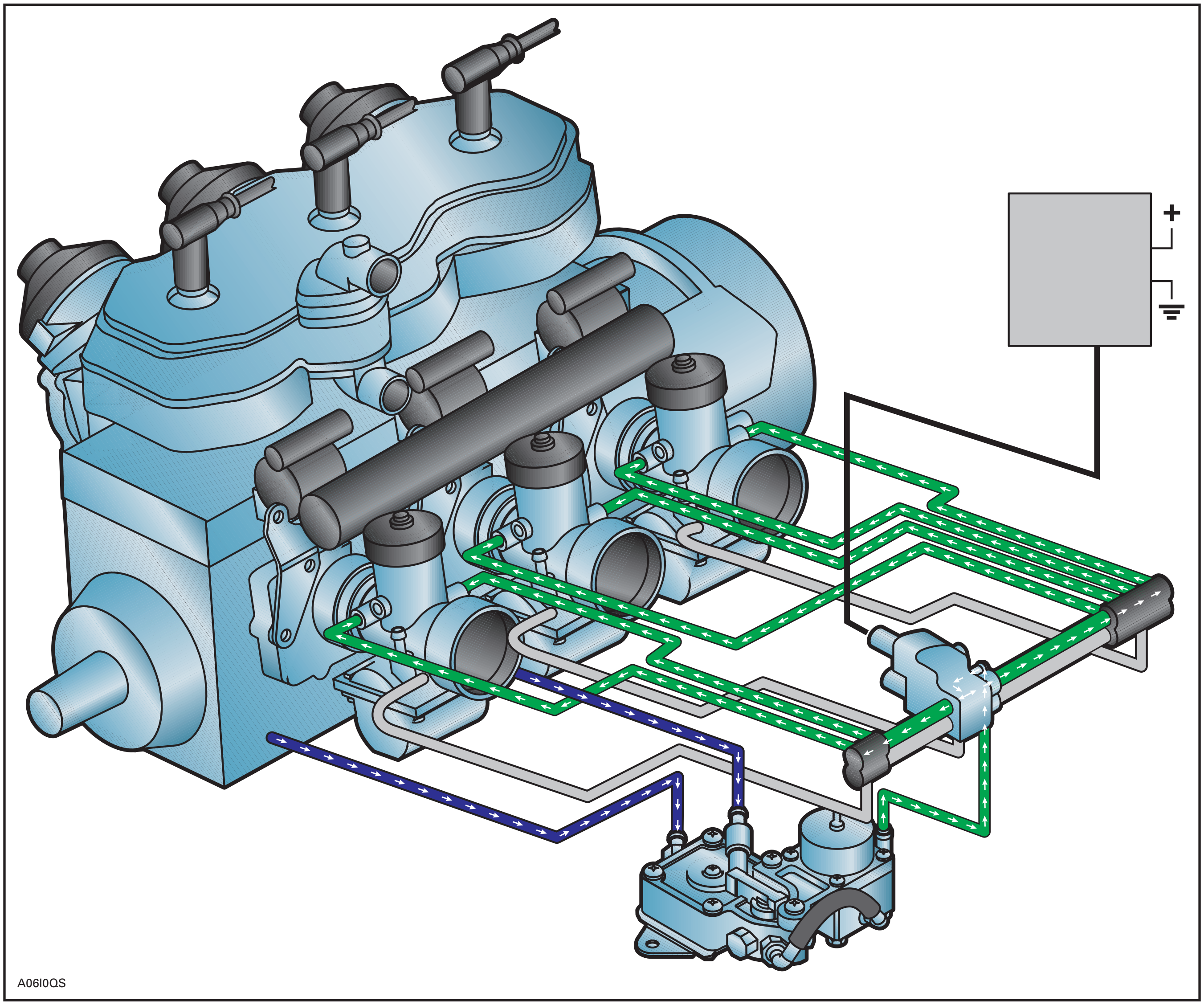
Float bowls are now under vacuum (lower than atmospheric pressure) and the air/fuel mixture is leaner.

NOTE: On Summit x 670 both modes (enrichment or compensation) **can** operate at the same time.

DPM SYSTEM OPERATION

BLACK and WHITE/GRAY wires (2-05 housing) are used for programming by the manufacturer. Nothing must be plugged to this housing.

Enrichment Mode (starting)



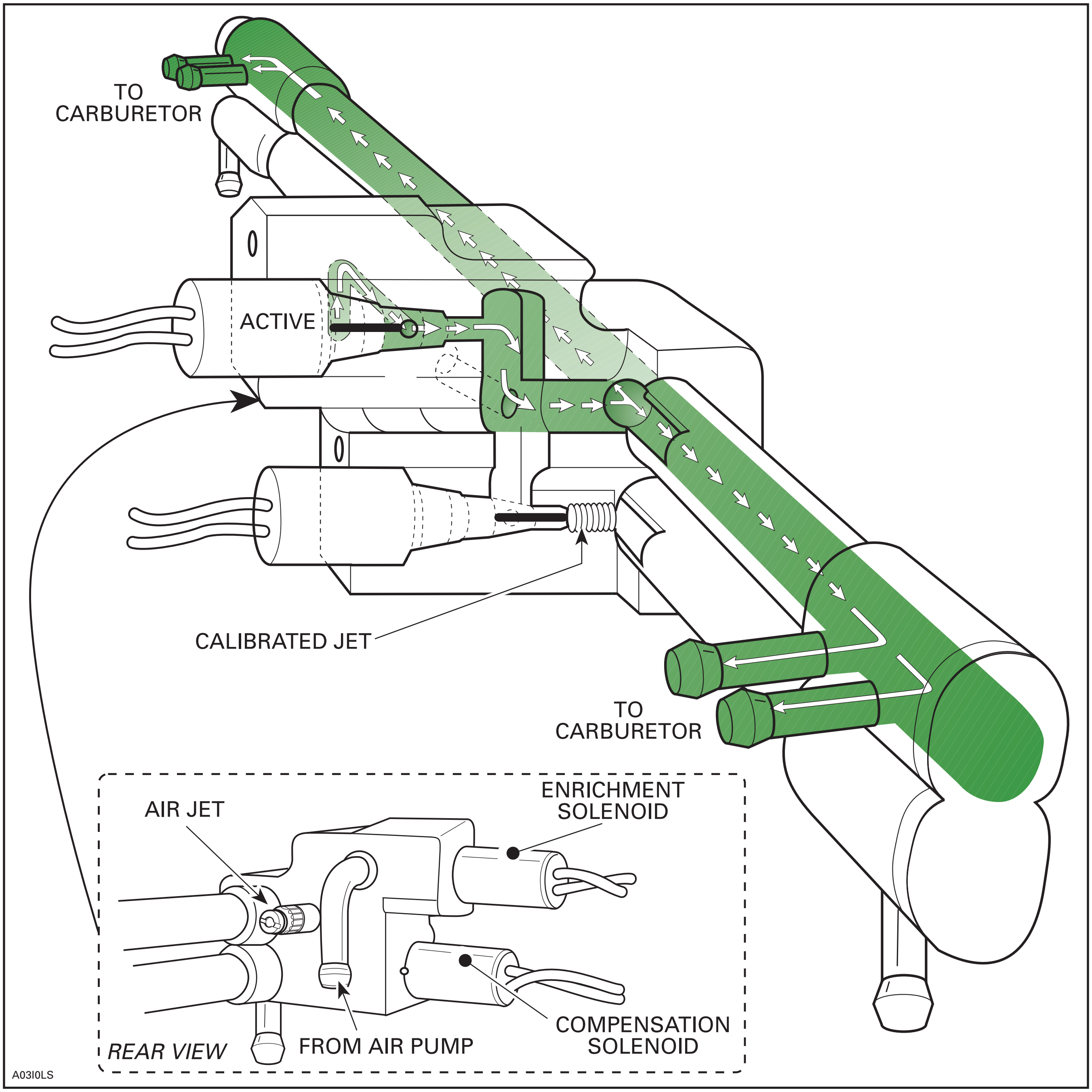
TYPICAL

Turning the ignition key to the ON position will not energize DPM system. The DPM system is energized only.

Once the engine turns over 250 RPM.

The DPM system then comes on by reading the engine temperature through the sensor located on the cylinder head. The DPM system calculates the enrichment solenoid opening time (duty cycle) and the enrichment rate according to the temperature. The air/fuel mixture is then enriched in order to facilitate starting.

The system pressurizes both carburetor bowls in order to enrich the air/fuel mixture. This is accomplished with the help of an air pump.



This enrichment mode of the air/fuel mixture takes place at start-up and during engine warm-up, and it depends on engine temperature.

The higher the engine temperature upon start-up, the leaner the mixture.

This enrichment mode progressively decreases (with time) by reducing the solenoid duty cycle. The warmer the engine, the shorter the enrichment mode.

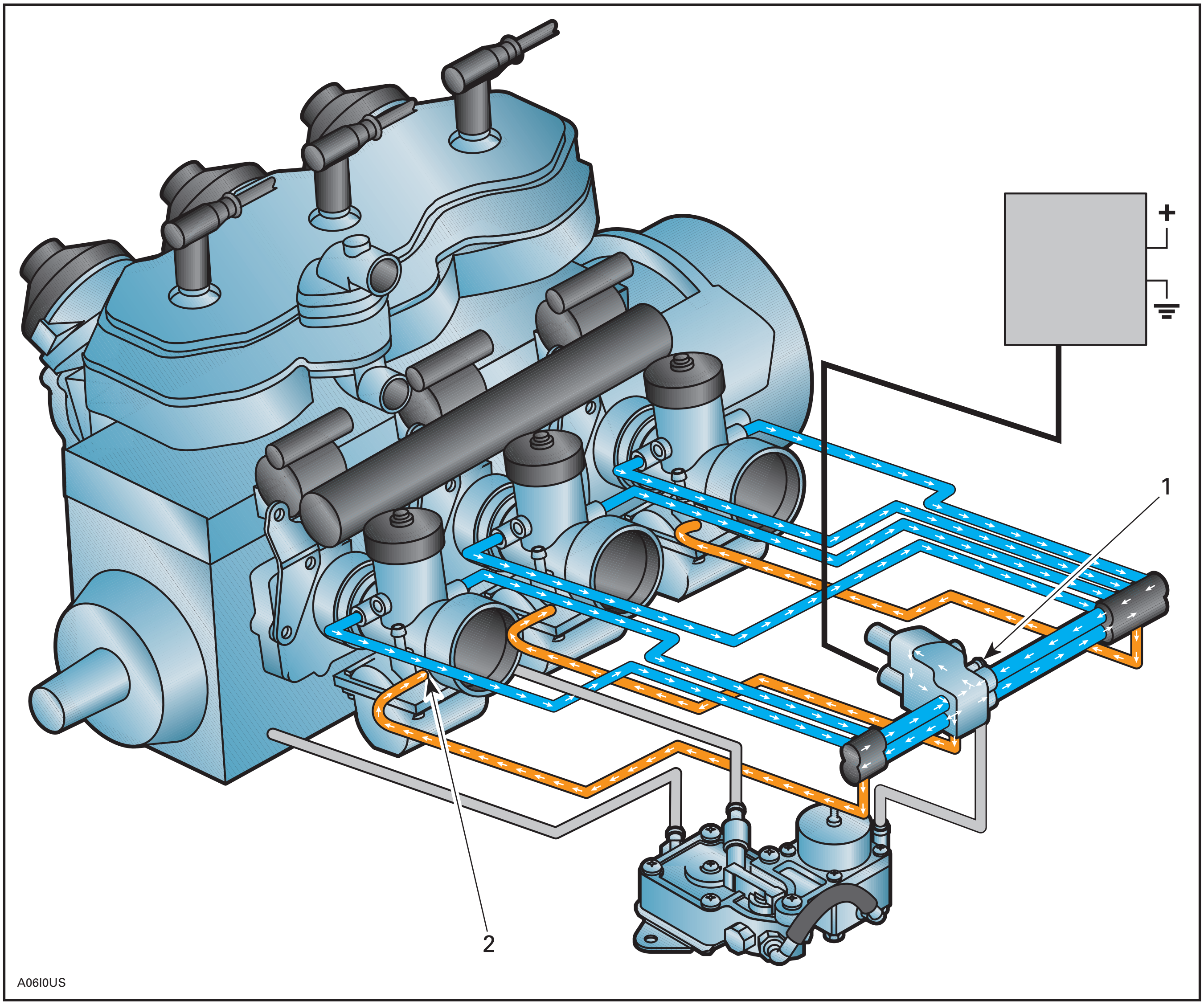
If the throttle opening exceeds one quarter, the enrichment mode is interrupted by a switch during the starting process, which allows unflooding the engine.

However, the enrichment mode is restored when releasing the throttle.

Following the enrichment mode, carburetors are operating normally, i.e. without additional pressure within bowls.

NOTE: Calibration is exactly the same on engines with a DPM system and those without.

Compensation Mode

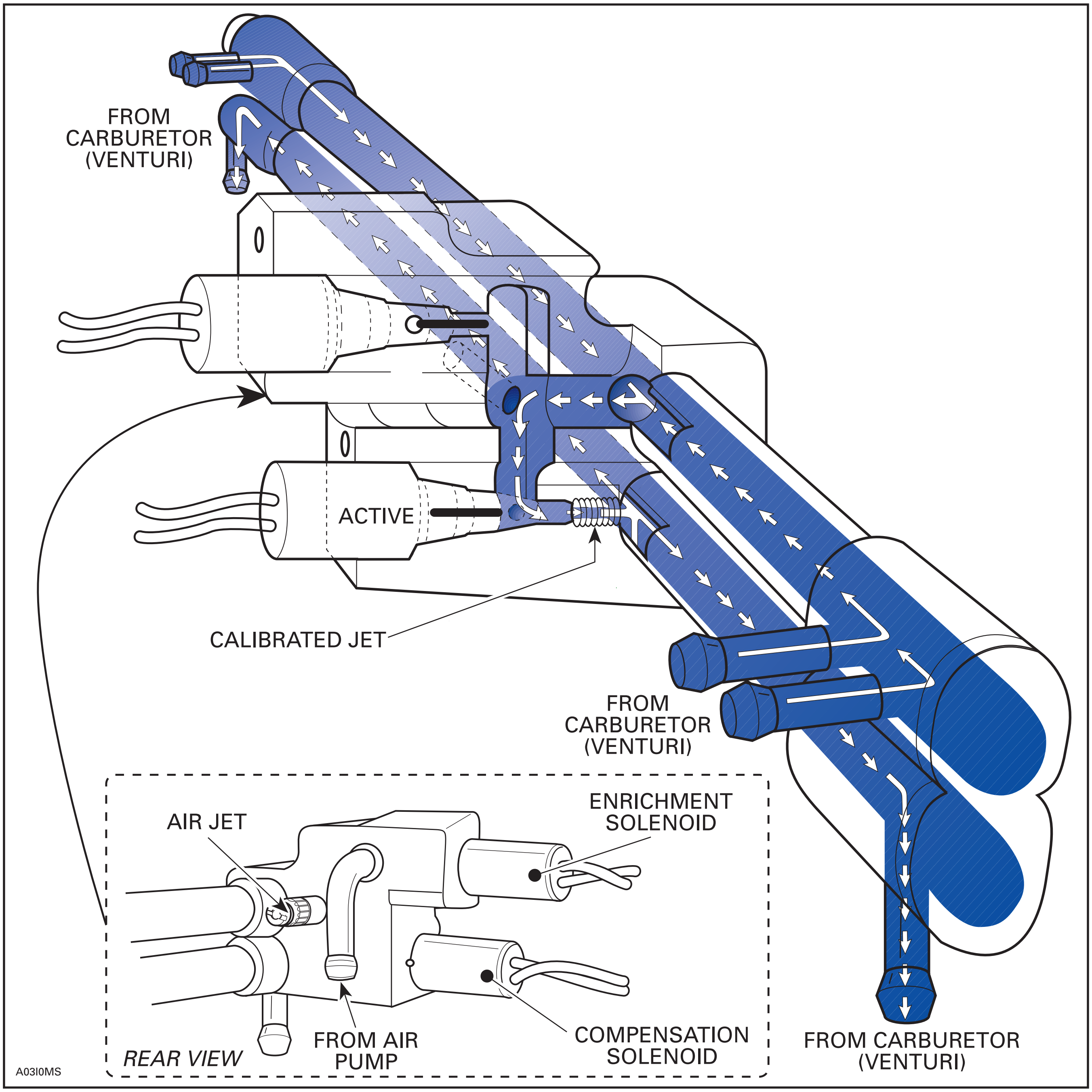


1. *Air jet*
2. *Needle jet air inlet*

Three conditions must be met for the compensation mode to operate:

1. Engine must rev over 3000 RPM.
2. Air temperature must exceed - 20°C (- 4°F).
3. Atmospheric pressure must be lower than 1000 mbar.

The compensation system brings both carburetor bowls under vacuum (lower than atmospheric pressure) in order to make the air/fuel mixture leaner. The required vacuum is produced within the needle jet air inlet.



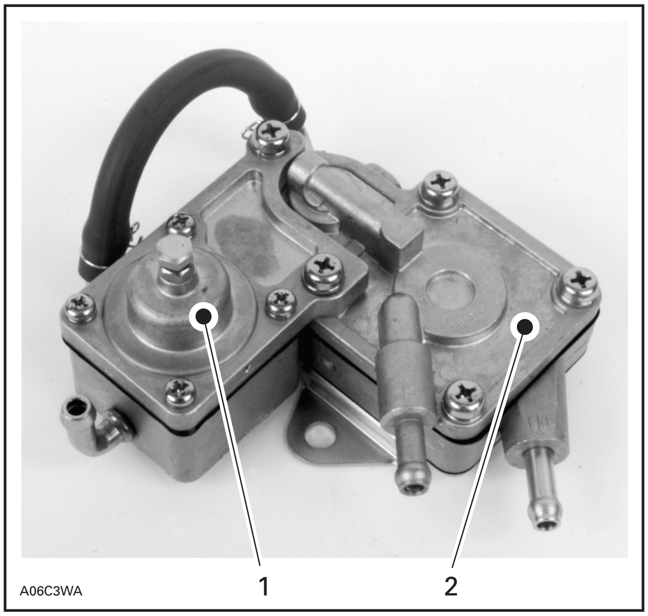
The compensation ratio will depend on the air temperature and the atmospheric pressure.

The higher the air temperature, the leaner the air/ fuel mixture.

The lower the atmospheric pressure, the leaner the air/fuel mixture.

NOTE: The atmospheric pressure decreases as the altitude increases.

AIR PUMP OPERATION



TYPICAL
1. *Regulator*
2. *Pump*

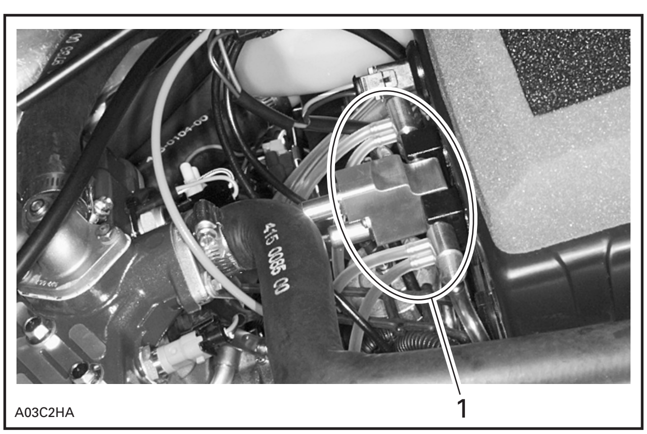
Air pump **no. 1** supplies the distribution gallery through a unique pipe.

Pump diaphragm is activated by the alternating pressure/vacuum within the engine crankcase. Two pipes connect the crankcase (cylinders nos. 1 and 2) to the pump.

A regulator within the pump stabilizes the pump pressure.

Since the pump pressure is insufficient upon starting, the regulator is fed directly by the crankcase pressure.

DPM MANIFOLD OPERATION

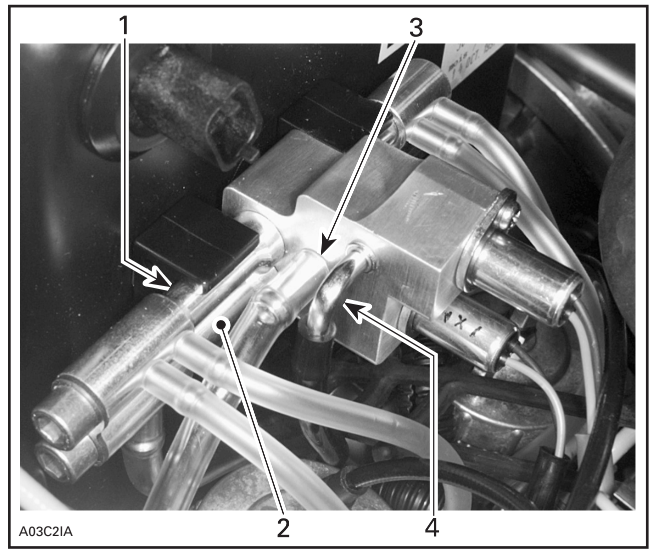


1. *Manifold*

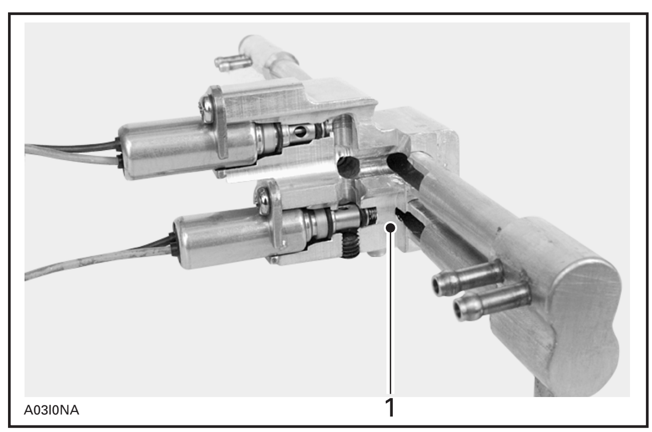
The DPM manifold **no. 2** consists of 2 tubes. Depending on the mode, the upper tube (distribution gallery) distributes pump pressure or vacuum to each bowl through 2 pipes. The passage is then opened by the enrichment or the compensation solenoid, depending on the mode.

The lower tube (vacuum collector) receives the vacuum created by each carburetor within the needle jet air inlet.

An air jet (manifold air jet) also allows the atmospheric pressure to enter.



MANIFOLD ASS'Y
1. *Upper tube: distribution gallery*
2. *Lower tube: vacuum collector*
3. *Manifold air jet (1.2 mm) — atmospheric pressure*
4. *From air pump*



TYPICAL
1. *Compensation solenoid air jet (1.4 mm)*

Enrichment Solenoid

Solenoid Operating Principle

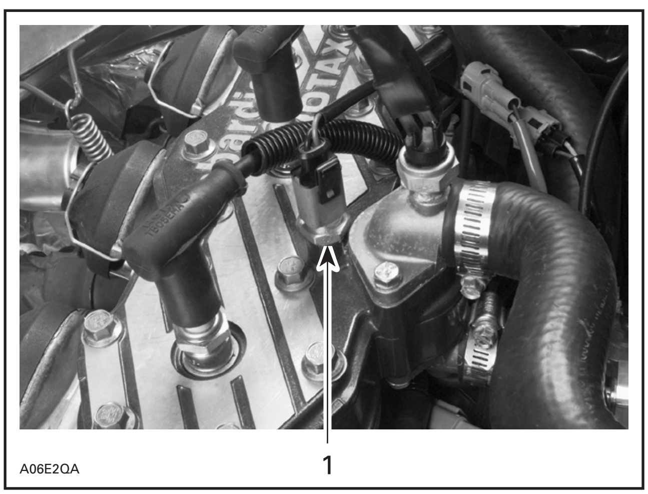
A solenoid is a winding coiled in order to produce a magnetic field. A metal rod crosses the coil and cuts the magnetic field. Each time the coil is activated, the magnetic field attracts the rod. If the supply current is interrupted, a spring pushes the rod.

Solenoid Function within the DPM System

The DPM system turns the solenoid **no. 3** ON and OFF 10 times per second, which means that it operates at 10 cycles/second or 10 Hertz (Hz). The solenoid therefore opens and closes 10 times per second, thus allowing the pump pressure to reach the distribution gallery (upper tube).

For the pressure to vary within the bowls, the solenoid is activated in part by the DPM during each cycle. This is what is called the duty cycle. In other words, the solenoid will not open throughout the whole cycle. The duty cycle depends on the engine temperature.

The colder the engine, the longer the duty cycle. Therefore, the solenoid will stay open longer, thus giving way to pressure.



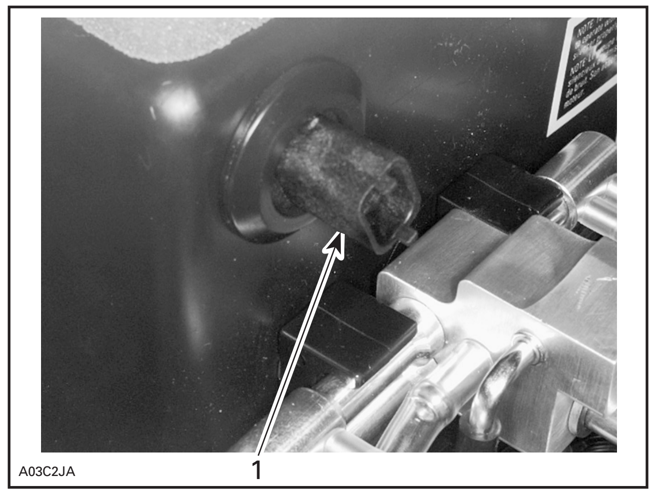
1. Engine temperature DPM sensor

Compensation Solenoid

NOTE: Same principle as enrichment solenoid. Read **Solenoid Operating Principle** at the beginning of the chapter concerning the enrichment solenoid.

The duty cycle of the compension solenoid depends on the air temperature and the atmospheric pressure.

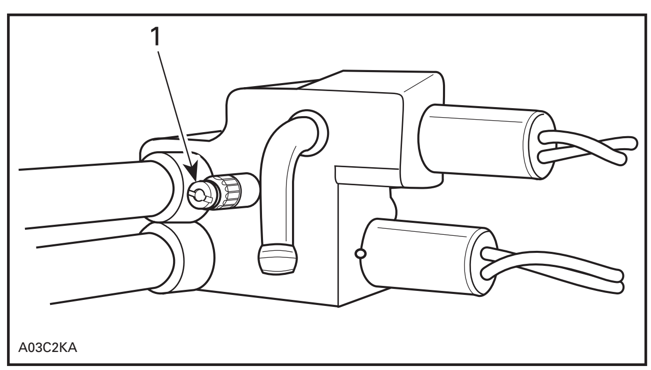
The warmer the air, the longer the duty cycle. Therefore, the solenoid will stay open longer, thus giving way to vacuum. The same applies when the altitude increases.



1. Air temperature sensor

Manifold Air Jet

This jet allows the atmospheric pressure to reach carburetor bowls when the DPM SYSTEM is on standby (returned to atmospheric pressure).



REAR VIEW

1. Atmospheric pressure air jet

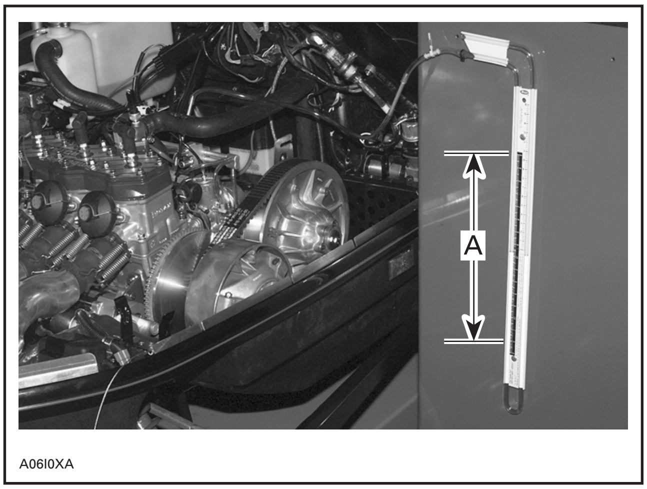
TESTING PROCEDURE

Pump

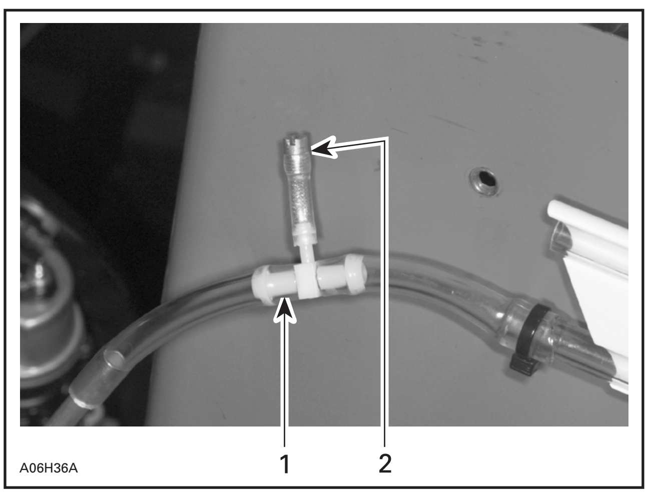
Pressure Test

The pump must create a minimum pressure of 400 ± 50 mm of water.

