RACING HANDBOOK

BOMBARDIER

Ski-doo®

1996

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1996 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.

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

Ski Doo Race Department
Bombardier Corp.,
PO Box 8035
Wausau, Wise.
54402-8035.

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

Your information is important to us

Ovals, Drags, Speed runs

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

Mountain, hill climb, deep snow

Mark Thompson	**Fax hotline**	**801-752-8249**

Cross-Country, Sno Cross

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

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

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

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

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

OVAL, DRAGS, RADAR RUNS

ATTN : B ll Rader

FAX : 715-847-6869

Date : ____________________

Driver Name : ________________________ **Driver Phone Number :** ____________________

Dealership Name : ____________________ **Dealer Phone Number :** ____________________

Vehicle Type : ________ **Odometer Reading :** ________ **Serial Number:** ______________

Race Type : ________________________ **Class :** __________________________________

Location : ________________________ **Finish Position :** ____________________________

Temperature : ________ **Altitude :** _______ **Main Jet :** ____________________________

Surface Conditions : ____

Top Speed Observed : __________________ **RPM Observed :** ________________________

OPTIONAL :

TRA: Spring : __________________ **DRIVEN : Spring :** __________________________

Ramps : ____________________ **Cam :** ____________________________

Adjuster Position : ___________ **Pre-Load :** _______________________

Pins : ____________________ **CHAINCASE GEARING : Top :** ____________________________

Arm Type : __________________ **Bottom :** _________________________

LIST PROBLEMS OBSERVED AND RECOMMENDED SOLUTIONS OR SUGGESTIONS,

PLEASE INCLUDE SKETCHES :

"Your information is important to us".

HILLCLIMB, MOUNTAIN

ATTN : Mark Thompson

FAX : 801-752-8249

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 :

"Your information is important to us".

CROSS-COUNTRY, SNO CROSS

ATTN : Bill Rader

FAX : 715-847-6869

Date : ____________________

Driver Name : ________________________ **Driver Phone Number:** ____________________

Dealership Name : ____________________ **Dealer Phone Number :** ____________________

Vehicle Type : ________ **Odometer Reading :** _________ **Serial Number:** ______________

Race Type : _________________________ **Class :** ___________________________________

Location : ________________________ **Finish Position :** ______________________________

Temperature : _________ **Altitude :** _______ **Main Jet :** ______________________________

Surface Conditions : ____

Top Speed Observed : ___________________ **RPM Observed :** ________________________

OPTIONAL :

TRA : Spring : ___________________ **DRIVEN : Spring :** __________________________

Ramps : ____________________ **Cam :** ____________________________

Adjuster Position : ___________ Pre-Load : ______________________

Pins : ____________________ **CHAINCASE GEARING :** Top : ____________________________

Arm Type : __________________ **Bottom :** _________________________

LIST PROBLEMS OBSERVED AND RECOMMENDED SOLUTIONS OR SUGGESTIONS,

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MODELS			MX Z 440	MX Z 583
Engine Type			454	583
Maximum HP RPM ①		RPM	7900 - 8100	7800 - 8000
Rotary Valve		P / N Opening (BTDC) Closing (ATDC)	420 9245 02 146 / 65	420 9245 02 140 / 71
Carburetor Type			2 x VM 34	2 x VM 40
Main Jet			PTO 230 MAG 210	PTO 270 MAG 260
Needle Jet			159 P-8	224 AA-2
Pilot Jet			40	45
Needle Identification – clip position			6FJ43-2	7ECY1-3
Slide Cut-away			2.5	2.5
Float Adjustment		mm (in)	23.9 (.94)	18.1 (.71)
Air Screw Adjustment		± 1/16 turn	1/2	1-3/4
Idle Speed		RPM	1600 - 1800	1800 - 2000
Gas Grade / Pump Octane Number		(R + M) / 2	Regular Unleaded / 87	Regular Unleaded / 87
Gas / Oil Ratio			Oil Injection	Oil Injection
Ignition Timing BTDC ②		mm (in)	1.48 (.058)	1.75 (.069)
Trigger Coil Air-Gap		mm (in)	0.55 - 1.45 (.022 - .057)	0.55 - 1.45 (.022 - .057)
Gear Ratio		teeth	23 / 44	25 / 44
Engagement Speed		±100 RPM	4400	3800
Drive Pulley Calibration Screw Position			3	2
Pulley Distance	Z	(+ 0, – 1) mm (+ 0, – 1/32 in)	16.5 (21/32)	
Offset	X	± 0.4 mm (± 1/64 in)	35.0 (1-3/8)	
	Y		Dimension Y must exceed X from 1mm (1/32in) to 2 mm (5/64 in)	
Drive Belt Adjustment	Deflection	mm (in)	32 (1-1/4)	
	Force ③	kg (lbf)	6.8 (15)	
Driven Pulley Preload		kg (lbf)	5.4 to 6.8 (12 to 15)	
Drive Chain Tension			Fully tighten adjusting screw **by hand** then back OFF only far enough for hair pin installation	
Track Adjustment	Deflection	mm (in)	45 to 50 (1-3/4 to 2) with a 7.3 kg (16 lb) downward pull	

① Engine speed at which maximum power is achieved.
② At 6000 RPM (engine cold) with headlamp turned on.
③ Force applied midway between pulleys to obtain specified deflection.

BTDC: Before Top Dead Center
ATDC : After Top Dead Center
PTO : Power Take OFF side
MAG : Magneto side

A dot (0) on right indicates changes from 1995 model.

MODEL			SUMMIT 670	
Ermine Type			**670**	
Maximum HP RPM ①		RPM	7600-7800	
Rotary Valve		**P/N** **Opening** (BTDC) / **Closing** (ATDC)	**420924500** **144° / 72°**	
Carburetor Type			PTO VM 40-81 MAG VM 40-82	●
Main Jet			PTO 380 MAG 370	●
Needle Jet			224 AA -2	●
Pilot Jet			75	
Needle Identification – clip position			7DPI1 -3	●
Slide Cut-away			2.5	
Float Adjustment		mm (in)	19.6 (.77)	
Air Screw Adjustment		±1/16 turn	2.25	●
Idle Speed		RPM	1800-2000	
Gas Grade / Pump Octane Number		(R + M)/ 2	Unleaded /87	
Gas / Oil Ratio			Oil Injection	
Ignition Timing BTDC ②		mm (in)	1.93 (.076)	
Trigger Coil Air-Gap		mm (in)	0.55-1.45 (.022 - .057)	
Gear Ratio		teeth	23/44	
Engagement Speed		RPM	3800-4000	
Drive Pulley Calibration Screw Position			See label on belt guard	
Pulley Distance	z	(+ **0,- 1)** mm (+ 0,- 1/32 in)	16.5 (21/32)	
Offset	**X**	± 0.4 mm (± 1/64 in)	35.0 (1 -3/8)	
	Y		Dimension Y must exceed **X** from 1 mm (1/32 in) to 2 mm (5/64 in)	
Drive Belt Adjustment	Deflection	mm (in)	32 (1-1/4)	
	Force ③	kg (lbf)	6.8 (15)	
Driven Pulley Preload		kg (lbf)	5.4 to 6.8 (12 to 15)	
Drive Chain Tension			Fully tighten adjusting screw **by hand then back OFF only far enough for hair pin installation**	
Track Adjustment	**Deflection**	**mm** (in)	**45 to 50 (1-3/4 -2)** with a 7.3 kg (16 lb) downward pull	

NOTE : See end of specifications for foot notes.

① **Engine speed at which maximum power is achieved.**
② **At 6000 RPM (engine cold) with headlamp turned on.**
③ **Force applied midway between pulleys to obtain specified deflection.**
√ H.A.C. : **High Altitude Compensator.**

BTDC: Before Top Dead Center
ATDC: After Top Dead Center
PTO : **Power Take OFF side**
MAG : **Magneto side**

A dot (o) on right indicates changes from 1995 model.

MODEL			FORMULA SS	
Engine Type			670	
Maximum HP RPM ①		RPM	7600 - 7800	
Rotary Valve		P / N Opening (BTDC) / Closing (ATDC)	420 9245 00 144° / 72°	
Carburetor Type		PTO / MAG	VM 40 - 79	●
Main Jet			360	
Needle Jet			224 AA - 3	
Pilot Jet			50	●
Needle Identification – clip position			7EDY1 - 3	
Slide Cut-away			2.5	
Float Adjustment		mm (in)	18.1 (.71)	
Air Screw Adjustment		± 1/16 turn	2 - 1/4	
Idle Speed		RPM	1800 - 2000	
Gas Grade / Pump Octane Number		(R + M) / 2	Regular Unleaded / 87	
Gas / Oil Ratio			Oil Injection	
Ignition Timing BTDC ②		mm (in)	1.93 (.076)	
Trigger Coil Air-Gap		mm (in)	0.55 - 1.45 (.022 - .057)	
Gear Ratio		teeth	26/44	
Engagement Speed		±100 RPM	3800	●
Drive Pulley Calibration Screw Position			3	
Pulley Distance	Z	(+ 0, – 1) mm (+ 0, – 1/32 in)	16.5 (21/32)	
Offset	X	± 0.4 mm (± 1/64 in)	35.0 (1-3/8)	
	Y		Dimension Y must exceed X from 1 mm (1/32in) to 2 mm (5/64 in)	
Drive Belt Adjustment	Deflection	mm (in)	32 (1-1/4)	
	Force ③	kg (lbf)	6.8 (15)	
Driven Pulley Preload		kg (lbf)	5.4 to 6.8 (12 to 15)	
Drive Chain Tension			Fully tighten adjusting screw **by hand** then back OFF only far enough for hair pin installation	
Track Adjustment	Deflection	mm (in)	45 to 50 (1-3/4 to 2) with a 7.3 kg (16 lb) downward pull	

NOTE : See end of specifications for foot notes.

A dot (0) on right indicates changes from 1995 model.

MODEL			SUMMIT 583	
Engine Type			583	
Maximum HP RPM ①		RPM	7700 - 7900	●
Rotary Valve		P / N Opening (BTDC) / Closing (ATDC)	420 9245 09 135° / 64°	
Carburetor Type			PTO VM 38 - 319 MAG VM 38 - 320	●
Main Jet			340	●
Needle Jet			480 Q- 6	●
Pilot Jet			75	
Needle Identification – clip position			6BGY15 - 2	●
Slide Cut-away			2.5	
Float Adjustment		mm (in)	19.6 (.77)	●
Air Screw Adjustment		± 1/16 turn	1.5	●
Idle Speed		RPM	1800 - 2000	
Gas Grade / Pump Octane Number		(R + M) / 2	Regular Unleaded / 87	
Gas / Oil Ratio			Oil Injection	
Ignition Timing BTDC ②		mm (in)	1.75 (.069)	
Trigger Coil Air-Gap		mm (in)	0.55 - 1.45 (.022 - .057)	
Gear Ratio		teeth	22/44	●
Engagement Speed		±100 RPM	4500	●
Drive Pulley Calibration Screw Position			See label on belt guard	
Pulley Distance	Z	(+ 0, – 1) mm (+ 0, – 1/32 in)	16.5 (21/32)	
Offset	X	± 0.4 mm (± 1/64 in)	35.0 (1-3/8)	
	Y		Dimension Y must exceed X from 1 mm (1/32 in) to 2 mm (5/64 in)	
Drive Belt Adjustment	Deflection	mm (in)	32 (1-1/4)	
	Force ③	kg (lbf)	6.8 (15)	
Driven Pulley Preload		kg (lbf)	6.1 to 7.5 (13.4 to 16.5)	●
Drive Chain Tension			Fully tighten adjusting screw **by hand** then back OFF only far enough for hair pin installation	
Track Adjustment	Deflection	mm (in)	45 to 50 (1-3/4 - 2) with a 7.3 kg (16 lb) downward pull	

NOTE : See end of specifications for foot notes.

MODEL			FORMULA III		
Engine Type			599		
Maximum HP RPM ①		RPM	8100 - 8300		
Rotary Valve		P / N Opening (BTDC) / Closing (ATDC)	Not applicable		
Carburetor Type			PTO VM 36-172	CTR VM 36-173	MAG VM 36-174
Main Jet			PTO 320	CTR 320	MAG 320
Needle Jet			480 P-3		
Pilot Jet			PTO 40	CTR 40	MAG 40
Needle Identification – clip position			6DHZ46-4		
Slide Cut-away			2.5		
Float Adjustment		mm (in)	18.1 (.71)		
Air Screw Adjustment		± 1/32 turn	PTO 1.5	CTR 1.0	MAG 1.0
Idle Speed		RPM	1800 - 2000		
Gas Grade / Pump Octane Number		(R + M) / 2	Regular Unleaded / 87		
Gas / Oil Ratio			Oil Injection		
Ignition Timing BTDC ②		mm (in)	2.18 (.086)		
Trigger Coil Air-Gap		mm (in)	0.55 - 1.45 (.022 - .057)		
Gear Ratio		Teeth	25/44		
Engagement Speed		RPM	4400 - 4600		
Drive Pulley Calibration Screw Position			4		
Pulley Distance	Z	(+ 0, – 1) mm (+ 0, – 1/32 in)	16.5 (21/32)		
Offset	X	± 0.4 mm (± 1/64 in)	35.0 (1-3/8)		
	Y		Dimension Y must exceed X from 1 mm (1/32 in) to 2 mm (5/64 in)		
Drive Belt Adjustment	Deflection	mm (in)	32 (1-1/4)		
	Force ③	kg (lbf)	6.8 (15)		
Driven Pulley Preload		kg (lbf)	5.4 to 6.8 (11.9 to 15.0)		
Drive Chain Tension			Fully tighten adjusing screw by hand then back OFF only far enough for hair pin installation		
Track Adjustment	Deflection	mm (in)	40 to 50 (1-3/4 to 2) with a 7.3 kg (16 lb) downward pull		

① Engine speed at which maximum power is achieved.
② At 6000 RPM (engine cold) with headlamp turned on.
③ Force applied midway between pulleys to obtain specified deflection.
BTDC: Before Top Dead Center.
ATDC: After Top Dead Center.
PTO : Power Take Off side.
CTR : Center.
MAG : Magneto side.

VEHICLE MODEL		FORMULA SLS	GRAND TOURING 500	SUMMIT 500	GRAND TOURING 580	FORMULA STX, STX LT
ENGINE TYPE		494	494	494	582	583
Number of Cylinders		2	2	2	2	2
Bore	mm (in)	69.50 (2.74)	69.50 (2.74)	69.50 (2.74)	76.00 (2.99)	76.00 (2.99)
Stroke	mm (in)	65.80 (2.59)	65.80 (2.59)	65.80 (2.59)	64.00 (2.520)	64.00 (2.520)
Displacement	cm^3 (in^3)	499.30 (30.47)	499.30 (30.47)	499.30 (30.47)	580.70 (35.44)	580.70 (35.44)
Compression Ratio (corrected)		6.8	6.8	6.8	6.70	6.10
Maximum Power Engine Speed ①	RPM	7400 –7600	7400 –7600	7400 –7600	7200 –7400	7800 – 8000
Piston Ring Type	1^{st} / 2^{nd}	ST / R	ST / R	ST / R	ST / N.A.	ST / N.A.
Ring End Gap (new) (wear limit)	mm (in) mm (in)	0.200 (.008) 1.000 (.040)	0.200 (.008) 1.000 (.040)	0.200 (.008) 1.000 (.040)	0.250 (.0100) 1.000 (.0400)	0.250 (.0100) 1.000 (.0400)
Ring / Piston Groove Clearance (new) (wear limit)	mm (in) mm (in)	0.030 (.0012) 0.200 (.008)	0.030 (.0012) 0.200 (.008)	0.030 (.0012) 0.200 (.008)	0.043 (.0017) 0.160 (.0064)	0.040 (.0016) 0.200 (.0080)
Piston / Cylinder Wall Clearance (new) (wear limit)	mm (in) mm (in)	0.090 (.0036) 0.150 (.006)	0.090 (.0036) 0.150 (.006)	0.090 (.0036) 0.150 (.006)	0.050 (.0020) 0.150 (.0060)	0.050 (.0020) 0.150 (.0060)
Connecting Rod Big End Axial Play (new) (wear limit)	mm (in) mm (in)	0.390 (.0156) 1.200 (.048)	0.390 (.0156) 1.200 (.048)	0.390 (.0156) 1.200 (.048)	0.400 (.0160) 1.200 (.0480)	0.390 (.0156) 1.200 (.0480)
Maximum Crankshaft End-play	mm (in)	0.300 (.0120)	0.300 (.0120)	0.300 (.0120)	0.300 (.0120)	0.300 (.0120)
Maximum Crankshaft Deflection	mm (in)	0.080 (.0032)	0.080 (.0032)	0.080 (.0032)	0.080 (.0032)	0.080 (.0032)
Rotary Valve Timing ② and P / N 420 924 XXX	Opening Closing	135° - 64° 509	135° - 64° 509	135° - 64° 509	129.5° - 69.5° 509	140° - 71° 502
Magneto Generator Output	W	220	220	220	220	220
Ignition Type		CDI	CDI	CDI	CDI	CDI
Spark Plug Make and Type		NGK BR9ES	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)	0.45 (.018)
Ignition Timing BTDC ③	mm (in)	1.81 (.071)	1.81 (.071)	1.81 (.071)	2.18 (.086)	1.75 (.069)
Generating Coil ⑤	Low Speed : Ω	10 - 17	10 - 17	10 - 17	10 - 17	10 - 17
	High Speed : Ω	N.A.	N.A.	N.A.	N.A.	N.A.
Lighting Coil ⑤	Ω	0.20 – 0.35	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	0.3 - 0.7
	Secondary kΩ	8 - 16	8 - 16	8 - 16	8 - 16	8 - 16
Carburetor Type	PTO / MAG	VM 38 311 / 311	VM 38 311 / 311	VM 38(HAC) 313 / 314	VM 38 317 / 318	VM 38 325 / 326
Main Jet	PTO / MAG	320	320	400	360 / 370	320 / 330
Needle Jet		480 - P7	480 - P7	480 - Q0	480 - O4	480 - P0
Pilot Jet		45	45	75	40	40
Needle Identification – Clip Position		6FEY1-3	6FEY1-3	6FEY1-3	6DHN44-4	6DHN44-3
Slide Cut-away		2.5	2.5	2.5	2.5	2.5
Float Adjustment	± 1 mm (± 0.40 in)	18.1 (.71)	18.1 (.71)	19.6 (.77)	18.1 (.71)	18.1 (.71)
Air Screw Adjustment	± 1/16 Turn	1.75	1.75	2.0	1.25	1.5
Idle Speed RPM	RPM	1700 – 1900	1700 – 1900	1700 – 1900	1800 – 2000	1800 – 2000
Gas Type / Pump Octane number		Unleaded / 87	Unleaded / 87	Unleaded / 87	Unleaded / 87	Unleaded / 87
Gas / Oil Ratio		Injection	Injection	Injection	Injection	Injection
Type		Liquid	Liquid	Liquid	Liquid	Liquid
Axial Fan Belt Adjustment	Deflection mm (in)	N.A.	N.A.	N.A.	N.A.	N.A.
	Force kg (lbf)	N.A.	N.A.	N.A.	N.A.	N.A.
Thermostat Opening Temperature	°C (°F)	42 (108)	42 (108)	42 (108)	42 (108)	42 (108)
Radiator Cap Opening Pressure	kPa (PSI)	90.0 (13.0)	90.0 (13.0)	90.0 (13.0)	90.0 (13.0)	90.0 (13.0)
ENGINE COLD N•m (lbf•ft): Drive Pulley Retaining Screw √		√	√	√	√	√
Exhaust Manifold Nuts or Bolts		23 (17)	23 (17)	23 (17)	23 (17)	23 (17)
Magneto Ring Nut		125 (92)	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)	9 (6.5) 29 (21)
Crankcase / Engine Support Nuts or Screws		40 (29)	40 (29)	40 (29)	40 (29)	40 (29)
Cylinder Head Nuts		29 (21)	29 (21)	29 (21)	29 (21)	29 (21)
Crankcase / Cylinder Nuts or Screws		29 (21)	29 (21)	29 (21)	29 (21)	29 (21)
Axial Fan Shaft Nut		N.A.	N.A.	N.A.	N.A.	N.A.

VEHICLE MODEL		GRAND TOURING SE	MACH 1
ENGINE TYPE		**670**	**670**
Number of Cylinders		2	2
Bore	mm (in)	78.00 (3.07)	78.00 (3.07)
Stroke	mm (in)	70.00 (2.760)	70.00 (2.760)
Displacement	cm^3 (in^3)	668.97 (40.82)	668.97 (40.82)
Compression Ratio (corrected)		6.20	6.0
Maximum Power Engine Speed ①	RPM	7600 – 7800	8100 – 8300
Piston Ring Type	1^{st} / 2^{nd}	ST / R	ST / R
Ring End Gap	(new) mm (in) (wear limit) mm (in)	0.250 (.0100) 1.000 (.0400)	0.250 (.0100) 1.000 (.0400)
Ring / Piston Groove Clearance	(new) mm (in) (wear limit) mm (in)	0.030 (.0012) 0.200 (.0080)	0.030 (.0012) 0.200 (.0080)
Piston / Cylinder Wall Clearance	(new) mm (in) (wear limit) mm (in)	0.070 (.0028) 0.150 (.0060)	0.070 (.0028) 0.150 (.0060)
Connecting Rod Big End Axial Play	(new) mm (in) (wear limit) mm (in)	0.390 (.0156) 1.200 (.0480)	0.390 (.0156) 1.200 (.0480)
Maximum Crankshaft End-play	mm (in)	0.300 (.0120)	0.300 (.0120)
Maximum Crankshaft Deflection	mm (in)	0.080 (.0032)	0.080 (.0032)
Rotary Valve Timing ② and P / N 420 924 XXX	Opening Closing	144° - 72° 500	145° - 76° 501
Magneto Generator Output	W	220	220
Ignition Type		CDI	CDI
Spark Plug Make and Type		NGK BR9ES	NGK BR10ES
Spark Plug Gap	mm (in)	0.45 (.018)	0.45 (.018)
Ignition Timing BTDC ③	mm (in)	1.93 (.076)	1.93 (.076)
Generating Coil ⑤	Low Speed : Ω	10 - 17	10 - 17
	High Speed : Ω	N.A.	N.A.
Lighting Coil ⑤	Ω	0.20 - 0.35	0.20 - 0.35
High Tension Coil ⑤	Primary Ω	0.3 - 0.7	0.3 - 0.7
	Secondary kΩ	8 - 16	8 - 16
Carburetor Type	PTO / MAG	VM 40 79 / 79	VM 44 32 / 33
Main Jet	PTO / MAG	360 / 360	420 / 400
Needle Jet		224 AA-3	224 AA-7
Pilot Jet		50	35
Needle Identification – Clip Position		7EDY1-3	7EGO6-3
Slide Cut-away		2.5	2.5
Float Adjustment	± 1 mm (± 0.40 in)	18.1 (.71)	18.1 (.71)
Air Screw Adjustment	± 1/16 Turn	2.25	1.5
Idle Speed RPM	RPM	1800 – 2000	1800 – 2000
Gas Type / Pump Octane number		Unleaded / 87	Super unleaded / 91
Gas / Oil Ratio		Injection	Injection
Type		Liquid	Liquid
Axial Fan Belt Adjustment	Deflection mm (in)	N.A.	N.A.
	Force kg (lbf)	N.A.	N.A.
Thermostat Opening Temperature	°C (°F)	42 (108)	42 (108)
Radiator Cap Opening Pressure	kPa (PSI)	90.0 (13.0)	90.0 (13.0)
ENGINE COLD N•m (lbf•ft): Drive Pulley Retaining Screw √		√	√
Exhaust Manifold Nuts or Bolts		23 (17)	23 (17)
Magneto Ring Nut		125 (92)	125 (92)
Crankcase Nuts or Screws	M6 M8	9 (6.5) 29 (21)	9 (6.5) 29 (21)
Crankcase / Engine Support Nuts or Screws		40 (29)	40 (29)
Cylinder Head Nuts		29 (21)	29 (21)
Crankcase / Cylinder Nuts or Screws		29 (21)	29 (21)
Axial Fan Shaft Nut		N.A.	N.A.