Connect a jet (P/N 270 500 157) to a hose then connect that little tube to the small nipple of a T-fitting (P/N 414 222 500). Install that T-fitting between a U-tube and air pump outlet.



TYPICAL
A. 400 ± 50 mm of water



1. T-fitting (P/N 414 222 500)
2. Jet (P/N 270 500 157)

Start engine and note water height.

DPM System

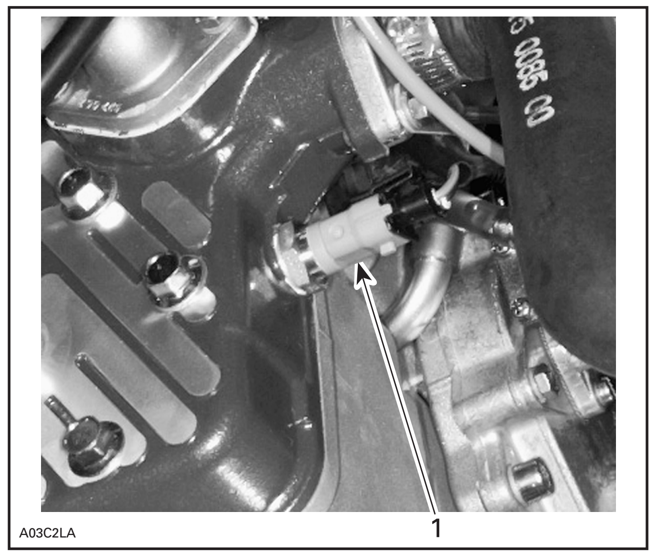
Solenoids are supplied by the MPEM module. If this module does not work, there will be no current on compensation solenoid RE/BL and BK connectors (3-10 housing); and on enrichment solenoid RE/GR and BK connectors (3-11 housing).

Unplug upper solenoid wire (enrichment). Connect a good solenoid to module output connector. Use adaptor (P/N 529 033 800) as required.

▼ CAUTION

Do not disconnect both DPM connectors. The compensation solenoid must remain plugged.

Disconnect engine temperature sensor connector. The DPM system now operates as though the engine temperature was - 20°C (- 4°F) to allow maximum mixture enrichment.



1. Engine temperature sensor

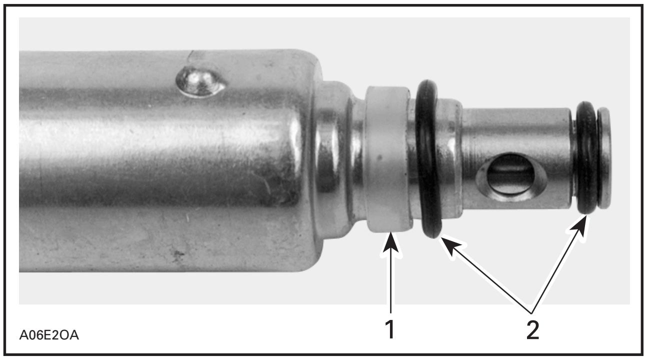
Start the engine and observe the solenoid. A vibrating solenoid indicates that the module is in good working order. If not, replace the module and repeat test.

Solenoid

Static Test

Disassemble the solenoid and connect it to a 12 V battery. The solenoid must open and stay open. Repeat test several times.

At reassembly, ensure that solenoid seals are in place.



1. *Plastic seal*
2. *O-rings*

Dynamic test

When checking the enrichment solenoid, disconnect engine temperature sensor connector. The DPM system now operates as though the engine temperature was - 20°C (- 4°F) to allow maximum mixture enrichment.

Remove the solenoid, hold it in hand and start the engine.

For the enrichment solenoid, check if it vibrates as soon as the engine is started.

For the compensation solenoid, the air temperature sensor **no. 4** must be at room temperature. Operate the engine at 3500 RPM. The solenoid must vibrate.

Temperature Sensor (air and engine)

At room temperature 20°C (68°F), the sensor resistance must be 2500 Ω ± 300.

STARTING PROCEDURE

Apply brake.

Check throttle lever operation. Make sure it returns to idle position when released.

Ensure that the emergency cut-out switch is in the ON position.

Ensure that the tether cut-out cap is on the DESS post and that the cord is attached to your clothing.

Initial Cold Starting

NOTE: Do not operate the throttle lever.

Above Freezing Point Temperature (0°C)

Grasp manual starter handle firmly and pull vigorously to crank engine.

If engine refuses to start, activate the primer button once then crank the engine again.

Below Freezing Point Temperature (0°C)

Activate primer button 2 or 3 times before cranking engine to inject fuel into intake manifold.

In extremely cold temperature, more priming may be required.

After the engine is started, the Digital Performance Management (DPM) system will control the carburation.

Warm Engine Starting

Priming is not necessary when engine is warm.

Crank engine normally without operating the throttle lever.

IMPORTANT: Operating the throttle lever while cranking the engine will deactivate the DPM system.

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 PSI) takes place at about 15° of crankshaft rotation ATDC. 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° ATDC, the spark must occur about 15° before TDC. Complete combustion will finish at about 35° ATDC. The actual amount of spark advance BTDC 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 BTDC 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 BTDC. 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

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

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

where:

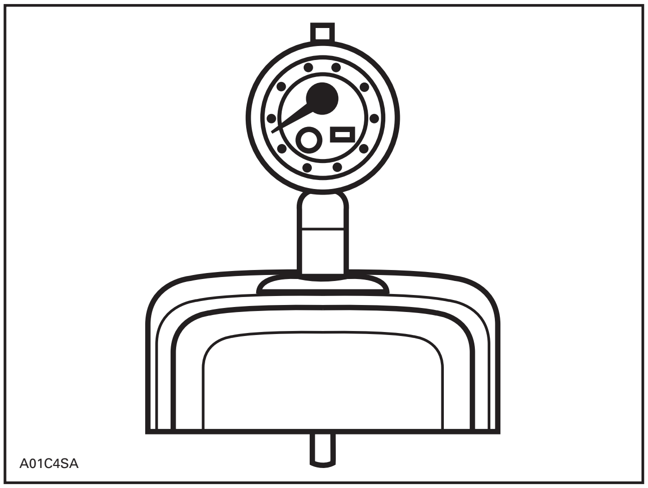
A = ignition advance in degrees of crankshaft rotation

T = ignition advance in millimeters BTDC

R = engine stroke divided by 2 (mm)

L = connecting rod length (mm)

P = R + L - T



DIRECT MEASUREMENT BTDC

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.

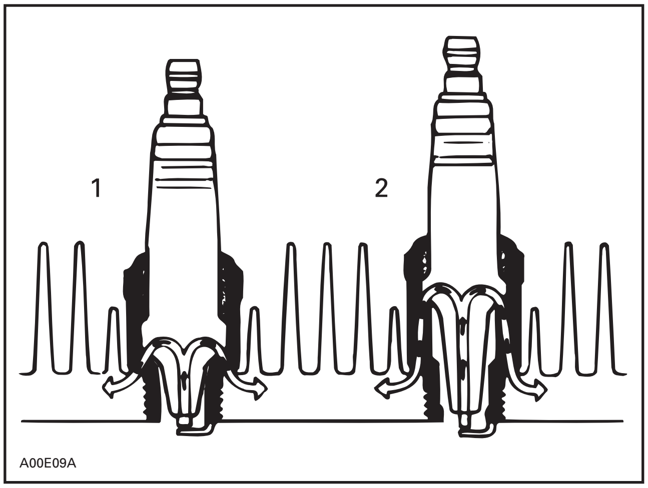
ENGINE TYPE	STROKE mm (in)	LENGTH mm (in)
253	61 (2.402)	115 (4.527)
377	61 (2.402)	115 (4.527)
447	61 (2.402)	115 (4.527)
247 (fan cooled)	66 (2.598)	132 (5.196)
640 (fan cooled)	70 (2.756)	132 (5.196)
670	70 (2.756)	132 (5.196)
277	66 (2.598)	120 (4.724)
354	61 (2.402)	120 (4.724)
454	61 (2.402)	120 (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)
593	66 (2.598)	125 (4.921)
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.

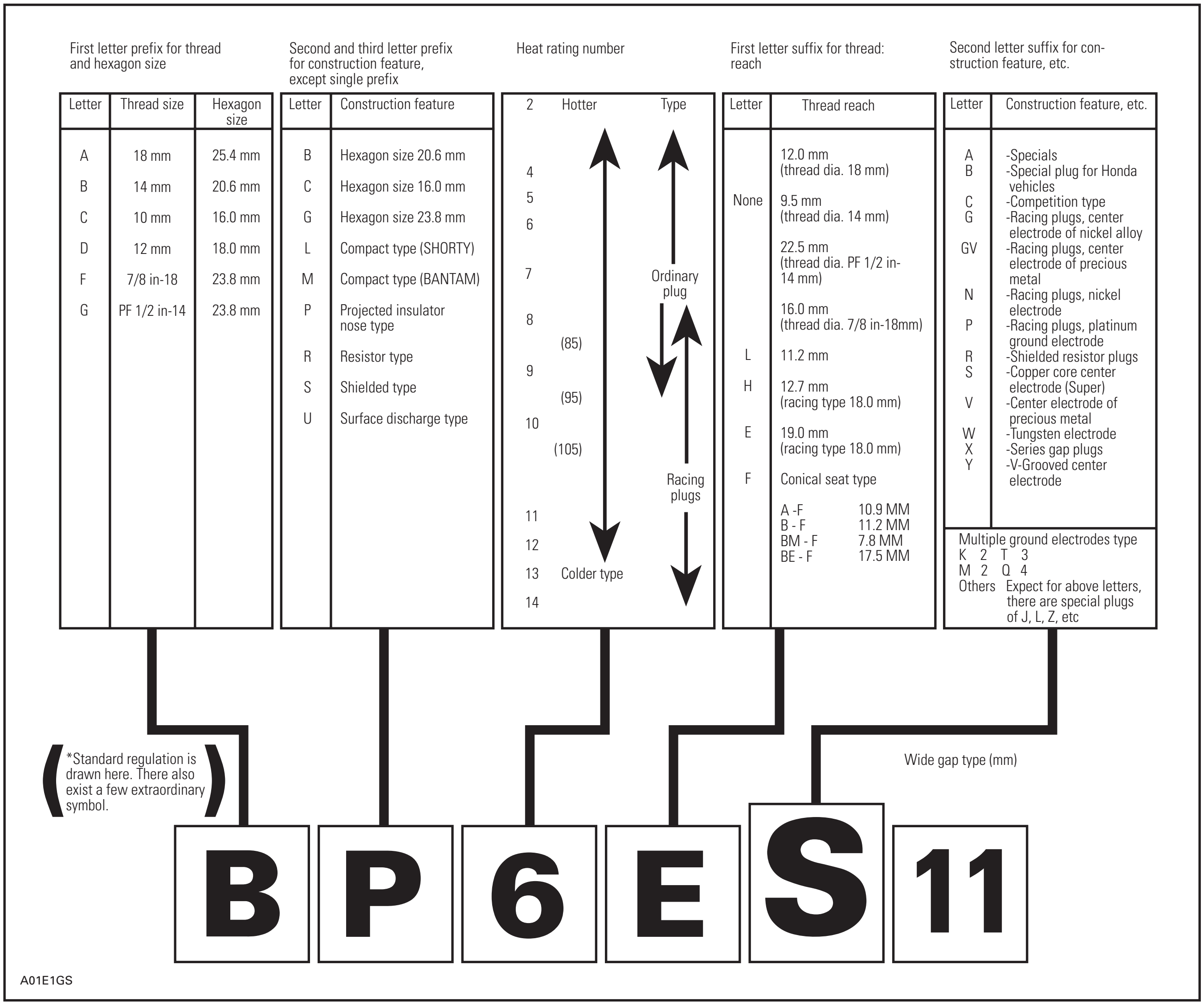
Such a plug is used in heavy duty or continuous high speed operation to avoid overheating.

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 engine is an NGK B10ES or B10EV.

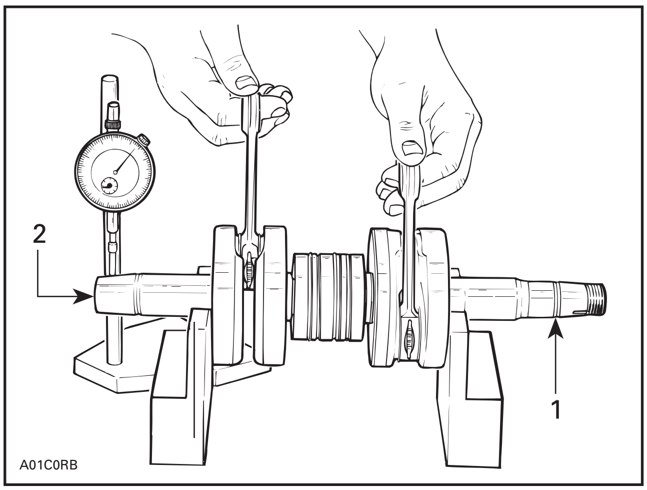
Design Symbols Used on NGK Spark Plugs



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. 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.
11. 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.
12. Use non resistor spark plugs — B9ES, B9EV, B10ES, B10EV of heat range required.
13. 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.

14. Tie wrap ignition wire connectors together.
15. Adjust carburetors for atmospheric conditions. (See carburetion section.)
16. 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.

TABLE OF CONTENTS

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. 1 74 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.

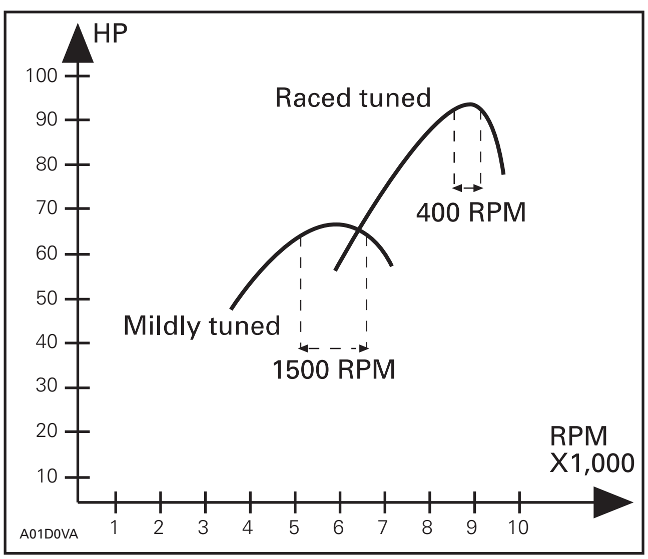
The goal of clutch calibration is to keep the engine, at full throttle at its peak horsepower RPM and, at the same time, to select the highest possible gear ratio as dictated by the load on the drive axle. The speed diagram illustrates what the goal of good clutch calibration is.

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.

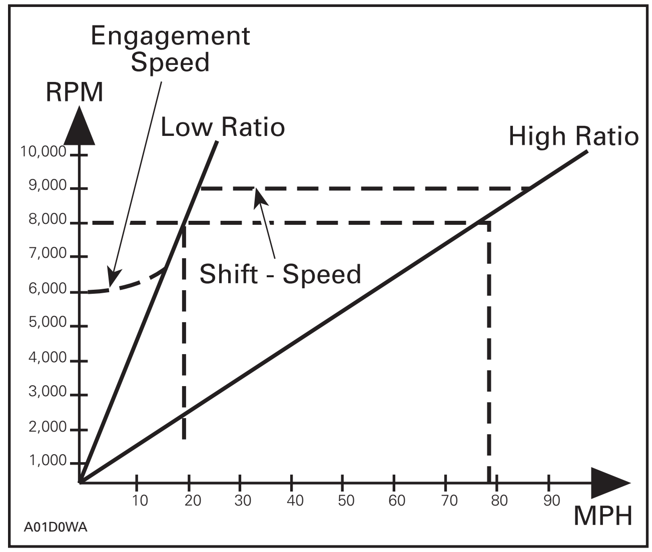
Engagement speed of the clutch is always set as low as possible to avoid track slippage and to prolong drive belt life. The clutch must be engaged at an RPM that is high enough, however, that the engine will be producing enough horsepower to overcome drag and allow acceleration without bogging. In the 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 centifugal 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.

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.

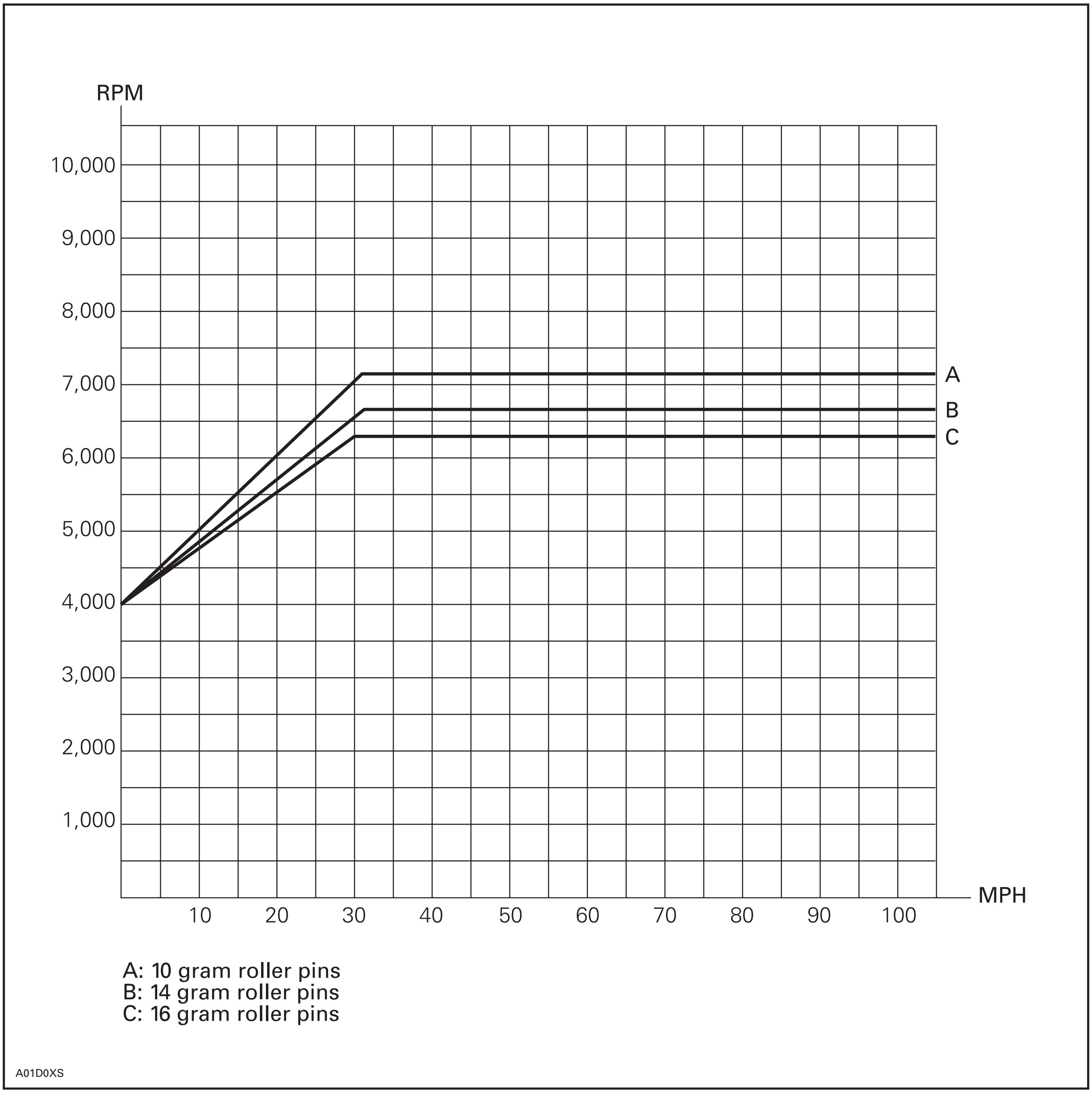
Curve A shows a clutch set up with three 10-gram type roller pins. This amount of weight will govern the engine to 7200 RPM and allow engagement of the clutch at 4000 RPM.

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 it may only take a 1 gram, increase per arm to see a 200 RPM decrease in peak operating RPM.

Drive Clutch Roller Pins



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 417 003 802) 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	417 003 801
Magnesium lever arm	27.3	417 003 802
Solid steel roller pin	16.4 (black)	504 259 600
Hollow steel roller pin	10.3	417 004 309
Threaded steel roller pin	10.3	504 151 700
Solid aluminum roller pin	5.9	N.A.
Threaded aluminum pin	3.8	504 260 3 00
Allen set screw 1/4″ – 28 N.F. × 1/4″	0.9	365 202 000
Steel roller	9.8	417 003 900
Steel roller	8.5	417 222 042
Aluminum roller	4.1	860 411 800 (kit)

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.

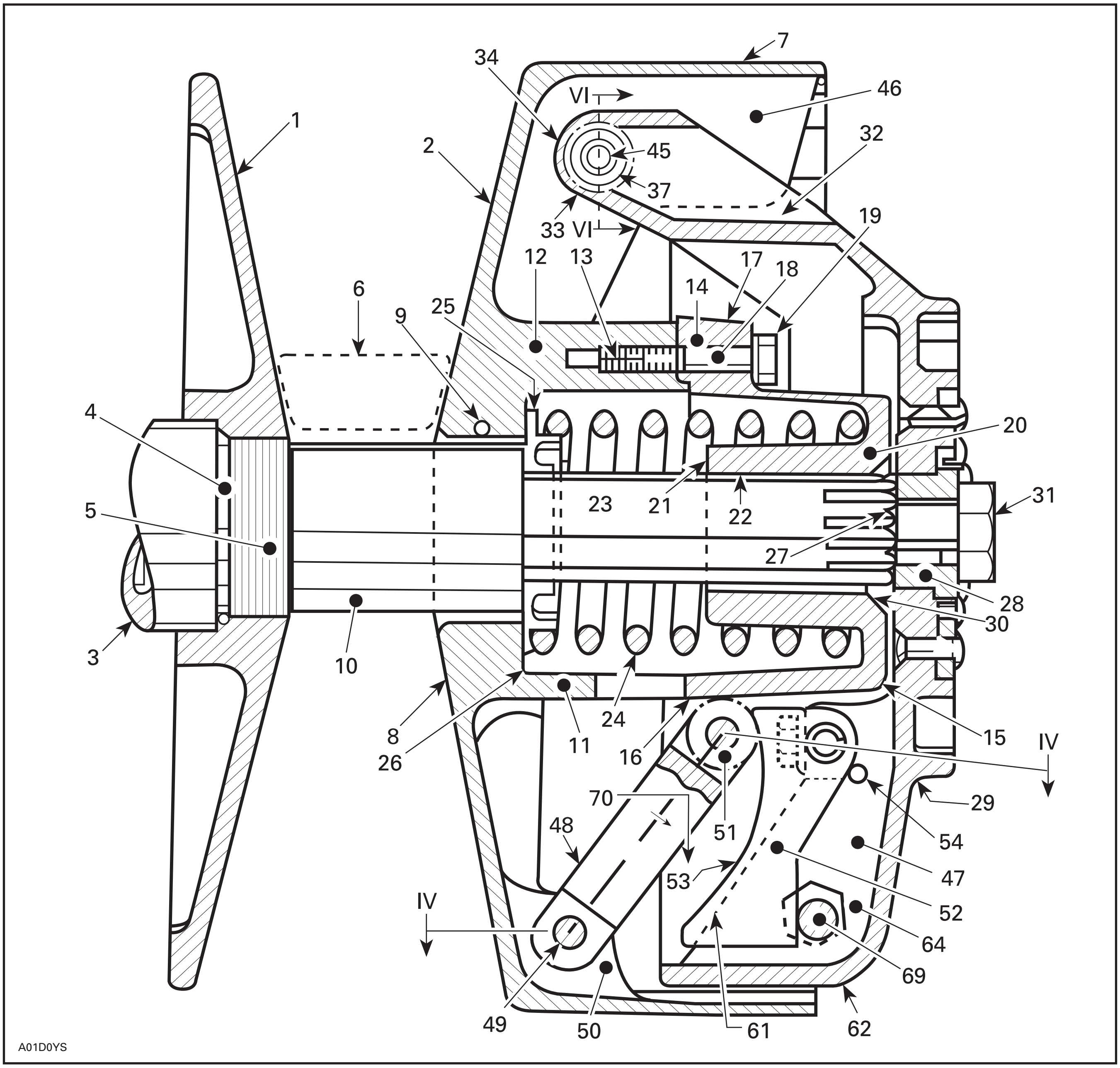
Note that at engagement and very low ratios, many ramp angles actually go downhill. These are generally used on engines with good low RPM power. Engines with narrower power bands and less low RPM power will usually have a flatter angle at engagement and low speed. A ramp with a small bump at engagement 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.

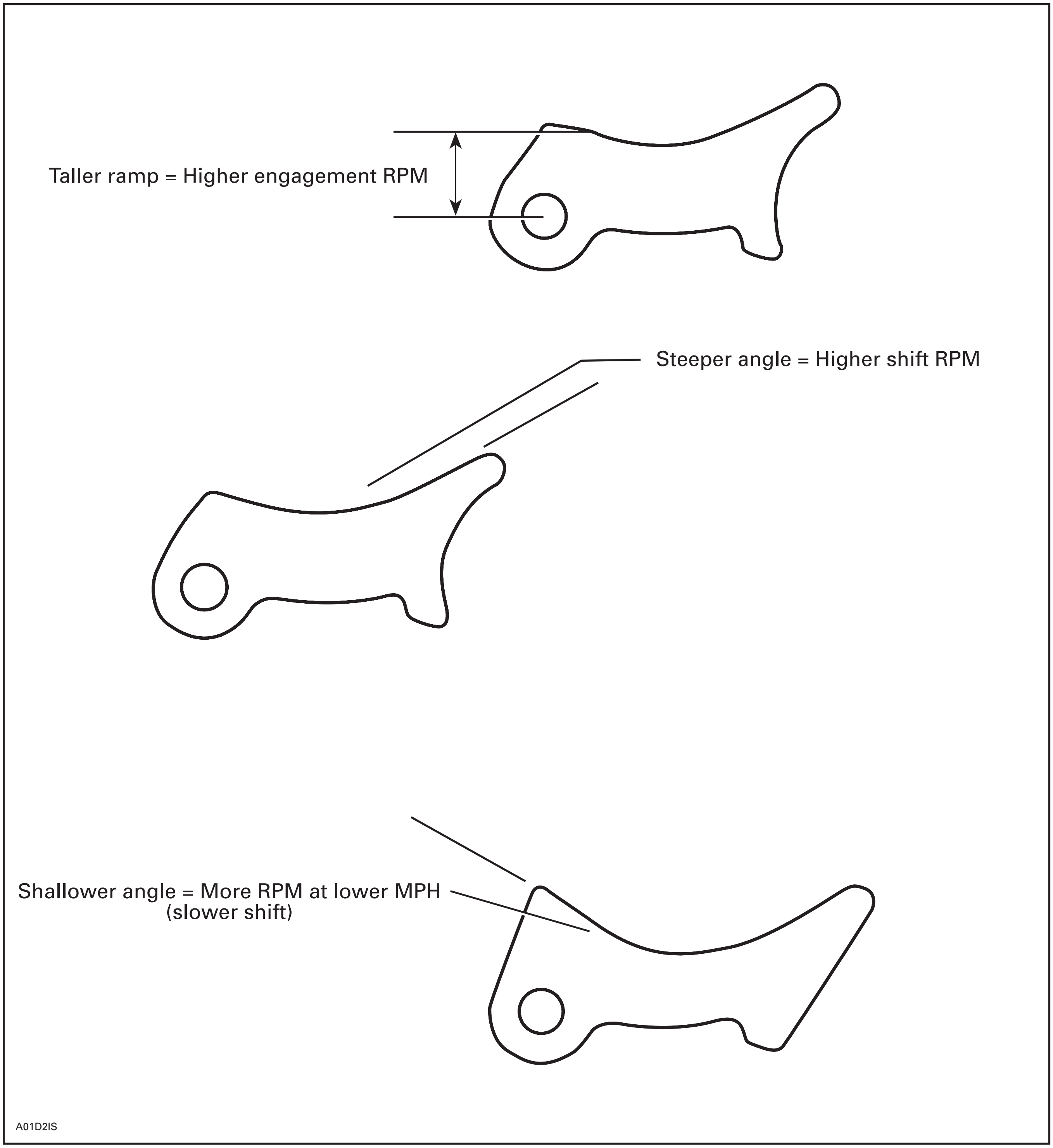


For drag racing and radar running, it is usually better to try to go as low as possible on the adjusters without dropping the engine peak RPM too much as this will give the vehicle its fastest acceleration and top speed.

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



TRA RAMP PROFILES

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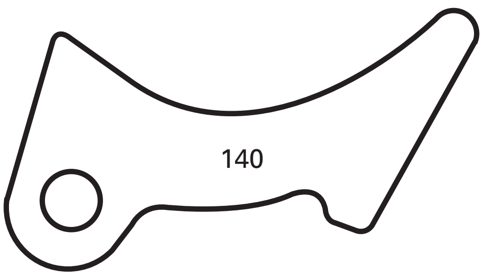

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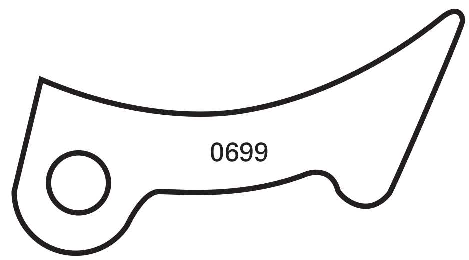

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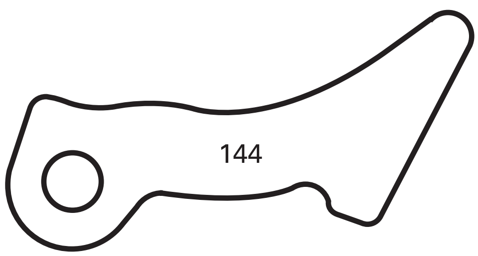

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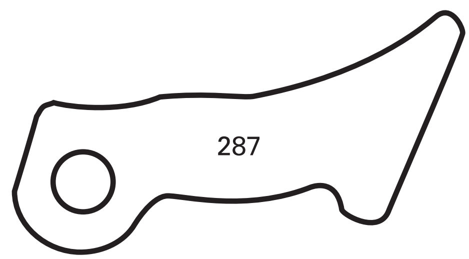

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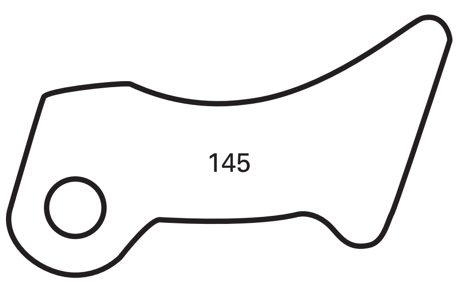

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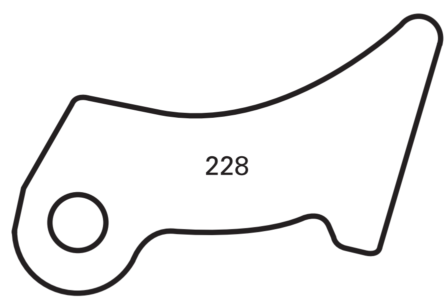

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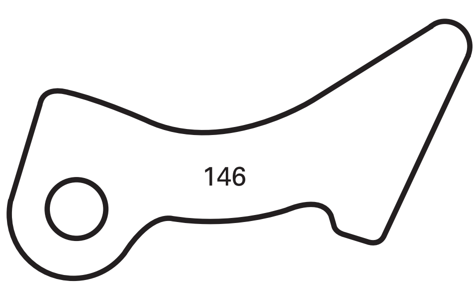

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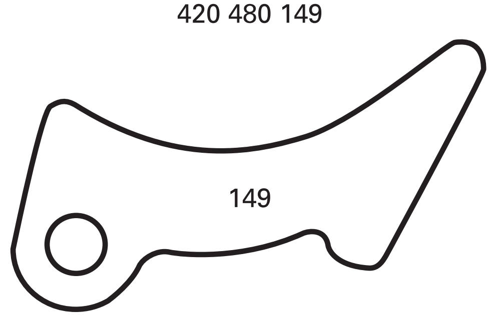

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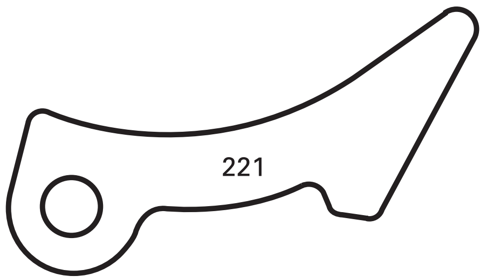

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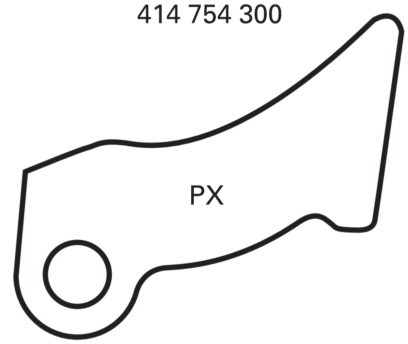

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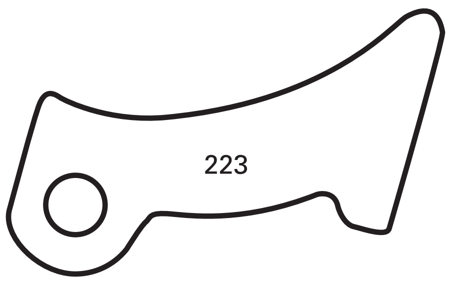

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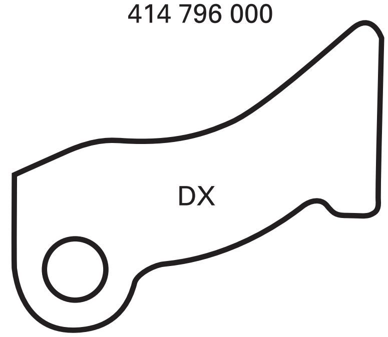

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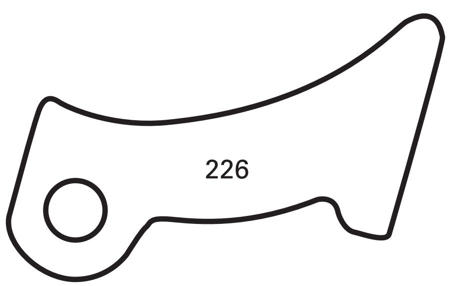

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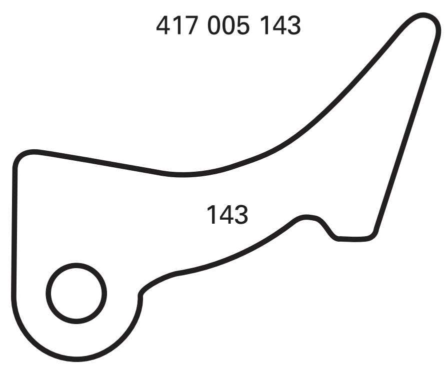

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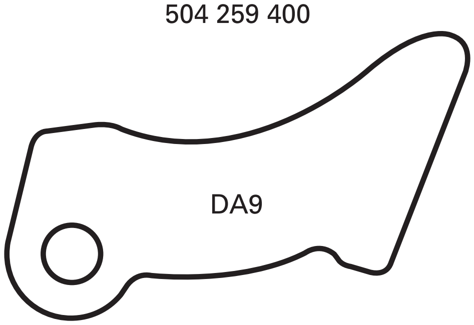

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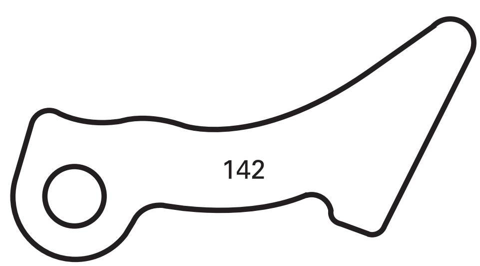

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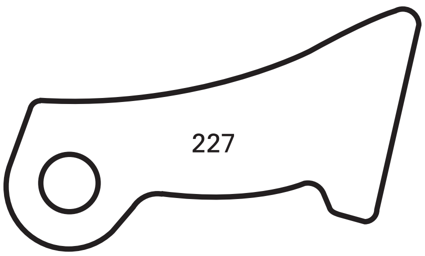

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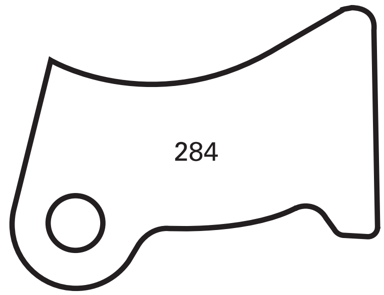

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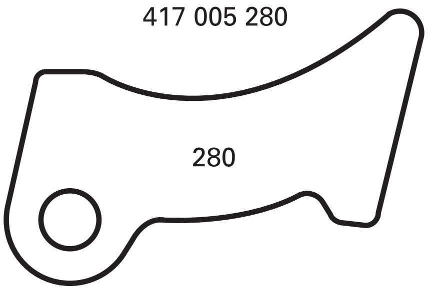

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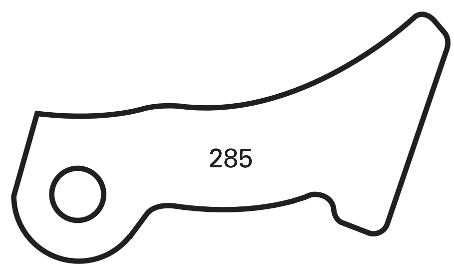

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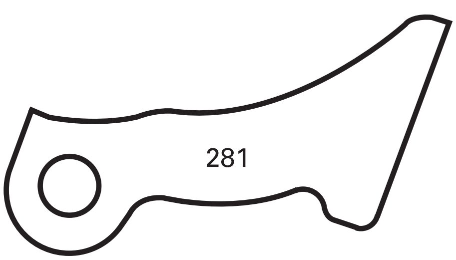

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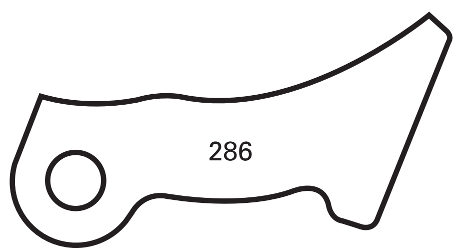

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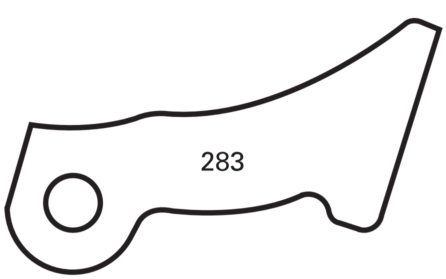

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A01D2DA

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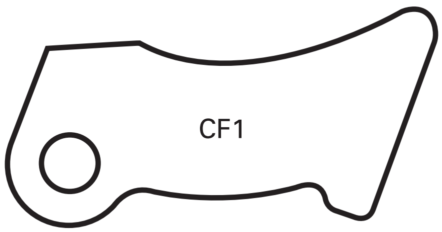

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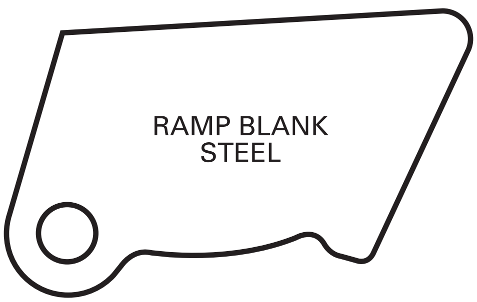

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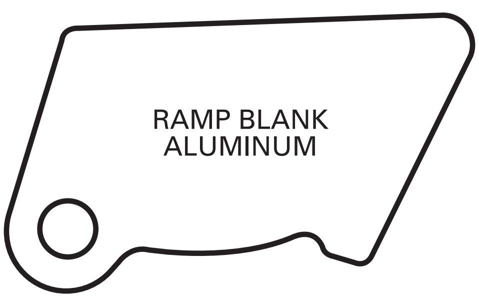

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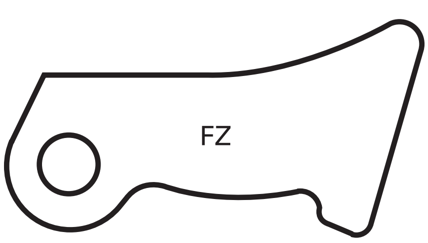

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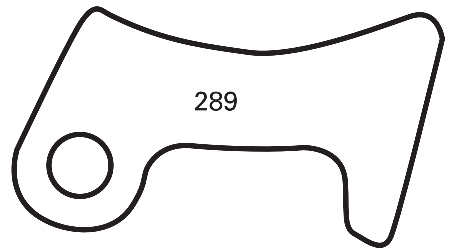

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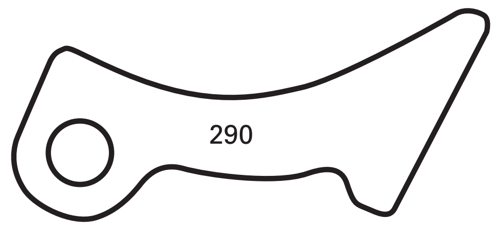

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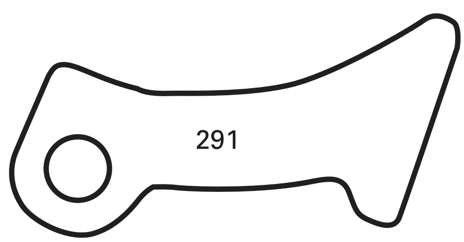

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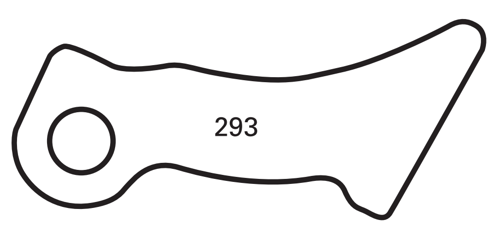

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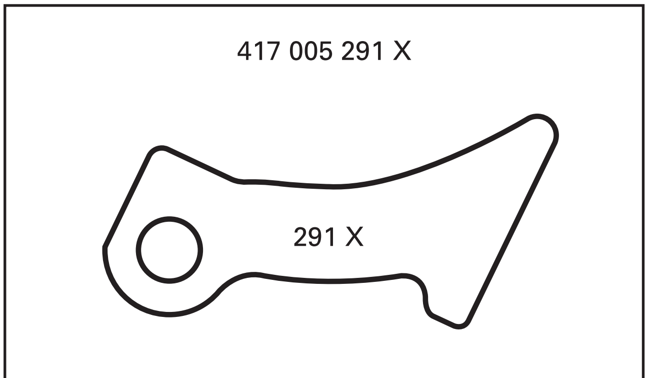

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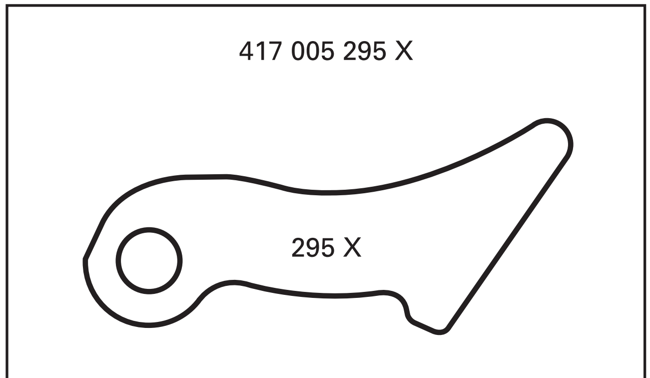

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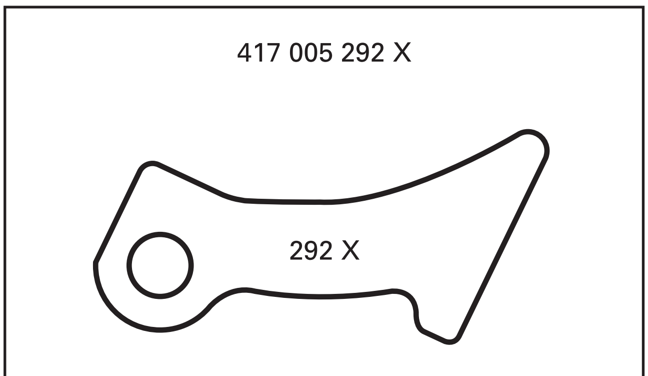

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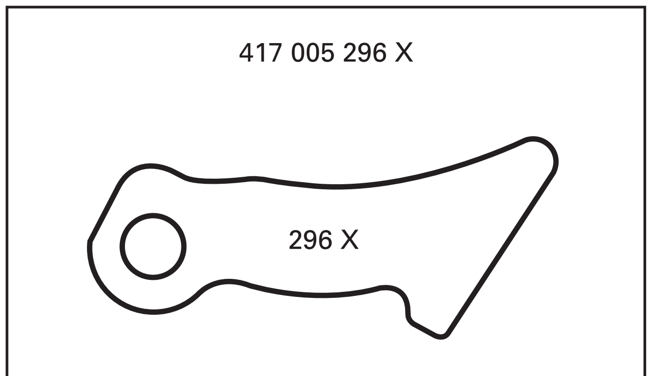

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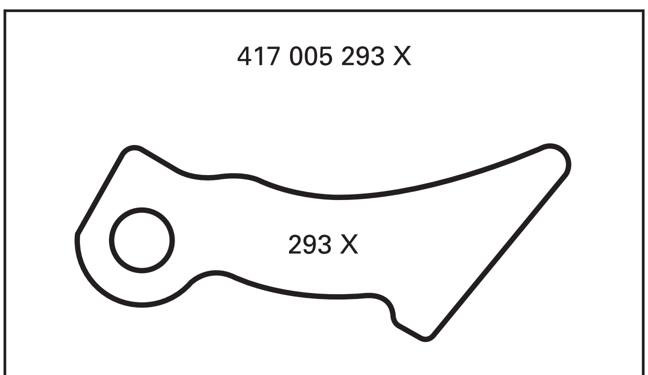

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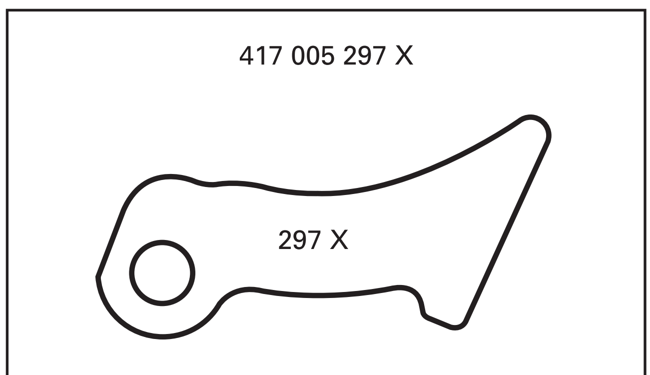

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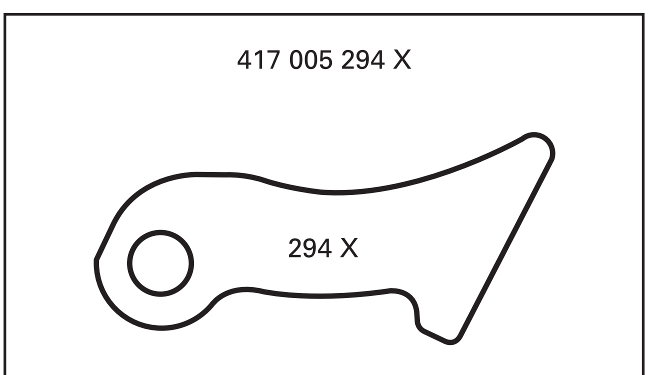


A01D31A

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.

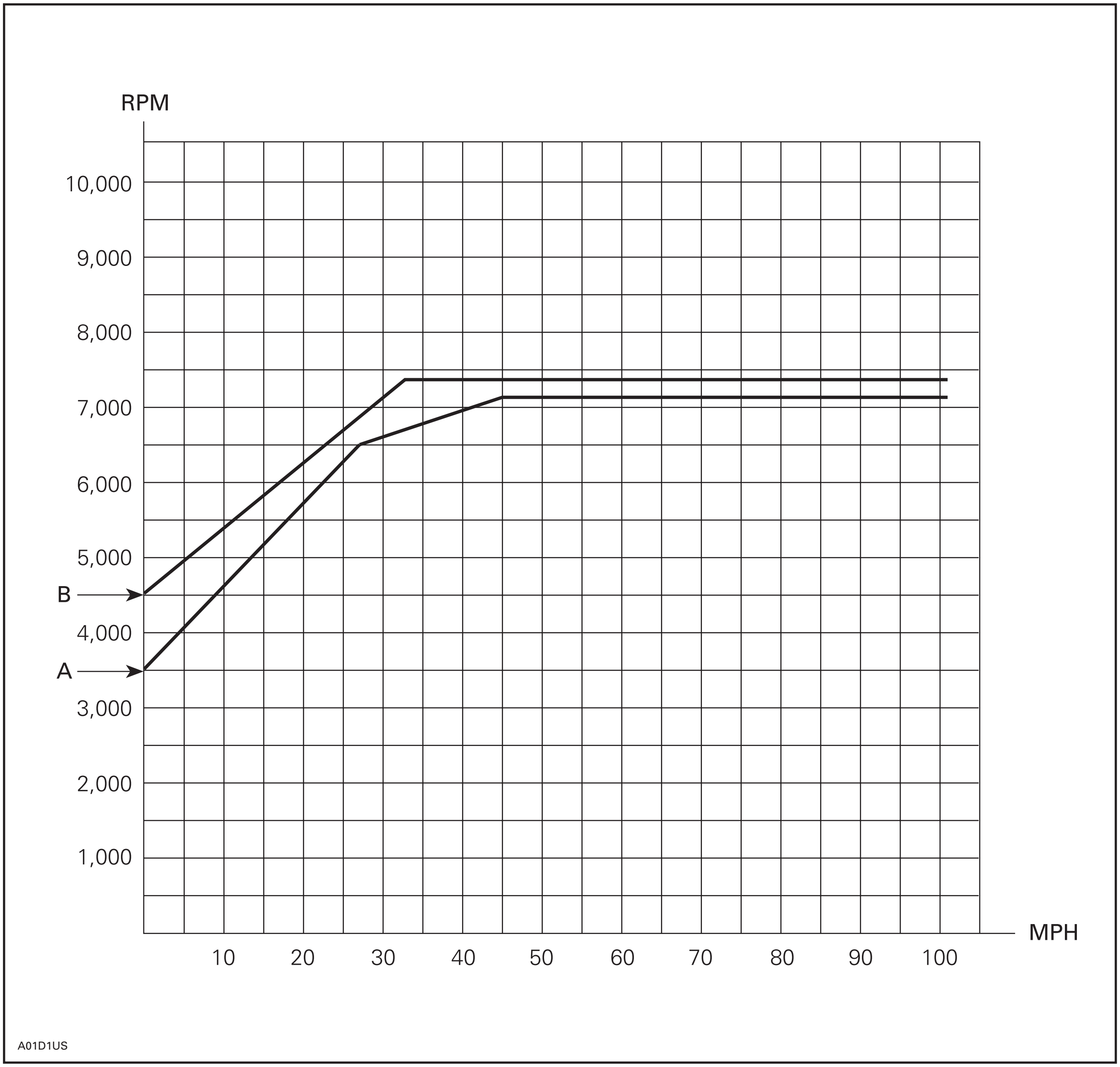
As the pressure of the spring when 74 mm (2.9 in) long is increased, the clutch engagement speed will increase. As the spring rate is increased, the engine will be required to turn more RPM to achieve a given gear ratio. Again, these facts hold true when all other tunable components are kept constant.

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

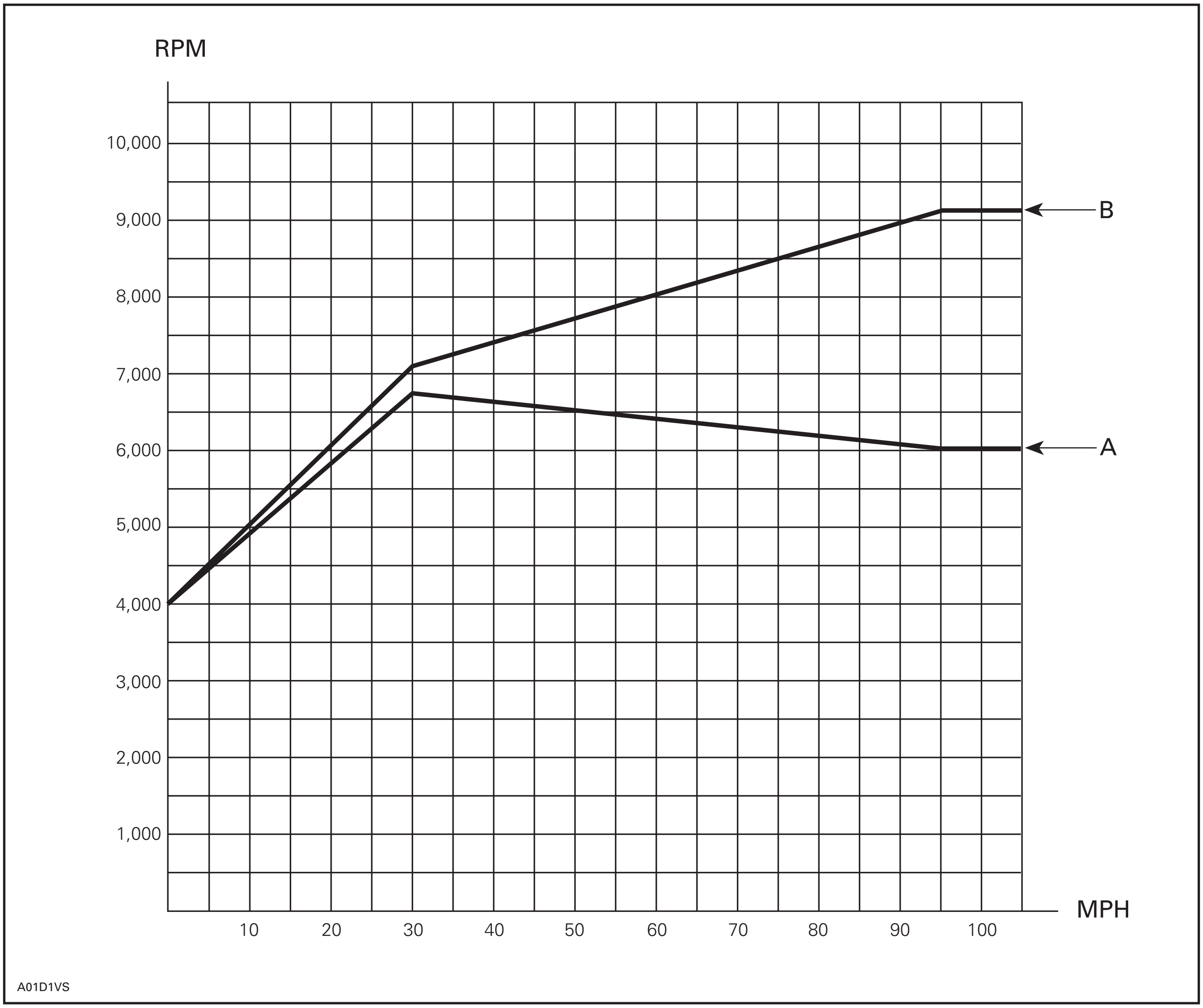
Effect at Engagement



	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)