VEHICLE MODEL				FORMULA SLS	GRAND TOURING 500	SUMMIT 500	GRAND TOURING 580
ENGINE TYPE				494	494	494	582
Chain Drive Ratio				25/44	23/44	22/44	25/44
Chain	Pitch		(m)	3/8	3/8	3/8	3/8
	Type, Links - Plates Qty			Silent 74-11	Silent 72-11	Silent 72-11	Silent 74-11
Drive Pulley	Type of Drive Pulley			TRAC	TRAC	TRAC	TRAC
	Ramp Identification			287 ⑤	228 ≈	287 ⑤	228 ⑤
	Calibration Screw Position or Calibration Disc Quantity			4	3	5	3
	Spring Color			Green / Blue	Green/Blue	Pink / White	Yellow / Red
	Spring Length		* 1.5 mm (± 0060 in)	1474 (5.80)	1474 (5 80)	1245 (4 90)	121.1 (4 77)
	Clutch Engagement		RPM	4400-4600	4400-4600	4700-4900	3100-3300
Driven Pulley Spring Preload Cam Angle			kg (lb) degree	6.1 -7.5 (13.4 - 16.5) 50"	5.4 – 6.8 (11.9 - 14.9) 44°	61 -7.5 (134 - 165) 47"	5.4-6 8(11 9- 149) 50"
Pulley Distance Z			(+0, -1) mm ((+0, -1/32) in)	165 (21/32)	165 (21/32)	165 (21/32)	165 (21/32)
Offset	X		± 0.4 mm (* 1/84 in)	350 (1-3/8)	350 (1-3/8)	350 (1-3/8)	350 (1-3/8)
	Y - x			10-20 (0.039 -0 079)	1,0- 2.0 (o 039-0 079)	1.0- 2.0 (o 039- 0.079)	10-2.0 (0.039 -0 079)
Drive Belt Part Number (P / N)				414860700	414860700	414860700	414860700
Drive Belt Width (new) ①			mm (in)	3490 (1-3/8)	3490 (1-3/8)	34.90 (1-3/8)	3490 (1-3/8)
Drive Belt Adjustment		Deflection	mm (in)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)
		Force ②	kg (lbf)	6.8 (15)	6.8 (15)	6.8 (15)	6.8 (15)
Track	Width		cm (in)	38 (15.0)	38.1 (15.0)	38.1 (15.0)	381 (15 o)
	Length		cm (in)	307 (121)	3455 (135 83)	3455 (135 83)	345.5 (136)
	Adjustment	Deflection	mm (in)	45-50 (1-3/4 - 1-31/32)	45-50 (1-3/4 - 1-31/32)	45-50 (1-3/4 - 1-31/32)	45-50 (1-3/4 - 1-31/32)
		Force ③	kg (lbf)	7,3 (16)	7.3 (16)	7.3 (16)	7.3 (16)
Suspension Type		Track		SC10 Sport	SC 10 Touring	SC-10 Touring	SC 10 Touring
		Ski		DSA	DSA	DSA	DSA
Length			cm (in)	272 (107.1)	2919 (1 14.9)	291.9 (114 9)	302 (1 19)
Width			cm (in)	115.6 (45,5)	115.6 (45.5)	108 (42 5)	1156 (45 5)
Height			cm (in)	112 (44)	122 (48)	112 (44)	1283 (50.5)
Ski Stance			cm (in)	101.6 (400)	101.6 (400)	94 (37)	1016 (400)
Mass (dry)			kg (lb)	211 (484)	232 (510)	218 (479)	255 (560)
Ground Contact Area			cm^2 (in^2)	6503 (1008)	7227.2 (1 120.2)	7479,2 (1 159.2)	7479.2 (1 159.2)
Ground Contact Pressure			kPa (PSI)	3.18 (.461)	315 (457)	286 (415)	334 (484)
Frame Material				Aluminum	Aluminium	Aluminum	Aluminum
Bottom Pan Material				Impact copolymer	impact copolymer	impact copolymer	Impact copolymer
Cab Material				RRIM	RRIM	BRIM	RRIM
Nose Piece Material				N A.	NA	NA	N.A
Battery			V (A•h)	NA	12 (22)	NA	12 (22)
Headlight			W	H4 60/55	H4 60/55	H4 60/55	H4 60/55
Taillight and Stoplight			W	8/27	8/27	6/27	8/27
Tachometer and Speedometer Bulb			W	2 x 3	2 x 3	2 x 3	2 x 3
Fuel and Temperature Gauge Bulb			w	NA	NA	NA	3,3
Fuse	Starter Solenoid		A	NA	30	NA	30
	Tachometer		A	N.A	NA	NA	N A.
Fuel Tank			L (US. gal)	40 (10.6)	40 (10.6)	40 (10.6)	421 (11.1)
Chaincase / Gearbox			mL (Us oz)	250 (85)	250 (8.5)	250 (85)	250 (8.5)
Cooling System √			L (Us. oz)	4.7 (159)	5.0 (169)	5.0 (169)	5.0 (169)
Injection 011 Reservoir			L (u s oz)	2.8 (94.7)	2.8 (94.7)	2.8 (94.7)	4.1 (138.7)

VEHICLE MODEL	Unit	FORMULA STX	FORMULA STX LT	GRAND TOURING SE	MACH 1
ENGINE TYPE		583	583	670	670
Chain Drive Ratio		25/44	23/44	25/44	26/44
Chain – Pitch	(in)	3/8	3/8	3/8	3/8
Chain – Type, Links - Plates Qty		Silent 74-11	Silent 72-11	Silent 74-13	Silent 74-13
Drive Pulley – Type of Drive Pulley		TRAC	TRAC	TRAC	TRAC
Drive Pulley – Ramp Identification		228 ⑤	228 ⑤	280 ⑤	286 ≈
Drive Pulley – Calibration Screw Position or Calibration Disc Quantity		4	3	3	2
Drive Pulley – Spring Color		Blue / Green	Yellow / Green	Yellow / Orange	Pink / White
Drive Pulley – Spring Length	± 1.5 mm (± 0.060 in)	105.7 (4.16)	94 (3.70)	105.7 (4.16)	124.5 (4.90)
Drive Pulley – Clutch Engagement	RPM	3400 – 3600	3100 – 3300	3400 – 3600	4400 – 4600
Driven Pulley Spring Preload Cam Angle	kg (lb) degree	5.5 – 7.0 (12.1 – 15.4) 50°	5.4 – 6.8 (11.9 – 14.9) 50°	5.4 – 6.8 (11.9 – 14.9) 47°	5.4 – 6.8 (11.9 – 14.9) 47°
Pulley Distance Z	(+0, −1) mm ((+0, −1/32) in)	16.5 (21/32)	16.5 (21/32)	16.5 (21/32)	16.5 (21/32)
Offset – X	± 0.4 mm (± 1/64 in)	35.0 (1-3/8)	35.0 (1-3/8)	35.0 (1-3/8)	35.0 (1-3/8)
Offset – Y - X		1.0 - 2.0 (0.039 - 0.079)	1.0 - 2.0 (0.039 - 0.079)	1.0 - 2.0 (0.039 - 0.079)	1.0 - 2.0 (0.039 - 0.079)
Drive Belt Part Number (P / N)		414 8607 00	414 8607 00	414 9182 00	414 9182 00
Drive Belt Width (new) ①	mm (in)	34.90 (1-3/8)	34.90 (1-3/8)	35.2 (1-3/8)	35.2 (1-3/8)
Drive Belt Adjustment – Deflection	mm (in)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)
Drive Belt Adjustment – Force ②	kg (lbf)	6.8 (15)	6.8 (15)	6.8 (15)	6.8 (15)
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)	345.5 (136)	345.5 (136)	307 (121)
Track – Adjustment – Deflection	mm (in)	45 - 50 (1-3/4 - 1-31/32)	45 - 50 (1-3/4 - 1-31/32)	45 - 50 (1-3/4 - 1-31/32)	45 - 50 (1-3/4 - 1-31/32)
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 Touring	C-7 Twin Shock Progressive Rate	C-7 Twin Shock Progressive Rate
Suspension Type – Ski		DSA	DSA	DSA	DSA
Length	cm (in)	272 (107.1)	291 (114.6)	302 (119)	272 (107.1)
Width	cm (in)	115.6 (45.5)	115.6 (45.5)	115.6 (45.5)	118.5 (46.7)
Height	cm (in)	128.3 (50.52)	128.3 (50.52)	128.3 (50.5)	108 (42.5)
Ski Stance	cm (in)	101.6 (40.0)	101.6 (40.0)	101.6 (40)	104.5 (41)
Mass (dry)	kg (lb)	231 (509)	239 (526)	268 (590)	239 (525)
Ground Contact Area	cm^2 (in^2)	6825.3 (1057.9)	7549.2 (1170.1)	7227.2 (1120.2)	6793.4 (1053)
Ground Contact Pressure	kPa (PSI)	3.32 (.481)	3.11 (.451)	3.15 (.457)	3.45 (.5)
Frame Material		Aluminum	Aluminum	Aluminum	Aluminum
Bottom Pan Material		Impact copolymer	Impact copolymer	Impact copolymer	Impact copolymer
Cab Material		RRIM	RRIM	RRIM	RRIM
Nose Piece Material		N.A.	N.A.	N.A.	N.A.
Battery	V (A•h)	N.A.	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 Bulb	W	2 x 3	2 x 3	2 x 3	2 x 3
Fuel and Temperature Gauge Bulb	W	N.A.	N.A.	3/3	3/3
Fuse – Starter Solenoid	A	N.A.	N.A.	30	N.A.
Fuse – Tachometer	A	N.A.	N.A.	N.A.	N.A.
Fuel Tank	L (U.S. gal)	42.1 (11.1)	42.1 (11.1)	42.1 (11.1)	42.1 (11.1)
Chaincase / Gearbox	mL (U.S. oz)	250 (8.5)	250 (8.5)	250 (8.5)	250 (8.5)
Cooling System √	L (U.S. oz)	4.7 (159)	5.0 (169)	5.0 (169)	4.7 (159)
Injection Oil Reservoir	L (U.S. oz)	4.1 (138.7)	4.1 (138.7)	4.1 (139)	4.1 (139)

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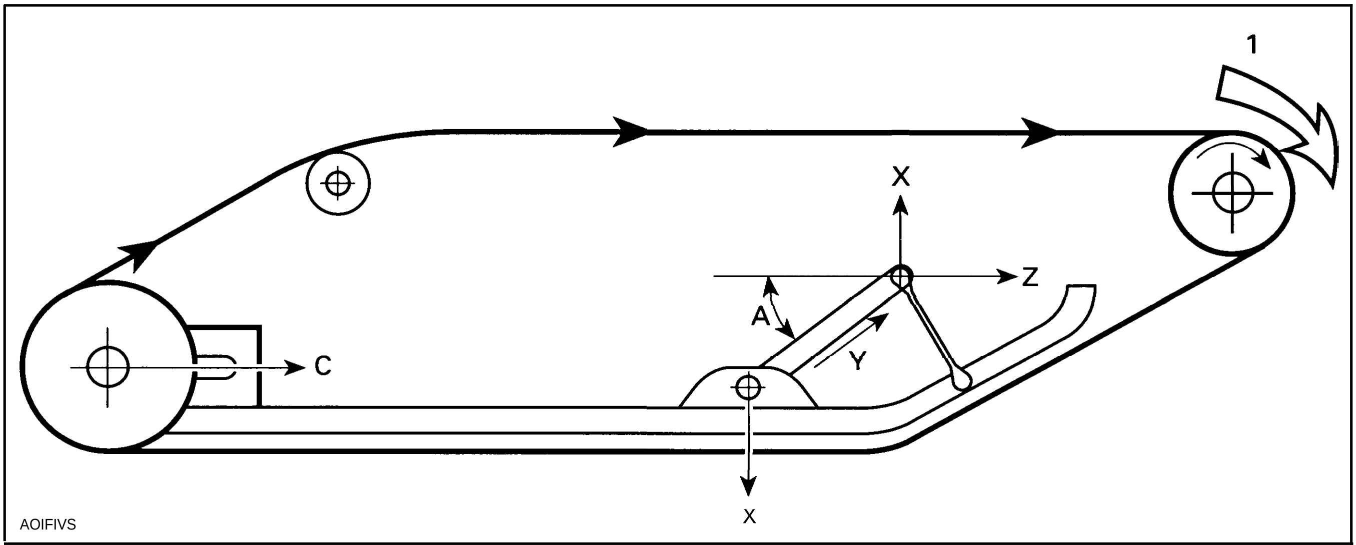
SUSPENSION OPERATION / WEIGHT TRANSFER

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 : A shorter nylon limiter strap is available for vehicles equipped with the strap and bolt style limiter. P / N 486056200.

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.

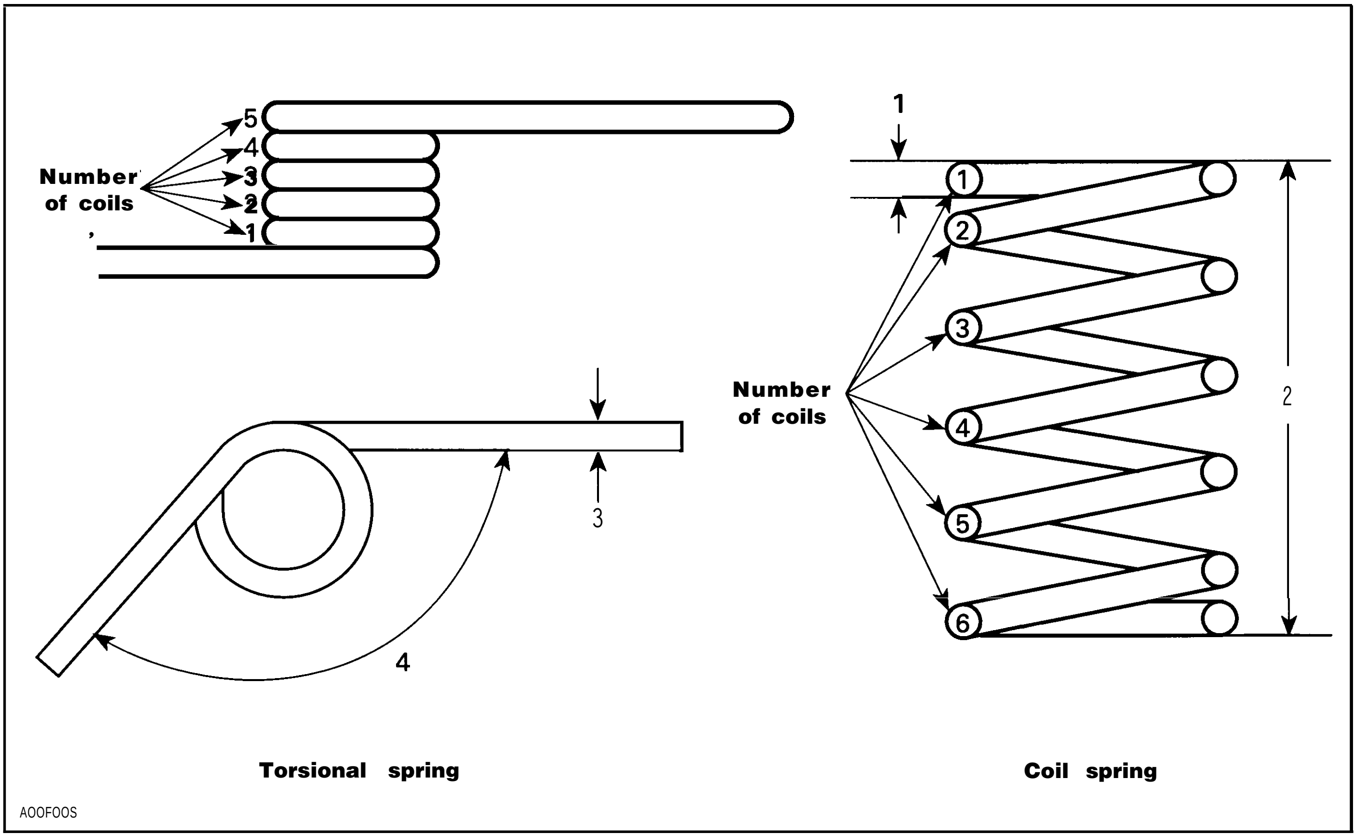
The main function of the rear arm is to support the weight of the vehicle and rider, yet provide usable travel to absorb bumps and jumps. The springs are chosen depending on the linkage design of the rear arm and the intended load to be applied. Stiffer springs will be used on vehicles intended to carry 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.

SPRINGS

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



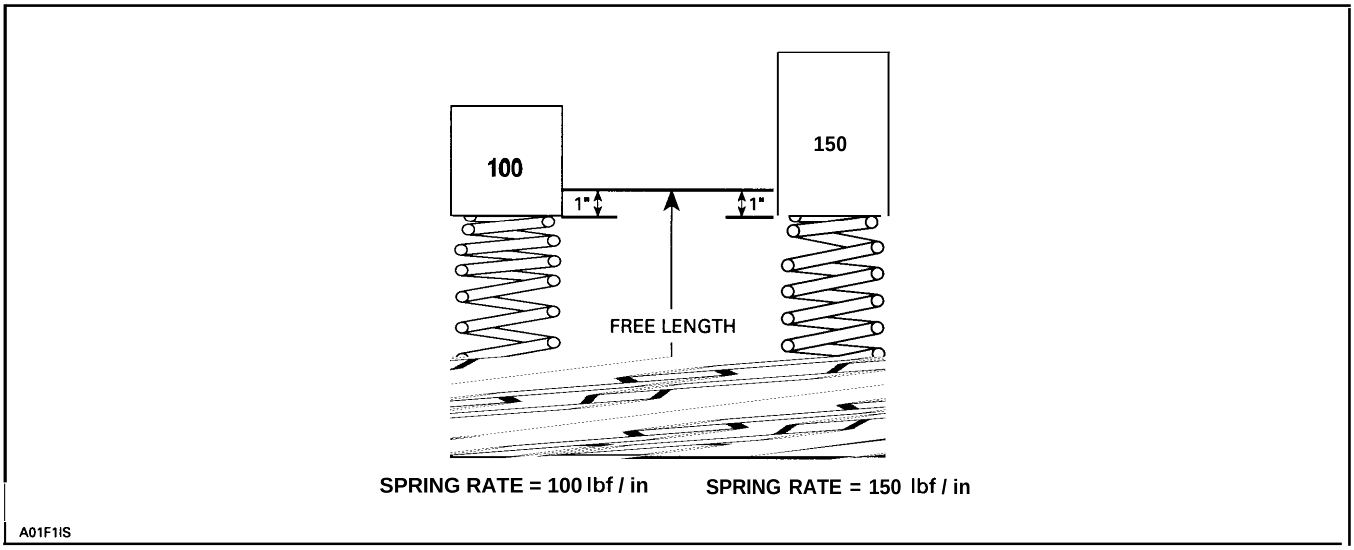
1. Wire diameter
2. Free length
3. Wire diameter
4. Opening angle

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.

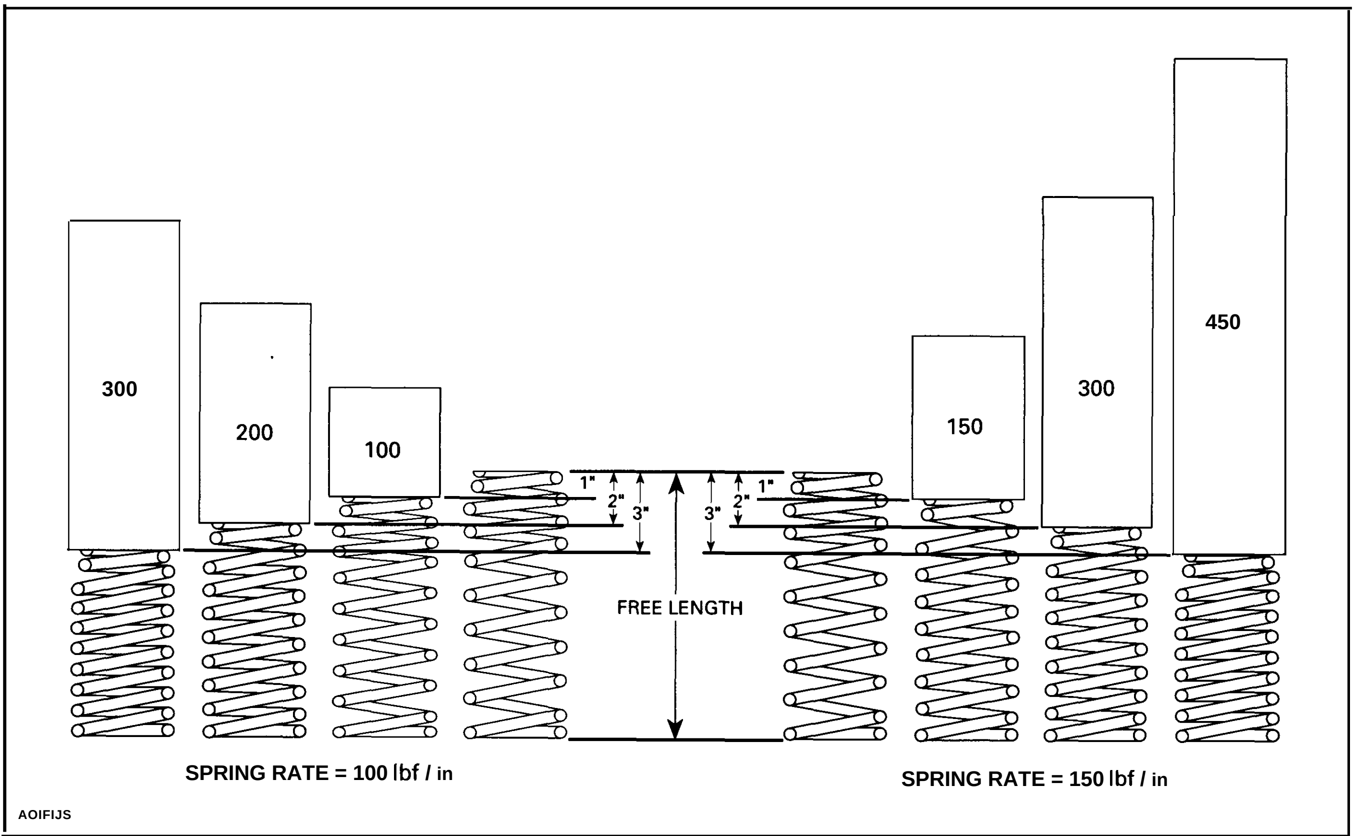
Coil Springs

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

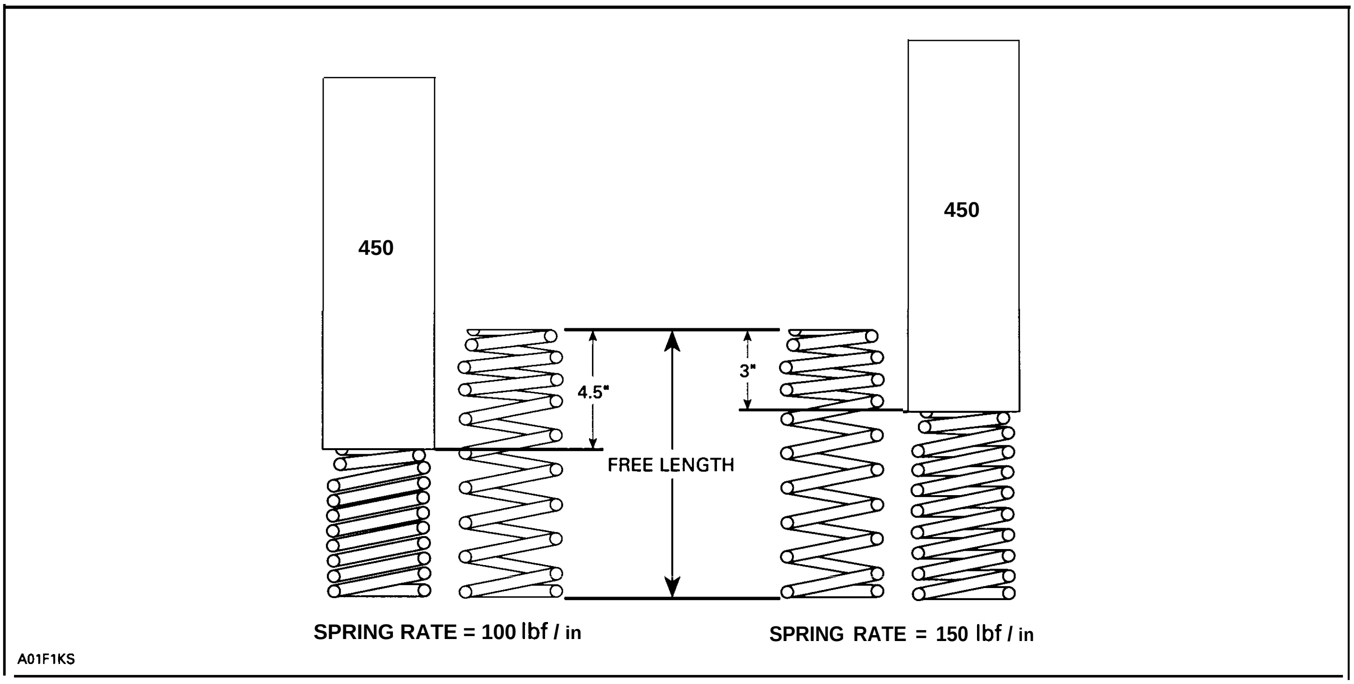
The spring rate of a coil spring is defined as the amount of force required to compress the spring one inch. 'If a 100 pound-force compresses a spring 1 inch it is referred to as having a rate of 100 lb / in (pounds per inch). If 150 pounds of force is required to compress a spring 1 inch then it would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



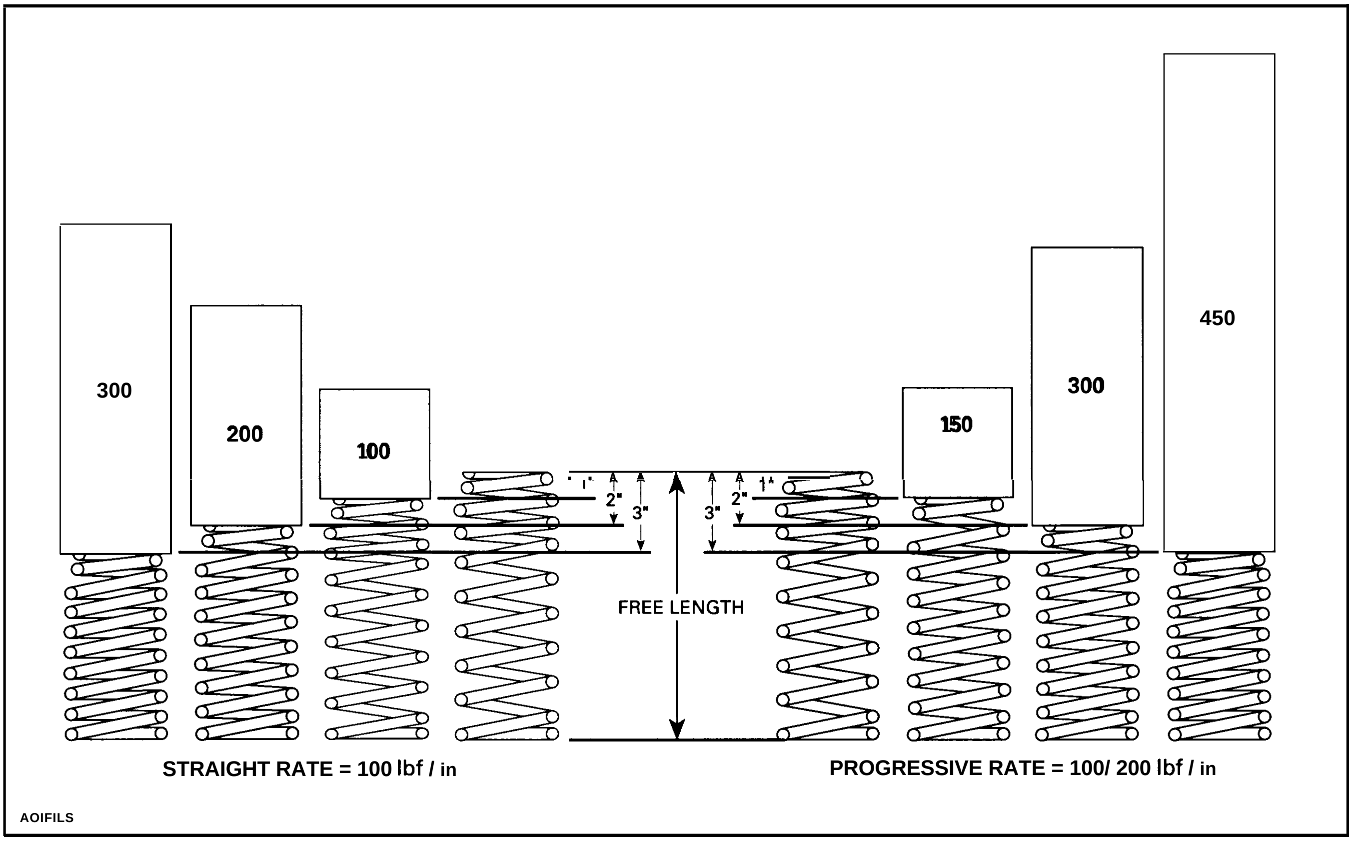
Most springs are designed as a straight rate spring. This means that the spring requires the same force to compress the last one inch of travel as the first one inch of travel. Example : A 100 lb/in rate spring will compress one inch for every 100 pounds applied. A force of 200 pounds will compress the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



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



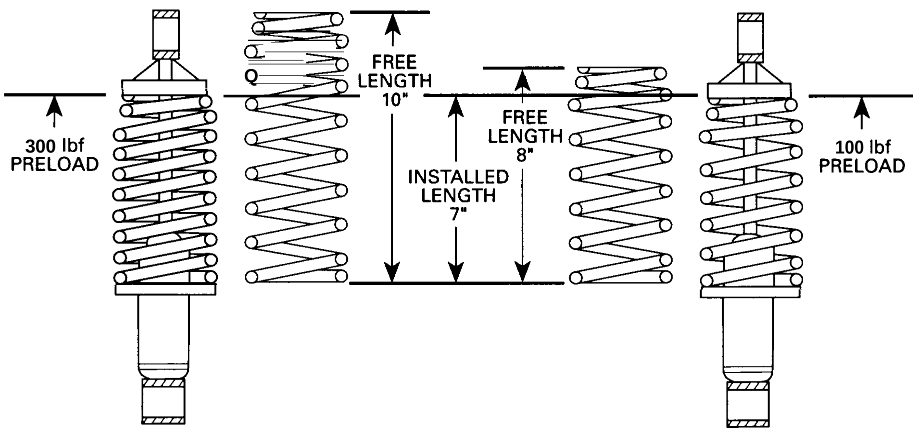
A spring can also be progressively wound. This means that the rate of the spring is increasing as it is compressed. A 100/ 200 lb/ in progressive spring will require 100 pounds to compress the first one inch but will require 200 additional pounds to compress the last one inch (see following illustration).