Drive Clutch Spring

Effect at Top Speed



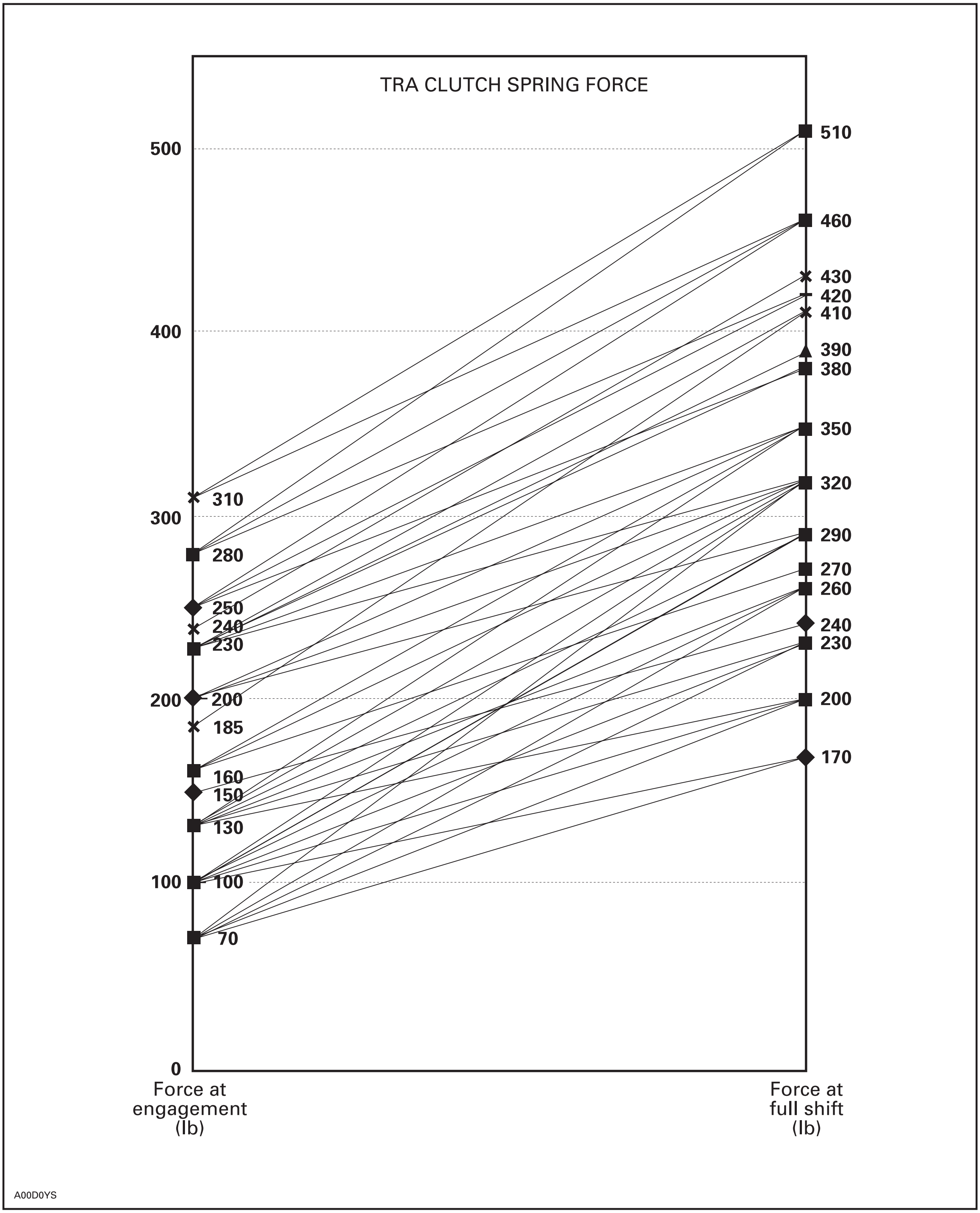
	Load at 74 mm (2.9 in)	Load at 41 mm (1.6 in)
A	311 N (70 lb)	756 N (170 lb)
B	311 N (70 lb)	1157 N (260 lb)

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	414 689 800	RED-RED	96,3	5,0	5,3
70-200	311-890	415 015 200	RED-ORANGE	91,2	5,25	5,1
70-230	311-1023	414 817 500	RED-YELLOW	87,9	5,6	5,0
70-260	311-1157	414 689 200	RED-GREEN	85,9	6,0	5,3
70-290	311-1290	414 691 500	RED-BLUE	84,1	6,0	4,8
70-320	311-1423	414 701 000	RED-PURPLE	83,1	6,3	5,0
100-170	445-756	414 993 000	YELLOW-RED	121,1	4,88	7,1
100-200	445-890	414 689 700	YELLOW-ORANGE	105,7	5,25	6,2
100-230	445-1023	414 748 600	YELLOW-YELLOW	100,3	5,4	6,6
100-260	445-1157	414 742 100	YELLOW-GREEN	94,0	6,0	6,1
100-290	445-1290	414 818 000	YELLOW-BLUE	90,7	6,0	5,3
100-320	445-1423	414 678 400	YELLOW-PURPLE	88,4	6,3	5,5
130-200	579-890	414 639 000	BLUE-ORANGE	135,5	4,88	7,25
130-230	579-1023	414 689 500	BLUE-YELLOW	115,1	5,25	6,8
130-260	579-1157	414 817 700	BLUE-GREEN	105,7	5,6	5,8
130-290	579-1290	414 689 400	BLUE-BLUE	99,8	6,0	6,1
130-320	579-1424	414 817 800	BLUE-PURPLE	96,6	6,17	6,6
130-350	579-1557	414 916 300	BLUE-PINK	93,5	6,3	5,6
160-230	712-1023	415 015 300	PURPLE-YELLOW	149,4	4,88	72,2
160-270	712-1157	415 005 400	PURPLE-GREEN	126,8	5,25	6,8
160-290	712-1290	415 034 900	PURPLE-BLUE	114,6	5,54	6,5
160-320	712-1423	414 817 900	PURPLE-PURPLE	105,7	6,0	6,1
160-350	712-1557	414 949 500	PURPLE-PINK	101,8	6,17	6,6
200-290	890-1290	414 768 200	GREEN-BLUE	147,4	5,25	7,4
200-320	890-1423	414 762 800	GREEN-PURPLE	126,7	5,72	7,11
200-350	890-1557	414 756 900	GREEN-PINK	118	5,72	6,38
250-380	1112-1690	415 019 400	GREEN-WHITE	110,7	5,94	6,2
230-320	1023-1423	414 754 200	PINK-PURPLE	154,7	5,25	7,02
230-350	1023-1557	415 074 800	PINK-PINK	137,2	5,54	6,88
230-380	1023-1690	415 019 300	PINK-WHITE	124,5	5,94	7,1

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
415 019 500	823 (185)	1824 (410)	BLACK
415 019 300	1023 (230)	1690 (380)	PINK-WHITE
415 019 600	1023 (230)	1725 (390)	GREEN
415 019 700	1023 (230)	1824 (410)	RED
415 019 800	1067 (240)	1913 (430)	BLUE
417 222 004	1112 (250)	1690 (380)	WHITE-GREEN
415 020 000	1112 (250)	1868 (420)	ORANGE
415 019 900	1112 (250)	2064 (460)	PINK
417 222 164	????? (260)	1868 (420)	WHITE-SILVER
415 020 100	1245 (280)	1868 (420)	GREEN-GREEN
415 020 200	1245 (280)	2064 (460)	RED-RED
415 020 300	1245 (280)	2268 (510)	BLUE-BLUE
415 020 400	1379 (310)	2064 (460)	OLD PINK-PINK
415 020 500	1379 (310)	2268 (510)	ORANGE-ORANGE GOLD-GOLD


TRA CLUTCH SPRING FORCE
500
400
300
200
100
0
310
280
250
240
230
200
185
160
150
130
100
70
510
460
430
420
410
390
380
350
320
290
270
260
240
230
200
170
Force at engagement (lb)
Force at full shift (lb)
A00D0YS

EFFECTS OF THE DRIVEN PULLEY SPRING

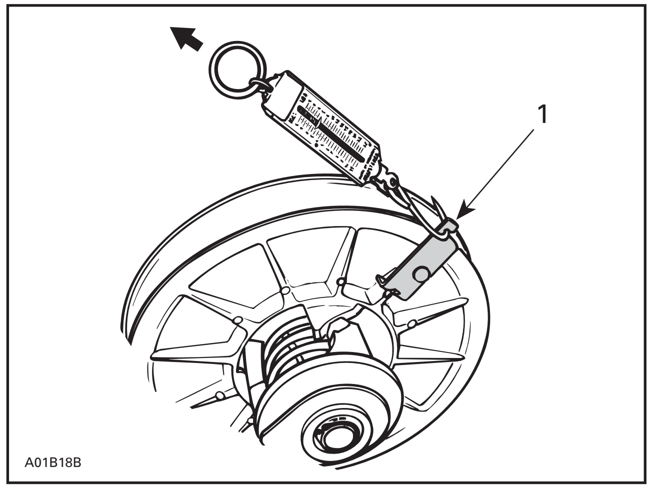
The driven pulley spring is needed to keep the plastic slider buttons in contact with the cam and to provide enough side force on the belt in the low gear position to allow initial acceleration while the torque rises to a point where the torque sensing cam begins to take over. At full load, the driven 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.

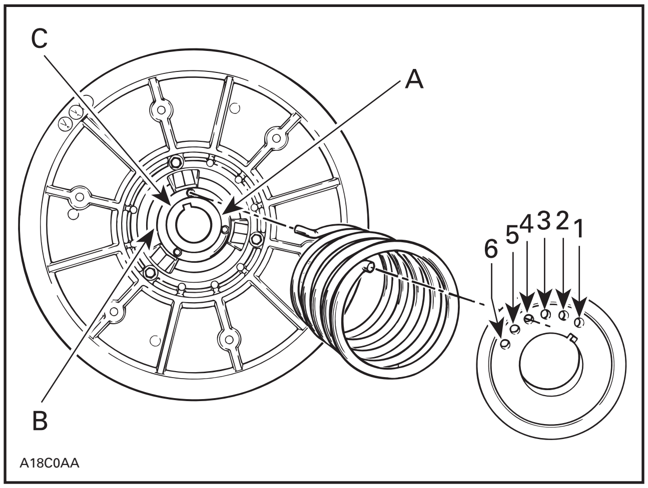


TYPICAL
1. Spring scale hook (529 030 900)

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	414 338 500
Orange	.187 in	414 505 800
Beige	.207 in	414 558 900

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.

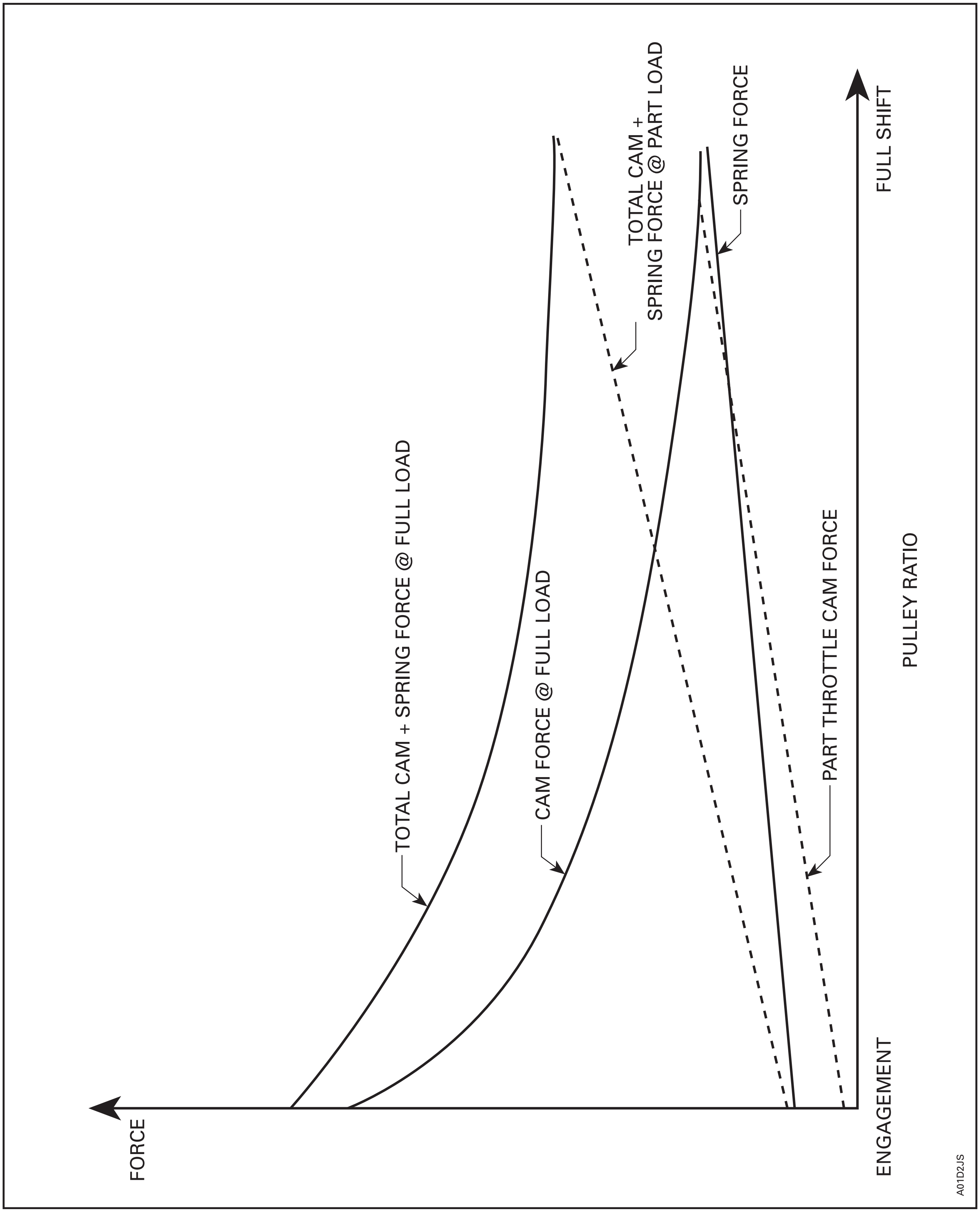
Remember the drive pulley signals or controls the upshift of the transmission while the driven pulley signals the downshift largely because of the effect of the cam.

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.

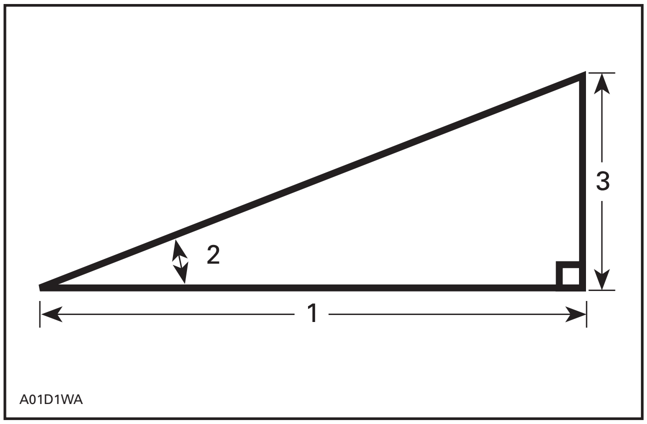
Multi-angle cams are sometimes used by racers needing a good holeshot. They generally work best on vehicles where no track spin is encountered. As a vehicle idles on the starting line, the exhaust temperature cools thus slightly lowering the optimum HP RPM of the engine. Because of this, a steeper (larger) 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 holeshot 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.


TOTAL CAM + SPRING FORCE @ PART LOAD
SPRING FORCE
FULL SHIFT
TOTAL CAM + SPRING FORCE @ FULL LOAD
CAM FORCE @ FULL LOAD
PART THROTTLE CAM FORCE
PULLEY RATIO
FORCE
ENGAGEMENT
A01D2JS

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).

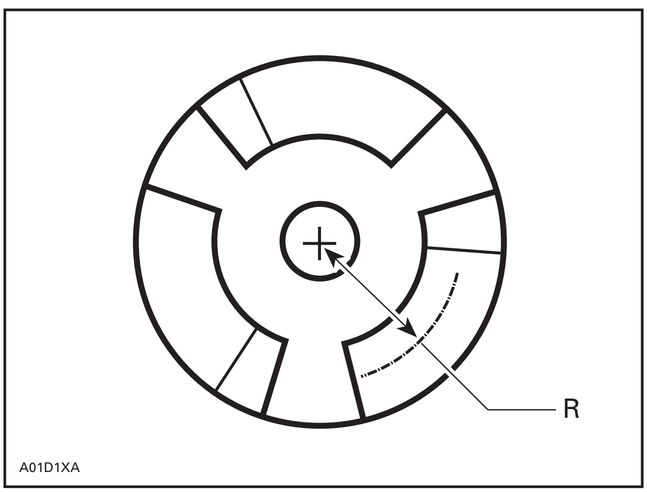
The helix angle is computed from the lead and the circumference of the helix.



1. *Circumference (C)*
2. *Helix angle A*
3. *Lead (L)*

$$\text{Tan A} = \frac{L}{C}$$

Helix angles for Ski-Doo cams are measured at the mean circumference of the cam. This is at the midpoint of the ramp surface.



Circumference (mean) = 2πR

$$\text{Tan A} = \frac{L}{C} \text{ or } L = C \times \text{Tan A}$$

Where:

L = Lead in inches

C = Circumference on outside diameter

A = Cam angle on outside diameter

NOTE: $C_{(mean)}$ for all Formula and Blizzard cams is 247 mm (9.72 in)

$D_{(mean)}$ for all Formula and Blizzard cams is 78.6 mm (3.09 in)

Example:

L = 9.72″ × TAN 44°

L = 9.72 × .966

L = 9.39 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 × Tan A

Where:

L = Lead

C = Circumference on outside diameter

A = Cam angle on outside diameter

NOTE: $C_{(outside)}$ for Formula and Blizzard cams is 276 mm (10.866 in) ('79-'93)

$C_{(outside)}$ 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.

$L = C_{(outside)} \times \text{Tan } A_{(outside)}$

L = 11.00″ × TAN 40.5°

L = 9.39 inches of lead

Inches of lead are directly comparable.

$$A_{(MEAN)} = \text{INVERSE TAN } \frac{L}{C_{(MEAN)}}$$

$$= \text{INVERSE TAN } \frac{9.39}{9.72}$$

$A_{(MEAN)}$ = 44° = SKI-DOO 44° 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.

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
415 021 100	44°-40°	415 022 800	30°
415 021 200	46°-42°	415 022 900	32°
415 021 300	48°-40°	415 023 000	34°
415 021 400	48°-44°	415 023 100	36°
415 021 500	50°-36°	415 022 700	38°
415 021 600	50°-40°	504 092 100	40°
415 021 700	50°-44°	415 022 500	42°
417 126 380	53°-47°		
415 021 800	54°-40°	504 096 000	44°
415 021 900	54°-44°	415 023 200	46°
415 022 000	54°-46°	504 140 900	47°
415 022 100	54°-48°	415 022 400	48°
415 022 200	58°-44°	504 096 100	50°
415 023 400	58°-48°	415 022 300	52°
417 122 200	*40°-44°	415 021 000	54°
417 125 900	*44°-40°	415 022 600	56°
417 126 391	*44°	415 023 300	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.

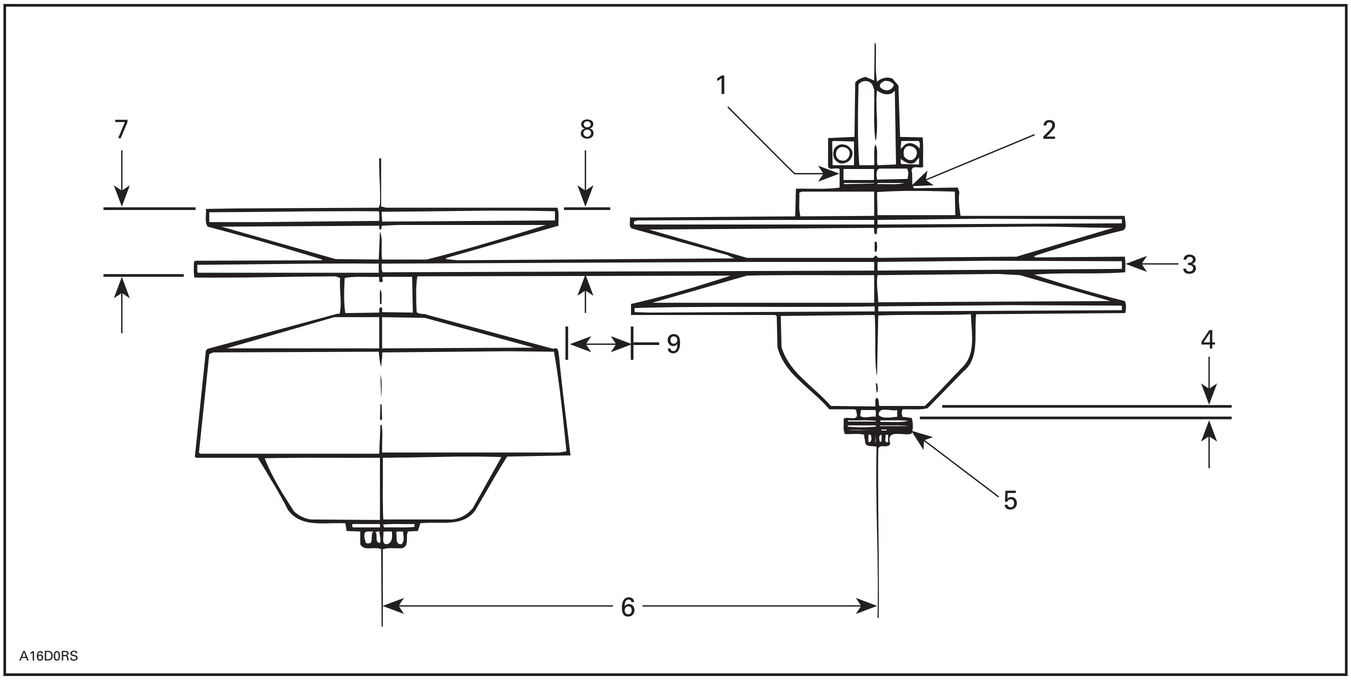
Drive belts can vary ± 6 mm (1/4 in) length from belt to belt. Because of this manufacturing tolerance, we recommend measuring your drive belts and marking their length on the outer cover. Try to use only belts that are the same length while racing to keep your clutch set up as consistent as possible.

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.

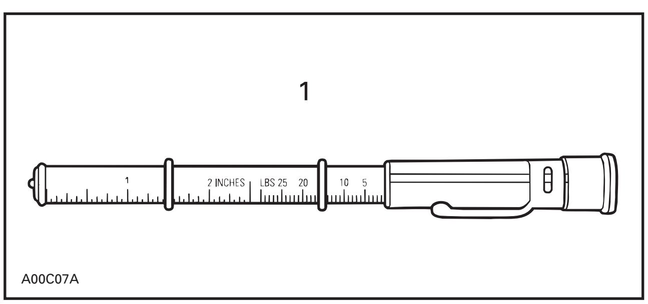
Be careful not to bend sharply or coil up these new hard compound drive belts since they are much more prone to cracking in cold weather than earlier belts.

Proper deflection, setup, alignment, and break-in will help insure maximum performance and longevity from the drive belt.

Proper Alignment of the TRA Clutch on a FORMULA Model



1. *Sleeve (Note: no clearance to this side of driven pulley)*
2. *2 shims (504-108 -200)*
3. *Use straight bar (.375 in × 19 in)*
4. *DSA/ZX platform: 0-1 mm (0-.040 in)*
5. *Shim as required to achieve clearance*
6. *PRS: 268.3 (10-9/16 in)*
   DSA/ZX platform: 257.5 (10-9/64 in)
   CK3: 361.0 (14-7/32 in)
7. *Y = X + 1.5 mm (.060 in)*
8. *X = PRS: 36.0 mm (1.460 in)*
   DSA/ZX platform: 35.0 mm (1.380 in)
   CK3: 35.5 (1.398 in)
9. *Z = PRS: 27.0 mm (1.060 in)*
   DSA/ZX platform: 16.5 mm (.650 in)
   CK3: 3 pipe 123.0 mm (4.842 in)
   CK3: 120.0 (4.724 in)

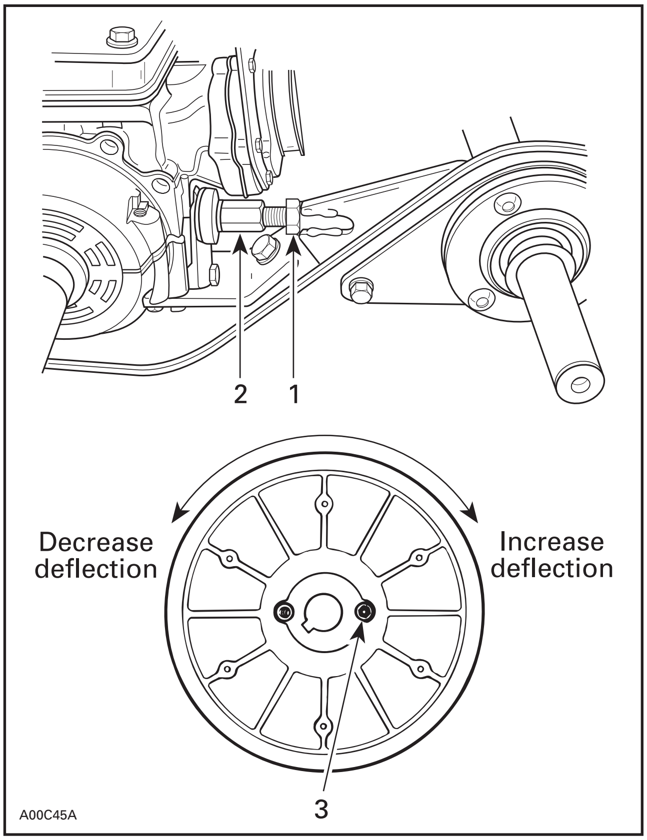


1. *Use Ski-Doo tool (P/N 414 348 200)*

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 other designs. Because of this, we have been able to lower the gearing in our chaincase considerably. 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 chaincase oil.

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 HP (DYNO HP)	ENGINE RPM	CLUTCH EFFICIENCY	H.P. TO TRACK (USEABLE HP)
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 overdrive 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.

$$\text{top speed in MPH} = \frac{\text{engine RPM}}{\text{clutch ratio}} \times \frac{\text{teeth, top sprocket}}{\text{teeth, bottom sprocket}} \times \frac{(\text{pitch of track} \times \text{No. of teeth on drive sprocket})}{12} \times \frac{60}{5280}$$

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.

Sprocket/Chain Chart

1997	S/L SPROCKETS
FORMULA S	21 × 44
FORMULA SL	22 × 44
FORMULA 500	22 × 44
FORMULA 583	25 × 44
MX Z 440 F	22 × 44
MX Z 440	23 × 44
MX Z 583	25 × 44
MX Z 670	26 × 44
FORMULA III	25 × 44
MACH 1	26 × 44
MACH Z	26 × 44
SUMMIT 500	22 × 44
SUMMIT 583	22 × 44
SUMMIT 670	23 x 44
MX Zx	23 x 43

1998	S/L SPROCKETS
FORMULA S	21 × 44
MX Z 440	22 × 44
MX Zx 440	21 × 43
FORMULA 500	23 × 43
MX Z 500	23 × 43
SUMMIT 500	22 × 43
FORMULA SL	22 × 44
FORMULA Z 583	25 × 43
MX Z 583	25 × 43
SUMMIT 583	22 × 43
FORMULA III 600	25 × 43
FORMULA Z 670	26 × 43
MX Z 670	26 × 43
SUMMIT 670	23 x 43
SUMMIT x	21 x 43
MACH 1	26 × 43
FORMULA III 700	26 × 43
MACH Z	27 × 43

1999	S/L SPROCKETS
FORMULA S	18 × 44
MX Z 440 F	21 × 44
MX Zx 440	21 × 43
FORMULA Z 500	23 × 43
MX Z 500	23 × 43
SUMMIT 500	21 × 43
FORMULA SL	21 × 44
FORMULA Z 583	25 × 43
MX Z 600	24 × 43
SUMMIT 600	21 × 43
FORMULA III 600	24 × 43
FORMULA Z 670	25 × 43
SUMMIT x 670	21 x 43
MACH 1	25 × 43
FORMULA III 700	25 × 43
FORMULA III 800	26 × 43
MACH Z	26 × 43

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 CK3	2.04 70 72	1.95 70 72	1.86 72 72	1.79 72 74	1.72 72 74	1.65 72 74
44	2.10 72	2.00 72	1.91 72	1.83 74	1.76 74	1.69 74

CHAINS		
LINKS	NARROW	WIDE
68	412 106 000	—
70	412 105 900	412 106 800
72	412 105 500	412 106 700
74	412 105 800	412 106 900

NARROW SPROCKETS		TEETH	WIDE SPROCKETS	
STEEL	POWDER		STEEL	POWDER
504 071 800	—	17	—	—
—	504 070 100	18	—	—
—	414 680 500	19	—	—
504 074 800	—	20	—	—
504 084 000	—	21	504 139 300	—
504 074 700	504 056 000	22	504 083 500	504 091 100
504 078 400	504 087 800	23	504 085 400	504 091 000
504 078 600	—	24	503 139 700	504 090 900
504 084 100	504 085 200	25	—	504 084 300
—	504 055 900	26	—	504 085 300
—	—	27	—	504 148 400
504 056 400	—	38	—	—
—	504 056 200	40	—	504 089 000
—	—	43	—	504 148 500
—	504 057 300	44	—	504 085 500

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.

1999 MX Zx/MX Z 600

GEAR	RATIO	CHAIN
17/44	2.59	72
18/44	2.44	72
19/44	2.32	74
20/44	2.20	74
21/44	2.10	74
22/44	2.00	74
23/44	1.91	74
24/44	1.83	76
25/44	1.76	76
26/44	1.69	76
27/44	1.63	76
17/43	2.53	72
18/43	2.39	72
19/43	2.26	72
20/43	2.15	74
21/43	2.05	74
22/43	1.95	74
23/43	1.87	74
24/43	1.79	74
25/43	1.72	76
26/43	1.65	76
27/43	1.59	76

GEAR	RATIO	CHAIN
17/40	2.35	70
18/40	2.22	70
19/40	2.11	70
20/40	2.00	72
21/40	1.90	72
22/40	1.82	72
23/40	1.74	72
24/40	1.67	74
25/40	1.60	74
26/40	1.54	74
27/38	1.48	74
17/38	2.24	68
18/38	2.11	70
19/38	2.00	70
20/38	1.90	70
21/38	1.81	70
22/38	1.73	72
23/38	1.65	72
24/38	1.58	72
25/38	1.52	72
26/38	1.46	74
27/38	1.41	74

1999	TRANSMISSION SYSTEM DEFINITION / DÉFINITION DU SYSTÈME DE TRANSMISSION								
Model Modèle	Engine Moteur	Model Modèle	Taper Cone	Spring Ressort	Pin or weight/ Pine ou pesée	Ramp or bloc/ Rampe ou bloc	Pos. calib. or/ou capsule	Engage ment ±100 RPM	Max. speed/ Régime max. ±100 RPM
TUNDRA	277	Powerbloc	1:10	Turquoise 417 1159 00	N/A	417 1143 00	417 1145 00 Q'ty=2	3100	6900
TUNDRA R	277	Powerbloc	1:10	Turquoise 417 1159 00	N/A	417 1143 00	417 1145 00 Q'ty=2	3100	6900
FORMULA S	377	Powerbloc	1:10	Red/Blue 417 1184 00	417 1204 00 Q'ty=1	417 1181 00	417 1145 00 Q,ty=1	3500	6900
FORMULA 377 De Luxe	377	Powerbloc	1:10	Red/Blue 417 1184 00	417 1204 00 Q'ty=1	417 1181 00	417 1145 00 Q,ty=1	3500	6900
TOURING E	377	Powerbloc	1:10	Green/Green 417 1253 00	417 1204 00 Q'ty=1	417 1181 00	417 1145 00 Q'ty=1	2500	6900
SKANDIC 380	377	Powerbloc	1:10	Green/Green 417 1253 00	417 1204 00 Q'ty=1	417 1181 00	417 1145 00 Q'ty=1	2500	6900
TOURING LE	443	TRA	1:10	Red/Yellow 414 8175 00	417 0043 09 Hollow	417 0052 84 284	2	2900	7000
MXZ 440 F	443	TRA	1:10	Blue/Yellow 414 6895 00	417 0043 09 Hollow	417 005 291X 291X	3	3700	7000
FORMULA 500 De Luxe	494	TRA	1:7.5	Violet/Blue 415 0349 00	417 0043 09 Hollow	417 0052 86 286	2	3800	7800
FORMULA Z 500	494	TRA	1:7.5	Violet/Yellow 415 0153 00	417 0043 09 Hollow	417 0052 81 281	2	4100	7800
GT 500	494	TRA	1:7.5	Blue/Green 414 8177 00	417 0043 09 Hollow	417 0052 28 228	2	3600	7800
MXZ 500	494	TRA	1:7.5	Violet/Yellow 415 0153 00	417 0043 09 Hollow	417 0052 81 281	2	4100	7800
SUMMIT 500	494	TRA	1:7.5	Green/Blue 414 7682 00	417 0043 09 Hollow	417 005 294 294	4	4200	7800
SKANDIC WTLC	494	TRA	1:7.5	Yellow/Blue 414 8180 00	417 0043 08 Solid	417 0052 90 290	4	2700	7000
FORMULA SL	503	TRA	1:10	Yellow/Red 414 9930 00	417 0043 09 Hollow	417 005 291X 291X	3	3300	7000
FORMULA 503 De Luxe	503	TRA	1:10	Yellow/Red 414 9930 00	417 0043 09 Hollow	417 005 291X 291X	3	3300	7000
SKANDIC WT	503	TRA	1:10	Yellow/Orange 414 6897 00	417 0043 09 Hollow	4170052 90 290	4	2800	6800
SKANDIC SWT	503	TRA	1:10	Red/Yellow 414 8175 00	417 0043 09 Hollow	417 0051 46 146	4	2300	6500
TOURING SLE	503	TRA	1:10	Red/Red 414 6898 00	417 0043 09 Hollow	417 005 291X 291X	3	2900	7000
SKANDIC 500	503	TRA	1:10	Red/Red 414 6898 00	417 0043 09 Hollow	417 005 292X 292X	3	2900	7000
FORMULA 583 De Luxe	583	TRA	1:10	Violet/Blue 415 0349 00	417 0043 09 Hollow	417 0052 86 286	3	4100	7900
FORMULA Z 583	583	TRA	1:10	Violet/Blue 415 0349 00	417 0043 09 Hollow	417 0052 86 286	3	4100	7900
GT 583	583	TRA	1:10	Red/Orange 415 0152 00	417 0043 09 Hollow	417 0052 85 285	3	3100	7900
MXZ 600	593	TRA	1:7.5	Violet/Yellow 415 0153 00	417 0043 08 Solid	417 0052 81 281	3	3800	8000
SUMMIT 600	593	TRA	1:7.5	Green/Blue 414 7682 00	417 0043 09 Hollow	417 005 294 294	5	4200	8000
FORMULA III 600	599	TRA	1:7.5	Green/Blue 414 7682 00	417 0043 08 Solid	417 2221 23 297	3	4200	8400
FORMULA 670 De Luxe	670	TRA	1:7.5	Violet/Yellow 415 0153 00	417 0043 08 Solid	417 0052 86 286	3	3800	7700
FORMULA Z 670	670	TRA	1:7.5	Violet/Yellow 415 0153 00	417 0043 08 Solid	417 0052 86 286	3	3800	7700
MXZ 670	670	TRA	1:7.5	Green/Blue 414 7682 00	417 0043 08 Solid	417 2221 23 297	2	4200	8000
SUMMIT X 670	670	TRA	1:7.5	Violet/Yellow 415 0153 00	417 0043 09 Hollow	417 0052 87 287	5	4100	8000
MACH 1	699	TRA	1:7.5	Green/Violet 414 7628 00	417 0043 08 Solid	417 0052 86 286	3	4200	8300
MACH 1 Reverse	699	TRA	1:7.5	Green/Violet 414 7628 00	417 0043 08 Solid	417 0052 86 286	3	4200	8300
FORMULA III 700 1 Pipe	699	TRA	1:7.5	Violet/Blue 415 0349 00	417 0043 08 Solid	417 2221 23 297	3	3800	8000
GT 700 1 Pipe	699	TRA	1:7.5	Yellow/Red 414 9930 00	417 0043 08 Solid	417 0052 85 285	4	3300	8000
FORMULA III 800 1 Pipe	809	TRA	1:7.5	Violet/Blue 415 0349 00	417 0043 08 Solid	417 2220 90 295	3	3800	8000
GT SE 1 Pipe	809	TRA	1:7.5	Yellow/Orange 414 6897 00	417 0043 08 Solid	417 2221 23 297	3	3300	8000
MACH Z	809	TRA	1:7.5	Green/Blue 414 7682 00	417 0043 08 Solid	417 2220 90 295	3	4200	8300
MACH Z Reverse	809	TRA	1:7.5	Green/Blue 414 7682 00	417 0043 08 Solid	417 2220 90 295	3	4200	8300
MACH Z LT	809	TRA	1:7.5	Green/Blue 414 7682 00	417 0043 08 Solid	417 2220 90 295	3	4200	8300
MACH Z LT Reverse	809	TRA	1:7.5	Green/Blue 414 7682 00	417 0043 08 Solid	417 2220 90 295	3	4200	8300

1999	TRANSMISSION SYSTEM DEFINITION / DÉFINITION DU SYSTÈME DE TRANSMISSION							
Model Modèle	Engine Moteur	Belt Courroie	Spring Ressort	Preload new / after break-in period Tension neuf / après rodage (±0.7 kg)	Cam Came (°)	Sprocket top / Pignon haut	Sprocket bottom / Pignon bas	Chain link / chaine maille
TUNDRA	277	414 8276 00	WHITE	3.6	37.8	14	25	62 Simple
TUNDRA R	277	414 8276 00	YELLOW	0.0 Position 3	37.8	14	25	62 Simple
FORMULA S	377	415 0606 00	ORANGE	4.8	44	18	44	70 11 wide
FORMULA 377 De Luxe	377	415 0606 00	YELLOW	0.0 Position 3	47-44	18	44	70 11 wide
TOURING E	377	415 0606 00	YELLOW	0.0 Position 3	47-44	18	44	70 11 wide
SKANDIC 380	377	415 0606 00	YELLOW	0.0 Position 3	47-44	18	44	70 11 wide
TOURING LE	443	415 0606 00	YELLOW	0.0 Position 3	47-44	21	44	72 11 wide
MXZ 440 F	443	415 0606 00	ORANGE	6.1	47	21	44	72 11 wide
FORMULA 500 De Luxe	494	414 8607 00	BEIGE	7.9 / 7.0	50	23	44	72 11 wide
FORMULA Z 500	494	414 8607 00	BEIGE	7.9 / 7.0	50	23	43 Light	72 11 wide
GT 500	494	414 8607 00	BEIGE	7.9 / 7.0	44	23	44	72 11 wide
MXZ 500	494	414 8607 00	BEIGE	7.9 / 7.0	50	23	43 Light	72 13 wide
SUMMIT 500	494	414 8607 00	BEIGE	7.9 / 7.0	44	21	43 Light	72 11 wide
SKANDIC WTLC	494	414 6338 00	BLUE	7.0	40	N/A	N/A	N/A
FORMULA SL	503	415 0606 00	ORANGE	4.8	44	21	44	72 11 wide
FORMULA 503 De Luxe	503	415 0606 00	YELLOW	0.0 Position 3	47-44	21	44	72 11 wide
SKANDIC WT	503	414 6338 00	BLUE	7.0	40	N/A	N/A	N/A
SKANDIC SWT	503	414 6338 00	BLUE	6.0	40	N/A	N/A	N/A
TOURING SLE	503	415 0606 00	YELLOW	0.0 Position 3	47-44	21	44	72 11 wide
SKANDIC 500	503	415 0606 00	YELLOW	0.0 Position 3	47-44	18	44	70 11 wide
FORMULA 583 De Luxe	583	414 8607 00	BEIGE	7.9 / 7.0	50	23	44	72 13 wide
FORMULA Z 583	583	414 8607 00	BEIGE	7.9 / 7.0	50	25	43 Light	74 13 wide
GT 583	583	414 8607 00	BEIGE	7.9 / 7.0	47	23	44	72 13 wide
MXZ 600	593	414 8607 00	BEIGE	7.9 / 7.0	50	24	43 Light	74 13 wide
SUMMIT 600	593	414 8607 00	BEIGE	7.9 / 7.0	47	21 Steel	43 Light	74 13 wide
FORMULA III 600	599	417 300 066	BEIGE	7.9 / 7.0	50-47	24	43 Light	72 13 wide
FORMULA 670 De Luxe	670	417 300 067	BEIGE	7.9 / 7.0	50	25	44	74 13 wide
FORMULA Z 670	670	417 300 067	BEIGE	7.9 / 7.0	50	25	43 Light	74 13 wide
MXZ 670	670	417 300 067	BEIGE	7.9 / 7.0	53-47	25	43 Light	74 13 wide
SUMMIT X 670	670	417 300 067	BEIGE	7.9 / 7.0	47	21 Steel	43 Light	72 13 wide
MACH 1	699	417 300 066	BEIGE	7.9 / 7.0	53-44	25	43 Light	72 13 wide
MACH 1 Renverse	699	417 300 066	VIOLET 1000N	0.0	47-44 Anodized	25	43 Light	72 13 wide
FORMULA III 700 1 Pipe	699	417 300 066	BEIGE	7.9 / 7.0	50-47	25	43 Light	72 13 wide
GT 700 1 Pipe	699	417 300 066	VIOLET 1000N	0.0	47-44 Anodized	24	43 Light	72 13 wide
FORMULA III 800 1 Pipe	809	417 300 066	BEIGE	7.9 / 7.0	50-47	26	43 Light	72 13 wide
GT SE 1 Pipe	809	417 300 066	VIOLET 1000N	0.0	47-44 Anodized	24	43 Light	72 13 wide
MACH Z	809	417 300 066	BEIGE	7.9 / 7.0	53-44	26	43 Light	72 13 wide
MACH Z Renverse	809	417 300 066	VIOLET 1000N	0.0	47-44 Anodized	26	43 Light	72 13 wide
MACH Z LT	809	417 300 066	BEIGE	7.9 / 7.0	53-44	25	43 Light	72 13 wide
MACH Z LT Renverse	809	417 300 066	VIOLET 1000N	0.0	47-44 Anodized	25	43 Light	72 `

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	93.5	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															

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 20.4 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	90.7	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

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	27/43 1.59	27/44 1.62			
6500	77.9	76.1	91.8	87.3	81.1	79.3	95.5	90.7	84.4	82.5	87.6	85.7			
6600	79.11	77.3	93.3	88.6	82.4	80.5	97.0	92.1	85.7	83.8	89.0	86.9			
6700	80.3	78.5	94.7	89.9	83.7	81.8	98.5	93.5	87.0	85.0	90.3	88.3			
6800	81.5	79.7	96.1	91.3	84.9	83.0	99.9	94.9	88.3	86.3	91.7	89.6			
6900	82.7	80.8	97.5	92.6	86.2	84.2	101.4	96.3	89.6	87.6	93.0	90.9			
7000	83.9	82.0	98.9	94.0	87.4	85.4	102.9	97.7	90.9	88.8	94.4	92.2			
7100	85.1	83.2	100.3	95.3	88.6	86.6	104.3	99.1	92.2	90.1	95.7	93.5			
7200	86.3	84.3	101.7	96.6	89.9	87.9	105.8	100.5	93.5	91.4	97.0	94.0			
7300	87.5	85.5	103.1	98.0	91.1	89.1	107.3	101.9	94.8	92.6	98.4	96.2			
7400	88.7	86.7	104.6	99.3	92.4	90.3	108.7	103.3	96.1	93.9	99.7	97.5			
7500	89.9	87.9	106.0	100.7	93.6	91.5	110.2	104.7	97.4	95.2	101.1	98.8			
7600	91.1	89.0	107.4	102.0	94.9	92.7	111.7	106.1	98.7	96.5	102.4	100.1			
7700	92.3	90.2	108.8	103.4	96.1	94.0	113.2	107.5	99.9	97.7	103.8	101.4			
7800	93.5	91.4	110.2	104.7	94.4	95.2	114.6	108.9	101.3	99.0	105.1	102.7			
7900	94.6	92.5	111.6	106.0	98.6	96.4	116.1	110.3	102.5	100.3	106.5	104.1			
8000	95.8	93.7	113.0	107.4	99.8	97.6	117.6	111.7	103.8	101.5	107.8	105.4			
8100	97.0	94.9	114.5	108.7	101.1	98.8	119.0	113.1	105.1	102.8	109.2	106.7			
8200	98.3	96.1	115.9	110.1	102.3	100.1	120.5	114.5	106.5	104.1	110.5	108.1			
8300	99.4	97.2	117.3	111.4	103.6	101.3	122.0	115.9	107.8	105.3	111.9	109.3			
8400	100.7	98.4	118.7	112.8	104.8	102.5	123.4	117.3	109.0	106.6	113.2	110.7			
8500	101.9	99.6	120.1	114.1	106.1	103.7	124.9	118.7	110.4	107.9	114.6	112.0			
8600	103.0	100.7	121.5	115.4	107.4	104.9	126.4	120.1	111.7	109.1	115.9	113.3			
8700	104.2	101.9	122.9	116.8	108.6	106.2	127.8	121.5	112.9	110.4	117.3	114.6			
8800	105.5	103.1	124.3	118.1	109.9	107.4	129.3	122.9	114.3	111.7	118.6	115.9			
8900	106.7	104.3	125.8	119.5	111.1	108.6	130.8	124.2	115.5	113.0	120.2	117.2			
9000	107.9	105.4	127.2	120.8	112.4	109.8	132.3	125.6	116.8	114.2	121.3	118.6			
9100	109.0	106.6	128.6	122.2	113.6	111.0	133.7	127.0	118.2	115.5	122.7	119.9			
9200	110.3	107.8	130.0	123.5	114.9	112.3	135.2	128.4	119.5	116.8	124.0	121.2			
9300	111.5	108.9	131.4	124.8	116.1	113.5	136.7	129.8	120.8	118.0	125.4	122.5			
9400	112.7	110.1	132.8	126.2	117.4	114.7	138.1	131.2	122.0	119.3	126.7	123.8			
9500	113.8	111.3	134.2	127.5	118.6	115.9	139.6	132.6	123.4	120.6	128.1	125.2			
9600	115.1	112.5	135.6	128.9	119.9	117.1	141.1	134.0	124.7	121.8	129.4	126.5			
9700	116.3	113.6	137.1	130.2	121.1	118.4	142.5	135.4	125.9	123.1	130.8	127.8			
9800	117.5	114.8	138.5	131.5	122.4	119.6	144.0	136.8	127.3	124.4	132.1	129.1			
9900	118.7	116.0	139.9	132.9	123.6	120.8	145.5	138.2	128.6	125.6	133.5	130.4			
10000	119.9	117.1	141.3	134.2	124.9	122.0	146.9	139.6	129.9	126.9	134.8	131.7			
NOTE: CLUTCH RATIO IS 1 TO 1															

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)*															
	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	75.2	71.5	66.5	65.0	79.7	75.7	70.4	68.8	84.1	79.9	74.3	72.6	88.5	84.1	78.2
6600	76.4	72.6	67.5	66.0	80.9	76.9	71.5	69.9	85.4	81.1	75.5	73.7	89.9	85.4	79.5
6700	77.6	73.7	68.5	67.0	82.1	78.0	72.6	70.9	86.7	82.4	76.6	74.9	91.2	86.7	80.6
6800	78.7	74.8	69.5	68.0	83.3	79.2	73.6	72.0	88.0	83.6	77.7	76.0	92.6	88.0	81.8
6900	79.9	75.9	70.5	69.0	84.6	80.3	74.7	73.0	89.3	84.8	78.9	77.1	94.0	89.3	83.0
7000	81.0	77.0	71.6	70.0	85.8	81.5	75.8	74.1	90.6	86.0	80.0	78.2	95.3	90.6	84.2
7100	82.2	78.1	72.6	71.0	87.0	82.7	76.9	75.2	91.9	87.3	81.2	79.3	96.7	91.9	85.4
7200	83.3	79.2	73.6	72.0	88.3	83.8	77.9	76.2	93.2	88.5	82.3	80.5	98.1	93.2	86.6
7300	84.5	80.3	74.7	73.0	89.5	85.0	79.1	77.3	94.4	89.7	83.5	81.6	99.4	94.4	87.8
7400	85.7	81.4	75.7	74.0	90.7	86.2	80.1	78.3	95.7	91.0	84.6	82.7	100.8	95.7	89.0
7500	86.8	82.5	76.7	75.0	91.9	87.3	81.2	79.4	97.0	92.2	85.7	83.8	102.1	97.0	90.3
7600	88.0	83.6	77.7	76.0	93.2	88.5	82.3	80.5	90.3	93.4	86.9	84.9	103.5	98.3	91.4
7700	89.1	84.7	78.8	77.0	94.4	89.7	83.4	81.5	99.6	94.6	88.0	86.0	104.9	99.6	92.6
7800	90.3	85.8	79.8	78.0	95.6	90.8	84.5	82.6	100.9	95.9	89.1	87.2	106.2	100.9	93.8
7900	91.5	86.9	80.8	79.0	96.8	92.0	85.6	83.6	102.2	97.1	90.3	88.3	107.6	102.2	95.1
8000	92.6	88.0	81.8	80.0	98.1	93.2	86.6	84.7	103.5	98.3	91.5	89.4	109.0	103.5	96.3
8100	93.8	89.1	82.8	81.0	99.3	94.3	87.7	85.7	104.8	99.6	92.6	90.5	110.3	104.8	97.4
8200	94.9	90.2	83.9	82.0	100.5	95.5	88.8	86.8	106.1	100.8	93.7	91.6	111.7	106.1	98.7
8300	96.1	91.3	84.9	83.0	101.7	96.6	89.9	87.9	107.4	102.0	94.9	92.7	113.0	107.4	99.8
8400	97.2	92.4	85.9	84.0	103.0	97.8	90.9	88.9	108.7	103.2	96.0	93.9	114.4	108.7	101.0
8500	98.4	93.5	86.9	85.0	104.2	99.0	92.0	90.0	110.0	104.5	97.1	95.0	115.8	110.0	102.3
8600	99.6	94.6	87.9	86.0	105.4	100.1	93.1	91.0	111.3	105.7	98.3	96.1	117.1	111.3	103.5
8700	100.7	95.7	89.0	87.0	106.6	101.3	94.2	92.1	112.6	106.9	99.5	97.2	118.5	112.6	104.7
8800	101.9	96.8	90.0	88.0	107.9	102.5	95.3	93.2	113.9	108.2	100.6	98.3	119.8	113.9	105.9
8900	103.0	97.9	91.0	89.0	109.1	103.6	96.4	94.2	115.1	109.4	101.7	99.4	121.2	115.1	107.1
9000	104.2	99.0	92.0	90.0	110.3	104.8	97.5	95.3	116.4	110.6	102.9	100.6	122.6	116.4	108.3
9100	105.3	100.1	93.1	91.0	111.5	106.0	98.6	96.3	117.7	111.9	104.0	101.7	123.9	117.7	109.5
9200	106.5	101.2	94.1	92.0	112.8	107.1	99.6	97.4	119.0	113.1	105.2	102.8	125.3	119.0	110.7
9300	107.7	102.3	95.1	93.0	114.0	108.3	100.7	98.4	120.3	114.3	106.3	103.9	126.7	120.3	111.9
9400	108.8	103.4	96.1	94.0	115.2	109.5	101.8	99.5	121.6	115.5	107.5	105.0	128.0	121.6	113.1
9500	110.0	104.5	97.2	95.0	116.4	110.6	102.9	100.6	122.9	116.8	108.6	106.2	129.4	122.9	114.3
9600	111.1	105.6	98.2	96.0	117.7	111.8	103.9	101.6	124.2	118.0	109.8	107.3	130.7	124.2	115.5
9700	112.3	106.7	99.2	97.0	118.9	112.9	105.0	102.7	125.5	119.2	110.9	108.4	132.1	125.5	116.7
9800	113.4	107.8	100.2	98.0	120.1	114.1	106.1	103.7	126.8	120.5	112.0	109.5	133.5	126.8	117.9
9900	114.6	108.9	101.3	99.0	121.3	115.3	107.2	104.8	128.1	121.7	113.2	110.6	134.8	128.1	119.1
10000	115.8	110.0	102.3	100.0	122.6	116.4	108.3	105.9	129.4	122.9	114.3	111.7	136.2	129.4	120.3
NOTE: CLUTCH RATIO IS 0.83 TO 1, INCLUDING FULL OVERDRIVE OF T.R.A.															

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 2.15 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	76.5	93.0	88.3	82.1	80.3	97.4	92.5	86.0	84.1	101.8	96.7	89.9	87.9	106.2	100.9
6600	77.6	94.4	89.7	83.4	81.5	98.9	93.9	87.4	85.4	103.4	98.2	91.3	89.3	107.9	102.5
6700	78.8	95.8	91.0	84.6	82.7	100.4	95.4	88.7	86.7	104.9	99.7	92.7	90.6	109.5	104.0
6800	80.0	97.2	92.4	85.9	84.0	101.9	96.8	90.0	88.0	106.5	101.2	94.1	92.0	111.1	105.6
6900	81.2	98.7	93.7	87.2	85.2	103.4	98.2	91.3	89.3	108.1	102.7	95.5	93.3	112.8	107.1
7000	82.3	100.1	95.1	88.5	86.5	104.9	99.6	92.7	90.6	109.6	104.2	96.9	94.7	114.4	108.7
7100	83.5	101.5	96.5	89.7	87.7	106.4	101.0	94.0	91.9	111.2	105.6	98.2	96.0	116.0	110.2
7200	84.7	103.0	97.8	91.0	88.9	107.9	102.5	95.3	93.2	112.4	107.1	99.6	97.4	117.7	111.8
7300	85.9	104.4	99.2	92.2	90.2	109.4	103.9	96.6	94.4	114.3	108.6	101.0	98.7	119.3	113.3
7400	87.0	105.8	100.5	93.5	91.4	110.9	105.3	97.9	95.7	115.9	110.1	102.4	100.1	120.9	114.9
7500	88.2	107.3	101.9	94.8	92.6	112.4	106.7	99.3	97.0	117.5	111.6	103.8	101.4	122.6	116.4
7600	89.4	108.7	103.2	96.0	93.9	113.9	108.2	100.6	98.3	119.0	113.1	105.2	102.8	124.2	118.0
7700	90.6	110.1	104.6	97.3	95.1	115.4	109.6	101.9	99.6	120.6	114.6	106.5	104.2	125.8	119.5
7800	91.7	111.5	106.0	98.6	96.3	116.9	111.0	103.3	100.9	122.2	116.1	107.9	105.5	127.5	121.1
7900	92.9	113.0	107.3	99.8	97.6	118.3	112.4	104.6	102.2	123.7	117.5	109.3	106.9	129.1	122.7
8000	94.1	114.4	108.7	101.1	98.8	119.8	113.9	105.9	103.5	125.3	119.0	110.7	108.2	130.7	124.2
8100	95.3	115.8	110.0	102.4	100.0	121.3	115.3	107.2	104.8	126.9	120.5	112.1	109.6	132.4	125.8
8200	96.4	117.3	111.4	103.6	101.3	122.8	116.7	108.5	106.1	128.4	122.0	113.5	110.9	134.0	127.3
8300	97.6	118.7	112.8	104.8	102.5	124.3	118.1	109.9	107.4	130.0	123.5	114.8	112.3	135.6	128.9
8400	98.8	120.1	114.1	106.1	103.7	125.8	119.5	111.2	108.7	131.6	125.0	116.2	113.6	137.3	130.4
8500	100.0	121.6	115.5	107.4	105.0	127.3	121.0	112.5	110.0	131.1	126.5	117.6	115.0	138.9	132.0
8600	101.2	123.0	116.8	108.7	106.2	128.8	122.4	113.8	111.3	134.7	128.0	119.0	116.3	140.5	133.5
8700	102.3	124.4	118.2	109.9	107.4	130.3	123.8	115.2	112.6	136.3	129.4	120.4	118.7	142.2	135.1
8800	103.5	125.8	119.5	111.2	108.7	131.8	125.2	116.5	113.9	137.8	130.9	121.8	119.0	143.8	136.6
8900	104.7	127.3	120.9	112.5	109.9	133.3	126.7	117.8	115.1	139.4	132.4	123.2	120.4	145.5	138.2
9000	105.9	128.7	122.3	113.7	111.2	134.8	128.1	119.1	116.4	141.0	133.9	124.5	121.7	147.1	139.7
9100	107.0	130.1	123.6	115.6	112.4	136.3	129.5	120.5	117.7	142.5	135.4	125.9	123.1	148.7	141.3
9200	108.2	131.6	125.0	116.2	113.6	137.8	130.9	121.8	119.0	144.1	136.9	127.3	124.4	150.4	142.8
9300	109.4	133.0	126.3	117.5	114.9	139.3	132.4	123.1	120.3	145.7	138.4	128.7	125.8	152.0	144.4
9400	110.6	134.4	127.7	118.8	116.1	140.8	133.8	124.4	121.6	147.2	139.9	130.1	127.1	153.6	145.9
9500	111.7	135.9	129.1	120.0	117.3	142.3	135.2	125.8	122.9	148.8	141.3	131.4	128.5	155.3	147.5
9600	112.9	137.3	130.4	121.3	118.6	143.2	136.6	127.0	124.2	150.4	142.8	132.8	129.9	156.9	149.0
9700	114.1	138.7	131.7	122.6	119.8	145.3	138.0	128.4	125.5	151.9	144.3	134.2	131.2	158.5	150.6
9800	115.3	140.1	133.1	123.8	121.0	146.8	139.5	129.7	126.8	153.5	145.8	135.6	132.6	160.2	152.2
9900	116.4	141.6	134.5	125.1	122.3	148.3	140.9	131.0	128.1	155.1	147.3	137.0	133.9	161.8	153.7
10000	117.6	143.0	135.9	126.4	123.5	149.8	142.3	132.4	129.4	156.6	148.8	138.4	135.3	163.4	155.3
***NOTE:* CLUTCH RATIO IS 0.83 TO 1, INCLUDING FULL OVERDRIVE OF T.R.A.**															