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-l 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 lb/in rated spring may test anywhere from 80 to 120 lb / 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 2100 lb/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.

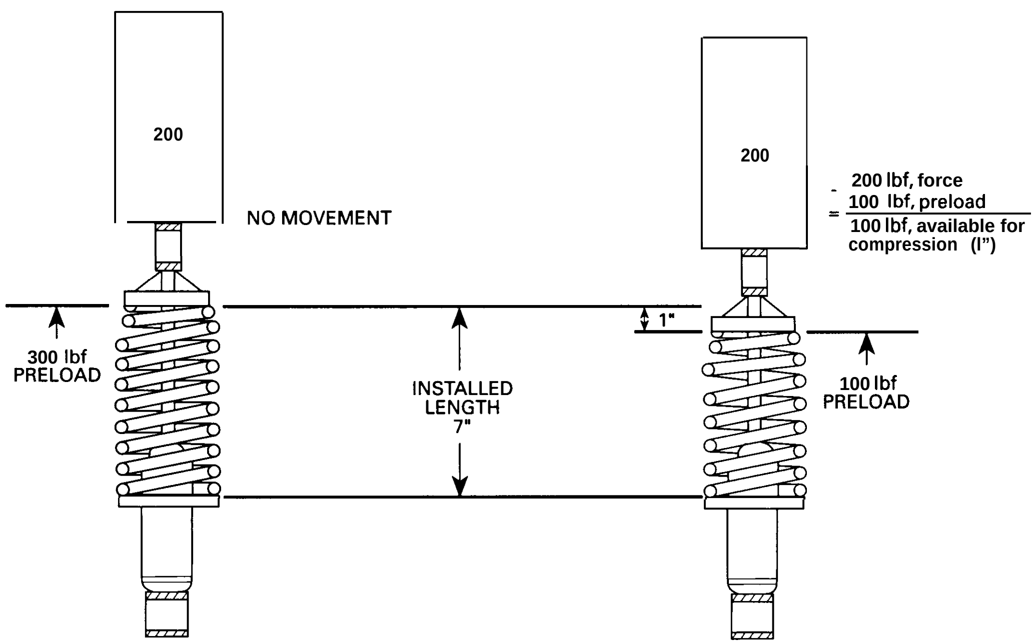


SPRING RATE = 100 lbf / in
10 in FREE LENGTH

SPRING RATE = 100 lbf / in
8 in FREE LENGTH

AOIFIMS

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).

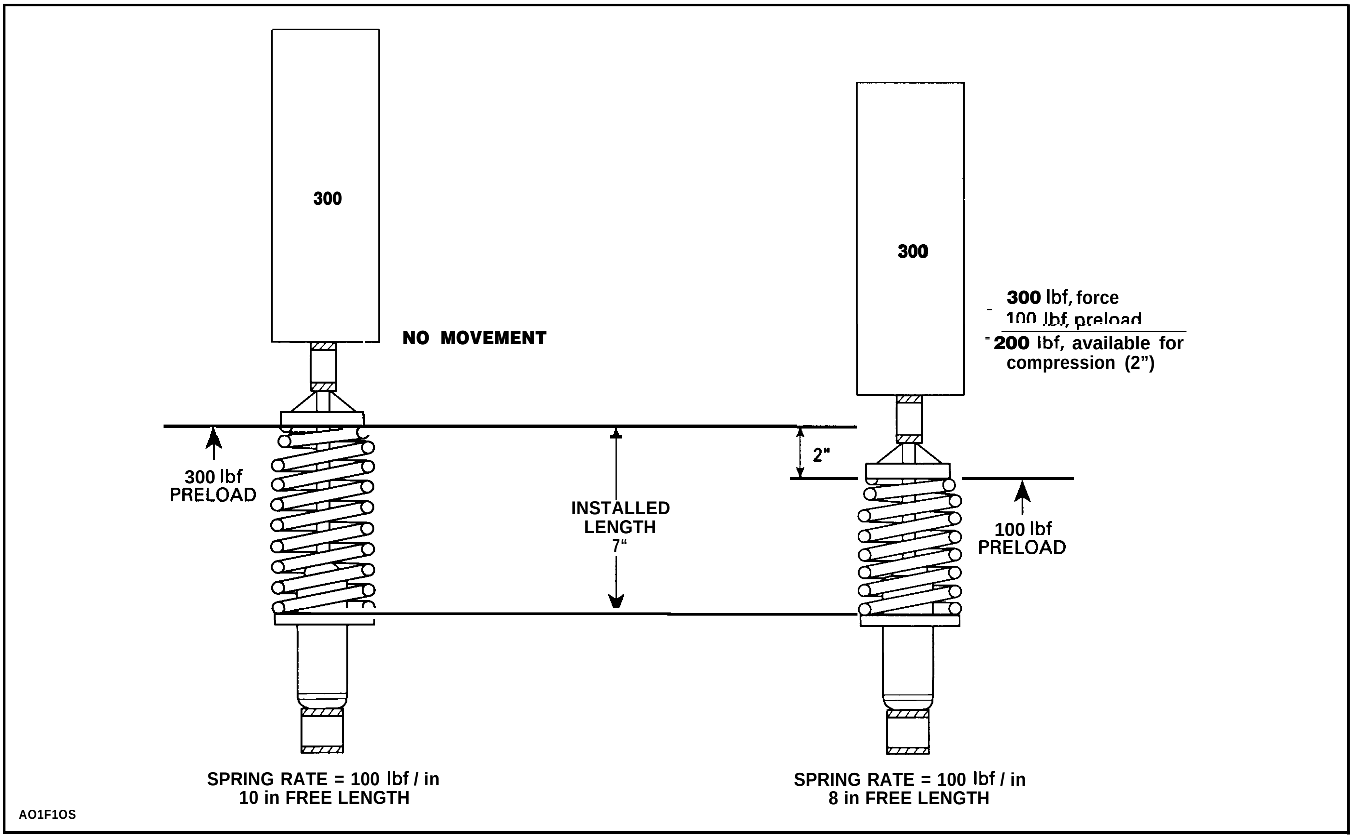


SPRING RATE = 100 lbf / in
10 in FREE LENGTH

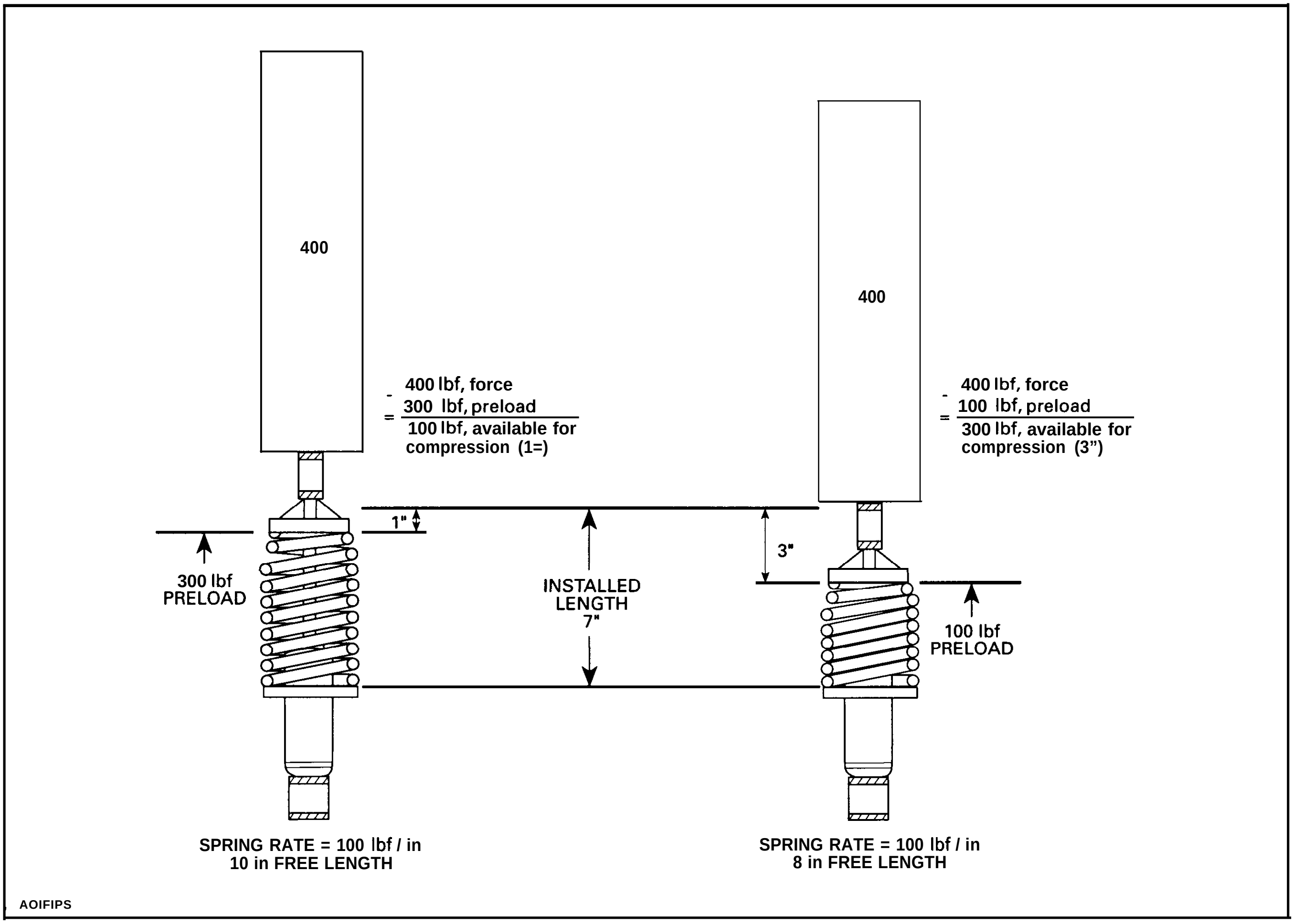
SPRING RATE = 100 lbf / in
8 in FREE LENGTH

AOIFINS

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).

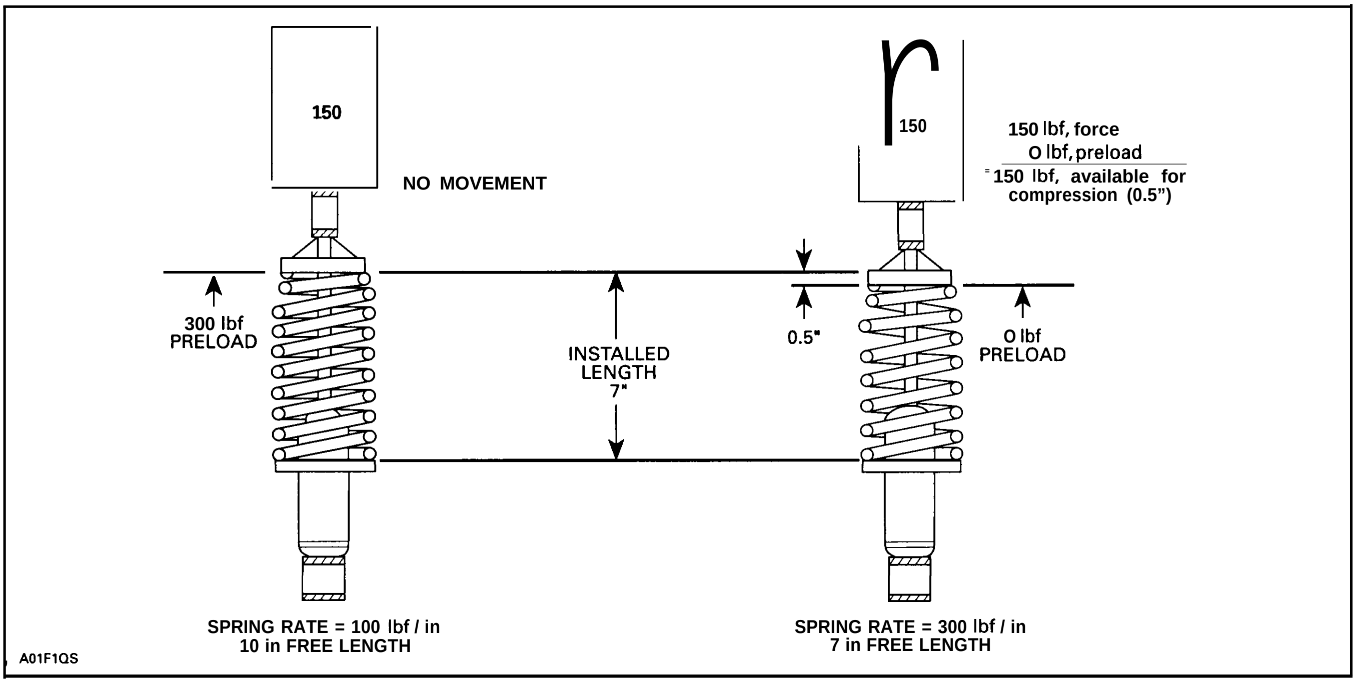


Finally, if more than 300 pounds is applied, the 10 inch spring will start to compress. If 400 pounds were applied the 10 inch spring will compress one inch and the 8 inch spring will compress 3 inches. Notice that each additional 100 pounds added after movement begins compresses the system one inch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

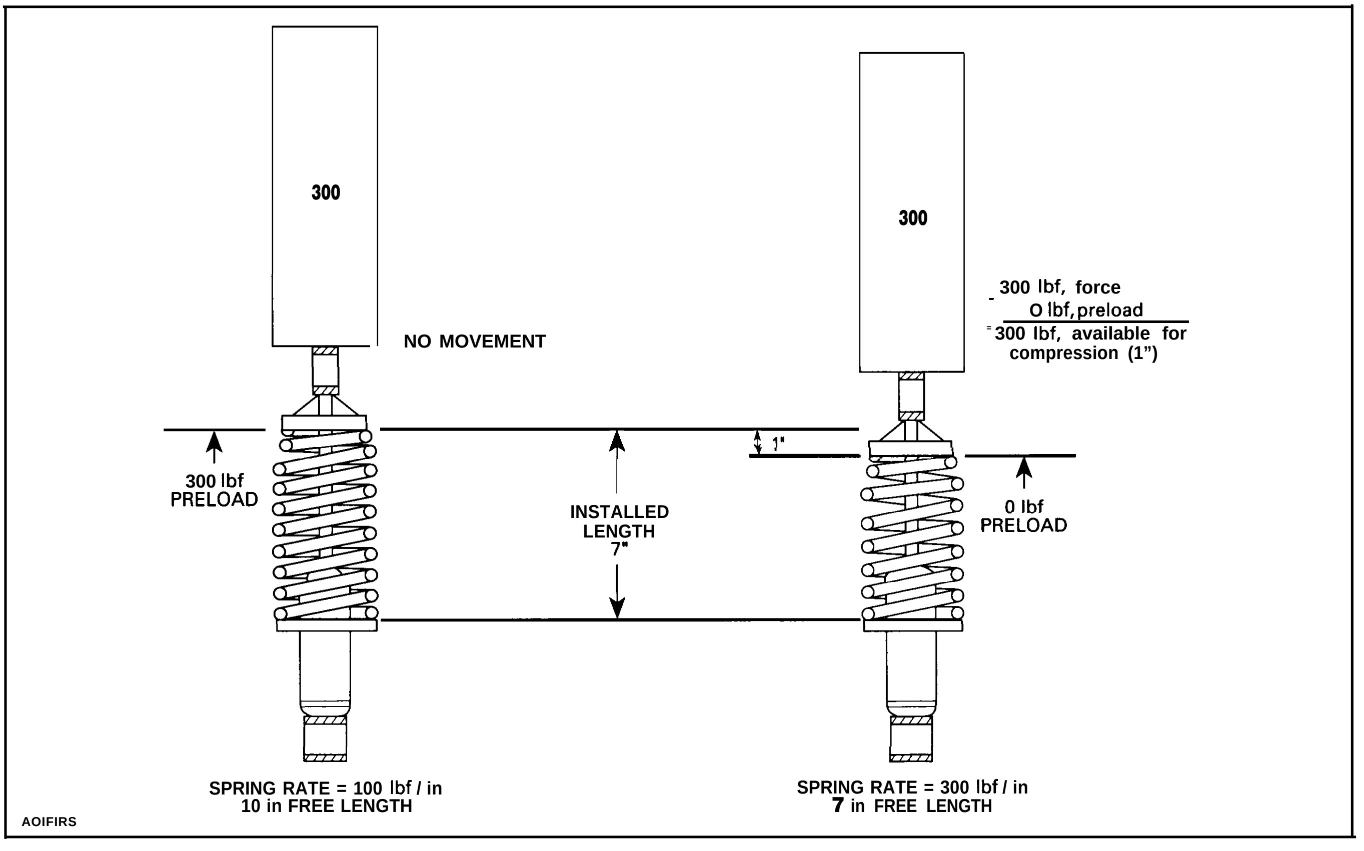


Now let's see what happens if we use a long, soft spring and a short, stiff spring. We will use a 100 lb/ in rate spring with a free length of 10 inches. Our 2nd spring will be a 300 lb/in rate spring with a free length of 7 inches. The installed length will be 7 inches as in the previous example, thus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

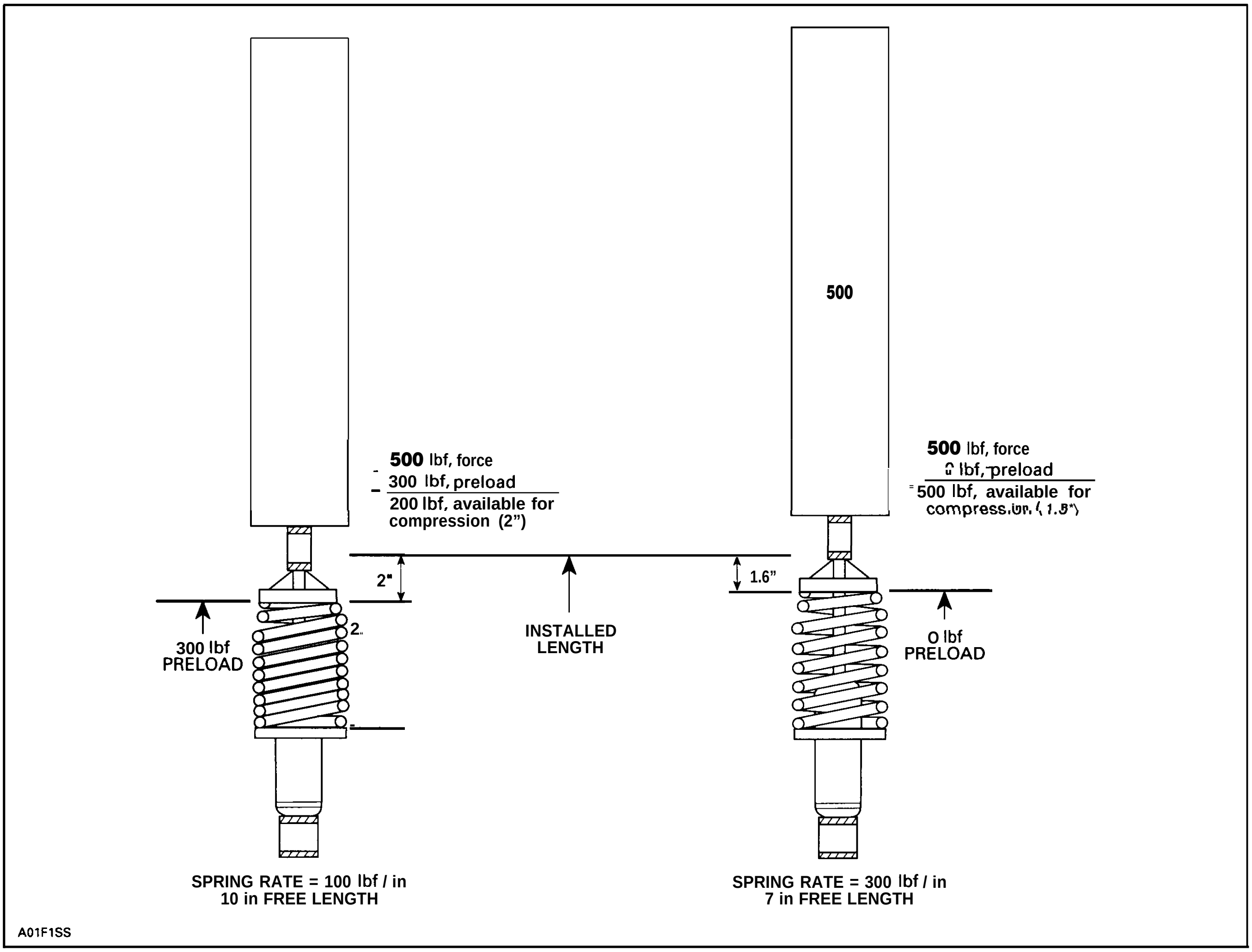
So if we apply 150 pounds of force, the 1st spring will not move, while the 2nd spring will compress 0.5 inches (see following illustration).



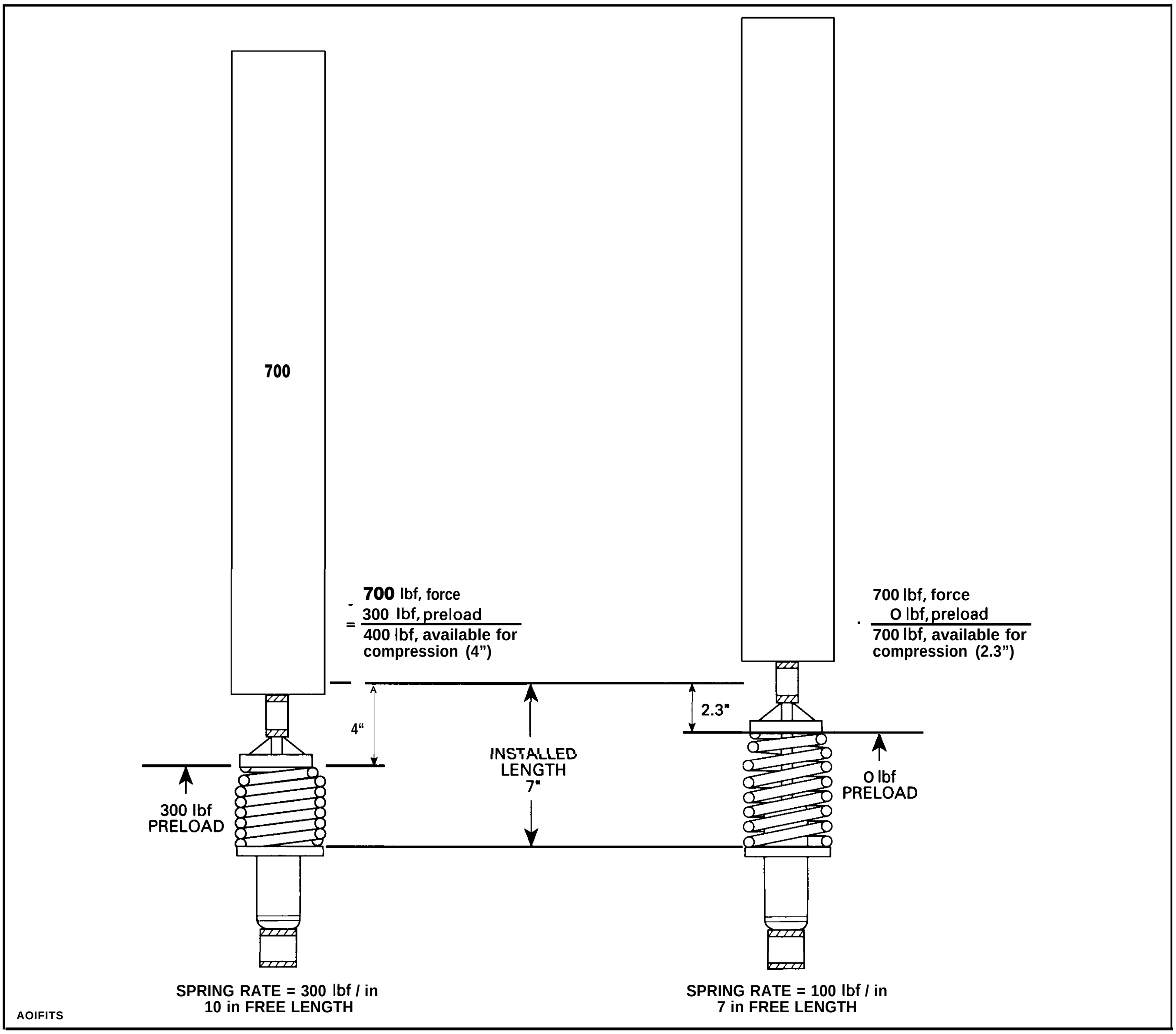
At 300 pounds applied force the 1st spring will not yet move and the 2nd spring will compress 1 inch (following illustration).



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 lb/in spring will now compress 4 inches while the 300 lb/in spring will only compress 2.3 inches (following illustration).

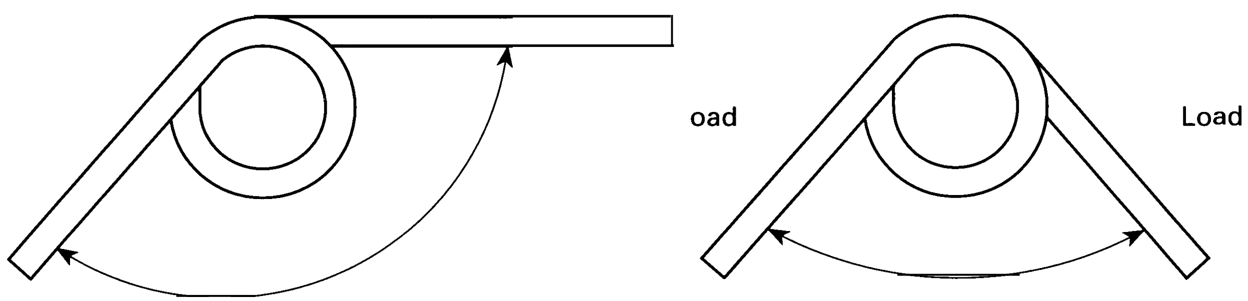


So while the soft spring with a lot of preload acted stiffer initially, it's rate allowed it to compress substantially with increasing loads. But the stiffer rate spring with no preload actually acted softer at small loadings but then became stiff very quickly as the load increased.