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	27/43 1.59	27/44 1.62			
6500	93.8	91.7	110.7	105.1	97.8	95.6	115.1	109.3	101.7	99.4	105.6	103.2			
6600	95.3	93.2	112.4	106.7	99.3	97.0	116.9	111.0	103.2	100.9	107.2	104.7			
6700	96.7	94.6	114.1	108.4	100.8	98.5	118.6	112.7	104.8	102.4	108.8	106.3			
6800	98.2	96.0	115.8	110.0	102.3	100.0	120.4	114.4	106.4	104.0	110.4	107.9			
6900	99.6	97.4	117.5	111.6	103.8	101.4	122.2	116.1	107.9	105.5	112.1	109.5			
7000	101.1	98.8	109.2	113.2	105.3	102.9	123.9	117.7	109.5	107.0	113.7	111.1			
7100	102.5	100.2	120.9	114.8	106.8	104.4	125.7	119.4	111.1	108.6	115.3	112.7			
7200	103.9	101.6	122.6	116.4	108.3	105.9	127.5	121.1	112.6	110.1	116.9	114.3			
7300	105.4	103.0	124.3	118.1	109.8	107.3	129.2	122.8	114.2	111.6	118.6	115.9			
7400	106.8	104.4	126.0	119.7	111.3	108.8	131.0	124.5	115.7	113.1	120.2	117.5			
7500	108.3	105.9	127.7	121.3	112.8	110.3	132.8	121.1	117.3	114.7	121.8	119.0			
7600	109.7	107.3	129.4	122.9	114.3	111.7	134.6	127.8	118.9	116.2	123.4	120.6			
7700	111.2	108.7	131.1	124.5	115.8	113.2	136.3	129.5	120.5	117.7	125.1	122.2			
7800	112.6	110.1	132.8	126.1	117.3	114.7	138.1	131.2	122.0	119.3	126.7	123.8			
7900	114.1	111.5	134.5	127.8	118.8	116.1	139.9	132.9	123.6	120.8	128.3	125.4			
8000	115.5	112.9	136.2	129.4	120.3	117.6	141.6	134.6	125.2	122.3	129.9	127.0			
8100	116.9	114.3	137.9	131.0	121.8	119.1	143.4	136.2	126.7	123.9	131.6	128.6			
8200	118.4	115.7	139.6	132.6	123.3	120.6	145.2	137.9	128.3	125.4	133.2	130.2			
8300	119.8	117.1	141.3	134.2	124.8	122.0	146.9	139.6	129.8	126.9	134.8	131.7			
8400	121.3	118.6	143.0	135.9	126.3	123.5	148.7	141.3	131.4	128.4	136.4	133.3			
8500	122.7	120.0	144.7	137.5	127.8	125.0	150.5	143.0	132.9	130.0	138.1	134.9			
8600	124.2	121.4	146.4	139.1	129.4	126.4	152.3	144.6	134.5	131.5	139.4	136.5			
8700	125.6	122.8	148.1	140.7	130.8	127.9	154.0	146.3	136.1	133.0	141.3	138.1			
8800	127.0	124.2	149.8	142.3	132.4	129.4	155.8	148.0	137.6	134.6	142.9	139.7			
8900	128.5	125.6	151.5	143.9	133.9	130.9	157.6	149.7	139.2	136.1	144.6	141.3			
9000	129.9	127.0	153.2	145.6	135.4	132.3	159.3	151.4	140.8	137.6	146.2	142.9			
9100	131.4	128.4	154.9	147.2	136.9	133.8	161.1	153.1	142.4	139.1	147.8	144.4			
9200	132.8	129.9	156.6	148.8	138.4	135.3	162.9	154.7	143.9	140.7	149.4	146.0			
9300	134.9	131.3	158.3	150.4	139.9	136.7	164.7	156.4	145.5	142.2	151.1	147.6			
9400	135.7	132.7	160.0	152.0	141.4	138.2	166.4	158.1	147.0	143.7	152.7	149.2			
9500	137.2	134.1	161.7	153.6	142.9	139.7	168.2	159.8	148.6	145.3	154.3	150.8			
9600	138.6	135.5	163.4	155.3	144.4	141.1	170.0	161.5	150.2	146.8	155.9	152.4			
9700	140.0	136.9	165.1	156.9	145.9	142.6	171.7	163.1	151.7	148.3	157.6	154.0			
9800	141.5	138.3	166.8	158.5	147.4	144.1	173.5	164.8	153.3	149.8	159.2	155.6			
9900	142.9	139.7	168.5	160.1	148.9	145.6	175.3	166.5	154.9	161.4	160.8	157.1			
10000	144.4	141.1	170.2	161.7	150.4	147.0	177.0	168.2	156.4	152.9	162.4	158.7			
NOTE: CLUTCH RATIO IS 0.83 TO 1, INCLUDING FULL OVERDRIVE OF T.R.A.															

The new CK3 and Zx 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.

CK3 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.

Transmission Tuning Test Sheet

DATE: ________________ VEHICLE: ________________ SHEET NO.: __________

TEST 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					

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 Cut-Away				
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				

TABLE OF CONTENTS

USEFUL PUBLICATIONS

DESCRIPTION		P/N
Shop Manuals x 3 for 1998		
Vol. 1	Tundra II LT, Touring E/LE, Formula S/S Electric/SL, Skandic 380/500	484 068 000
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	484 068 200
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	484 068 400
Shop Manual Mini Z 1998		484 069 300
Supplement MX Zx 440 LC 1998		484 069 500
Supplement Touring SLE, Tundra R 1998		484 069 600
Supplement Summit x 670 1998		484 069 700
High Altitude and Sea Level Technical Data 1994-1998		480 068 600
Specification Booklet 1995-1998		480 068 500
Shop Manuals x 3 for 1999		
Vol. 1	Tundra R, Touring E/LE/SLE, Formula S/SL, Formula Deluxe 377/500, Skandic 380/500	484 200 001
Vol. 2	Grand Touring 500/583, Summit 500/670 X, MX Z 440/500/670 H.O., Formula Z 500/583/670, Formula Deluxe 500 LC/583/670, Skandic WT/SWT/WT LC	484 200 003
Vol. 3	Grand Touring 700/SE, Formula III 600/700/800, Mach 1/1 R/Z/Z R/Z LT/Z LT R	484 200 005
Supplement MX Zx, MX Z 600, Summit 600		484 200 009
Specification Booklet 95-99		484 300 002
High Altitude Booklet		484 300 004

TECHNICAL DATA

Supplement for Model: 1999 MX Z 670 H.O.

			MODEL: 1999 MX Z 670 H.O.	PRELIMINARY		
	RACING TYPE		*-Grass drags-*	*500′*		
	Maximum horsepower *	RPM		*7900*		
CARBURETOR						
	Carburetor type			*VM 44*		
	Main jet			*PTO*	*CENTER*	*MAG*
				350	*N.A.*	*320*
	Needle		**K & N Filters**	*7ECY1*		*7ECY1*
	Needle clip position			*4*		*4*
	Slide cut-away			*2.5*		*2.5*
	Pilot jet			*60*		*60*
	Needle jet			*AA4*		*AA4*
	Air screw adjustment		± 1/8 turn	*0.5 (1/2)*		*0.5 (1/2)*
	Needle valve			*1.5*	*1.5*	*1.5*
				Super unleaded		
DRIVE RATIO	Drive ratio			*23-43*		
	Chain			*Links*		
	Drive pulley	Type of drive pulley		*TRA*		
		Ramp identification P/N 417 005 280		*280*		
		Calibration screw position		*no. 3*		
		Spring color P/N 414 754 200		*230/320 Pink/Purple*		
		Clutch engagement	RPM			
		Pin		*Solid (16 gr)*		
		Lever		*Std Aluminum*		
	Driven pulley	Spring	Color	*Beige*		
			Preload kg (lb)	*(B6)*		
		Cam	Angle P/N 504 096 100	*50°*		
	Drive belt		Part number	*414 860 700*		
	Spring rave		Part number			
	Calibration done at temperature of			*80°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.					

Supplement for Model: 1998 Mach Z 809

	MODEL: 1998 Mach Z 809			***PRELIMINARY***		
	RACING TYPE	*-Grass drags-*				
	Maximum horsepower *	RPM				
CARBURETOR						
	Carburetor type			*3 - TM38*		
				PTO	*CENTER*	*MAG*
	Main jet			*250*	*250*	*250*
	Needle			*8ABY1-40*	*8ABY1-40*	*8ABY1-40*
	Needle clip position			*2*	*2*	*2*
	Slide cut-away			*2.0*	*2.0*	*2.0*
	Pilot jet			*50*	*50*	*50*
	Needle jet			*O-3 (327)*	*O-3 (327)*	*O-3 (327)*
	Air screw adjustment		± 1/8 turn	*3.0*	*3.0*	*3.0*
	Needle valve			*1.5*	*1.5*	*1.5*
				Super unleaded		
DRIVE RATIO	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	**P/N=M17 004 308**	*Solid 23 gr*		
		Lever		*Std 98*		
	Driven pulley	Spring	Color	*Beige*		
			Preload kg (lb)	*(B-1)*		
		Cam	Angle	*50° - 47°*		
	Drive belt		Part number	*415 045 000*		
	Spring rave		Part number			
	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.					

Supplement for Model: 1998 MX Z 500

MODEL: 1998 MX Z 500				*PRELIMINARY*	
RACING TYPE				*-Grass drags-*	
	Maximum horsepower *	RPM		*7700-7800*	
CARBURETOR					
	Carburetor type			*2 x VM38*	
				PTO	*MAG*
	Main jet			*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			*Super unleaded*	
DRIVE RATIO	Drive ratio			*21-43*	
	Chain			*Links 72*	
	Drive pulley	Type of drive pulley		*TRA*	
		Ramp identification		*CF-1*	
		Calibration screw position		*3*	
		Spring color		*160/320 (Pu/Pu)*	
		Clutch engagement	RPM		
		Pin		*Steel threaded + 2 screw sets*	
		Lever		*Std 98*	
	Driven pulley	Spring	Color	*Beige*	
			Preload kg (lb)	*19 lbs - B6*	
		Cam	Angle	*54°-48°*	
	Drive belt		Part number	*414 860 700*	
	Spring rave	*1.0 x 38 mm*	Part number	*420 239 948*	
	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.

Supplement for Model: 1998 MX Zx 440 LC

MODEL: 1998 MX Zx 440 LC				*PRELIMINARY*		
	RACING TYPE	*-Grass drags-*		*500'*		
	Maximum horsepower *	RPM		*8450*		
CARBURETOR						
	Carburetor type			*VM 34*		
				PTO	*CENTER*	*MAG*
	Main jet			*200*	*N.A.*	*200*
	Needle			*6FJ43*	*N.A.*	*6FJ43*
	Needle clip position			*1*	*N.A.*	*1*
	Slide cut-away			*2.5*	*N.A.*	*2.5*
	Pilot jet			*65*	*N.A.*	*65*
	Needle jet			*Q-0*	*N.A.*	*Q-0*
	Air screw adjustment		± 1/8 turn	*1.5*	*N.A.*	*1.5*
	Needle valve					
				Super unleaded		
DRIVE RATIO	Drive ratio			*19 - 43*		
	Chain			*Links*		
	Drive pulley	Type of drive pulley		*TRA*		
		Ramp identification		*293*		
		Calibration screw position		*6*		
		Spring color P/N 417 222 004		*250/380 White/White*		
		Clutch engagement	RPM			
		Pin		*THD. Steel + 1 Set SCR*		
		Lever		*Std Aluminum*		
	Driven pulley	Spring	Color	*Beige*		
			Preload kg (lb)	*no. 26*		
		Cam	Angle P/N 415 021 200	*46° - 42°*		
	Drive belt		Part number	*414 860 700*		
	Spring rave		Part number			
	Calibration done at temperature of			*80°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.					

Supplement for Model: 1997 Mach 1 700

MODEL: 1997 Mach 1 700						
	RACING TYPE	*-Grass drags-*				
	Maximum horsepower *	RPM		*8500*		
CARBURETOR				*VM-38*		
	Carburetor type					
				PTO	*CENTER*	*MAG*
	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*
				Unleaded		
DRIVE RATIO	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	*415 060 300*		
	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.					

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				
CARBURETOR	Carburetor type			VM 34		VM 34	
				PTO	MAG	PTO	MAG
	Main jet			150	135	155	140
	Needle			Stock	Stock	Stock	Stock
	Needle clip position			4	4	4	4
	Slide cut-away			Stock	Stock	Stock	Stock
	Pilot jet			Stock	Stock	Stock	Stock
	Needle jet			Stock	Stock	Stock	Stock
	Air screw adjustment		± 1/8 turn	1-1/4	1-1/4	1-1/4	1-1/4
	Needle valve			Stock	Stock	Stock	Stock
	Idle speed		RPM				
	Gas grade			Super unleaded		Super unleaded	
DRIVE RATIO	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		415 060 600	
	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.						

Supplement for Model: 1996 Mach Z

MODEL: 1996 Mach Z						
	RACING TYPE	*-Grass drags-*				
	Maximum horsepower *	RPM		*8250*		
CARBURETOR				*TM-38*		
CARBURETOR	Carburetor type					
CARBURETOR				*PTO*	*CENTER*	*MAG*
CARBURETOR	Main jet			*250*	*250*	*250*
CARBURETOR	Needle			*Stock*	*Stock*	*Stock*
CARBURETOR	Needle clip position			*4*	*4*	*4*
CARBURETOR	Slide cut-away			*Stock*	*Stock*	*Stock*
CARBURETOR	Pilot jet			*Stock*	*Stock*	*Stock*
CARBURETOR	Needle jet			*Stock*	*Stock*	*Stock*
CARBURETOR	Air screw adjustment		± 1/8 turn	*3/4 turn*	*3/4 turn*	*3/4 turn*
CARBURETOR	Needle valve			*Stock*	*Stock*	*Stock*
CARBURETOR				*Super unleaded*		
DRIVE RATIO	Drive ratio			*22-44*		
DRIVE RATIO	Chain			*Links* *72*		
DRIVE RATIO	Drive pulley	Type of drive pulley		*TRA*		
DRIVE RATIO		Ramp identification		*286*		
DRIVE RATIO		Calibration screw position		*2*		
DRIVE RATIO		Spring		*230/350 (Pink/Pink)*		
DRIVE RATIO		Clutch engagement	RPM	*4500*		
DRIVE RATIO		Pin		*Solid*		
DRIVE RATIO		Lever		*Std alum.*		
DRIVE RATIO	Driven pulley	Spring	Color	*Beige*		
DRIVE RATIO			Preload kg (lb)	*23 lbs (B-5)*		
DRIVE RATIO		Cam	Angle	*54°-48°*		
DRIVE RATIO	Drive belt		Part number	*415 060 300*		
	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.					

Supplement for Model: 1996 Formula III

MODEL: 1996 Formula III					
	RACING TYPE	*-Grass drags-*	*500'*		
	Maximum horsepower *	RPM	*8300*		
CARBURETOR			*TM-38*		
	Carburetor type				
			PTO	*CENTER*	*MAG*
	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		*P-O 286*	*P-O 286*	*P-O 286*
	Air screw adjustment	± 1/8 turn	*1.5*	*1.5*	*1.5*
	Needle valve		*1.5 V*	*1.5 V*	*1.5 V*
			Unleaded		
DRIVE RATIO	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	*Hollow steel + sets screws*		
		Lever	*Std aluminum*		
	Driven pulley	Spring — Color	*Beige*		
		Spring — Preload kg (lb)	*19 lbs (B-6)*		
		Cam — Angle	*54°-48°*		
	Drive belt	Part number	*415 060 300*		
	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.

Supplement for Model: 1996 Formula MX Z 583

MODEL: 1996 Formula MX Z 583					
	RACING TYPE	*-Grass drags-*			
	Maximum horsepower *	RPM		*7750*	
CARBURETOR	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*	
DRIVE RATIO	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)	*16 lbs*	
		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.

Supplement for Model: 1996 Formula SLS

MODEL: 1996 Formula SLS					
	RACING TYPE	*-Grass drags-*			
	Maximum horsepower *	RPM		*7700*	
CARBURETOR	Rotary valve	Part number			
		Timing	**opening**		
			closing		
	Carburetor type			*VM38*	
				PTO	*MAG*
	Main jet			*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*	
DRIVE RATIO	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.

TABLE OF CONTENTS

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 200 PSI.

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.
- 570 208 600 15 × 136 × 1.5 Paddle track
- 570 208 900 15 × 121 × 1.5 Paddle track
- 570 021 200 15 x 136 x 1.75 Paddle track
- 861 759 800 15 x 136 x 2 Paddle track (Kit includes drive axle ass'y)
- 570 210 200 15 x 136 x 2 Paddle track
- 860 304 500 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 (435) 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.
- 415 020 600 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 (414 955 300). 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 minimum.

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 3 mm (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.

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.

Fore 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.

415 020 600	DSA front spring	125 lbs/in	8 inch free length
415 020 700	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 415 020 800 (70 lbs/inch, 6 inch free length) and soft preload.
- Use SC-10 front arm quick adjust ass’y (P/N 861 754 700).

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 9844, it has 3/4 inch 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 holeshot 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!

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.

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.

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

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.

ISR	International Snowmobile Racing	414-335-2401 PH 414-335-9440 Fax
WSA	World Snowmobile Association	612-497-0776 PH 612-497-0766 Fax
CSRA	Canadian Snocross Racing Association	905-476-7182 905-476-7157 Fax
ASRA	American Snowcross Racing Association	905-476-9182 PH 905-476-7157 Fax
RMR	Rock Maple Racing	802-368-2747 PH
USSA	United States Snowmobile Association	920-732-3563 PH 920-732-3900 Fax
MRPPI	Motorsports Racing Plus Pro Ice	612-428-3800 PH 612-428-3897 Fax
SCM	Super Competition Motorsport	450-794-2298 PH 450-794-2450 Fax
PRO	Power Sled Racing Organization	315-827-4849
FANS	First American North Star Series	218-681-2544 PH 218-681-6228 Fax
MSDRA	Michigan Snowmobile Drag Racing Association	734-995-6995
NSSR	National Snowmobile Straightline Racing	612-221-0154
CCMQ	Circuit de Courses de Motoneiges du Québec	514-252-3076 PH 514-254-2066 Fax
CSRC	Colorado Snowmobile Racing Club	970-663-2296
CCC	Colorado Cross Country	907-468-4839
MIRA	Midwest International Racing Association	517-736-6784
RMSHA	Rocky Mountain Snowmobile Hillclimb	435-752-1892

PARTS SUPPORT

The **Ski-Doo** factory support trucks will be on hand at most major Snocross, grass drag and oval events across the U.S. and Canada. The purpose of these trucks is to provide parts, and technical support for all racers racing Ski--Doo snowmobiles.

The Ski-Doo race support trucks carry an extensive inventory of parts, however it is always best to be self contained and not to count on anyone but himself for parts support.

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	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 in sled	Cam pos. 2	
	300 PSI	300 PSI	300 PSI	

***NOTE:** Sway bar installed, ACM tight.

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 Cut-Away	2.5	2.5	Stock	
Pilot Jet	45	45	Stock	
Drive Pulley		BEST	CLUTCHING NOTES:	OPTION 2ND 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	417 005 287	Stock
TRA Adjuster Position		3		3
Spring Identification		Pink/White	415 019 300	Stock
Spring Pressure @ Engagement		230		230
Spring Pressure @ Full Shift		380		350
Engagement RPM		5000		5050
Shift RPM		8450 - 8500		8500
Drive Belt Identification		414 860 700	Stock	
Driven Pulley				
Cam Identification		40/44	Stock	
Spring Identification		Beige	Stock	
Spring Preload and Location		17# B-6		
Chaincase Gearing		21/43	21 no. 504 139 300	
	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		
Limiter Adjustment				
Rear Spring Ident.	Stock	Stock		
Ride Height	Full Travel	Full Travel		
Stud Quantity and Type	144	.875 w/ 1/8″ Backer Plate		

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 x15 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	414 859 300 BL/WH	STOCK	486 071 100 YL/YL 486 071 200 YL/YL
PRELOAD	5/8″	0	1st Cam	3rd or 4th Cam
	300 PSI	300 PSI	300 PSI	

NOTE: ACM tight, install 1/2 in diameter steel sway bar (P/N 506 134 300), levers (P/N 506 134 402) and bushings (P/N 415 039 500).

Install bushings (P/N 572 086 100) in rear torsion springs.

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 Cut-away	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	
TRA 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		
Limiter Adjustment	2″ Front	Arm to Bump Stop		
Rear Spring Ident.	Stock	Stock		
Ride Height				
Stud Quantity and Type	192 Picks	.875 w/ 1/8″ Aluminum Backer Plate		

1998 Ski-Doo MX Zx Racing Tip Sheet

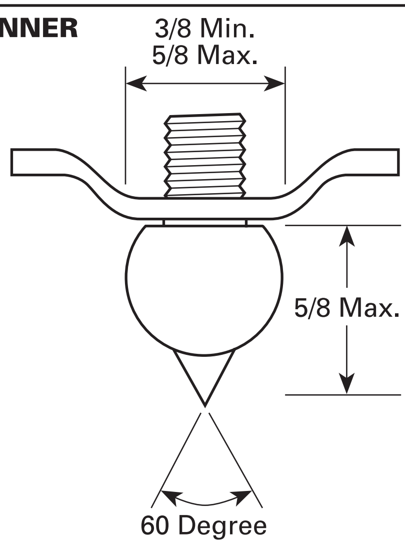
Ski-Doo Racing, P.O. Box 8035, Wausau, WI 54402-8035, Phone: 715-847-6849

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.

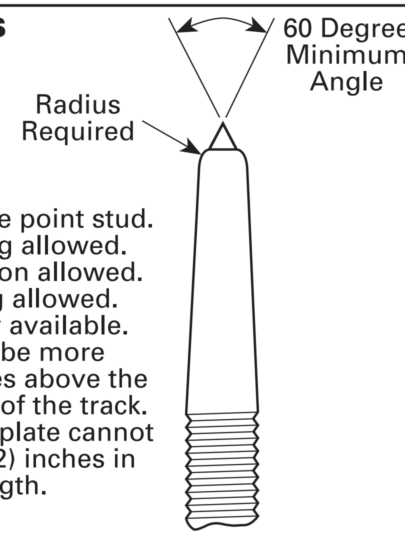
SKI RUNNER



A02F0XA

TRACK STUDS

1. Must be single point stud.
2. No sharpening allowed.
3. No modification allowed.
4. No machining allowed.
5. Commercially available.
6. Studs cannot be more than 3/8 inches above the highest point of the track.
7. Stud backing plate cannot be over two (2) inches in width and length.



A02F0YA

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 in (.375 inch) minimum width
5. 5/8 in (.625 inch) maximum width
6. Maximum height equal to or less than the width plus 1/8 in (.125 inch) with a limit of 5/8 in (.625 inch)

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 1998	570-2113	.725″	570 2126	.875″
MX Zx 1998	570-2126	.875″	* 700-9850	1.100″
MX Z 500 1998	570-2122	.912″	* 700-9850	1.100″
MX Z 583 1998	570-2122	.912″	* 700-9850	1.100″
MX Z 670 1998	570-2124	.880″	* 700-9850	1.100″

* Denotes Camoplast Part Number

no. 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 in (.375 inch) past the highest part of the track.

Approximate stud lengths are:

.920 in with 570-2126 MX Zx Track
1.075 in with Camoplast 700-9850 Track
with a backer plate thickness of 1/4 in (.250 inch)

Roetin and Woody's are manufacturing a legal carbide for Sno Cross with 10 in of carbide.

Roetin Part Number	SX-434 for ’97 MX Zx SX-440 for ’98 MX Zx
Woody's Part Number	SCS - 6700 for ’97 MX Zx SCS - 6800 for ’98 MX Zx

1998 Ski-Doo MX Zx Racing Tip Sheet

Ski-Doo Racing, P.O. Box 8035, Wausau, WI 54402-8035,
Phone: 715-847-6849 Fax: 715-847-6869

The Shock Valving listed below is recommended for Cross Country Racing.

MODEL: **RIDING CONDITIONS:**		**1998 MX Zx** **CROSS COUNTRY**	
	FRONT	CENTER	REAR
Piston slits	6	4	1
IFP Height	40 mm	142 mm	176 mm
Comp.	4 x 30 x .203	4 x 30 x .203	4 x 30 x .203
	1 x 15 x .203	1 x 15 x .203	1 x 15 x .203
	2 x 30 x .254	3 x 30 x .254	3 x 30 x .254
	1 x 26 x .203	2 x 28 x .203	1 x 22 x .152
	1 x 24 x .152	1 x 22 x .152	6 x 30 x .254
	1 x 20 x .114	1 x 18 x .152	3 x 28 x .203
	1 x 16 x .114	1 x 16 x .114	1 x 26 x .203
			1 x 24 x .152
			1 x 21 x .114
Rebound	8 x 26 x .254	7 x 26 x .254	6 x 26 x .203
	1 x 15 x .203	1 x 20 x .203	1 x 16 x .152
		1 x 15 x .152	6 x 26 x .254
			1 x 22 x .203
			1 x 15 x .114
Spring	Stock	Stock	Stock
Preload		*see notes	

*NOTES: Set limiter tp 6-1/2″ from bottom of center arm to bump stop with suspension installed. Back off all pre-load on center shock.

Designated Replacement Tracks

In each venve of stock class racing designated track of tracks are allowed as a replacement for the O.E.M. track. Use the following list as a guide only. Check with your Racing Association to verify legality.

Grass Drag Stock Classes

*Camoplast 679-9811, 679-9812, 679-9813, 679-9814.

Oval Stock Classes

*Camoplast 700-9844, 679-9811, 679-9812, 679-9813, 679-9814.

Ice Lemans Stock Classes

*Camoplast 700-9844, 679-9811, 679-9812, 679-9813, 679-9814.

They will 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

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

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
- large 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

– 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

Up to date snocross technical information is available from the Ski-Doo Racing Department by way of a tip sheet.

If you have a designated fax line and wish to receive the tip sheets. Please contact the Racing Department at (715) 847-6849.

We also encourage your feed back and would like to hear about any problems or possible solutions you may have.

Contact Bill Rader at:
715-847-6884
715-847-6869

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 lets 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 carbos 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 extention.
   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 place 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 also important to know your sled and it's 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.

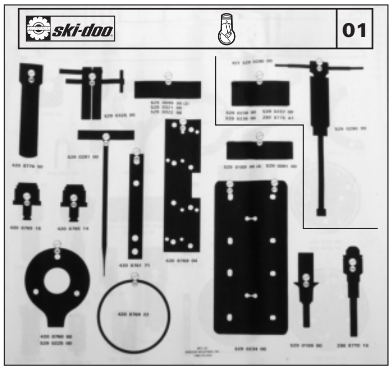
SERVICE TOOLS

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.

Following mention points out new tool: NEW

WORKSHOP — MANDATORY SERVICE TOOLS

Tool board
(P/N 529 034 000)

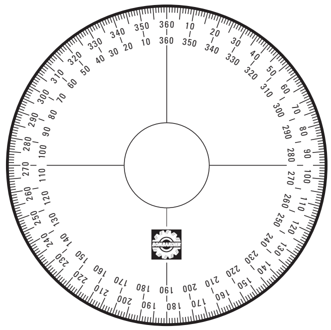


A00A3X4

APPLICATION
All models.

ENGINE — MANDATORY SERVICE TOOLS

Degree wheel
(P/N 295 000 007)



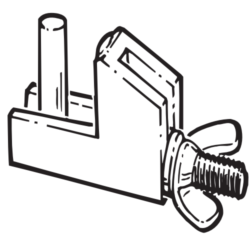
A00B334

APPLICATION

All rotary valve engines.

NOTE: Only the P/N has been changed. This degree wheel is identical to the P/N 414 352 900.

Hose pincher (2)
(P/N 295 000 076)



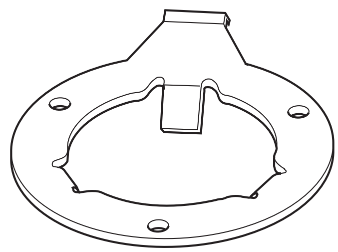
A01B2I4

APPLICATION

All vehicles.

NOTE: Only the P/N has been changed. This hose pincher is identical to the P/N 529 009 900.

Fan holder
(P/N 420 876 357)

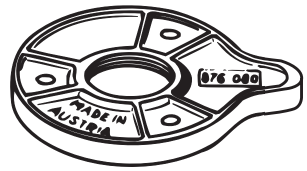


A00C0Q4

APPLICATION

377, 443 and 503 engines.

Magneto puller ring
(P/N 420 876 080)

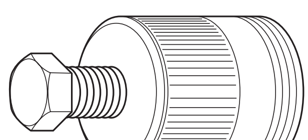


A00C1R4

APPLICATION

All engines except 247.

Magneto puller
(P/N 529 033 547)



A00C1A4

APPLICATION

All engines except 247.

NOTE: The previous extractor (P/N 529 022 500) can be upgraded by replacing the screw with the new one (P/N 529 035 549).

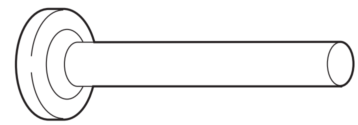
Aligning pin (4)
(P/N 529 018 900)

A00A1D4

APPLICATION

467, 494 and 582 engines.

Pusher
(washer behind the impeller)
(P/N 529 020 700)

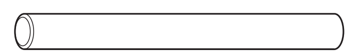


A00C3H4

APPLICATION

Rotary valve engines.

Rotary valve shaft pusher
(P/N 420 876 612)

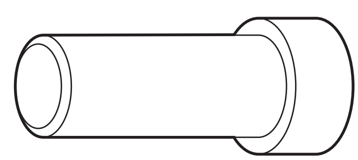


A00C0F4

APPLICATION

Rotary valve engines with a 10 mm impeller shaft.

Rotary valve seal pusher
(valve side)
(P/N 420 876 607)



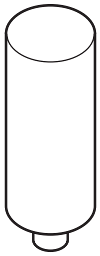
A00C0Y4

APPLICATION

Rotary valve engines.

ENGINE (continued) — MANDATORY SERVICE TOOLS

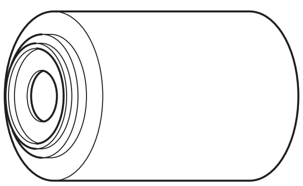
Rotary valve shaft seal pusher (inner, water pump side)
(P/N 420 876 512)



A00C374

APPLICATION
Rotary valve engines, 1991 and newer with a 10 mm impeller shaft.

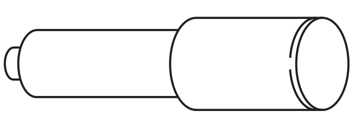
Rotary valve shaft seal pusher (outer, water pump side)
(P/N 420 877 050)



A00C0X4

APPLICATION
Rotary valve engines.

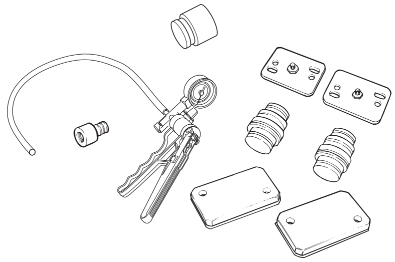
Bearing pusher (rotary valve)
(P/N 420 876 500)



A00B2J4

APPLICATION
Rotary valve engines.

Engine leak tester kit
(P/N 861 749 100)

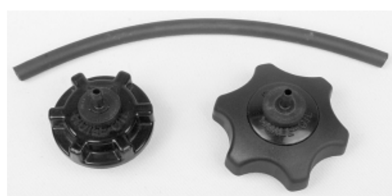


A01B2D5

APPLICATION
All engines.

Fuel and oil system leak tester kit
(P/N 529 033 100)

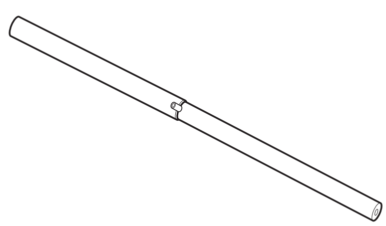
NEW



A01B5E4

APPLICATION
All models.

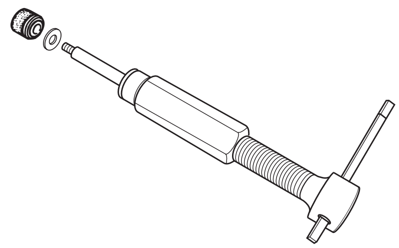
Choke plunger tool
(P/N 529 032 100)



A01C5D4

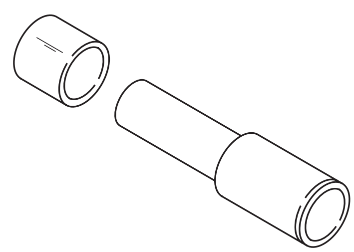
APPLICATION
All models equipped with chokes.

1) Piston pin puller
(P/N 529 035 503)



A02B094

2) Sleeve kit 18 mm
(P/N 529 035 541)
3) Sleeve kit 20 mm
(P/N 529 035 542)

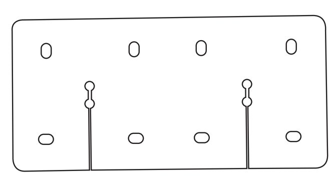


A01B5A4

APPLICATION
1) All engines.
2) 277, 443, 503 and 809 engine.
3) 670 engine.

NOTE: The previous piston pin puller (P/N 529 029 000) can be upgraded by adding protector (P/N 529 035 513) and replacing the locating sleeve and expansion sleeve with appropriate sleeve kit.

Rubber pad
(P/N 529 023 400)

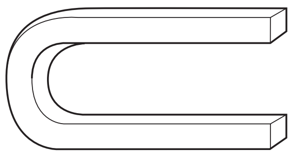


A01B4C4

APPLICATION
All cageless bearing engines.

ENGINE (continued) — MANDATORY SERVICE TOOLS

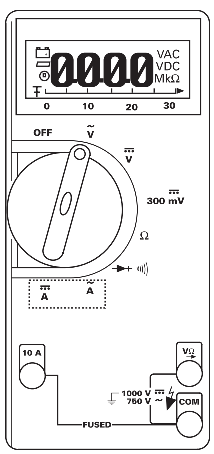
Rotary valve circlip tool
A) (P/N 529 029 100)
B) (P/N 529 020 800)



A00C3I4

APPLICATION
A) 1994 and on rotary valve engines.
B) Up to 1993 rotary valve engines.

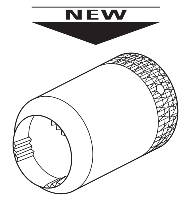
Multimeter
(P/N 529 022 000)



F01B1O4

APPLICATION
All models.

Choke/DESS nut tool
(P/N 529 034 600)



A01B554

APPLICATION
All models equipped with a choke and/or a DESS.

NOTE: This tool replaces choke nut tool (P/N 529 032 200).

Programmer
(P/N 529 035 585)

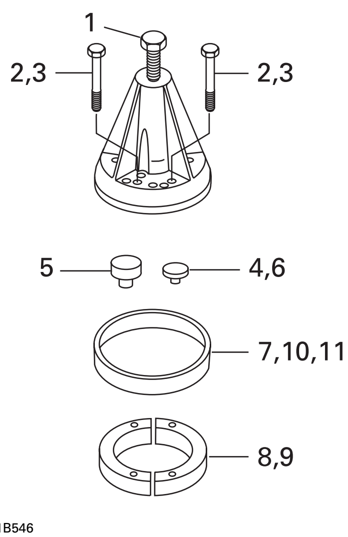
A01B5B4

APPLICATION
All models equipped with a DESS.

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 420 877 635)



APPLICATION
All engines.

1) Screw (M16 x 1.5 x 150)	(P/N 420 940 755)
2) Screw M8 x 40 (4)	(P/N 420 840 681)
3) Screw M8 x 70 (4)	(P/N 420 841 201)
4) Crankshaft protector 247 engine.	(P/N 420 976 890)
5) Crankshaft protector PTO All engines except 247.	(P/N 420 876 552)
6) Crankshaft protector MAG All engines except 247.	(P/N 420 876 557)
7) Puller ring Use with half rings (P/N 420 977 475 or 420 276 025).	(P/N 420 977 490)
8) Half ring (2) For 72 mm O.D. bearings.	(P/N 420 977 475)
9) Half ring For 62 mm O.D. bearings.	(P/N 420 276 025)
10) Puller ring For half rings (P/N 420 977 479).	(P/N 420 977 494)
11) Half ring For 80 mm O.D. bearings.	(P/N 420 977 479)

ENGINE (continued) — RECOMMENDED SERVICE TOOLS

Piston circlip installer
A) (P/N 529 035 561) 18 mm
B) (P/N 529 035 562) 20 mm

NEW

A00B4Y4

APPLICATION

A) All engines except 670.

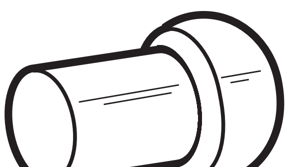
NOTE: This tool replaces circlip installer (P/N 529 016 900).

B) 670 engine.

NOTE: This tool replaces circlip installers (P/N 529 035 562 and 290 877 016).

Piston pin/connecting rod bearing centering tool
(P/N 529 009 100)

NOTE: New diameter is 9.65 mm (0.380'').



A01B1R4

APPLICATION

All engines except cageless and 670 engines.

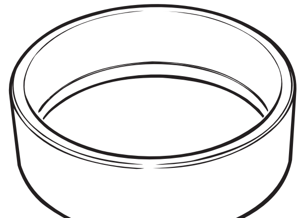
Ring compressor
A) (P/N 420 876 090) (62 mm)
B) (P/N 420 876 974) (69.5 mm)
C) (P/N 420 876 970) (72 mm)
D) (P/N 420 876 972) (76 mm)
E) (P/N 420 876 975) (67.5 mm)
F) (P/N 529 030 800) (78 mm)

A01B1T4

APPLICATION

A) 377 engine.
B) 467 and 494 engines.
C) 503, 253 and 536 engines.
D) 582, 583 and 643 engines.
E) 443 and 447 engines.
F) 670 engine.

Magneto coil centering ring
(P/N 420 876 922)

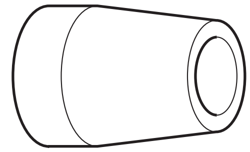


A01B1V4

APPLICATION

All engines with Nippondenso CDI (160 W).

Seal protector sleeve
(P/N 420 276 900)
(MAG)

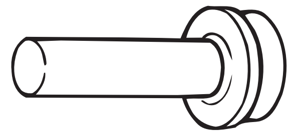


A00C0D4

APPLICATION

247 engine.

Polyamid ring pusher
(P/N 420 276 930)

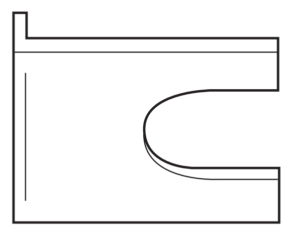


A00C0Z4

APPLICATION

247 engine.

Crankshaft feeler gauge
(P/N 420 876 620)



A00C114

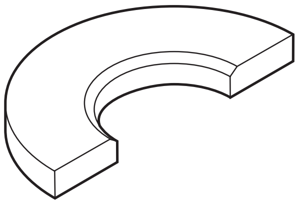
APPLICATION

377, 443, 447 and 503 engines.

ENGINE (continued) — RECOMMENDED SERVICE TOOLS

Crankshaft distance gauge (5.7 mm)

(P/N 420 876 822)



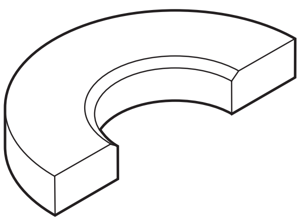
A00C294

APPLICATION

377, 443 and 447 engines.

Crankshaft distance gauge (12.7 mm)

(P/N 420 876 824)



A00C3A4

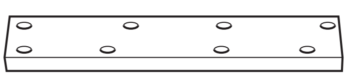
APPLICATION

503 engine.

Cylinder aligning tool

A) (P/N 420 876 904) (on exhaust side)

B) (P/N 420 876 171) (on intake side)



A00B084

APPLICATION

A) 2-cylinder liquid cooled engines.

B) 2-cylinder fan cooled engines.

Driver tool

(P/N 529 035 521)

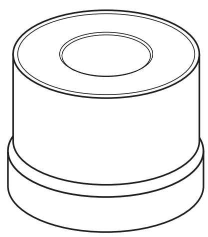
A00B4O4

APPLICATION

Mini Z.

Attachment

(P/N 529 035 522)



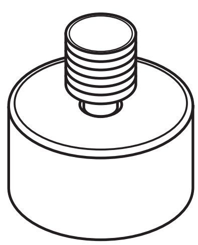
A00B4P4

APPLICATION

Mini Z.

Pilot 22 mm

(P/N 529 035 523)



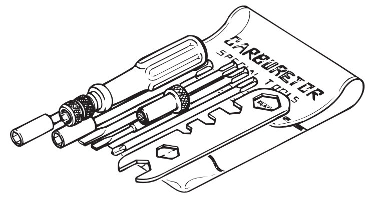
A00B4Q4

APPLICATION

Mini Z.

Carburetor tool kit

(P/N 404 112 000)



A00B2F4

APPLICATION

All models.

Adaptor

(P/N 529 033 800)

(TYPICAL)

A00B4H4

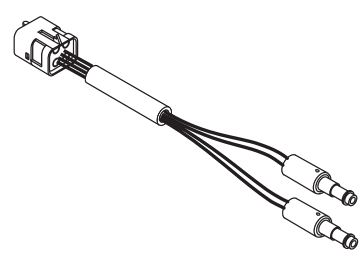
APPLICATION

1997 and 1998 Grand Touring SE
1998 Summit x 670.

Adaptor

(P/N 512 058 922)

NEW



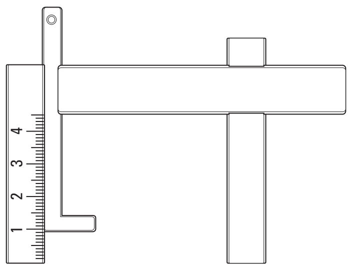
A00B4Z4

APPLICATION

1999 Grand Touring SE,
1999 Summit x 670 and MX Z 670.

ENGINE (continued) — RECOMMENDED SERVICE TOOLS

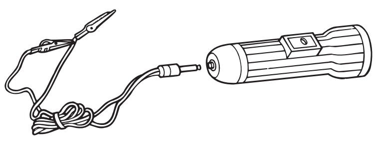
Float level gauge
(P/N 529 035 520)



A00B4N4

APPLICATION
All models.

Circuit tester
(continuity light)
(P/N 414 012 200)



A00C214

APPLICATION
All vehicles.

Stroboscopic timing light
(P/N 529 031 900)

A00B4F4

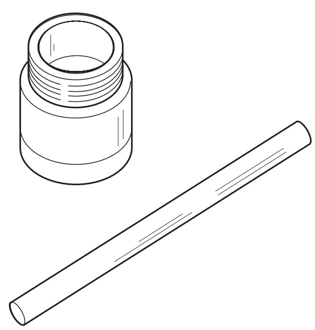
APPLICATION
All engines.

Bypass wires
(P/N 529 033 300)

A00I094

APPLICATION
360 W magneto (Grand Touring 700/SE).

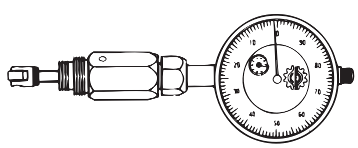
RAVE movement indicator
(P/N 861 725 800)



A18B014

APPLICATION
All RAVE equipped engines.

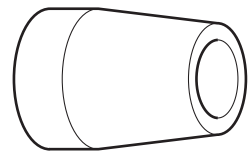
Dial indicator
(TDC gauge)
(P/N 414 104 700)



A00B4E4

APPLICATION
All engines.

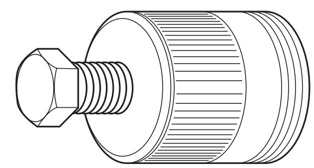
Seal protector sleeve
A) (P/N 420 876 980)
B) (P/N 420 876 490)



A00C0D4

APPLICATION
A) Rotary valve engines with 10 mm shaft.
B) Rotary valve engines with 12 mm shaft.

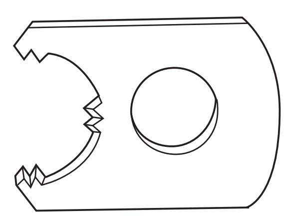
Magneto puller
(P/N 420 976 235)



A00C1A4

APPLICATION
247 engine.

Injection pump gear holder
(P/N 420 876 695)

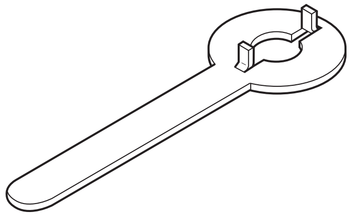


A00B314

APPLICATION
253, 377, 447 and 503 engines.

ENGINE (continued) — RECOMMENDED SERVICE TOOLS

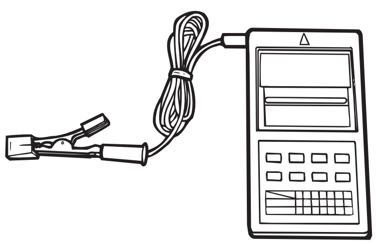
Injection pump gear holder
(P/N 420 277 905)



A00C164

APPLICATION
All liquid cooled engines.

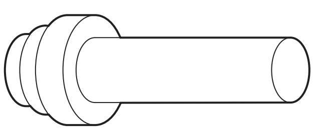
Digital/induction type tachometer
(P/N 529 014 500)



F01B1G4

APPLICATION
All engines.

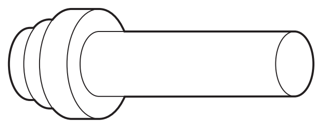
MAG seal pusher
(P/N 420 277 875)



A00C0V4

APPLICATION
277 engine.

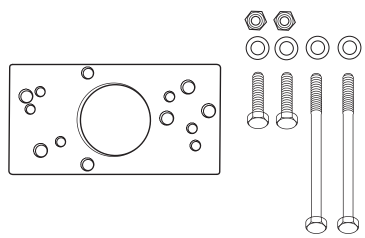
PTO seal pusher
(P/N 420 876 660)



A00C0V4

APPLICATION
277 engine.

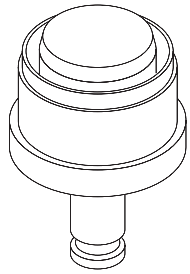
Base puller plate kit
(P/N 529 024 900)



A05C0M4

APPLICATION
277 engine.

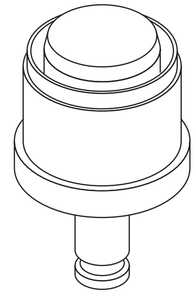
Insertion jig
(magneto side seal)
(P/N 420 876 516)



A00C3T4

APPLICATION
779 engine.

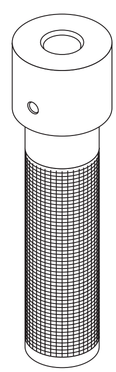
Insertion jig
(magneto seal)
(P/N 420 876 514)



A00C3U4

APPLICATION
454, 494, 599, 670, 699 and 809 engines.

Handle for insertion jig
(P/N 420 877 650)

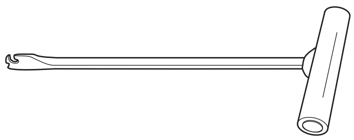


A00C3V4

APPLICATION
454, 494, 599, 670, 699, 779 and 809 engines.

ENGINE (continued) — RECOMMENDED SERVICE TOOLS

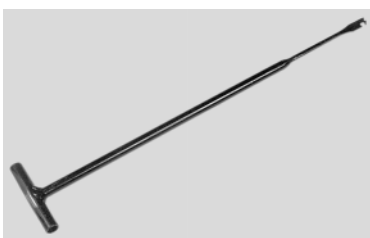
Exhaust spring installer/remover
(P/N 529 035 559)



A00C3S4

APPLICATION
All models except CK3 series.
NOTE: This tool replaces exhaust spring installer/remover (P/N 529 028 100).

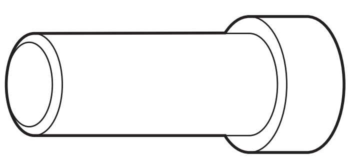
Exhaust spring installer/remover
(P/N 529 035 400)



A01B584

APPLICATION
CK3 series.

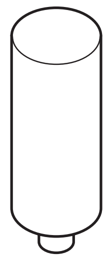
Rotary valve seal and shaft pusher
(P/N 420 876 605)



A00C0Y4

APPLICATION
Rotary valve engines 1990 models and older.

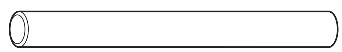
Seal pusher (rotary valve)
(P/N 420 876 510)



A00C374

APPLICATION
All rotary valve shaft seals with a 12 mm I.D.

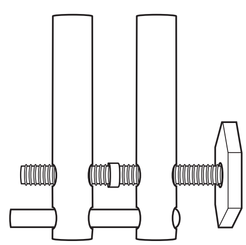
Rotary valve shaft pusher
(P/N 420 876 610)



A00C0F4

APPLICATION
All rotary valve engines with 12 mm shaft.

Large hose pincher
(P/N 529 032 500)
(TYPICAL)

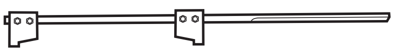


F01B234

APPLICATION
All vehicles.

TRANSMISSION — MANDATORY SERVICE TOOLS

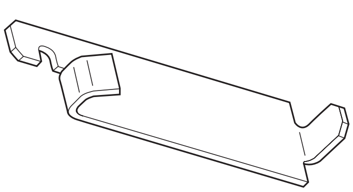
Transmission alignment bar
A) (P/N 529 026 900)
B) (P/N 529 030 000)
C) (P/N 529 035 586)
D) (P/N 529 026 700)
E) (P/N 529 035 530)
F) (P/N 529 035 545)
G) (P/N 529 035 502)
H) (P/N 529 035 527)
I) (P/N 529 035 572)



A01B4D4

APPLICATION
A) Tundra II LT/R.
B) S-Series with Bombardier Lite.
C) S-Series with Bombardier Lite and RER.
D) F-Series and S-Series with TRA.
E) S-Series with TRA and RER.
F) Skandic WT.
G) Skandic WT LC/SWT.
H) CK3 series except Mach Z series.
I) Mach Z series.

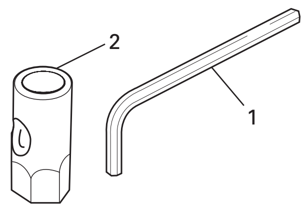
Spring scale hook (long)
A) (P/N 529 006 500)
B) (P/N 529 030 900)
C) (P/N 529 035 557)
(TYPICAL)



A00B4A4

APPLICATION
A) Tundra II LT.
B) F-Series and S-Series (1995 and newer).
C) CK3 without RER.

Drive belt tension adjuster tool
(P/N 529 008 700)

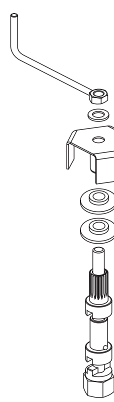


A15B044

APPLICATION
All vehicles except Élan, Tundra II and Skandic WT.

Parts included:
1) Hex. wrench
(P/N 420 876 730)
2) Socket wrench
(P/N 529 015 000)

Pulley spring compressor
(P/N 529 035 524)

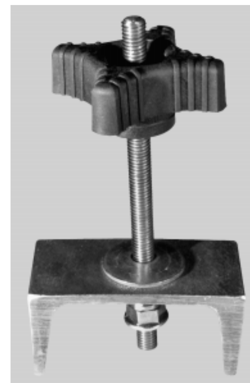


A02D1P4

APPLICATION
All models.

NOTE: This tool has Acme threads and replaces spring compressor (P/N 529 018 600).

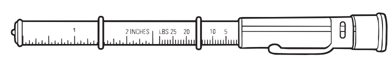
Driven pulley spring compressor
(P/N 529 035 300)



A05B034

APPLICATION
Tundra R.

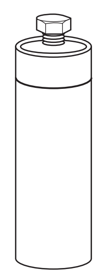
Tension tester
(P/N 414 348 200)



A00C074

APPLICATION
All models.

Countershaft bearing installer
(P/N 529 030 200)

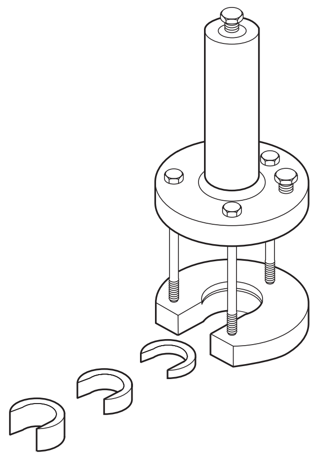


A00A194

APPLICATION
S-Series and F-Series.

TRANSMISSION (continued) — MANDATORY SERVICE TOOLS

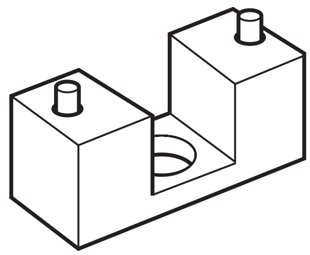
Countershaft bearing remover
(P/N 529 030 100)



A00A274

APPLICATION
S-Series and F-Series.

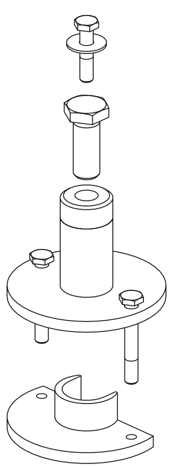
Spring cover tool
(P/N 529 027 300)



A01B4M4

APPLICATION
Bombardier Lite drive pulley.

Countershaft bearing remover/installer
(P/N 529 035 554)



A01B5C4

APPLICATION
CK3 Series.

TRANSMISSION (continued) — RECOMMENDED SERVICE TOOLS

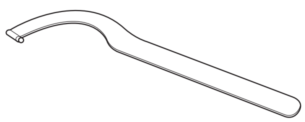
The following tools are highly recommended to optimize your basic tool kit and reduce repair time.

Clutch holder
(P/N 529 006 400)

A01B154

APPLICATION
All TRA drive pulleys.

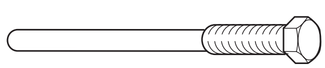
Clutch holder
(P/N 529 027 600)



A02B034

APPLICATION
Bombardier Lite drive pulley.

Drive pulley puller
(P/N 529 031 400)



A18B044

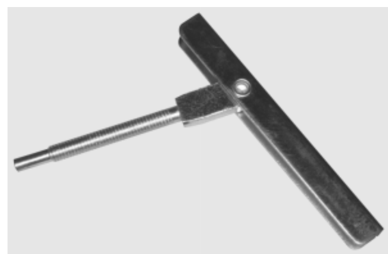
APPLICATION
Bombardier Lite drive pulley, except Élan.

Forks (3)
(P/N 529 005 500)

A16B014

APPLICATION
All vehicles equipped with a TRA drive pulley.

Driven pulley opening tool
(P/N 529 035 500)



A02D1O4

APPLICATION
All vehicles except Élan, Tundra series, Skandic WT series, and all vehicles with RER.

Driven pulley opening tool
(P/N 529 035 501)

A03D2P4

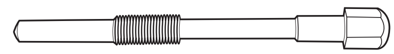
APPLICATION
S and CK3 series with RER.

Driven pulley opening tool
(P/N 529 034 200)

A05B044

APPLICATION
Tundra R.

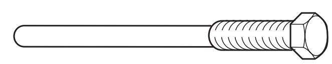
TRA drive pulley puller
(P/N 529 022 400)



A06B014

APPLICATION
TRA drive pulley for the 454, 494, 599, 670, 699, 779 and 809 engines.