Torsional Springs

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

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



Spring Identification

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

NOTE : Springs that fit the front of the F-2000 Chassis will generally fit the front of the S-2000 Chassis.

Springs that fit the center of the F-2000 Chassis will generally fit the center of the S-2000 Chassis if the plastic snow protector is taken off the shock.

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

SPRING PRELOAD SPACERS:

503117100 8.25 mm thick x 46.8 mm I.D.

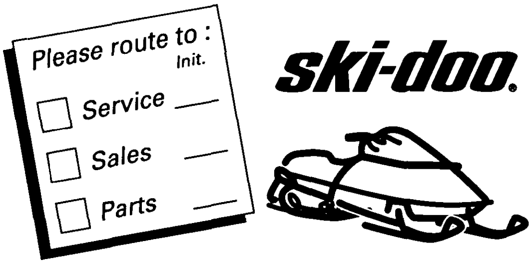
503162100 15.0 mm thick x 47.8 mm I.D.

PRODUCTION SUSPENSION SPRINGS

	FRONT			CENTER			REAR		
MODEL	P / N	RATE N / mm (lbf / in)	LENGTH mm (in)	P / N	RATE N / mm (lbf / in)	LENGTH mm (in)	P / N	RATE N / mm (lbf / in)	LENGTH mm (in)
1993 MX Z	414810100	219 (125)	257 (10.1)	414809300	28.0 (160)	213 (8.4)	414809100	21.9 (125)	274 (10.8)
1993 MX	414824800	42.0 (240)	227 (8.9)	503080300	48.9 (279)	216 (8.5)	414789400	23.7 (135)	272 (10.7)
1993 MX XTCR	414824900	38.8 (210)	227 (8.9)	503080300	48.9 (279)	216 (85)	414789400	23.7 (135)	272 (107)
1993 PLUS / E	414824800	42.0 (240)	227 (8.9)	503080300	48.9 (279)	216 (8.5)	414797700	23.7 (135)	272 (10.7)
1993 PLUS XTC	414824900	36.8 (210)	227 (8.9)	503080300	48.9 (279)	216 (85)	414797700	23.7 (135)	272 (10.7)
1993 GRAND TOURING	414824800	42.0 (240)	227 (8.9)	503080300	48.9 (279)	216 (8.5)	414797800	23.7 (135)	272 (10.7)
1993 PLUS EFI	414824800	42.0 (240)	227 (8.9)	503080300	48.9 (279)	216 (8.5)	414811800	23.7 (135)	259 (102)
1993 PLUS X	414782300	39.5 (225)	165 (6.5)	503080300	48.9 (279)	216 (8.5)	414788200	26.3 (150)	272 (10.7)
1993 MACH 1	414824800	42.0 (240)	227 (8.9)	503080300	48.9 (279)	216 (8.5)	414815500	23.7 (135)	259 (10.2)
1993 MACH 1 XTC	414824900	36.8 (210)	227 (8.9)	503080300	48.9 (279)	216 (8.5)	414797900	23.7 (135)	272 (10.7)
1993 MACH Z	414809500	26.3 (150)	257 (10.1)	414809300	28.0 (160)	213 (84)	414809100	21.9 (125)	274 (108)
1994 GRAND TOURING SERIES	414824800	42.0 (240)	227 (8.9)	503080300	48.9 (279)	216 (8.5)	414841300	23.8 (136)	259 (10.2)
1994 SUMMIT 470/583	414859300	15.8 (90)	239 (9.4)	414877800	28.0 (160)	223 (8.8)	414852800	17.5 (loo)	279 (11)
1994 SUMMIT 470/583(2)	414859300	15.8 (90)	239 (9.4)	414877800	28.0 (160)	223 (8.8)	414884100	19.6 (112)	279 (11)
1994MX	414810100	21.9 (125)	257 (7.3)	414877800	28.0 (160)	223 (8.8)	414861600	23.7 (135)	272 (10.7)
1994 MX Z	414810100	21.9 (135)	257 (10.7)	414877800	28.0 (160)	223 (8.8)	414861600	23.7 (135)	272 (10.7)
1994 FORMULA ST/STX	414869000	21.9 (125)	257 (101)	414877800	28.0 (160)	223 (8.8)	414871300	21.9 (125)	274 (10.8)
1994 FORMULAZ	414881000	17.5 (loo)	260 (10.2)	414877800	28.0 (160)	223 (8.8)	414871300	21.9 (125)	274 (10.8)
1994 MACH 1	414824800	42.0 (240)	227 (8.9)	503080300	48.9 (279)	216 (8.5)	414815500	236 (135)	259 (102)
1994 MACH Z	414871600	26.3 (150)	257 (10.1)	414877800	28.0 (160)	223 (8.8)	414871500	21.9 (125)	274 (10.8)

PRODUCTION SUSPENSION SPRINGS

	FRONT			CENTER			REAR		
MODEL	P / N	RATE N / mm (lbf / in)	LENGTH mm (in)	P / N	RATE N / mm (lbf / in)	LENGTH mm (in)	P / N	RATE N / mm (lbf / in)	LENGTH mm (in)
1995 FORMULA STX	414869000	219 (125)	257 (10.1)	414877800	28.0 (160)	223 (8.8)	414871300	21.9 (125)	274 (10,8)
1995 FORMULA STX LT	414928100	19.3 (1 10)	257 (10.1)	414877800	28.0 (160)	223 (8.8)	414926900	19.3 (110)	279 (11.0)
1995 MX	414810100	21.9 (125)	257 (10.1)	414877800	28.0 (160)	223 (88)	414809100	21.9 (125)	274 (10 8)
1995 MX-Z	414810100	21.9 (125)	25.7 (10.1)	414877800	28.0 (160)	223 (8.8)	414861600	23.7 (135)	272 (10.7)
1995 SUMMIT	414916800	15.8 (90)	239 (9.4)	414877800	28.0 (160)	223 (8.8)	414916900	17.5 (loo)	279 (11 .0)
1995 GRAND TOURING SE	414929500	17.5 (loo)	260 (10.2)	414877800	28.0 (160)	223 (8.8)	414927500	17.5 (loo)	279 (11.0)
1995 GRAND TOURING 580	414929300	19.3 (1 10)	257 (10.1)	414877800	28.0 (160)	223 (8.8)	414927100	19.3 (1 10)	279 (1 1.0)
1995 GRAND TOURING 470	414929300	19.3 (110)	257 (10.1)	414877800	28.0 (160)	223 (8.8)	414927100	19.3 (110)	279 (11.0)
1995 FORMULA S /TOURING L	414932000	21.9 (125)	257 (10.1)	414866600	15.8 (90)	265 (10.4)	414866300 414866200	R.H. L.H.	.825 lb/ ft degree
1995 FORMULA SL	414932000	21.9 (125)	257 (10.1)	414866600	15.8 (90)	265 (10.4)	414866300 414866200	R.H. L.H.	.825 lb/ ft degree
1995 TOURING LE / SLE	414932000	21.9 (125)	257 (10.1)	414944000	20.2 (115)	265 (10.4)	414943500 414943600	R.H. L.H.	.925 lb/ ft degree
1995 SKANDIC 380 / 500	414932100	17.5 (loo)	239 (9.4)	414944000	20.2 (115)	265 (10.4)	414943500 414 943600	R.H. L.H.	.925 lb/ ft degree
1995 FORMULA Z	414891000	17.5 (loo)	260 (10.2)	414877800	28.0 (160)	223 (8.8)	414925400	17.5 (loo)	279 (11)
1995 FORMULA SS	414869000	21.9 (125)	257 (10.1)	414877800	28.0 (160)	223 (8.8)	414925400	17.5 (loo)	279 (11)
1995 MACH 1 / MACH Z	414928600	17.5 (loo)	260 (10.2)	414877800	28.0 (160)	223 (8.8)	414926000	17.5 (loo)	279 (11)



SERVICE
Bulletin

No. 96-2

Date: August 28, 1995

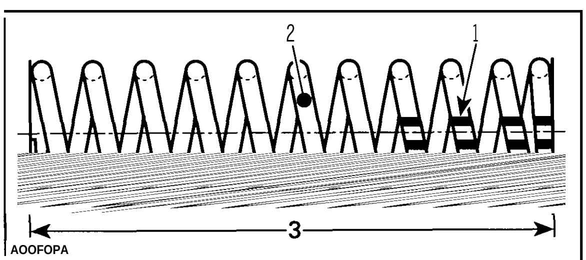
SUBJECT : Spring Application Chart

YEAR	MODEL NAME	MODEL NUMBER	SERIAL NUMBER
1996	All, except utility models	ALL	ALL

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

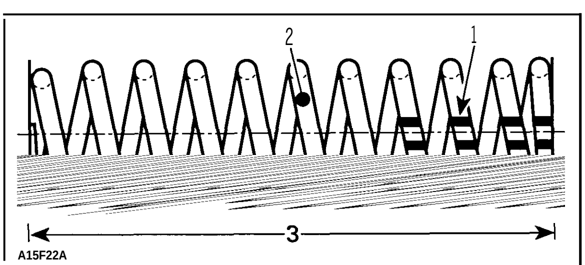
COIL SPRING (Compression)

Type R (Straight on Both Ends)



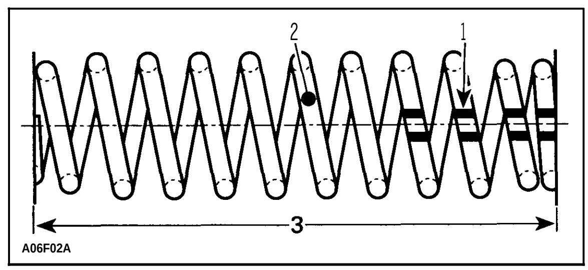
1. *Color Code Stripes*
2. *Wire Diameter*
3. *L- Length*

Type S (Barrel Shaped on One End)



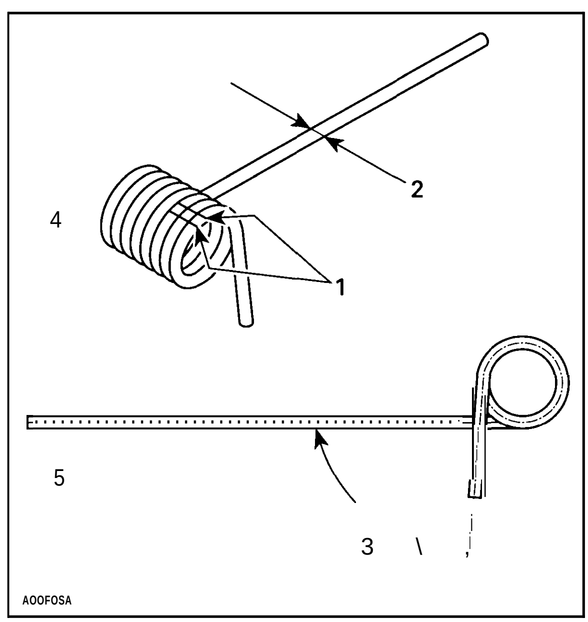
1. *Color Code Stripes*
2. *Wire Diameter*
3. *L-* **Length**

Type T (Barrel Shaped on Both Ends)



Color Code Stripes
Wire Diameter
L- Length

TORSION SPRINGS



1. *Color Code Stripes*
2. *Wire Diameter*
3. *Opening Angle °*
4. *LH*
5. *RH*

MODELS		FRONT SUSPENSION SPRINGS	REAR SUSPENSION SPRINGS CENTER	REAR SOFT	REAR STANDARD	REAR HARD
MACHZ	P / N (type)	414956500-(R)	414 8778 00-(R)		415014500-(T)	
	Spring Rate (lbs / in) ±10	100	160		150	
	Length (mm) ±3	260	223.1		264	
	Wire diameter (mm) +.05	7.14	7.92		7.77	
	Opening angle *7”	N / A	N / A		N/A	
	Color code stripes	BL / YL / GN	WH / WH		BK / WH / OR	
	Notes-color	1,4-RD	1,4-BK		1,4-RD	
MACH Z LT	P / N (type)	4149565 00-(R)	4150137 00-(R)		415 0145 00-(T)	
	Spring Rate (lbs / in) ±10	100	200		150	
	Length (mm) ±3	260	230		264	
	Wire diameter (mm) ±.05	7.14	8.71		7.77	
	Opening angle ±7°	N / A	N / A		N / A	
	Color code stripes	BL / YL / GN	PI/ OR/ YL		BK / WH / OR	
	Notes-color	1,4-RD	1,4-BK		1,4-RD	
MACH 1	P / N (type)	4149565 00-(R)	4148778 00-(R)		4150145 00-(T)	
	Spring Rate (lbs / in) ±10	100	160		150	
	Length (mm) ±3	260	223.1		264	
	Wire diameter (mm) ±.05	7.14	7.92		7.77	
	Opening angle ±7°	N / A	N / A		N/A	
	Color code stripes	BL / YL / GN	WH / WH		BK / WH / OR	
	Notes-color	1,4-RD	1,4-BK		1,4-RD	
FORMULA III	P / N (type)	414 9564 00-(R)	414 8778 00-(R)		415013900-(T)	
	Spring Rate (lbs / in) ±10	100	160		150	
	Length (mm) ±3	260	223.1		264	
	Wire diameter (mm) ±.05	7.14	7.92		7.77	
	Opening angle ±7°	N / A	N / A		N/A	
	Color code stripes	RD / YL / BL	WH / WH		RD / BK / YL	
	Notes-color	1,4-VI	1,4-BK		1,4-VI	
FORMULA III LT	P / N (type)	4149564 00-(R)	4150137 00-(R)		415 0139 00-(T)	
	Spring Rate (lbs / in) ±10	100	200		150	
	Length (mm) ±3	260	230		264	
	Wire diameter (mm) ± .05	7.14	8.71		7.77	
	Opening angle ±7°	N / A	N / A		N / A	
	Color code stripes	RD / YL / BL	PI / OR/ YL		RD / BK / YL	
	Notes-color	1,4-VI	1,4-BK		1,4-VI	
FORMULA Z	P / N (type)	414 9761 00-(R)	415 0129 00-(R)		415 0106 00 LH 415 0105 00 RH	
	Spring Rate (lbs / in) ±10	125	115		N / A	
	Length (mm) ±3	262	260		N / A	
	Wire diameter (mm) ±.05	7.92	7.92		10.6 mm	
	Opening angle ±7°	N / A	N / A		80°	
	Color code stripes	RD / YL	RD / YL		RD	
	Notes-color	1,4-RD	1,4-BK		2,3	

BK-BLACK	BL-BLUE	GN-GREEN	OR-ORANGE	RD-RED	WH-WHITE	YL-YELLOW	PI-PINK

Notes and spring types are explained on the last page.

MODELS		FRONT SUSPENSION SPRINGS	REAR SUSPENSION SPRINGS CENTER	REAR SOFT	REAR STANDARD	REAR HARD
FORMULA Ss	P / N (type)	4149761 00-(R)	415 0129604RI		415 0106 00 LH 415010506 RH	
K	Spring Rate (lbs / in) ±10	125	115		N / A	
L	Length (mm) ±3	262	260		N / A	
	[Wire diameter (mm) +.05	7.92	7.92		10.6 mm	
°	Opening angle ±7°	N / A	N / A		80°	
	Color code stripes	RD / YL	RD / YL		RD	
	Notes-color	1,4-RD	1,4-BK		2,3	
FORMULA STX	P / N (type)	4149561 00-(R)	4$49582 00-(R)		414 9436 00 LH 414 9435 00 RH	
K	Spring Rate (lbs / in) ±10	125	115		N / A	
L	Length (mm) ±3	262	242		N / A	
	Wire diameter (mm) ±.05	7.92	7.77		10.6	
°	Opening angle ±7°	N / A	N / A		90"	
	Color code stripes	RD / YL	RD / BL		WH	
	Notes-color	1,4-RD	1,4-BK		2,3	
FORMULA STX LT (2)	P / N (type)	4149561 *00-(R)*	4149760 00-(R)		415 O1O6OOLH 415 010500 RH	
K	Spring Rate (lbs / in) ±10	125	135		N / A	
L	Length (mm) ±3	*262*	242		N / A	
	Wire diameter (mm) ±.05	*7.92*	8.25		10.6 mm	
°	Opening angle ±7°	*N / A*	N / A		80°	
	Color code stripes	*RD / YL*	RD / GR		RD	
	Notes-color	*1.4-RD*	1.4-BK		2,3	
FORMULA SLS	P / N (type)	4149561 00-(R)	414956200-(R)		414:143600 LH 414943500 RH	
<	Spring Rate (lbs / in) ±10	125	115		N / A	
	Length (mm) ±3	262	242		*N / A*	
	Wire diameter (mm) +.05	7.92	7.77		10.6	
)	Opening angle ±7°	N / A	N / A		90°	
	Color code stripes	RD / YL	RD / BL		WH	
	Notes-color	4-RD	4-BK		2,3	
FORMULA SL	P / N (type)	4149561 00-(R)	4149744 00-(R)		414866300 LH 414866200 RH	414944300 LH 414944200 RH
K	Spring Rate (lbs / in) ±10	125	90		N / A	N / A
L	Length (mm) ±3	262	265		N / A	N / A
	Wire diameter (mm) +.05	7.92	7.14		10.3	11.1
°	Opening angle ±7°	N / A	N / A		85°	90°
	Color code stripes	RD / YL	GN / OR		YL	GN
	Notes-color	4-RD	4-BK		2,3	
FORMULA s	P / N (type)	4149560 00-(R)	4149744 00-(R)		414866300 LH 414866200 RH	414944300 LH 414944200 RI-
K	Spring Rate (lbs / in) ±10	125	90		N / A	N / A
L	Length (mm) ±3	257	265		N / A	N / A
	Wire diameter (mm) +.05	7.49	7.14		10.3	11.1
°	Opening angle ±7°	N / A	N / A		85°	90°
	Color code stripes	BL / RD	GN / OR		YL	GN
	Notes-color	4-BK	4-BK		2,3	

SPRING COLOR CODES							
BK-BLACK	BL-BLUE	GN-GREEN	OR-ORANGE	RD-RED	WH-WHITE	YL-YELLOW	PI-PINK

Notes and spring types are explained on the last page.

MODELS		FRONT SUSPENSION SPRINGS	REAR SUSPENSION SPRINGS CENTER	REAR SOFT	REAR STANDARD	REAR HARD
MX-Z583	P/ N(type)	4149563 00-(R)	4148951 00-(R)		414943600 LH 414943500 RH	
K	Spring Rate (lbs / in) ±10	100	100		N / A	
L	Length (mm) ±3	265	255		N / A	
	Wire diameter (mm) +.05	7.14	7.14		10.6	
°	Opening angle *7°	N / A	N / A		90°	
	Color code stripes	RD / WH / BL	RD 10R		WH	
	Notes-color	1.5-YL	1.5-BK		2.3	
MX-Z 440	P / N (type)	414 9563 00-(R)	414 8951 00-(R)		414 9436 00 LH 414 9435 00 RH	
K	Spring Rate (lbs / in) ±10	100	100		N / A	
L	Length (mm) ±3	265	255		N / A	
	Wire diameter (mm) ±.05	7.14	7.14		10.6	
°	Opening angle ±7°	N / A	N / A		90°	
	Color code stripes	RD / WH / BL	RD / OR		WH	
	Notes-color	4,5-YL	4,5-BK		2,3	
SUMMIT 670	P/N (type)	414968600-(R)	4"l4 9760 00-(R)		414 8663 00 LH 414 8662 00 RH	
K	Spring Rate (lbs / in) ±10	*125*	135		N / A	
L	Length (mm) ±3	*235*	242		N / A	
	Wire diameter (mm) ±.05	*7.49*	8.25		10.3	
°	Opening angle ±7°	*N / A*	N / A		85°	
	Color code stripes	*RD*	RD / GR		YL	
	Notes-color	*1,4-GN*	1,4-BK		2,3	
SUMMIT 583	P / N (type)	*414 9686 00-(R)*	414 9760 00-(R)		414 8663 00 LH 414 8662 00 RH	
K	Spring Rate (lbs / in) ±10	*125*	135		N / A	
L	Length (mm) ±3	235	242		N / A	
	Wire diameter (mm) ±.05	7.49	8.25		10.3	
°	Opening angle ±7°	N / A	N / A		85°	
	Color code stripes	*RD*	RD / GR		YL	
	Notes-color	*1.4-GN*	1.4-BK		2,3	
SUMMIT 500	P / N (type)	4149686 00-(R)	4149760 00-(R)		414866300LH 414866200 RH	
K	Spring Rate (lbs / in) ±10	125	135		N / A	
L	Length (mm) ±3	235	242		N / A	
	Wire diameter (mm) ±.05	7.49	8.25		10.3	
°	Opening angle ±7°	N / A	N / A		85°	
	Color code stripes	RD	RD / GR		YL	
	Notes-color	1,4-GN	1,4-BK		2,3	
GRAND TOURING SE	P / N (type)	4149568 00-(R)	4150137 *00-(R)*	4149271 00-(T)	4150138 *00-(T)*	
K	Spring Rate (lbs / in) ±10	100	200	110	150	
L	Length (mm) ±3	260	230	279	264	
	Wire diameter (mm) ±.05	7.14	8.71	7.77	7.77	
°	Opening angle ±7°	N / A	*N / A*	*N* / A	*N / A*	
	Color code stripes	RD / YL	*PI / OR / YL*	BK / YL	*BK/ RD / WH*	
	Notes-color	1,4-GN	*1,4-BK*	BL	*1,4-GN*	

SPRING COLOR CODES							
BK-BLACK	BL-BLUE	GN-GREEN	OR-ORANGE	RD-RED	WH-WHITE	YL-YELLOW	PI-PINK

Notes and spring types are explained on the last page.

MODELS		FRONT SUSPENSION SPRINGS	REAR SUSPENSION SPRINGS			
			CENTER	REAR SOFT	**REAR STANDARD**	REAR HARD
GRAND TOURING 580	P / N (type)	***414 9559 00-(R)***	**414 9760 00-(R)**		**415 0106 00 LH** **415 0105 00 RH**	
	Spring Rate (lbs / in) ±10	***125***	**135**		**N / A**	
	Length (mm) ±3	***257***	**242**		**N / A**	
	Wire diameter (mm) ±.05	***7.49***	**8.25**		**10.6 mm**	
	Opening angle ±7°	***N / A***	**N / A**		**80°**	
	Color code stripes	***BK / RD***	**RD / GR**		**RD**	
	Notes-color	***1.4-GN***	**1,4-BK**		**2,3**	
GRAND TOURING 500	P / N (type)	***414 9559 00-(R)***	**414 9760 00-(R)**		**415 0106 00 LH** **415 0105 00 RH**	
	Spring Rate (lbs / in) ±10	***125***	**135**		**N / A**	
	Length (mm) ±3	***257***	**242**		**N / A**	
	Wire diameter (mm) ±.05	***7.49***	**8.25**		**10.6 mm**	
	Opening angle ±7°	***N / A***	**N / A**		**80°**	
	Color code stripes	***BK / RD***	**RD / GR**		**RD**	
	Notes-color	***1,4-GN***	**1,4-BK**		**2,3**	
TOURING SLE	P / N (type)	**4149560 00-(R)**	**4149440 00-(s)**		**414 9436 00** LH 414943500 RH	1414944300 LH 414944200 RH
	Spring Rate (lbs / in) ±10	125	115		N / A	N / A
	Lenath (mm) ±3	**257**	**265**		**N / A**	**N** 1A
	Wire diameter (mm) **+.05**	**7.49**	**7.49**		**10.6**	11.1
	Opening angle ±7°	**N / A**	**N / A**		**90°**	**90°**
	Color code stripes	**BL / RD**	**OR/ WH**		**WH**	**GN**
	Notes-color	**4-BK**	**4-BK**		**2,3**	
TOURING LE	P / N (type)	**4149560 00-(R)**	**4149440 00-(s)**		**414943600 LH** **414943500 RH**	**414944300** LH **414944200** RH
	Spring Rate (lbs / in) i-10	125	115		N/A	N / A
	Length (mm) ±3	257	265		**N / A**	**N** / A
	Wire diameter (mm) **+.05**	**7.49**	**7.49**		**10.6**	11.1
	Opening angle ***7°**	**N / A**	**N / A**		**90°**	**90°**
	Color code stripes	**BL / RD**	**OR / WH**		**WH**	GR
	Notes-color	**4-BK**	**4-BK**		**2,3**	
TOURING ELT	P / N (type)	**4149560 00-(R)**	**4149440 00-(s)**		**414943600 LH** **414943500 RH**	**414944300** LH **414944200** RH
	Spring Rate (lbs / in) ±10	**125**	**115**		**N / A**	N / A
	Length (mm) ±3	**257**	**265**		**N / A**	**N** 1A
	Wire diameter (mm) ±.05	**7.49**	**7.49**		**10.6**	11.1
	Opening angle ±7°	**N / A**	**N / A**		**90°**	**90°**
	Color code stripes	**BL / RD**	**OR / WH**		**WH**	GN
	Notes-color	**4-BK**	**4-BK**		**2,3**	

SPRING COLOR CODES							
BK-BLACK	BL-BLUE	GN-GREEN	OR-ORANGE	RD-RED	WH-WHITE	YL-YELLOW	PI-PINK

Notes and spring types are explained on the last page.

MODELS			FRONT SUSPENSION SPRINGS	REAR SUSPENSION SPRINGS CENTER	REAR SOFT	REAR STANDARD	REAR HARD
TOURING E		P / N (type)	**4149560 00-(R)**	**4149744 00-(R)**		**414866300 LH** **414866200 RH**	414944300 LH **414944200** RH
	K	Spring Rate (lbs / in) ±10	125	**90**		**N / A**	**N / A**
	L	Length (mm) ±3	**257**	**265**		**N / A**	**N / A**
		Wire diameter (mm) *.05	7.49	**7.14**		**10.3**	**11.1**
	°	Opening angle ±7°	**N / A**	**N / A**		**85°**	**90°**
		Color code stripes	**BL / RD**	**GN / OR**		**YL**	**GN**
		Notes-color	**4-BK**	**4-BK**		2,3	
SKANDIC 500		P / N (type)	**4149558 00-(R)**	4149440 **00-(s)**		**414943600 LH** **414943500RH**	**414944300** LH **414944200** RH
	K	Spring Rate (lbs / in) ±10	**100**	115		**N / A**	**N / A**
	L	Length (mm) ±3	**239**	**265**		**N / A**	**N / A**
		Wire diameter (mm) ±.05	**7.14**	**7.49**		**10.6**	**11.1**
	°	Opening angle ±7°	**N / A**	**N / A**		**90°**	**90°**
		Color code stripes	**RD / GN / GN**	**OR/ WH**		**WH**	GR
		Notes-color	**4-BK**	**4-BK**		2,3	
SKANDIC 380		P / N (type)	**4149558 00-(R)**	**4149440 00-(s)**		**414943600 LH** 414943500 RH	**414944300** LH 414944200 RH
	K	Spring Rate (lbs / in) ±10	**100**	**115**		**N / A**	**N / A**
	L	Length (mm) ±3	239	265		**N/A**	**N / A**
		Wire diameter (mm) ±.05	**7.14**	**7.49**		**10.6**	**11.1**
	°	Opening angle ±7°	N / A	N / A		**90°**	**90°**
		Color code stripes	RD / GN / GN	OR/ WH		WH	GR
		Notes-color	**4-BK**	**4-BK**		2,3	
TUNDRA II LT		P / N (type)	**4148030 00-(R)**	**414880500 LH** **414880400 RH**		**414880300 LH** **414 8802 00 RH**	
	K	Spring Rate (lbs / in) ±10	65	N / A		N / A	
	L	Length (mm) ±3	408	N / A		N / A	
		Wire diameter (mm) ±.05	6.17				
	°	Opening angle ±7°	N / A				
		Color code stripes	BL / OR	BK		BK	
		Notes-color	**4-BK**	2,3		2,3	

SPRING COLOR CODES							
BK-BLACK	BL-BLUE	GN-GREEN	OR-ORANGE	RD-RED	WH-WHITE	YL-YELLOW	PI-PINK

Notes and spring types are explained on the last page.

MODEL		FRONT	CENTER SOFT	CENTER STANDARD		REAR STANDARD
SKANDIC WIDE TRACK	P I N **(type)**	M548756	M538797 M538798	**M529895** **M529896**		**M538805** **M538806**
K	Spring **Rate** (lbs / in) ±10		**N** / A	N/A		N / A
L	Length (mm) ±3	**410mm**	**N 1A**	N/A		N / A
	Wire **diameter (mm)** ±.05	**7.0 mm**	**9.0 mm**	**10.0 mm**		**10.5**
°	**Opening angle *7°**	N / A	1 00°	**100°**		90°
	Color code stripes					
	Notes-color					**2**

NOTES:

1 7- Position cam on the shocks to adjust spring pre-load.
2 4- Position cams on the rear arm to adjust spring pre-load.
3 Color codes are paint stripes on 3 coils of the spring.
4 Color codes are paint stripes on 4 coils of the spring.
5 Threaded adjustable collars on shock.

Types of Compression Springs

T Barrel shaped on both ends (1 to 1-1 / 2 coils).
S Barrel shaped on 1 end (1 to 1-1 / 2 coils) and straight on the other end.
R Straight shape on both ends.

Types of Torsion Springs

RH Right Hand.
LH Left Hand.

Italics indicate a new (comparing 1995 to 1996) spring rate on a same type of suspension.
Gray shading indicates a new suspension for 1996 as compared to the 1995 model.
N / A Not Applicable

OPTIONAL SUSPENSION SPRING

P / N	COLORS	SPRING RATE	FREE LENGTH	TYPE
414559100	BLUE / BLUE	45.5 (260)	241.3 (9.50)	S2
414675700	YELLOW/ ORANGE	29.8 (170)	254.0 (10.00)	S2
414677100	BLACK / WHITE	28.9(165)	302.0 (1 1.87)	S4
414743300	GREEN / RED/ GREEN	30.6 (175)	301.0 (1 1.86)	S4
414769900	RED / RED	30.6 (175)	241.5 (9.50)	S2
414771300	BLACK / BLACK	23.6 (135)	272.5 (10.70)	RI
414771700	GREEN / RED	46.3 (265)	227.0 (8.90)	S2
414782300	BLACK	39.5 (225)	165.0 (6.50)	RI
414788200	BLACK / YELLOW	26.3 (150)	272.0 (10.70)	RI
414789400	BLACK / BLACK	23.7 (135)	272.0 (10.70)	RI
414797700	BLACK / BLACK	23.7 (135)	272.0 (10.70)	RI
414797800	BLACK/ BLACK	23.7 (135)	272.0 (10.70)	RI
414797900	BLACK / BLACK	23.7 (135)	272.0 (10.70)	RI
414809100	GOLD	21.9 (125)	274.0 (10.80)	T2
414809300	WHITE	28.0 (160)	213.0 (8.40)	RI
414809500	BLACK	26.3 (150)	257.0 (10.10)	R2
414810100	WHITE	21.9 (125)	257.0 (10.10)	R2
414811800	BLACK / BLACK	23.4 (135)	259.0 (10.20)	T3
414815500	BLACK / WHITE	23.7 (135)	259.0 (10.20)	T3
414824800	GREEN /YELLOW	42.0(240)	227.0 (8.90)	S4
414824900	GREEN / WHITE	36.8 (210)	227.0 (8.90)	S4
414841300	BLACK / WHITE	23.8 (136)	259.0 (10.2)	T
414852800	RED	17.5(100)	279.0 (1 1.0)	T
414859300	BLACK / WHITE	15.8 (90)	239.0 (9.40)	R
414869000	WHITE	21.9 (125)	257.0 (10.10)	R
414871300	GOLD	21.9 (125)	274.0 (10.80)	T
414871500	GOLD	21.9 (125)	274.0 (10.80)	T
414871600	WHITE	26.3 (150)	257.0 (10.10)	R
414877800	WHITE / WHITE	28.0 (160)	223.0 (8.80)	R
414891000	WHITE / BLACK	17.5 (loo)	260.0 (10.20)	R
503080300	WHITE / WHITE	49.0 (279)	216.0 (8.50)	S2
503080400	GREEN / GREEN	35.0 (200)	241.3 (9.50)	S2
503090200	YELLOW / YELLOW	28.0 (160)	247.6 (9.75)	S2
503124300	YELLOW/ GREEN	33.3 (190)	294.0 (1 1.58)	S4
503127100	WHITE / GREEN	28.0 (160)	281.2 (1 1.07)	S4
503127400	YELLOW / RED	17.5 (loo)	254.0 (10.00)	S4
503130500	GREEN / WHITE/ GREEN	43.8 (250)	294.0 (1 1.57)	S4

OPTIONAL SUSPENSION SPRING

P/N	COLORS	SPRING RATE	FREE LENGTH	TYPE
414536200	BROWN / RED	49.0 (280)	188.0 (7.40)	SI
414558100	BROWN / PINK	21.0 (120)	216.0 (8.50)	SI
414703400	YELLOW/ WHITE	24.5 (140)	311.2 (12.25)	S4
414708000	GOLD /YELLOW	32.4 (185)	248.0 (8.76)	S3
414754900	SILVER / BLUE	26.2 (150)	288.0 (1 1.30)	S4
414761600	RED / WHITE	30.6 (175)	300.0 (1 1.80)	TI
414761900	SILVER / YELLOW	29.8 (170)	291.8 (1 1.50)	S4
414762000	SILVER / RED	53.3 (304)	198.0 (7.80)	S4
414768300	RED / ORANGE	43.8 (250)	300.0 (1 1.80)	TI
414769900	RED / RED	30.6 (175)	241.0 (9.50)	S4
414771700	GREEN / RED	46.4 (265)	227.0 (8.90)	S4
414782200	GREEN / BLACK	17.6 (100)	215.0 (8.46)	S5
414782300	BLACK	39.5 (225)	165.0 (6.50)	RI
414808800	BLACK / ORANGE	21.0 (120)	272.0 (10.70)	RI
414893800	GREEN / GREEN	32.4 (185)	213.0 (8.40)	R
414894100	BLACK / GREEN	19.6 (1 12)	279.0 (1 1.0)	T
503090400	ORANGE / ORANGE	24.5 (140)	241.3 (9.50)	S3
503135400	RED / ORANGE	43.8 (250)	300.0 (1 1.80)	TI
486066300	4 GREEN	21.9 (125)	203.0 (8)	R2
486066400	4 RED	26.3 (150)	203.0 (8)	R2
486066500	4 BLUE	12.2 (70)	152.0 (6)	R
486066600	4 PINK	31.5 (180)	190.0 (7.5)	R

O **NOTE :** Type key.

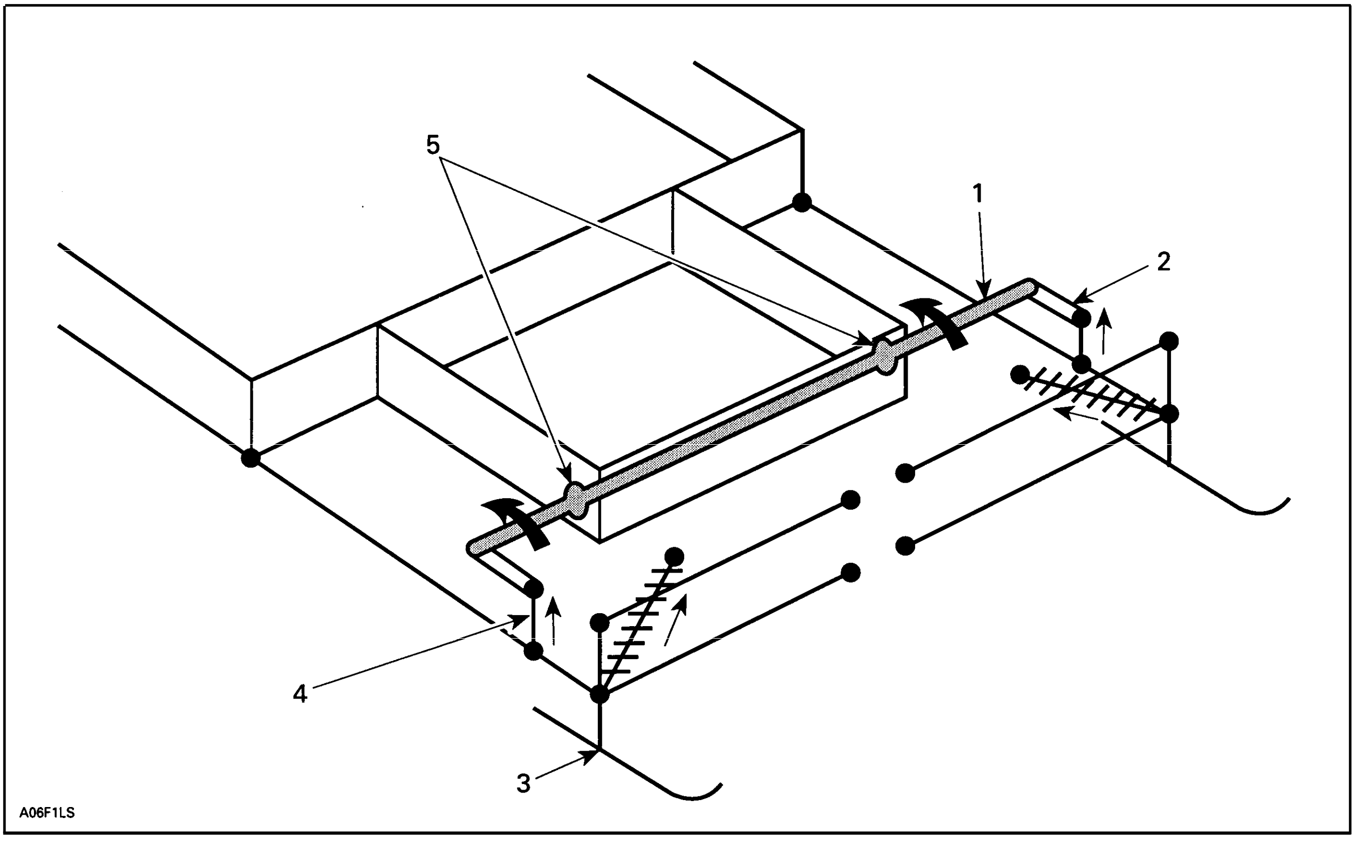
R = STRAIGHT INSIDE DIAMETER OF 48.25 mm (l.9")
RI = STRAIGHT INSIDE DIAMETER OF 48.25 mm (l.9")
R2 = STRAIGHT INSIDE DIAMETER OF 50 mm (1.97")
s = TOP INSIDE DIAMETER SMALLER THAN BOTTOM
SI = TOP 38.1 mm (1.5"), BOTTOM 44.5 mm (1.75")
S2 = TOP 38.1 mm (1.5"), BOTTOM 47.9 mm (1.88")
S3 = TOP 38.1 mm (1.5"), BOTTOM 46.7 mm (1.83")
S4 = TOP 38.1 mm (1.5"), BOTTOM 48.25 mm (l.9")
T = BOTH ENDS SMALLER THAN ACTIVE COILS
TI = 46.5 mm (1.83") BOTH ENDS
T2 = 46.3 mm (1.82") BOTH ENDS
T3 = 46 mm (1.81") BOTH ENDS
THE BOTTOM END GOES ON ADJUSTING RING SIDE

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.

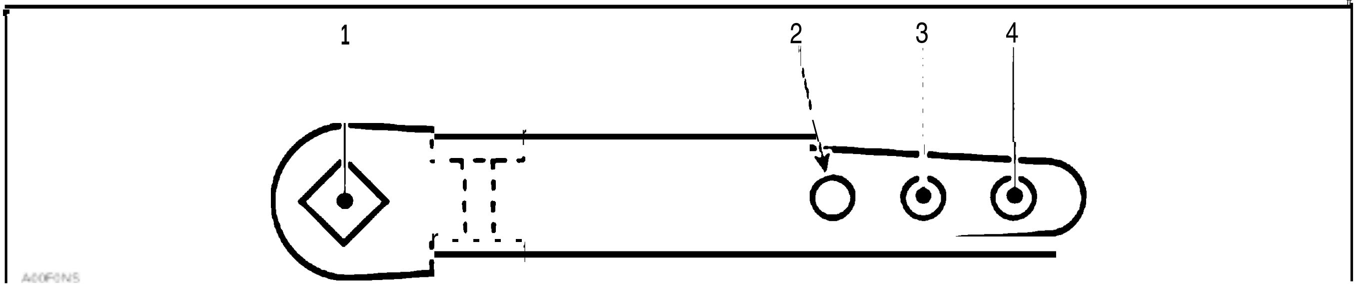
Roll can be reduced by installing stiff springs on the front suspension and/or a lot of preload**, but this will cause a harsher ride than necessary. Lowering the center of gravity will also reduce roll but there are practical limits as to how low the center of gravity can go. Most vehicles are equipped 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.

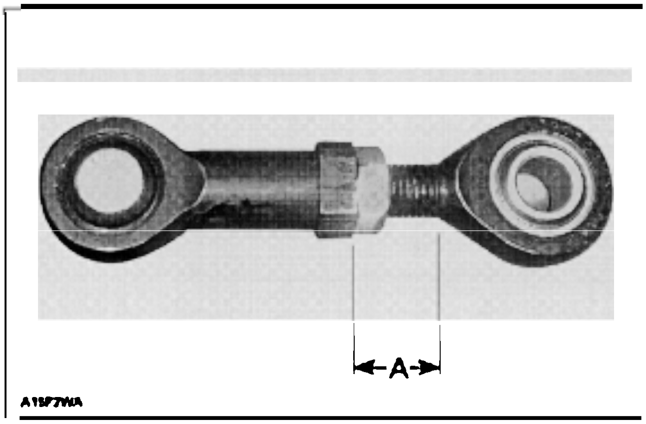
The length of the lever arm also affects the "stiffness" of the sway bar. A shorter lever will 'stiffen" the bar and a longer lever will "soften" the bar. Many lever arms will have 2 holes to mount the connector linkage. The hole closest to the bar will act stiffer (see following illustration).



END LEVER
1. Sway bar
2. Stiffer
3. Softer

When adjusting the sway bar lever arm and /or linkage length, take care of the following.

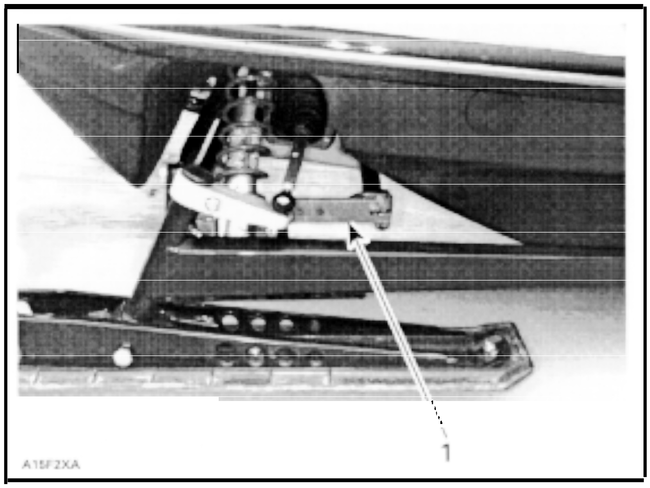
—The minimum threaded length screwed in the **ball** joint should be 1-1/2 times the rod diameter (1.5 D) **as a** general rule **OR** the **maximum** threaded length outside the ball joint must not be more than 16 mm (5/8 in).



A. 16 mm (5/8 in) MAX. outside ball joint

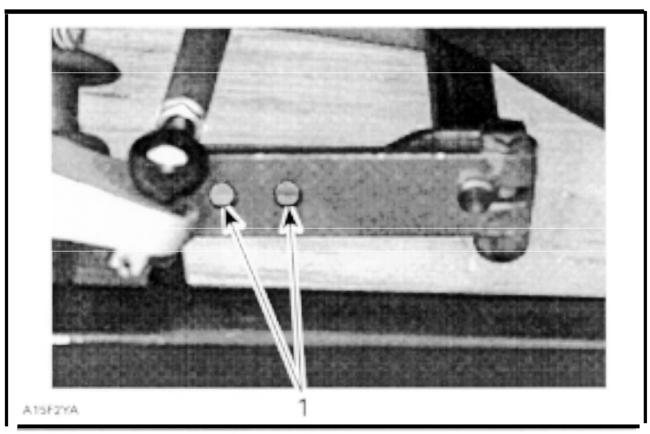
—Besides, when performing the adjustment, ensure to keep the lever arm horizontal when the snowmobile rest on the ground.

◆ WARNING : **If the lever arm is adjusted too** high, **the engaged threaded length of ball** joint will not **be adequate and the sway bar lever arm may rub** against the steering tie **rod.**



1. Horizontal with snowmobile on the ground

—Ensure that the ball joint is attached in end hole of the lever arm. **Never use** the other **holes.**



1. Never use these holes

—Ensure to perform the same adjustment on lever arms / linkage length each side of the snowmobile.

There are currently 5 sway bars used on the DSA (F2000 & S2000) chassis :

1 * 11/16" inch diameter bar with integral, non-adjustable end levers.

Used on most F2000 & S2000 chassis.

(While this bar is a rather large diameter, it "acts" soft because the end levers are quite long and the bar is also not mounted as rigidly. This sway bar acts similar to the 1/2 inch diameter adjustable bar with the connector linkages mounted in the softest holes).

2* 1994 MX-Z

1/2 inch diameter bar (hex. ends)	(1) (p/ N 5061123 00)
1/2 inch end levers (aluminum with hex. hole)	(2) (P/ N 5061187 00)
1/2 inch I.D. plastic bushings	(2) (p/ N 4148785 00)
1/2 inch circlips	(2) (p/ N 3719016 00)
Screw-Hex. M8 x 30	(2) (p/ N 2220850 65)
Flanged Lock Nut M8	(2) (p/ N 2287810 45)

3* 1994 Formula Z

5/8 inch diameter bar (splined ends)	(1) (p/ N 5061195 00)
5/8 inch end levers (steel with splined hole)	(2) (p/ N 5061206 00)
5/8 inch I.D. plastic bushings	(2) (p/ N 4148810 00)
Screw-Hex. M8 x 50	(2) (p/ N 2220850 65)
Lock Nut M8	(2) (p/ N 2285810 45)
Flat Washer M8	(4) (p/ N 2240812 01)

4* 1995 Formula Z, Mach 1, Mach Z, MX-Z

1/2 inch diameter bar (splined ends)	(1) (p/ N 5061238 00)
1/2 inch end levers (steel with splined hole)	(2) (p/ N 5061239 00)

NOTE : To use the 1/2 and 5/8 inch bars on vehicles that come with the non-adjustable bar you must also use the following pieces:

L.H. Swing arm-black (chrome moly, heavy duty, 94 MX-Z)	(1) (p/ N 5061207 00)
R.H. Swing arm-black (chrome moly, heavy duty, 94 MX-Z)	(1) (p/ N 5061208 00)
Tube Support Housing	(2) (p/ N 5061185 00)
Set Screw	(4) (p/ N 4144408 00)
Rivet	(4) (p/ N 3904023 00)
Washer (for rivet)	(4) (p/ N 5172259 00)
Tube	(1) (p/ N 5061186 00)
Ball Joint	(2) (p/ N 4147784 00)
Ball Joint	(2) (p/ N 4145340 00)
Hex. Nut M10	(2) (p/ N 7326100 10)
Hex. Lock Nut M10	(4) (p/ N 7326100 42)

5* 3/4 inch diameter bar kit (1) (p/ N 5806045 00)

O NOTE : This kit is designed as a replacement for the 11/16 inch diameter, non-adjustable sway bar. The instructions for installation of this kit are on the following page. To fit vehicles that come with the 1/2 or 5/8 inch bar, slight modifications to the tube and end levers will be required. This 3/4 inch bar is slightly shorter than the 1/2 or 5/8 inch bars. This requires shortening the tube an appropriate amount and bending the end lever arms outward to keep the connecting linkages vertical.

The 5/8 inch bar is a good choice for aggressive trail riding and cross country racers that like more "bite" in the front end. The 1/2 inch bar will have a slightly softer ride but it will allow much more roll. The 3/4 inch bar should be used only on smooth surfaces like oval or ice lemans type racing or groomed trails.

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

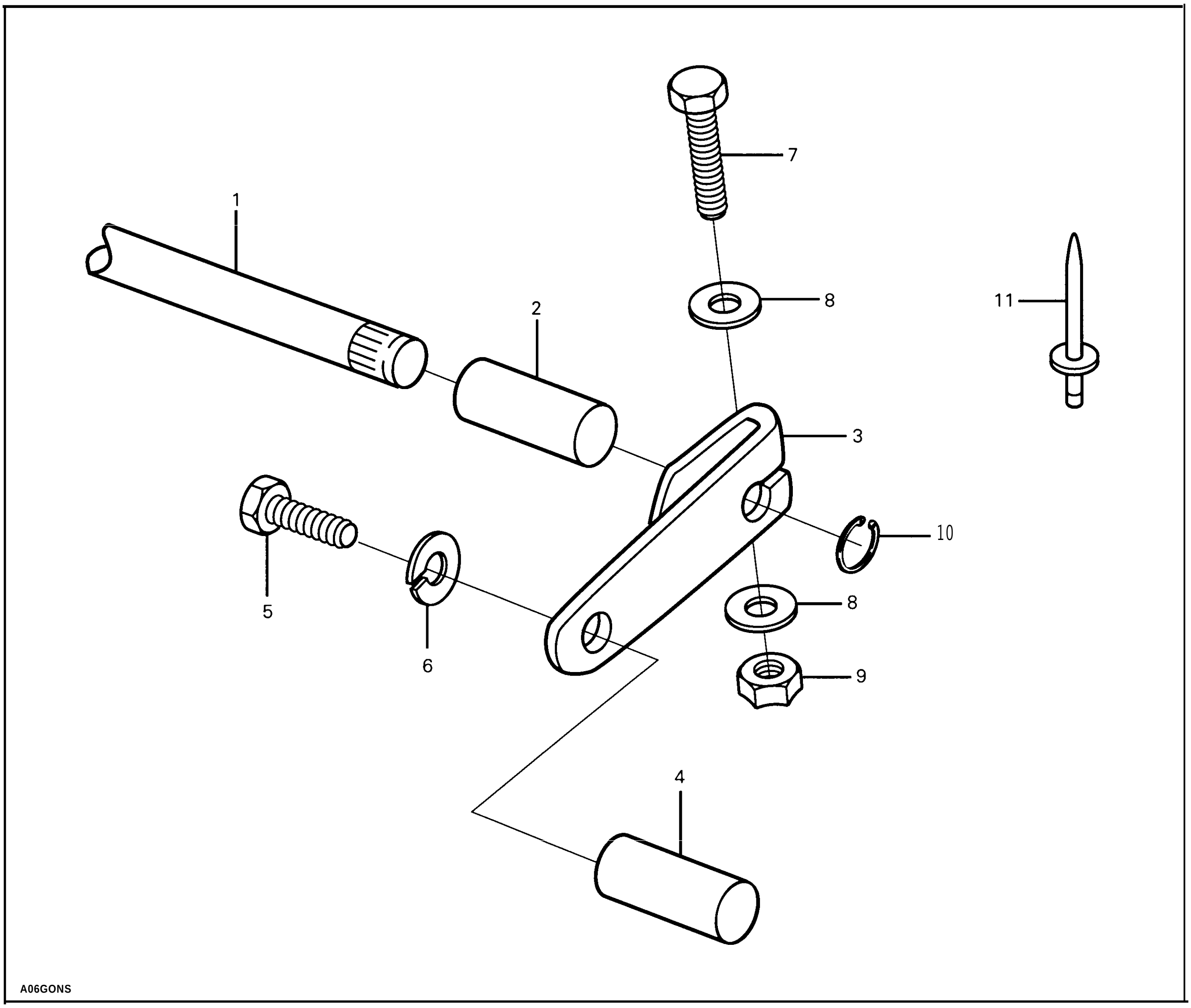
Another little known fact that has a large affect on roll is the limiter strap length. As mentioned earlier, if the limiter is lengthened, the front suspension will extend during acceleration, which reduces ski pressure. If this vehicle was in a corner when power was applied, it would have quite a bit of chassis roll and the inside ski will start to lift off of the ground. Shortening the limiter in this case will have a very large affect on controlling roll. A general guideline for initially setting limiter length for good ski pressure and reducing roll is to have the front and back of the track touch the ground at the same time when you set the back of the vehicle down. If the front of the track touches much sooner than the rear, there will be quite a lot of weight transfer and chassis roll during hard cornering. If the adjuster nut is all the way tight and you would like more ski pressure, install a shorter limiter strap P / N 486056200.

3/4” STABILIZER BAR KIT (P/ N 5806045 00)

WARNING : For safety reasons, this kit must be installed by an authorized Bombardier snowmobile dealer. Should removal of a locking device be required when undergoing disassembly / assembly, always replace with a new one. This instruction sheet should be given to the purchaser.

NOTE : Installation time is approximately 1.0 hour.

PARTS TO BE INSTALLED



1. 506115100 Stabilizer Bar
2. 506115200 Spacer (2)
3. 506108100 Lever (2)
4. 506115000 Spacer (2)
5. 222003565 Screw MIO x 1.5 x 35 (2)
6. 224701170 Lock Washer (2)
7. 222085065 Screw M8 x 1.25 x 50 (2)
8. 224081201 Flat Washer M8 (4)
9. 228581045 Nut M8 (2)
10. 371900900 Snap Ring (2)
11. 390402300 Rivet (8)

INSTALLATION PROCEDURE

Unfasten rear attachment of swing arms.