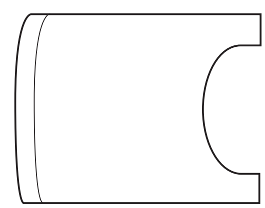
TRA drive pulley puller
(P/N 529 007 900) (25 mm)



A18B044

APPLICATION
TRA drive pulley for 443 and 503 engines.

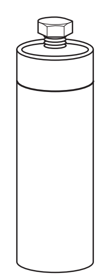
Alignment tool
(P/N 420 476 010)



A00C1D4

APPLICATION
Skandic WT and Alpine II gearbox.

Countershaft bearing installer
(P/N 529 018 800)

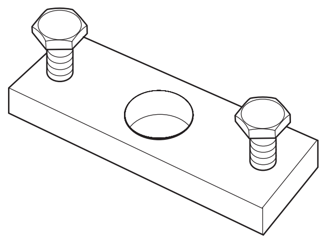


A00A194

APPLICATION
PRS chassis.

TRANSMISSION (continued) — RECOMMENDED SERVICE TOOLS

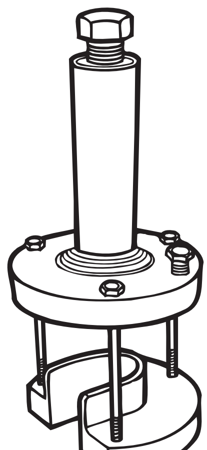
Cam pusher
(P/N 529 012 900)



A18B064

APPLICATION
Tundra II LT.

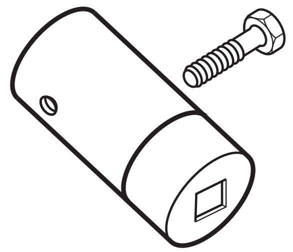
Countershaft bearing remover
(P/N 529 018 700)



A00A164

APPLICATION
PRS chassis.

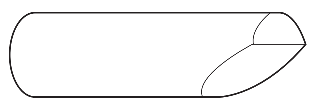
Drive pulley puller
(P/N 529 023 100)



A00C3J4

APPLICATION
Élan.

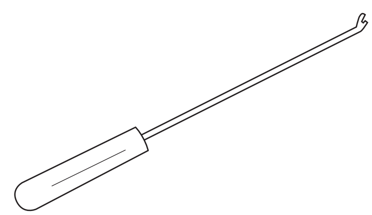
Transmission ball mounting pin
(P/N 420 476 020)



A00C1C4

APPLICATION
Alpine II 3-speed gearbox.

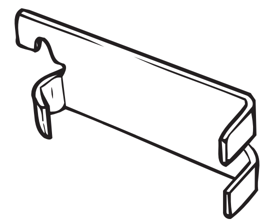
Transmission adjuster
(P/N 529 028 500)



A00D0X4

APPLICATION
F-Series equipped with "twist shifter" reverse transmission.

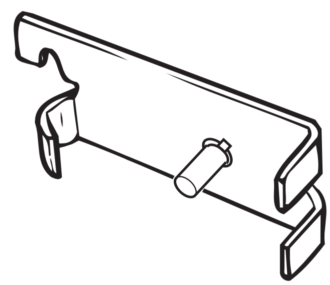
Spring scale hook (long)
(P/N 529 015 200)



A01B514

APPLICATION
1994 models and older except Alpine II.

Spring scale hook (short)
(P/N 529 006 500)

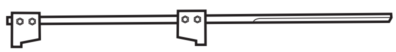


A01B174

APPLICATION
Alpine II 1994 and older.

TRANSMISSION (continued) — RECOMMENDED SERVICE TOOLS

Alignment bar
A) (P/N 529 025 600)
B) (P/N 529 028 200)
C) (P/N 529 028 300)
D) (P/N 529 026 800)
E) (P/N 529 031 000)



A01B4D4

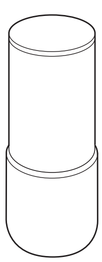
F) (P/N 529 008 300)

A03B034

APPLICATION

A) PRS chassis.
B) Alpine II.
C) Élan.
D) Safari L.
E) Skandic WT 1996.
F) Scout.

Burnishing bar
(P/N 529 026 402)

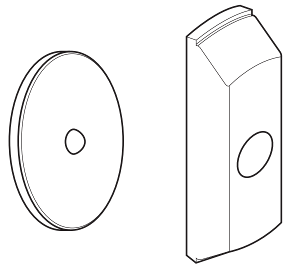


A00B464

APPLICATION

Tundra II LT, Safari L and Skandic.

Large bushing extractor
(P/N 529 031 100)



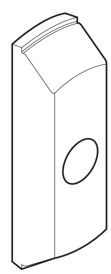
A00B4I4

APPLICATION

All models except Tundra/R, Skandic WT/SWT/WT LC and S-Series with RER.

NOTE: Use this tool only with former puller (P/N 529 018 600) that has regular threads.

Large bushing extractor
(P/N 529 035 576)



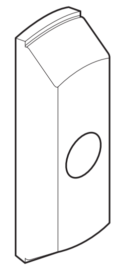
A02D1Q4

APPLICATION

All models except Tundra/R, Skandic WT/SWT/WT LC and S-Series with RER.

NOTE: Use this tool only with new puller (P/N 529 035 524) that has Acme threads.

Large bushing extractor
(P/N 529 035 575)



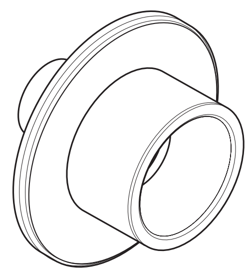
A02D1Q4

APPLICATION

S-Series with RER.

NOTE: Use this tool only with new puller (P/N 529 035 524) that has Acme threads.

Large bushing installer and small bushing extractor
(P/N 529 031 200)



A00B4J4

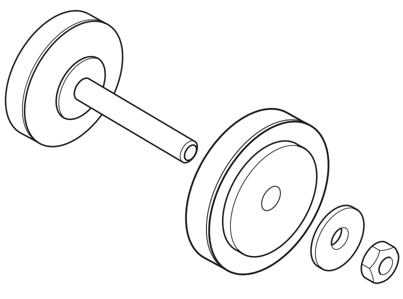
APPLICATION

All models except Tundra/R, Skandic WT/SWT/WT LC and S-Series with RER.

TRANSMISSION (continued) — RECOMMENDED SERVICE TOOLS

Chaincase seal pusher
(P/N 529 035 584)

NEW



A00B504

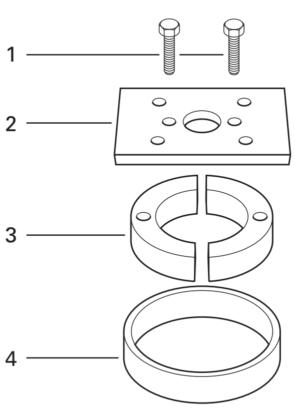
APPLICATION

S, F, CK3 and ZX Series.

NOTE: This tool replaces chaincase upper seal pusher (P/N 529 032 300).

3-speed transmission bearing extractor

1) Screw M8 x 25 (2) (P/N 222 082 565)
2) Plate
3) Half ring (2) (P/N 420 876 330)
4) Ring (P/N 420 977 480)

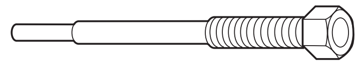


A00C1B4

APPLICATION

Alpine II 3-speed transmission.

Drive pulley puller
(P/N 529 002 100)
(standard threads)

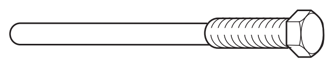


A00C084

APPLICATION

Square shaft, standard (SAE) threads.

TRA drive pulley puller (27 mm)
(P/N 529 010 100)

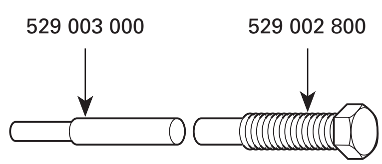


A18B044

APPLICATION

TRA drive pulley (27 mm) shaft except 454, 670 and 779 engines.

Drive pulley puller
(P/N 860 414 200)
(square shaft metric)
Consists of:

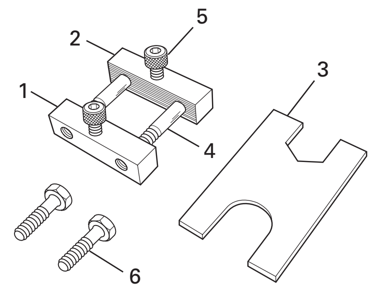


A00C095

APPLICATION

Square shaft, metric threads drive pulley.

Drive axle sprocket adjuster
(P/N 861 725 700)



A01B2O4

APPLICATION

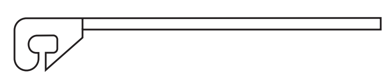
All vehicles except Élan.

Parts included in the kit:

1) Block with threads (P/N 529 010 700)
2) Block without threads (P/N 529 010 800)
3) Plate (P/N 529 010 600)
4) Bolt M10 (2) (P/N 222 007 565)
5) Allen screw M8 (2) (P/N 222 983 065)
6) Screw M8 (2) (P/N 222 082 565)

NOTE: When the tool is to be used between tunnel and sprocket use screw M8.

Transmission adjuster
(P/N 529 030 300)



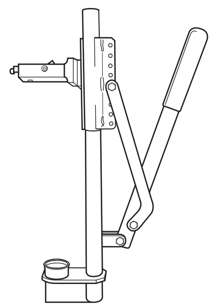
A03D1T4

APPLICATION

Vehicles equipped with “push-pull shifter” reverse transmission.

SUSPENSION — MANDATORY SERVICE TOOLS

Shock spring removal kit
(P/N 529 035 504)
Replacement clevis pin:
(P/N 414 528 400)



A01B4O4

APPLICATION

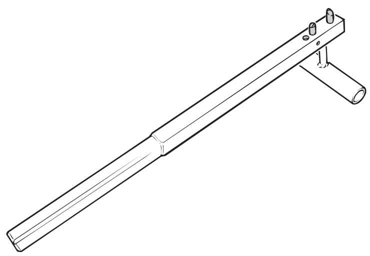
All suspensions with coil spring.

NOTE: The previous shock spring removal kit (P/N 529 027 100) can be upgraded by replacing the stopper with a wider stopper (P/N 529 035 551).

SUSPENSION (continued) — RECOMMENDED SERVICE TOOLS

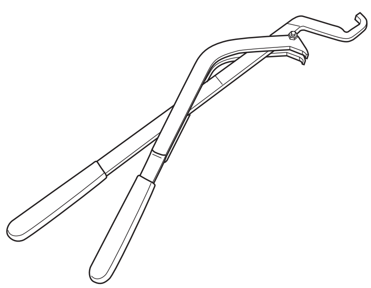
A) Track cleat remover
(P/N 529 008 200)
Pins
(P/N 529 008 204)

NOTE: Pins can be rotated 180° depending on whether the tool is used by a left-hander or right-hander.



A01B1J4

B) Track cleat remover
(P/N 529 028 700)



A01F224

APPLICATION

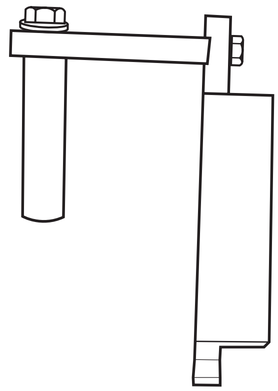
A) 1993 and older.

B) 1994 and newer except Élan and Tundra II.

Camber angle tool
(P/N 529 021 600)

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

Suggestion: K-D tool no. 2968

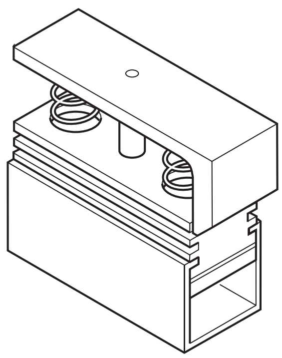


A06B024

APPLICATION

All DSA front suspensions.

Track tension gauge
(P/N 529 021 500)



A00B3X4

APPLICATION

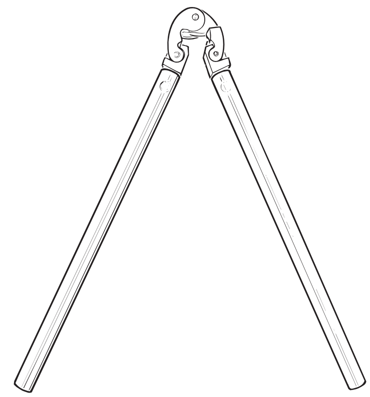
All models except Élan.

Track cleat installer

A) (P/N 529 008 500)
Narrow

B) (P/N 529 028 800)
Narrow

C) (P/N 529 007 700)
Wide



A01B1M4

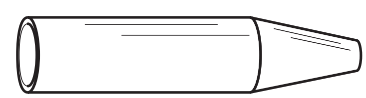
APPLICATION

A) 1993 and older.

B) 1994 and newer.

C) 1992 and older with wide cleat opening.

Dome guide
(P/N 529 026 500



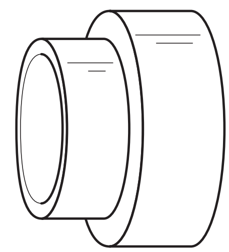
A06F1B4

APPLICATION

T/A shocks.

SUSPENSION (continued) — RECOMMENDED SERVICE TOOLS

Piston guide
(P/N 529 026 600)

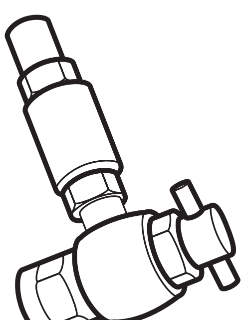


A06F1C4

APPLICATION
T/A shocks.

Gas shock valve tool
(P/N 529 035 570)

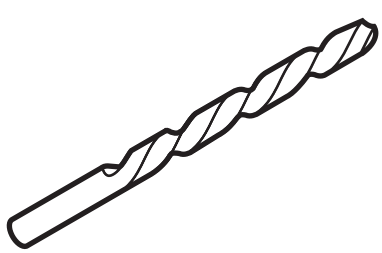
NEW



A02F134

APPLICATION
T/A shocks.

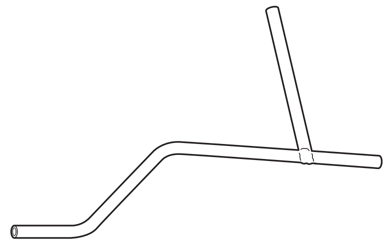
Drill bit
(P/N 529 031 800)



A01B564

APPLICATION
All 3/16 inch rivets.

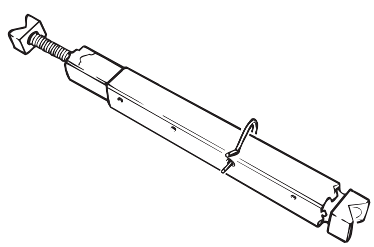
Spring installer (bar)
(P/N 529 005 000)



A00C1I4

APPLICATION
Tundra II LT, Scout and all SC-10 suspensions.

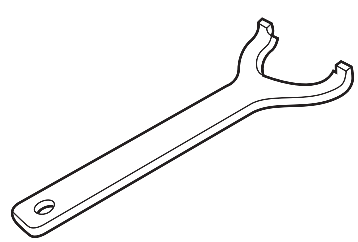
Drive axle holder
(P/N 529 007 200)



A01B1E4

APPLICATION
All models.

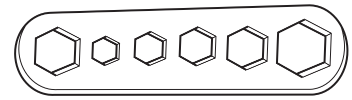
Kayaba shock adjustment tool
(P/N 529 019 000)



A00A1K4

APPLICATION
C-7 suspension.

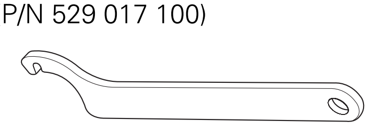
Hexagonal wrench
(P/N 529 014 700)



A19B024

APPLICATION
All SC 10 suspensions, Safari and Skandic prior to 1995.

Suspension adjustment wrench
(P/N 529 017 100)



A15B094

APPLICATION
1992 and old Formula C-7.

Suspension adjustment wrench
(P/N 529 032 900)

A02F114

APPLICATION
Arm suspension.

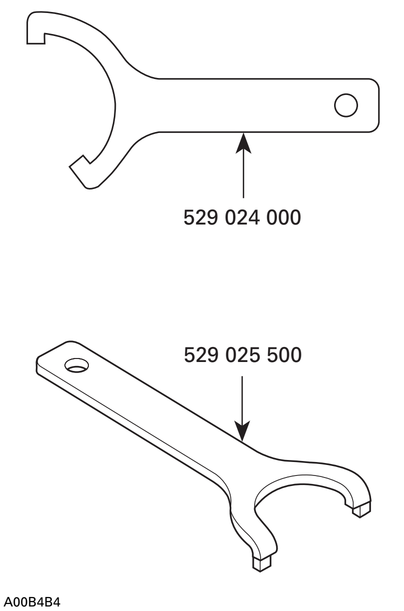
Suspension adjustment wrench
(P/N 529 034 100)

A02F124

APPLICATION
CK3 series.

SUSPENSION (continued) — RECOMMENDED SERVICE TOOLS

Adjustment wrench
(P/N 861 743 900)
Consists of:



APPLICATION
T/A shock.

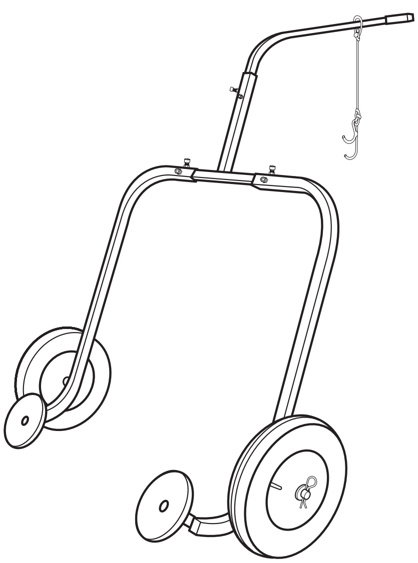
VEHICLES — RECOMMENDED SERVICE TOOLS

Protective mat
(P/N 529 030 600)

A01B45W

APPLICATION
All vehicles.

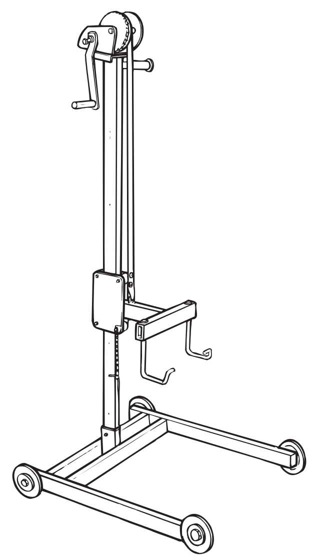
Dolly
(P/N 529 029 900)



A00B4CJ

APPLICATION
All models.

Snowmobile jack
(P/N 529 020 000)



A01A1JJ

APPLICATION
All models.

VEHICLES (continued) — RECOMMENDED SERVICE TOOLS

Template for hood drilling
(P/N 529 034 400)

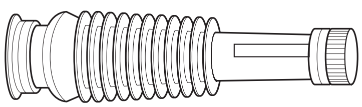
A02H154

APPLICATION

S-Series.

NOTE: To drill new hood prior to install meters.

Flexible spout for oil container
(P/N 414 837 300)



F04B044

APPLICATION

All models.

SERVICE PRODUCTS

MANDATORY SERVICE PRODUCTS

Loctite® is a trademarks of Loctite Corporation.

Dow Corning® is a trademarks of Dow Corning Corporation.

Retaining compound

(P/N 413 703 100)

Loctite® RC/609:

Retaining compound (10 mL) (green)

A00B2S4

APPLICATION

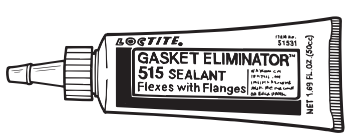
Used for retaining bushings, bearings in slightly worn housing or on shaft.

Paste gasket

(P/N 413 702 700)

Loctite® 515:

Gasket eliminator (50 mL)



A00B2T4

APPLICATION

Crankcase halves, transmission and gearbox mating surfaces.

Medium-strength threadlocker

(P/N 293 800 015)

Loctite® 242:

Threadlocker (10 mL) (blue, medium strength)

A00B324

APPLICATION

Flywheel nut, crankcase studs, etc.

NOTE: Only the P/N has been changed. This product is identical to the P/N 413 703 000.

High strength threadlocker

(P/N 293 800 005)

Loctite® 271:

Threadlocker (10 mL) (red, high strength)

A00B2U4

APPLICATION

Fasteners and studs up to 1 in diameter.

NOTE: Only the P/N has been changed. This product is identical to the P/N 413 707 400.

Gasket/paint remover

(P/N 413 708 500)

Loctite® 79040 Chisel 510 g (18 oz)

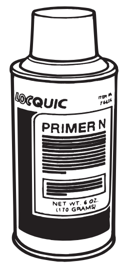
A00B3L4

APPLICATION

Clean mating surfaces of cylinders and crankcase. Remove carbon in combustion chambers.

MANDATORY SERVICE PRODUCTS (continued)

Loctite® primer
(P/N 293 800 041)
Loctite® 764-56
Primer N
170 g (6 oz)



A00B3N4

APPLICATION

To prepare mating surfaces before applying paste gasket, retaining compound or threadlockers.

NOTE: Only the P/N has been changed. This product is identical to the P/N 413 708 100.

Silicone compound
(P/N 420 897 061)
Dow Corning® MS4

A00B3R4

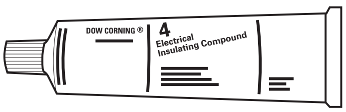
APPLICATION

Lubricate pawl and pawl lock of rewind starter.

RECOMMENDED SERVICE PRODUCTS

Silicone dielectric grease
(3 oz)

(P/N 293 550 004)



A00B1X4

APPLICATION

On all electric connections. High tension coil and spark plug connections. Connector housings, etc.

NOTE: Only the P/N has been changed. This product is identical to the P/N 413 701 700.

Grease LMZ no. 1
(400 g)

(P/N 413 707 500)

A00B1Y4

APPLICATION

Mainly used between regulators or rectifiers and upper column to transfer the heat build-up and to assure a good ground.

Chaincase oil
(16 x 250 mL)

(P/N 413 801 900)

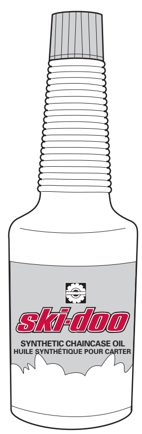
A00B2R4

APPLICATION

Chaincase lubricant on all fan-cooled models except Skandic WT series.

Synthetic chaincase oil
(12 x 355 mL)

(P/N 413 803 300)



A01B4Q4

APPLICATION

Chaincase lubricant on all liquid-cooled models and Skandic WT series.

Blizzard oil
(12 x 500 mL)

(P/N 413 803 100)

A00B2Q4

APPLICATION

All pre-mix models.

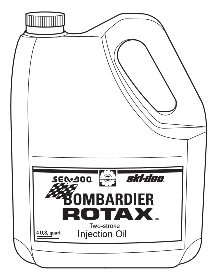
Injection oil

(P/N 413 802 900)
(12 x 1 liter)

(P/N 413 803 000)
(3 x 4 liter)

(P/N 413 803 200)

(205 liters)



F01B2H4

APPLICATION

All engines.

RECOMMENDED SERVICE PRODUCTS (continued)

BOMBARDIER-ROTAX Formula XP-S synthetic injection oil

(P/N 413 711 000)
(3 x 4 liter)

(P/N 413 710 700)
(205 liters)

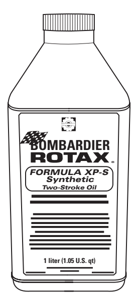
F01B354

APPLICATION

All engines.

BOMBARDIER-ROTAX Formula XP-S synthetic injection oil

(P/N 413 710 500)
(12 x 1 liter)



F01B2G4

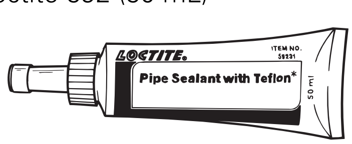
APPLICATION

All models.

Pipe sealant

(P/N 413 702 300)

Loctite 592 (50 mL)



A00B2W4

APPLICATION

Engine plugs and senders.

High temperature threadlocker

(P/N 420 899 788)

Loctite 648 (green)
(5 g)

A00B3D4

APPLICATION

For RAVE valve rod distance nut.

Anti-seize lubricant

(P/N 413 701 000)

Loctite anti-seize lubricant 454 g (16 oz)

F01B174

APPLICATION

Unpainted surfaces of driven pulley countershaft.

Synthetic grease
(400 g)

(P/N 413 711 500)

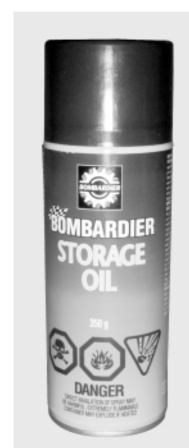
A01B574

APPLICATION

For idler bearings, ski legs, leaf spring cushion pads, seal interior lips, rear hub bearings, bogie wheels, countershaft bearings, etc.

Storage oil
(350 g spray can)
(12 x 350 g)

(P/N 496 014 100)



A02B054

APPLICATION

All models.

RECOMMENDED SERVICE PRODUCTS (continued)

Degreaser
(P/N 413 708 400)
Permatex® 48 TA
433 g (15 oz)

A00B3K4

APPLICATION

Engine, chaincase and any greasy surfaces.

Plastic & vinyl cleaner
(P/N 413 711 200)
6 x 1 L

A00B4V4

APPLICATION

Hood, bottom pan and seat.

Parts cleaner
(P/N 413 711 809)
320 g

A00B4X4

APPLICATION

Engine crankcase joining surfaces, pulleys and any greasy surfaces.

NOTE: This product replaces Loctite Safety solvent (P/N 413 708 200).

Gel instant adhesive
(P/N 413 708 300)
Loctite 454-40
20 g (.70 oz)

A00B3O4

APPLICATION

Isolating foam and rubber strip.

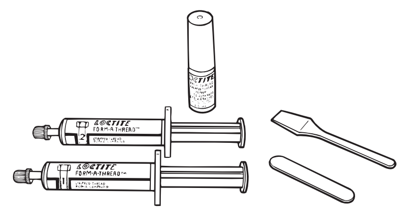
Tough adhesive
(P/N 413 408 300)
Loctite Black Max 38004
3 mL (.10 oz)

A00B3P4

APPLICATION

Shifter boot or grip.

Stripped threads repair kit
(P/N 413 708 600)
Loctite 81668
Form-A-thread 81668

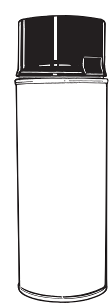


A00A1J4

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.

Paint for frame touch-up
(P/N 413 401 000)
Black semi-gloss
(spray can)



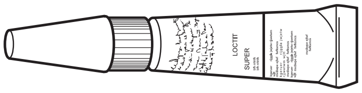
A00B3H4

APPLICATION

All models with a black frame.

RECOMMENDED SERVICE PRODUCTS (continued)

General purpose instant adhesive
Loctite 495 (3 g)
(P/N 413 703 200)



A00B2V4

APPLICATION
Rubber to metal bonding and most hard plastic.

High temperature RTV sealant
Ultra Copper
(P/N 413 710 300)
Loctite 17914 (80 mL)

A02B044

APPLICATION
All models.

Bombardier cleaner
(P/N 293 110 001) (400 g)
(P/N 293 110 002) (4 L)

F01B2J4

APPLICATION
All models.

Clear silicone
(P/N 293 800 033)

F01B1S4

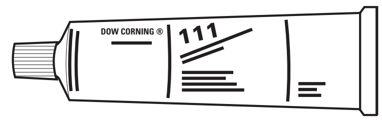
APPLICATION
All models to seal bottom pan.

Fuel stabilizer
(12 x 8 oz)
(P/N 413 408 600)

A00B3V4

APPLICATION
All models.

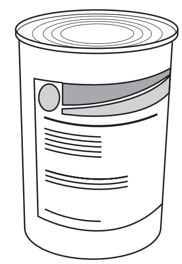
Molykote 111
(P/N 413 707 000)



A00B3W4

APPLICATION
Engine crankshaft seals.

Shock oil
(32 oz)
(P/N 413 709 400)



A06F0P4

APPLICATION
T/A shocks.

Bombardier Lube
(12 x 14 oz)
(P/N 293 600 016)

A00B4W4

APPLICATION
Steering ball joints on all models.

RECOMMENDED SERVICE PRODUCTS (continued)

Super Lube (grease)
(P/N 293 550 014)

A00B474

APPLICATION
Exhaust tail pipe grommet.

BOMBARDIER
RECREATIONAL PRODUCTS