Remove existing stabilizer bar by drilling out rivets of plastic bushings on both side.

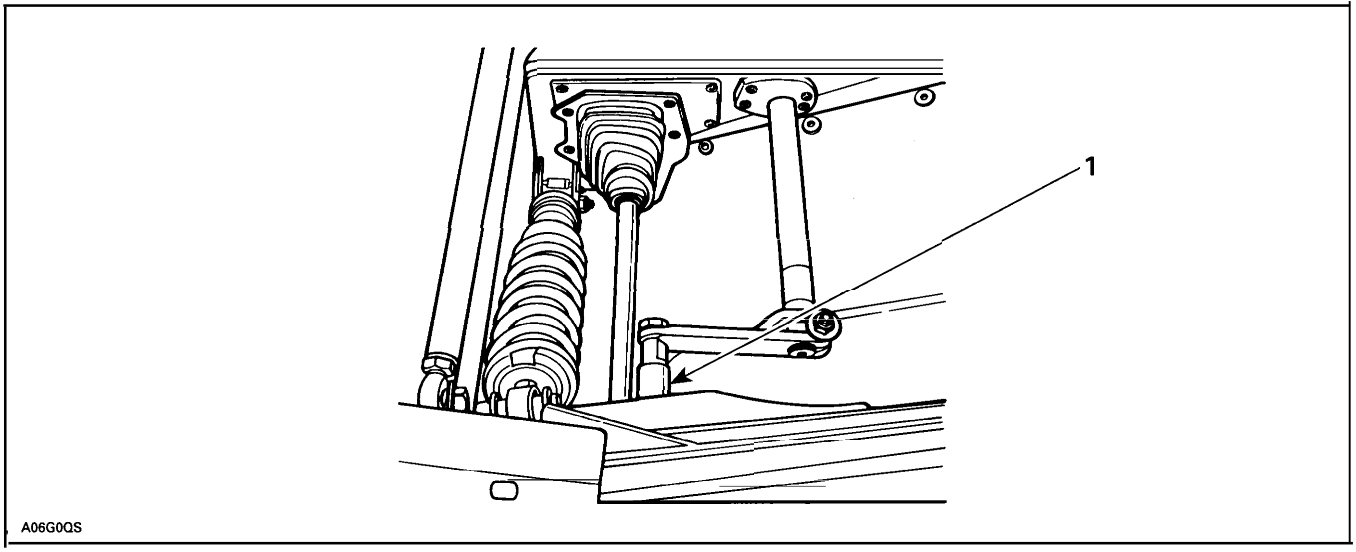
Ream plastic bushings to 19.05 mm (.750 in) inside diameter.

Reinstall plastic bushings with supplied rivets. Install new stabilizer bar, spacers and levers.

NOTE : Position of levers depends on snowmobile use.

Apply grease to both spacers linking swing arms.

Install snap rings.



SEEN FROM UNDERNEATH
1. Grease

Fasten rear attachment of swing arms.

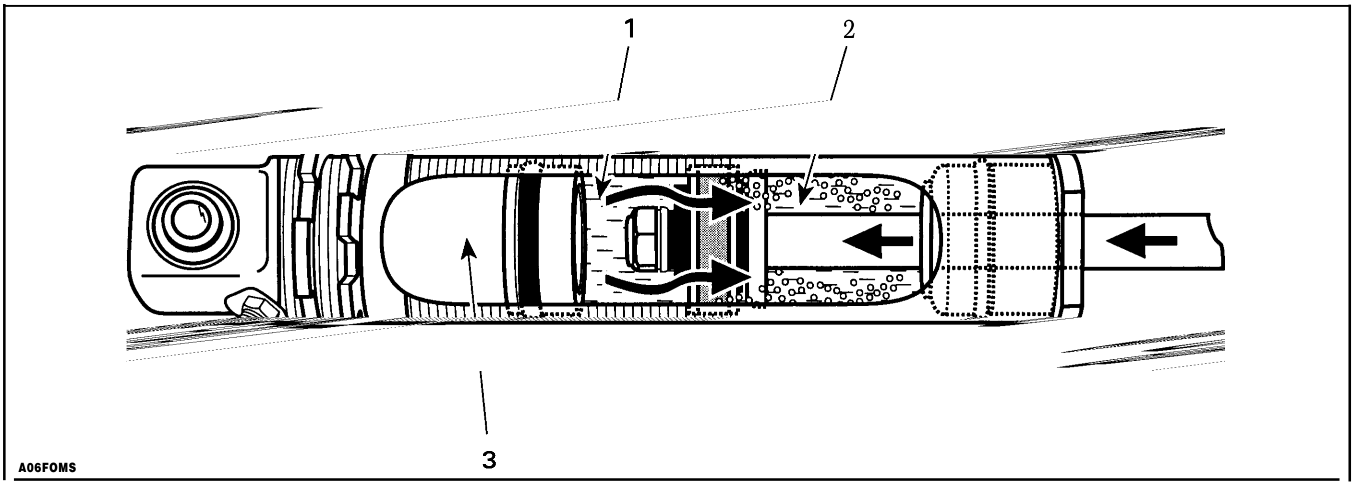
SHOCK ABSORBER

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.

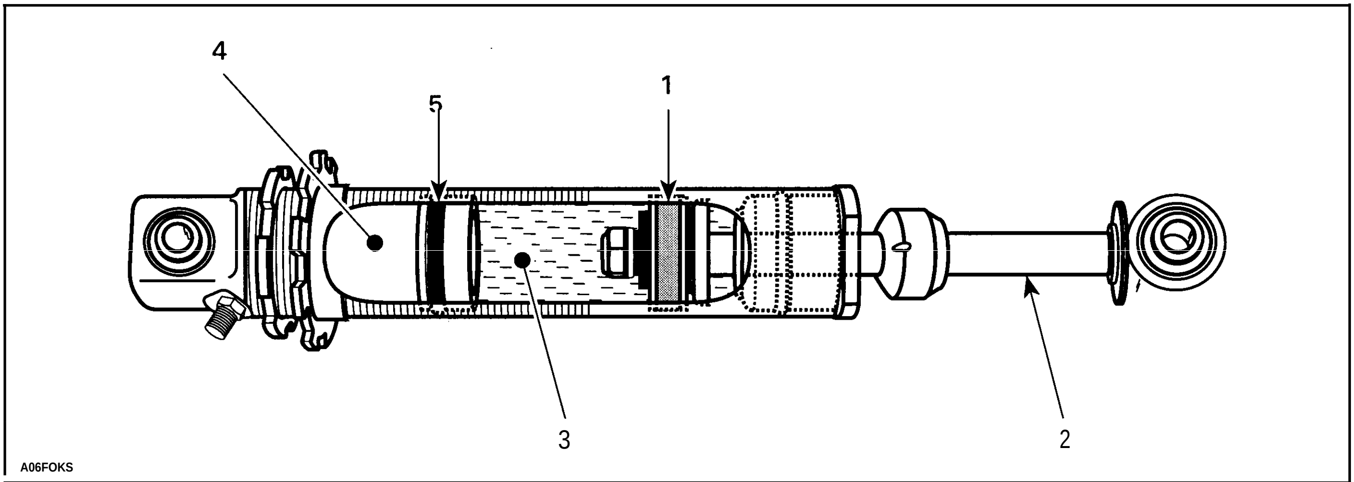
As dampers of the air/ oil type are cycled rapidly, a low pressure will be generated on the oil exit side of the valved piston. If the pressure drops too much, a vaporization or aeration of the oil can occur. If this oil aeration is allowed to continue, a loss in damping performance will result. This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

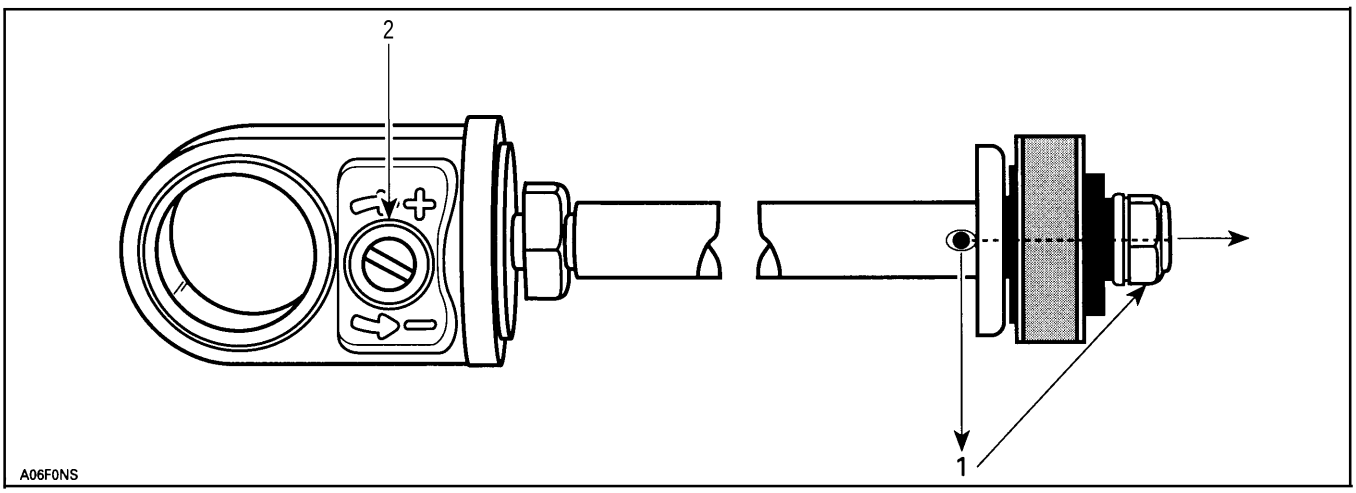


1. Valved piston
2. Damper shaft
3. Oil volume
4. Highpressure gaschamber(300PSI N_2)
5. Floating piston

HPG, MVA (Multi-Valve Adjustable)

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

Although this damper is not rebuildable, the feature of offering trail-side adjustability and the benefits of a gas-filled shock will be recognized at first use. It is possible to upgrade C7 rear HPG T/A shocks with the optional MVA shaft-order P / N 4860671 00 Qty (2) required. Note : you must change shock spring stoppers to P / N 414762500 Qty (2).



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

HPG, Emulsion Gas Shock

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

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

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

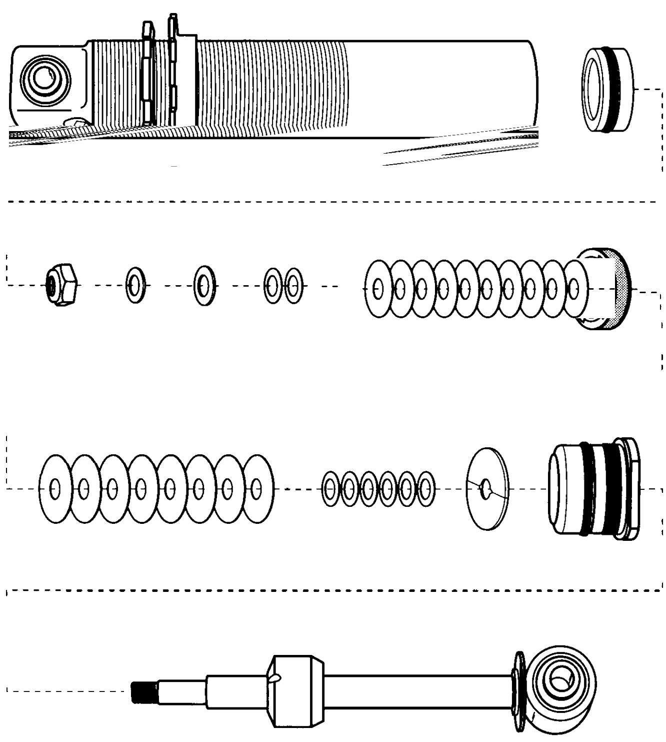
HPG, Gas Shock

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

HPG, T / A (Take Apart) Gas Shock

This damper is completely rebuildable and all versions use an internal floating piston (IFP). It offers the options of replacing valves or revalving 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.



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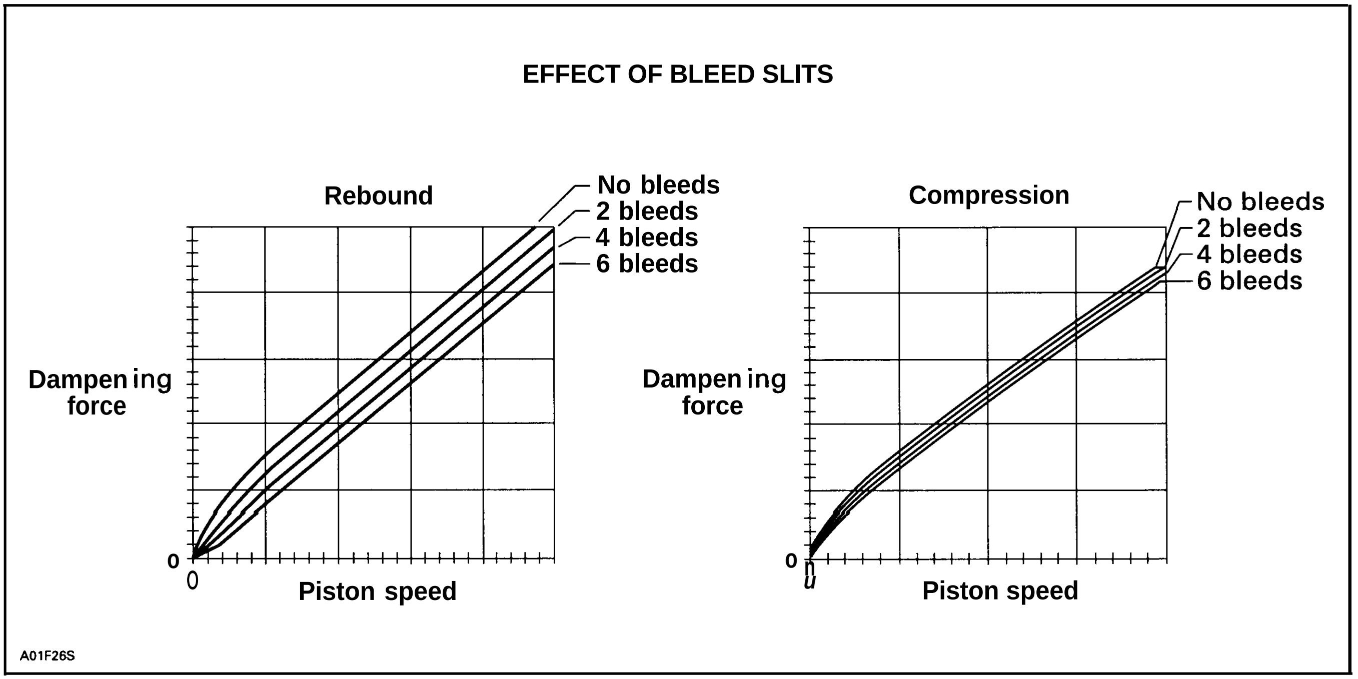
Valving and Dampening

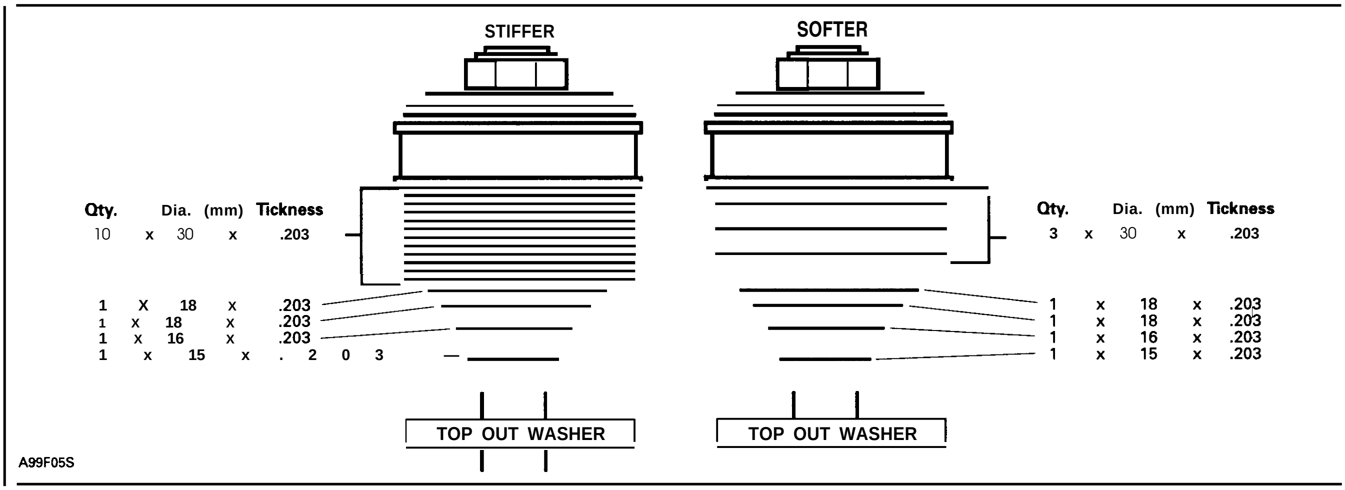
In the HPG shock, the piston passages are covered by a stack of thin metal shims of various thicknesses and diameters. The shims provide dampening by acting as spring loaded valves offering resistance to the oil traveling through the piston. There is a stack of shims on both sides of the piston. One 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 x .203 mm shims. This will result in firmer dampening at both low and high piston speeds. Thicker shims will also result in firmer dampening but it is better to use more thin shims than fewer thick shims. More thin shims will provide better, smoother dampening than a few thick shims. There is an equivalency between thick and thin shims, though. The following chart indicates how many thin shims are required to equal the stiffness of one thick shim.

(mm)

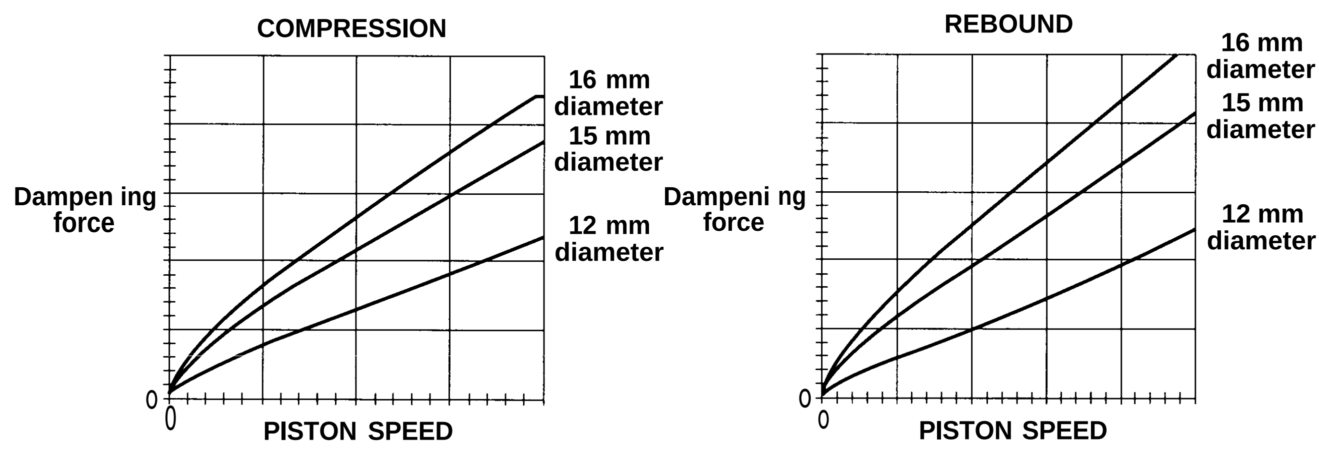
1 x .152 = 2.4X .114
1 x .203 = 2.3 x .152
1 x .254= 2.0X .152

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

(mm)

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

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.



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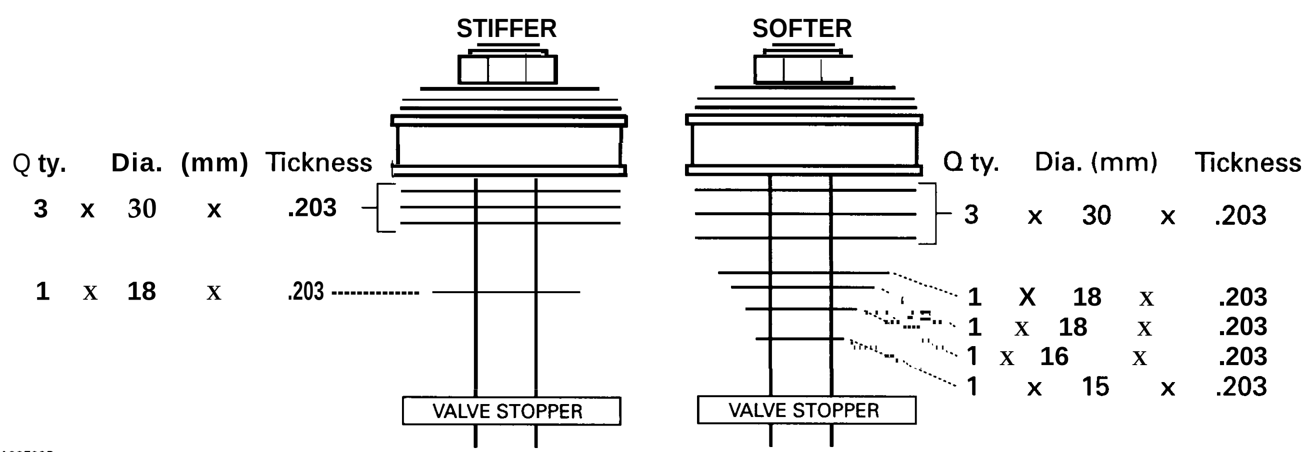
Another method of changing dampening is by controlling the amount of space the stack has to open. This is done by reducing the amount of smaller shims which support the larger shims. The larger shims act the same until they "bottom out" against the valve stopper.



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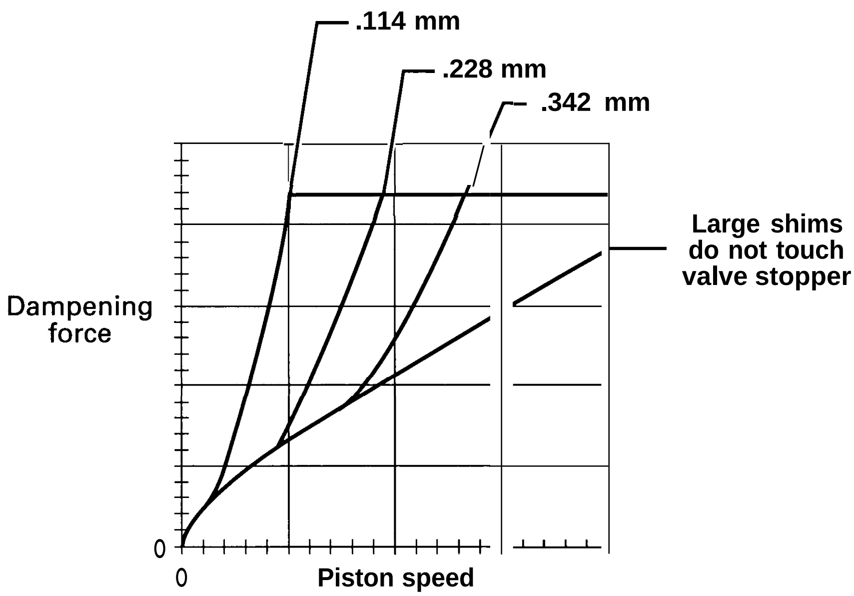
The large shims are only able to deflect .203 mm instead of .610 mm thus reducing the flow area of the piston. This will result in the same low speed dampening, but the medium and high speed damping will be increased. The following graph represents the effect of changing the total thickness of small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



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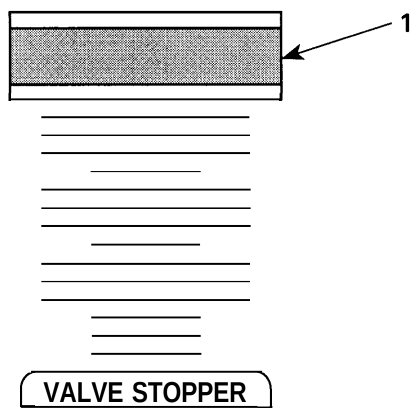
As you can see, low speed dampening remains the same until the shim stack bottoms out against the valve stopper. Then the dampening becomes significantly stiffer. This is sometimes referred to as progressive dampening. Another similar way to achieve this type of dampening is to use multiple stacks of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



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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.

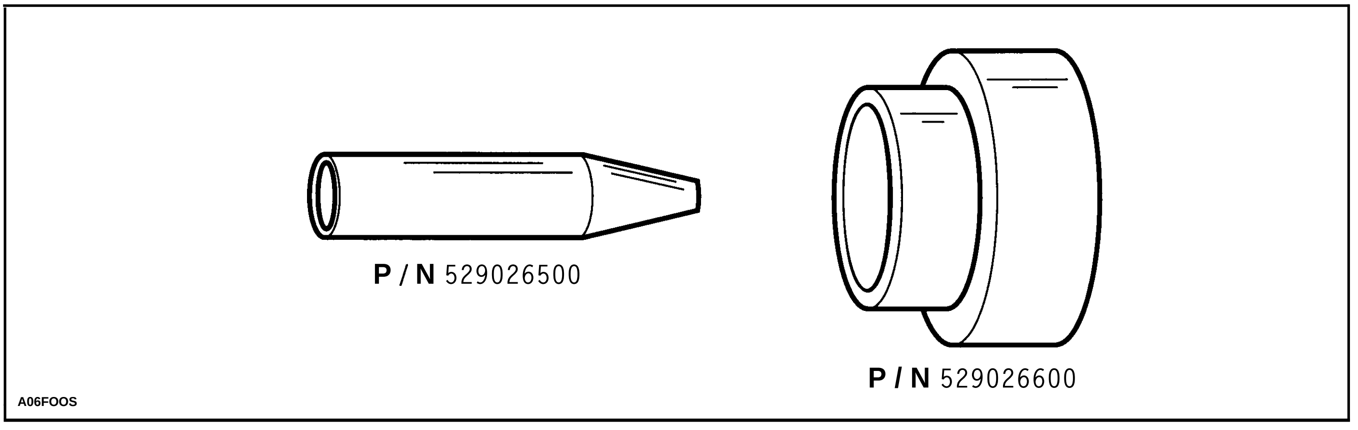
—Underdampening maybe due to an aerated shock due to low gas pressure and/or old, used oil. Change the oil and recharge the gas pressure to 300 PSI before altering the shock valving.

—If the vehicle bounces or "pogos" a lot, the problem may be too little compression dampening NOT too little rebound dampening. Do not use too much rebound dampening! Excessive rebound dampening is a common error. Over-dampening will not allow the suspension to recycle to full extension after an obstacle compresses the suspension. This situation (called "packing") will eventually bottom the suspension and not allow it to cycle properly.

—For faster weight transfer under acceleration and deceleration, use a piston with more bleed slits.

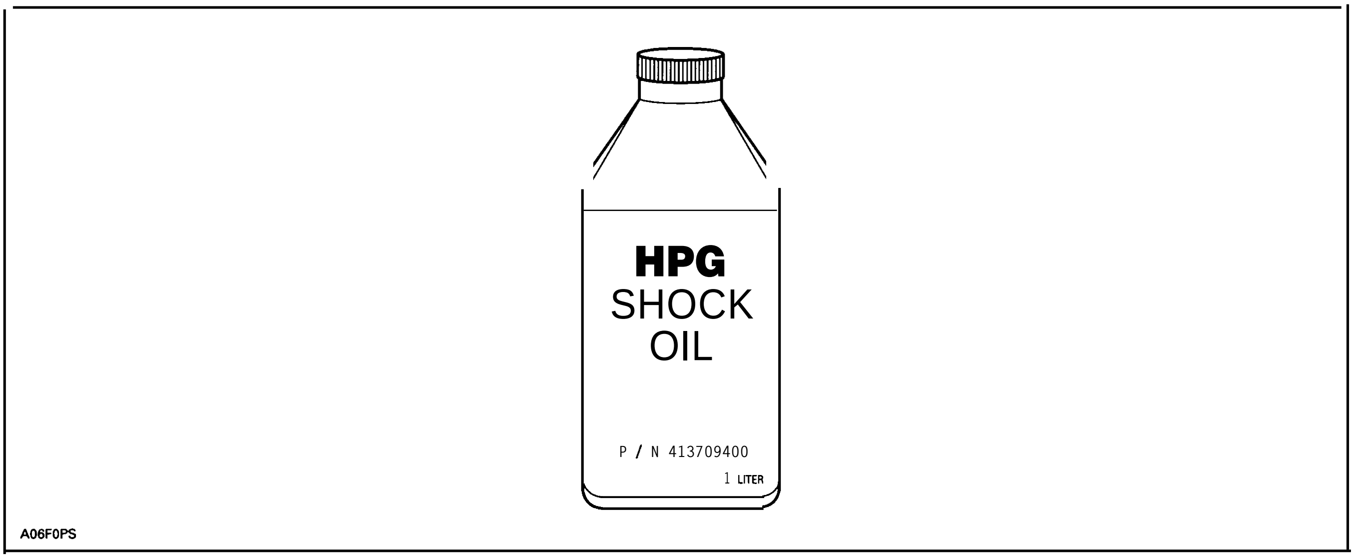
Special Tools

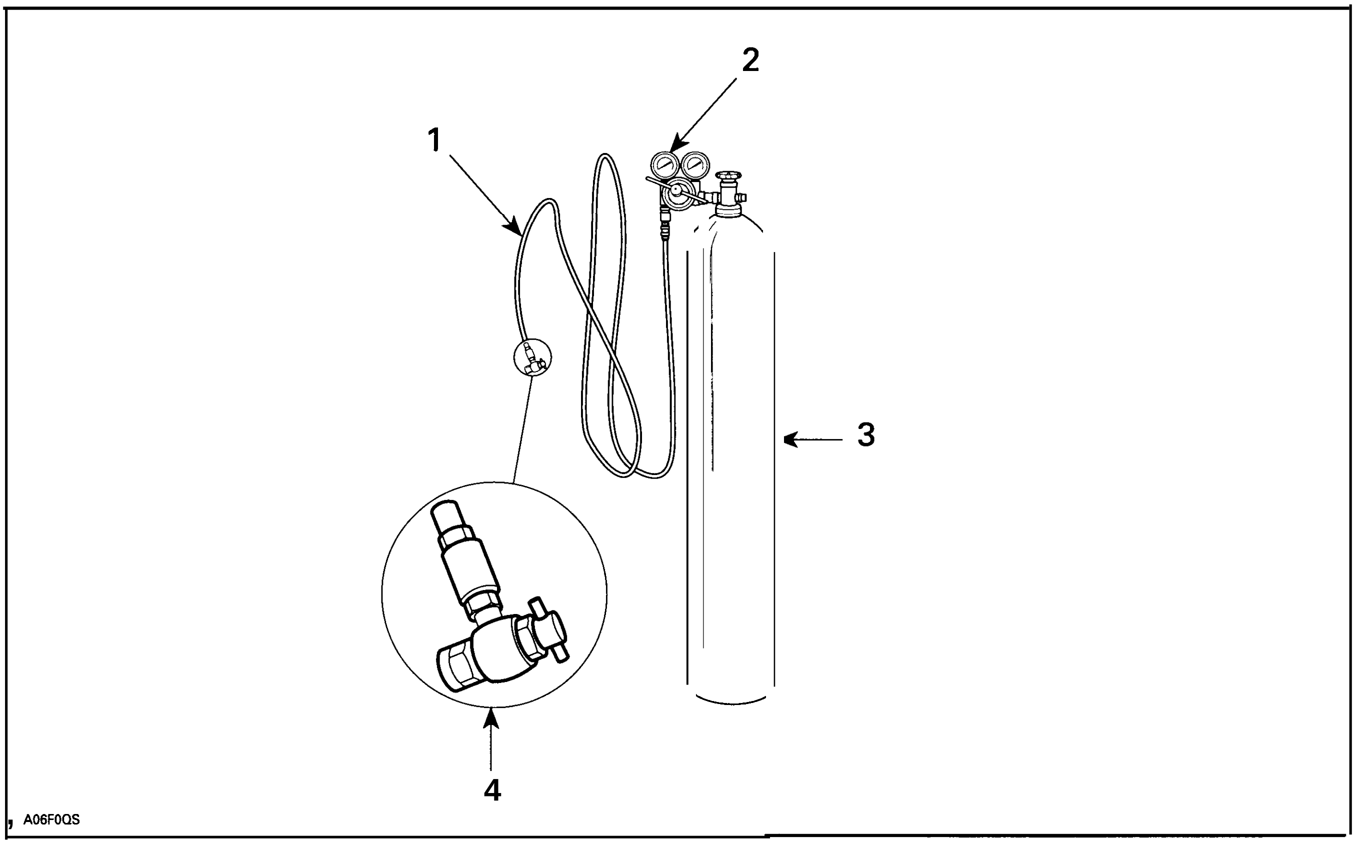
Special tools specific to the HPG T / A shock will be the seal pilot P / N 529026500 and piston guide P / N 529026600 from Bombardier.



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 P / N 413709400 (1 Liter)





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

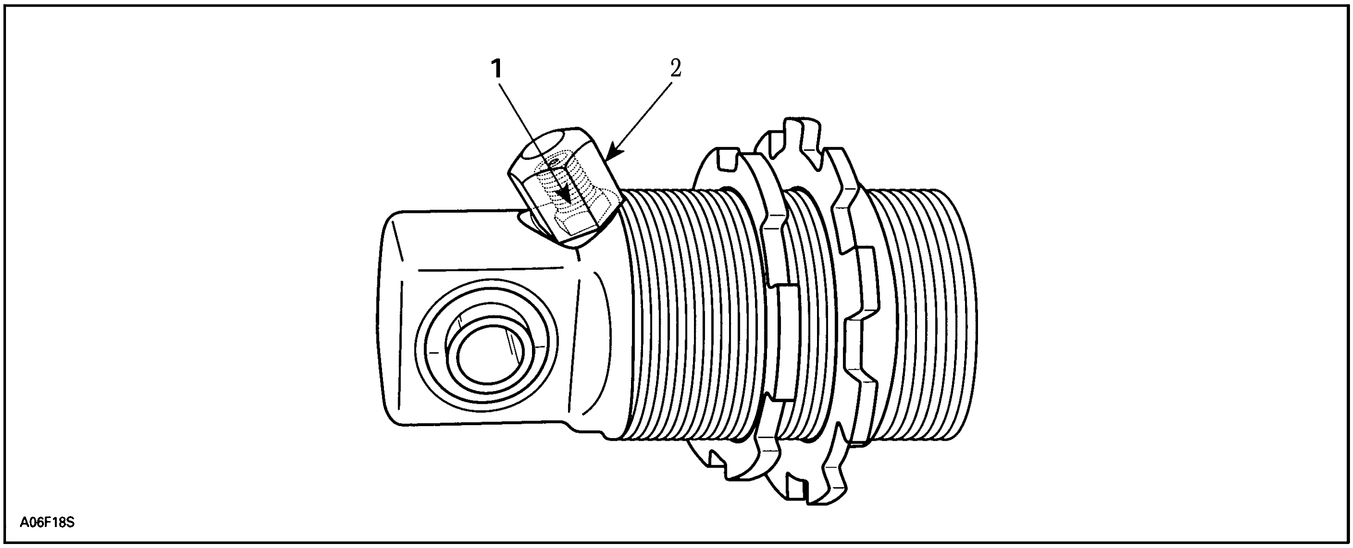
NOTE : Commercially available through compressed gas dealers.

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 1994 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.

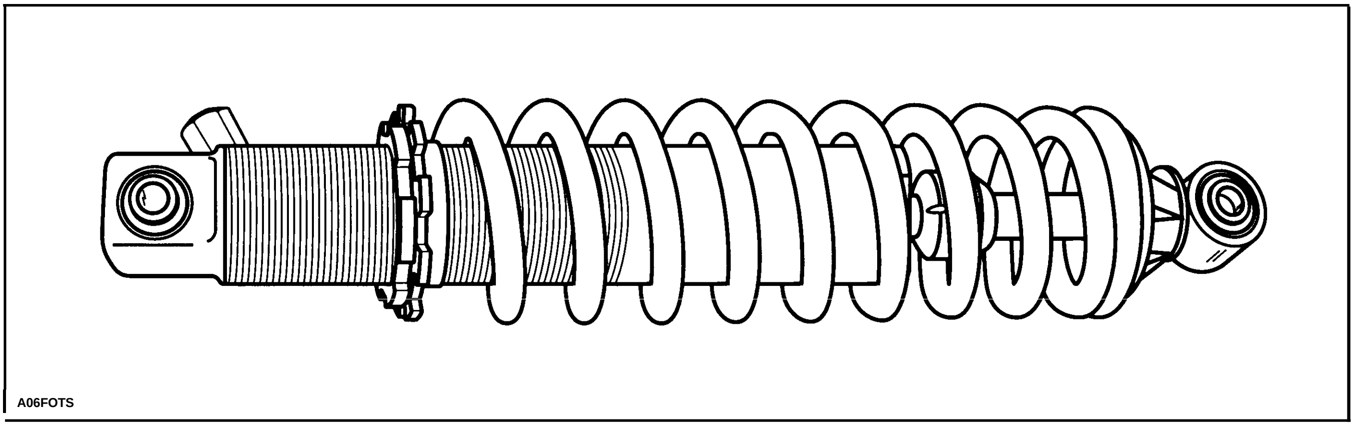
WARNING : **Nitrogen gas is under extreme pressure. Use caution when releasing this gas volume. Protective eye wear should be used.**



1. Schrader valve 1.5-2 N•m (13-17 lbf•*in*)
2. Schrader cap 5-6,5 N•m (44-57 lbf•*in*)

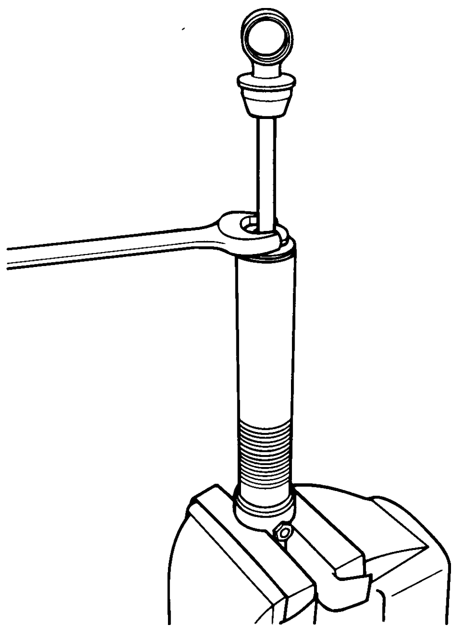
NOTE : Before unscrewing pre-load rings, measure the compressed length of the installed spring and mark position for reinstallation. For factory adjustment refer to the end of this section.

Use tools (P/ N 8617439 00) to remove damper spring by unthreading spring pre-load rings, then removing spring retainer or use the spring removal tool P / N 529027100.



TYPICAL

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



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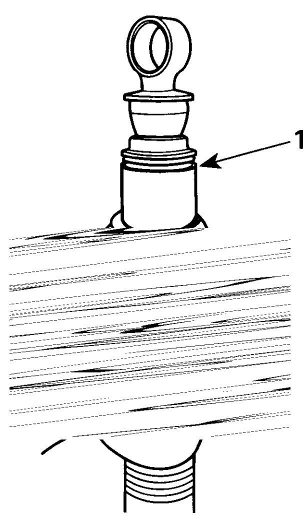
With the seal assembly removed, slowly lift and remove damper rod assembly from the damper body.

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



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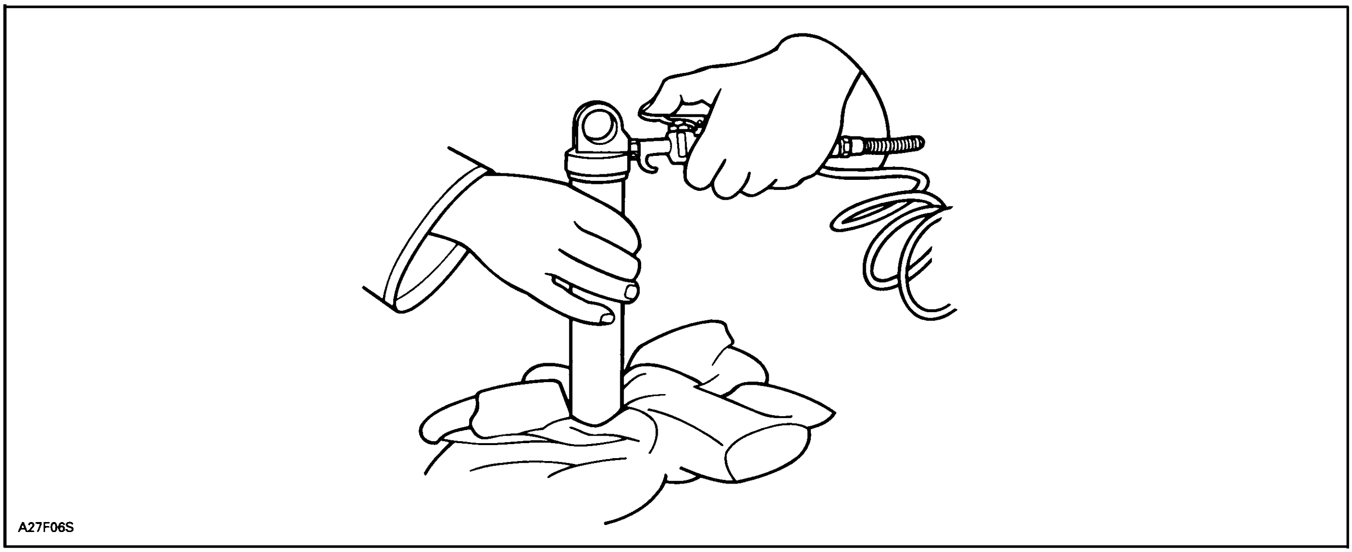
1. Oil flows

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.



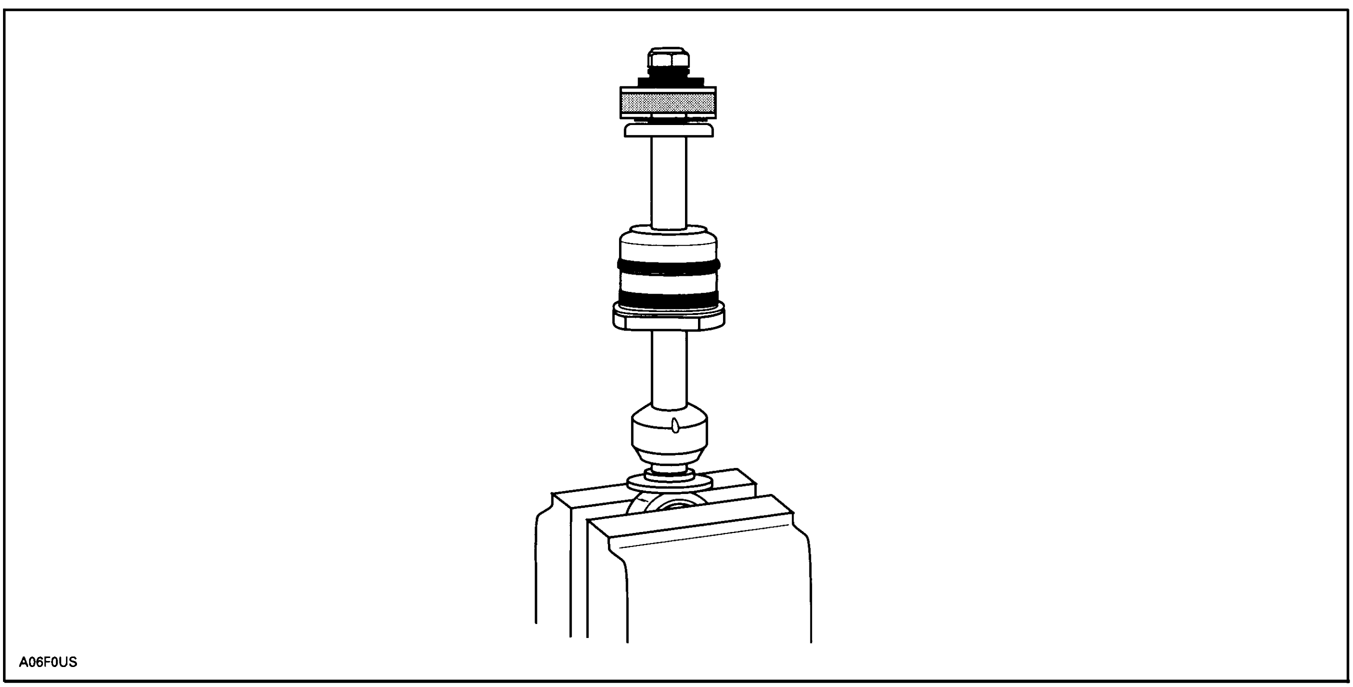
TYPICAL

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

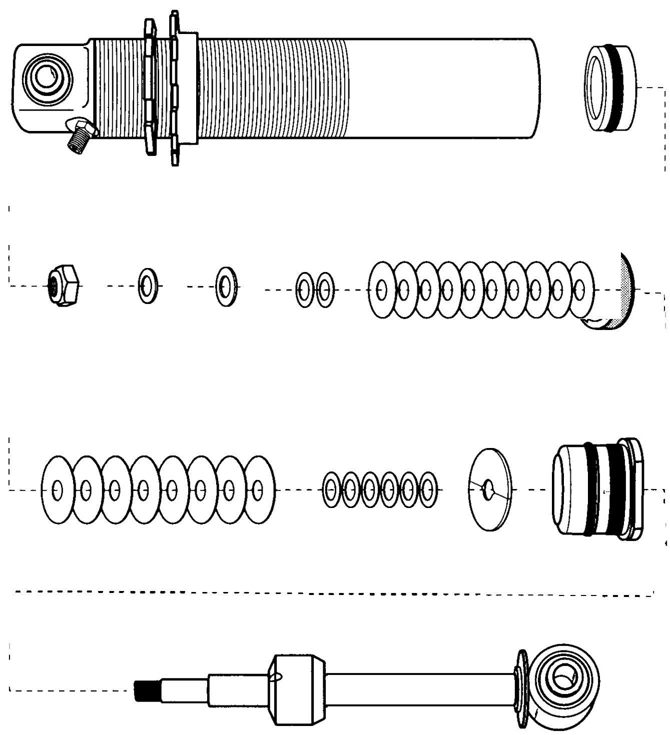
Thoroughly clean, with a typical cleaning solution, and blow dry using low pressure air. Carefully inspect the damper body for any imperfections or signs of wear in the damper bore.

Replace damper body if wear is identified.

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



Always arrange parts removed in the sequence of disassembly.



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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.

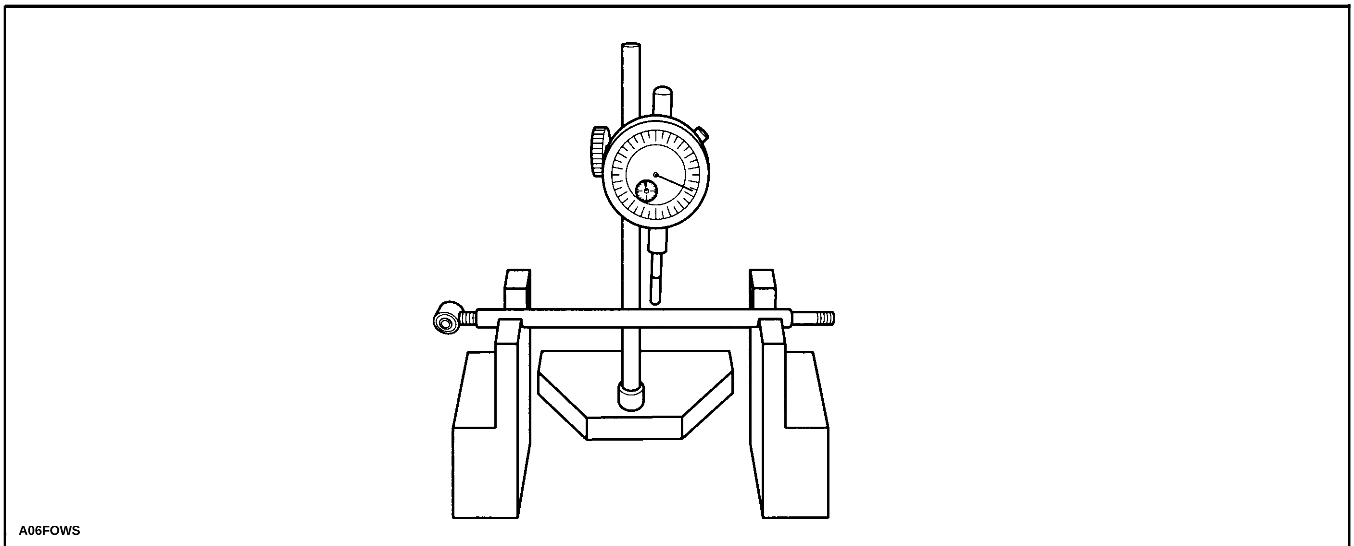
NOTE : If revalving is to be done, it is imperative that you identify the original shim pack (size and number of shims). The seal carrier need not be removed if only revalving is to be done.

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.

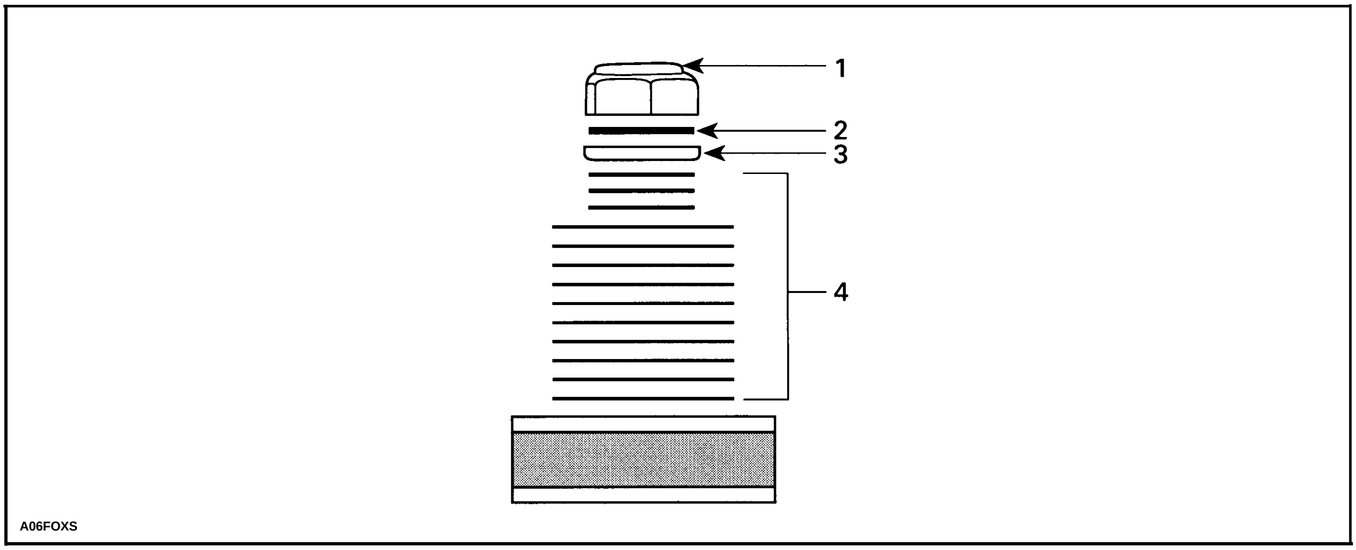
The damper rod is constructed of a plated shaft design. This damper shaft must be inspected for any visible wear on the surface of the damper rod.

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.

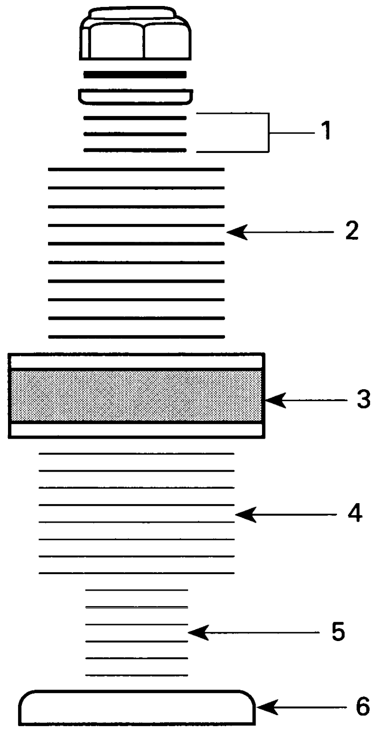


1. **CAUTION: The damper rod nut can only be reused 4 times, then, must be replaced. Do not substitute this part for non - O.E.M. use Loctite 271 on nut each time.**

2. This spacer washer(s) P/N 414888309 must be used as shown to ensure damper rod nut does not bottom out or contact shaft threads.

3. Rebound valve stopper with round edge facing shim stack.

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



Rebound

1. 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 x .203 mm.
2. 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.

o **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.

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

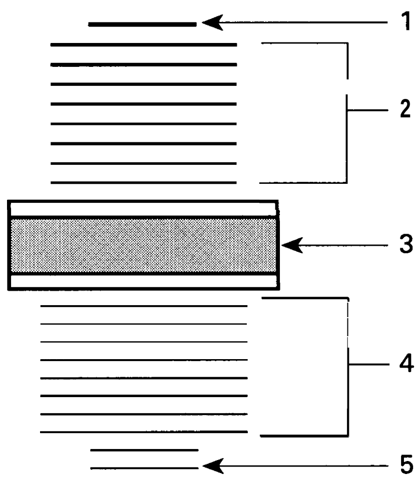
Compression

4. 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.

o **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.

5. Fewer spacer shims will result in more high speed dampening. A minimum of O-114 mm (.0045 in) clearance should be allowed between shim stack and compression valve stopper. Use at least one shim of 12 x .114.
6. Compression valve stopper must have groove facing shim stack.

FACTORY HPG T/A SHOCK CALIBRATIONS



FRONT / SKI SHOCK

1994/95 Rebound
1. 1 X 12 xO.203
2. 8 X26X 0.203
3. 4 SLIT PISTON

Compression
4. 8 X30X 0.152
5. 2 x 15x 0.114

1996* Rebound
1. 1 X 12 X 0.203
2. 5 X26X 0.203
3. 4 SLIT PISTON

Compression
4. 8 X30X 0.152
5. 2 x 15x 0.114

* 440 & 583 MX Z

CENTER SHOCK

1994 Rebound
1. 2 x 15x 0.114
2. 8 X26X 0.203
3. 6 SLIT PISTON

Compression
4. 9 X30X 0.152
5. 6 X 15X 0.114

1995 Rebound
1. 1 X 16X 0.203
2. 9 X26X 0.203
3. 6 SLIT PISTON

Compression
4. 6 X30X 0.203
5. 1 x 15x 0.114

1996* Rebound
1. 1 X 12 X 0.203
2. 8 X26X 0.152
3. 4 SLIT PISTON

Compression
4. 10X 30 X 0.203
5. 3 X 16X 0.203

* 440 & 583 MX Z

REAR SHOCK

1994/95 Rebound
1. 2 x 15x 0.114
2. 10 X26X 0.152
3. 6 SLIT PISTON

Compression
4. 8 X 30 X 0.203
5. 6 x 15X 0.114

1996* Rebound
1. 1 x 15X 0.203
2. 10X26X 0.152
3. 2 SLIT PISTON

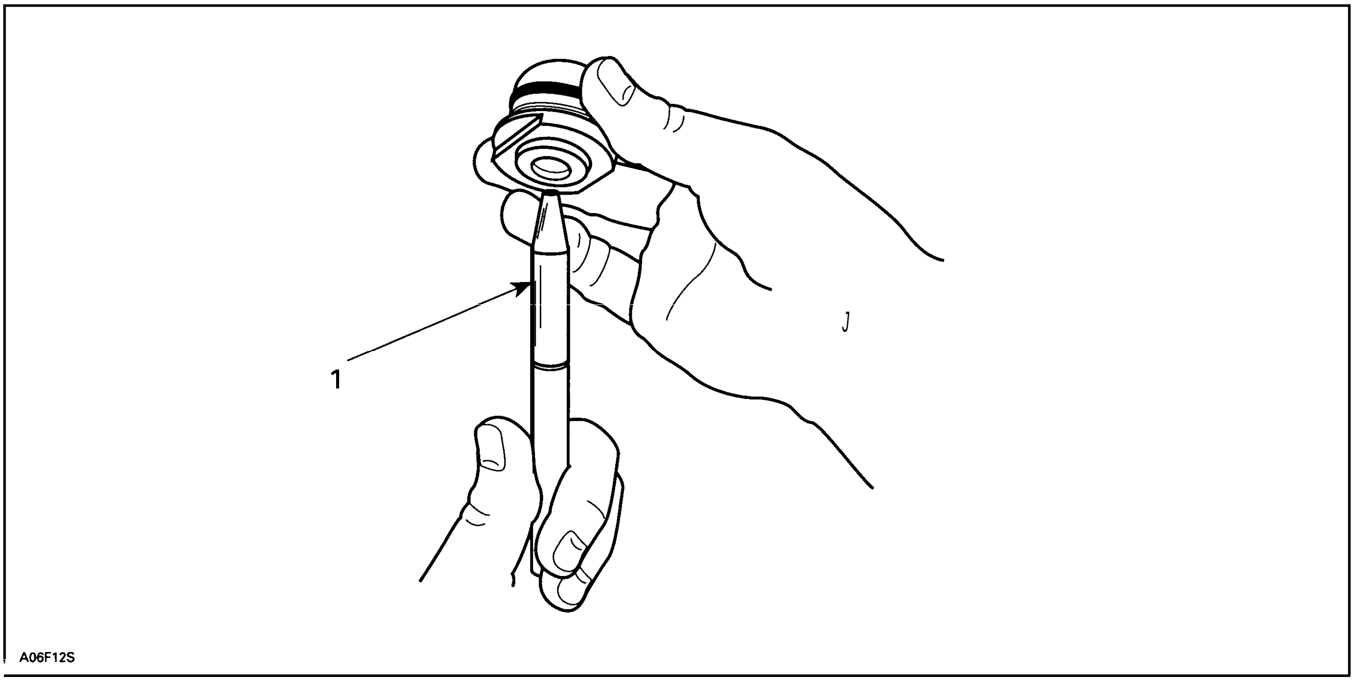
Compression
4. 7 X30X 0.203
5. 3 X 15X 0.203

* 4408(583 MX Z

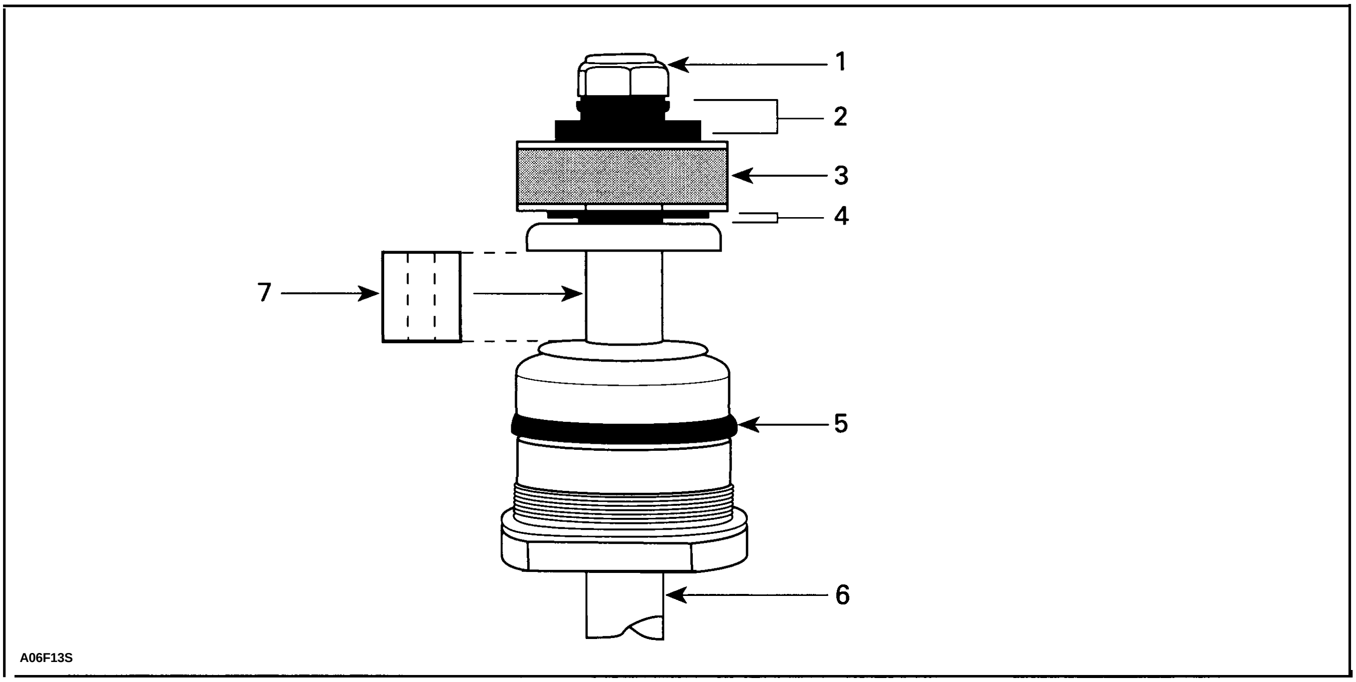
If the seal carrier assembly is replaced, use seal pilot (P/N 5290265 00) to guide seal over damper shaft. Lubricate seal carrier guide pilot before use.

▼ CAUTION: Failure to use seal pilot will result in seal damage.

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



1. Pilot (P/N 5290269 00)



1. Damper nuttorque 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 spacerkit(P/N8617442 00).

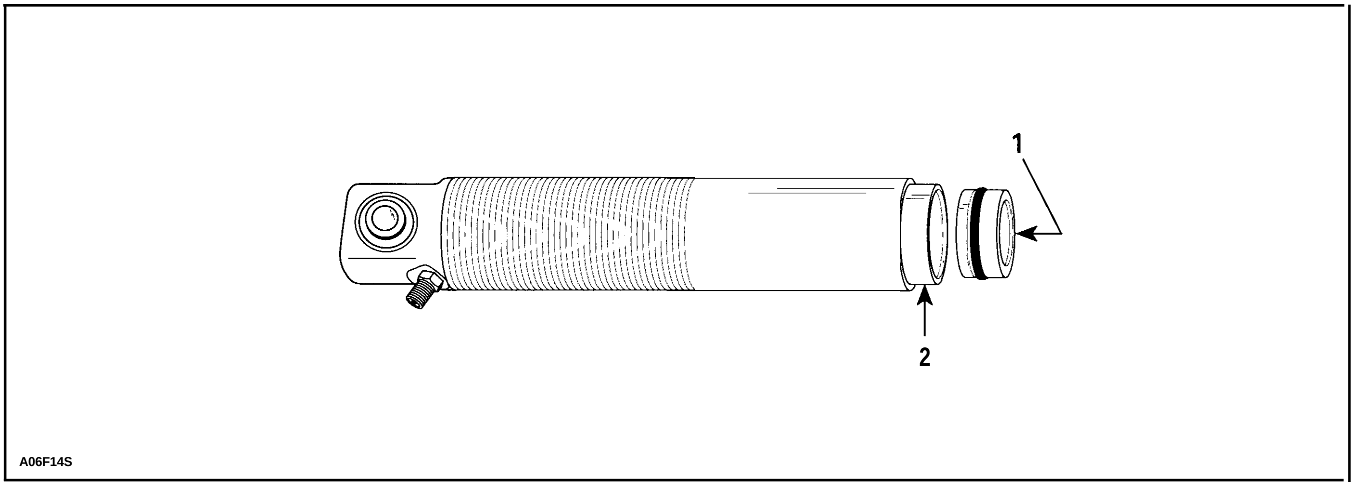
Kit includes :

2- 26 mm long spacer
1- 48 mm long spacer
2- 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 4137037 00) or silicone grease Dow Corning MS4 (P / N 420 897061) to ease O-ring past damper body threads with floating piston pilot (P/ N 5290266 00).

▼ CAUTION : **Failure to install IFP correctly could result in shock damage.**

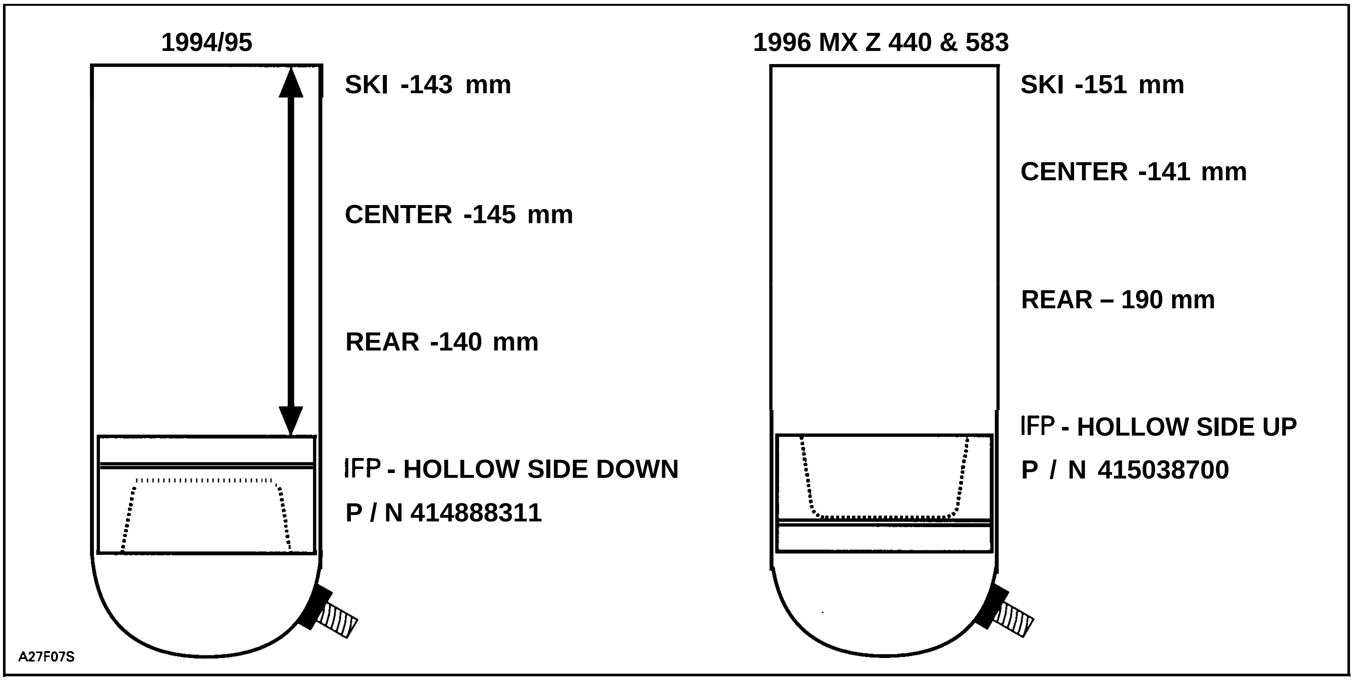
NOTE: For 1994 / 95 HPG's install hollow side of IFP towards Schrader valve. For 1996 HPG's hollow side should face away from Schrader valve.



1. Push (slowly) by hand
2. Floating piston guide (P/N 529 026600)

NOTE : Lubricate inside of piston guide with molykote GN paste (P/N 413 7037 00) or MS4 silicone grease (P/N 4208970 61).

Install floating piston to the proper depth.



Required distance for floating piston installation

The 1994 MX **Z,** center gas emulsion shock, does not use a floating piston. Center shock oil level must be measured and adjusted to 80 mm (3.15 in). Measuring from the top edge of the damper body to the oil level.

o **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.

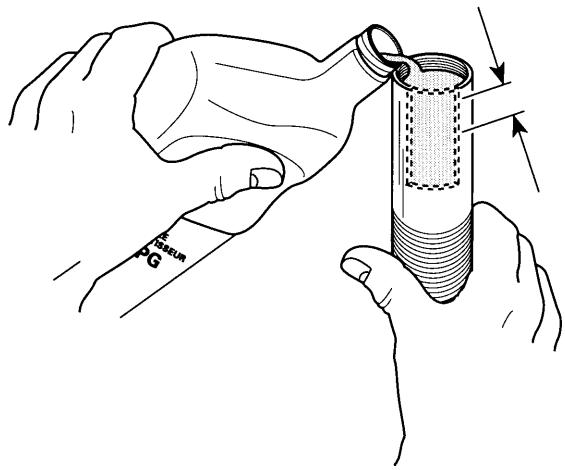
o **NOTE :** Reinstall Schrader valve core after IFP has been installed at correct height and before adding oil.

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 4137094 00) to approximately 10 mm (**.393** in), from the base of seal carrier threads.



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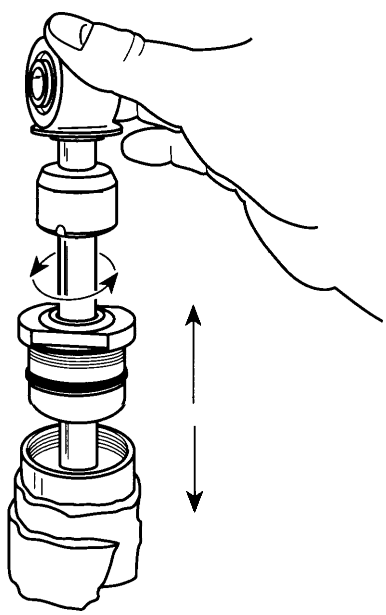
Fill to 10 mm

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

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



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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.

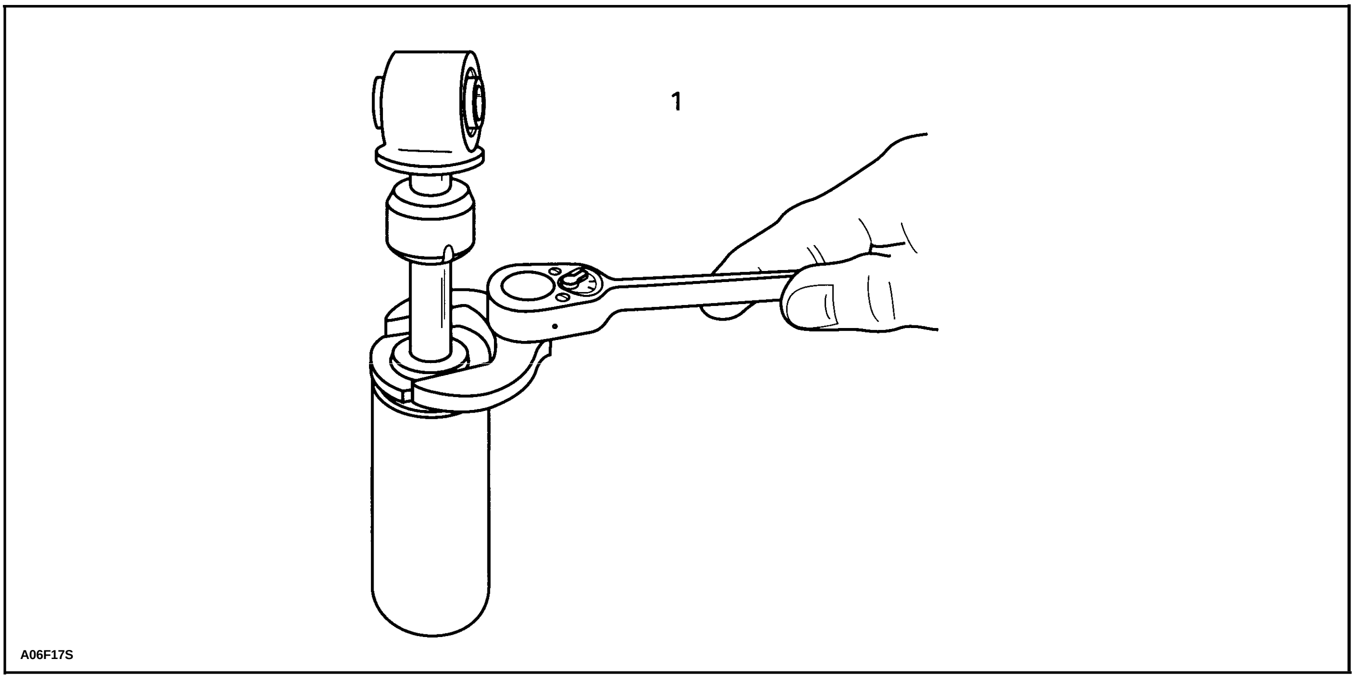
Slight oscillation of damper rod may be required to allow piston to enter damper body bore.

Slowly push piston into damper body. Slight up and down movement maybe 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.

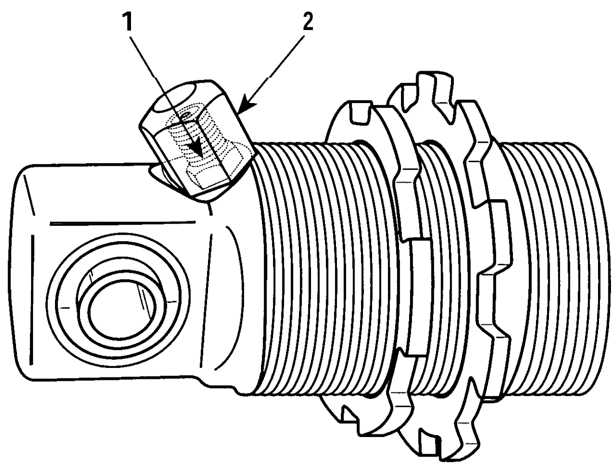
o **NOTE :** Fast installation of the damper rod may displace the floating piston from its original position. This must not occur if the damper is expected to perform as designed.

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 to88-89 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.

o **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.

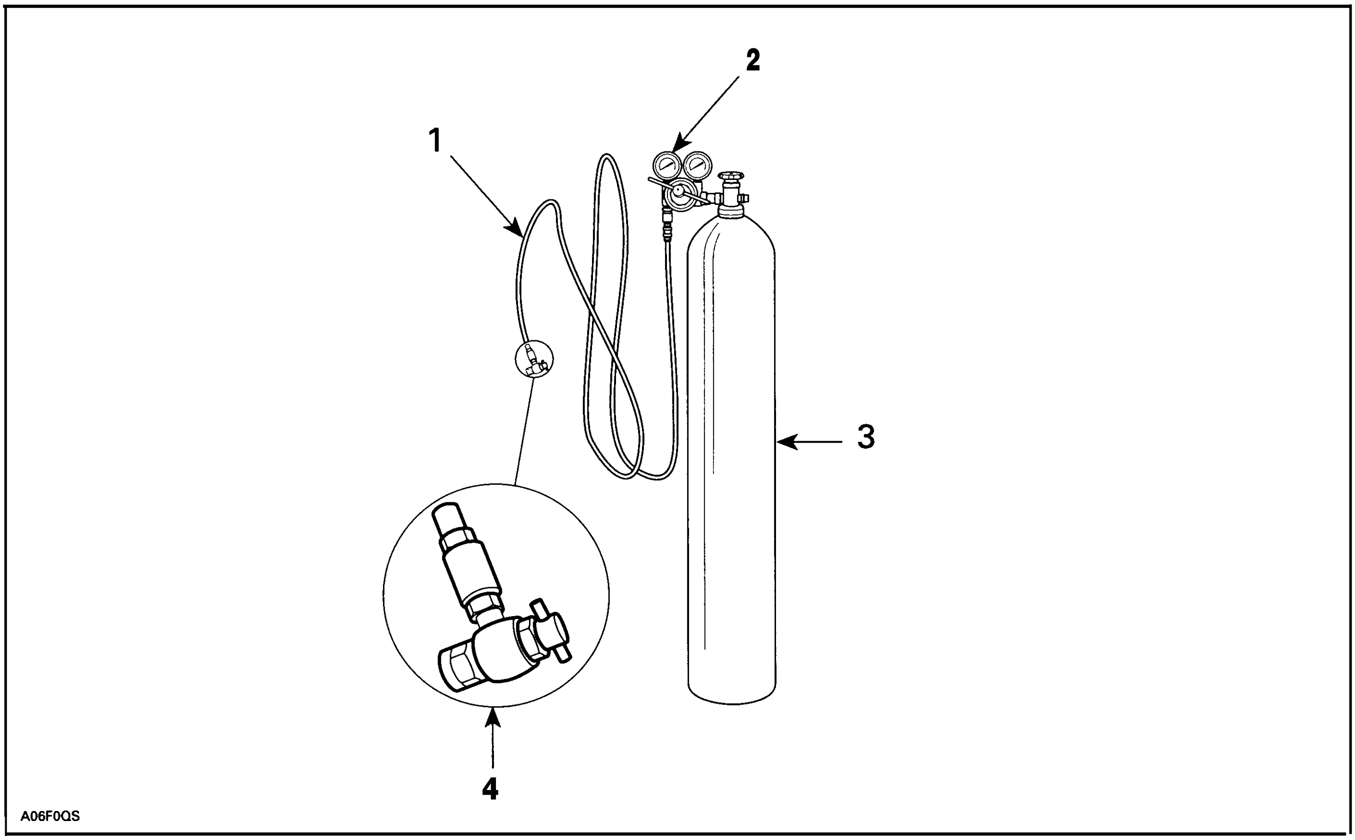
When removing and retightening the Schrader valve acorn nut use minimal torque. When the cap is over tightened and subsequently removed it may prematurely break the seal of the Schrader valve to the shock body and cause a loss of nitrogen charge without being noticed. If you suspect this has happened 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.**

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

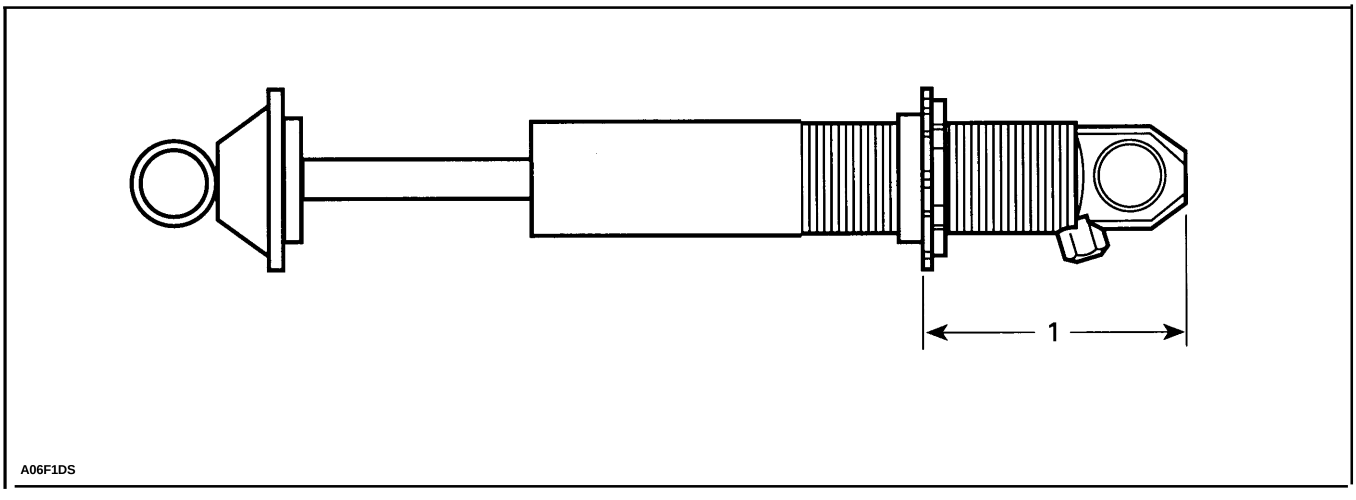
Damper gas pressure cannot be confirmed by using a pressure gauge. The volume of gas in the shock is very small, and the amount lost during gauge installation will lower the pressure too much and require refilling.

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



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

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



1. FACTORY ADJUSTMENT: 1994/1995
   Front: L = 85.5 mm (3.0 in)
   Center: L = 104 mm (4.0 in)
   Rear: L =78 mm (3 11/32 in)

1996
Front: L =76 mm (3.0 in)
Center: L = 70.1 mm (2.75 in)
Rear: L = N/A

CALIBRATION WORK SHEET

	FRONT	CENTER	REAR	OPTION
PISTON-SLIT				
IFP HEIGHT				
SPRING PRELOAD				
COMPRESSION				
REBOUND				

Model · ______________________________

Date : ______________________________

Riding conditions : ______________________________

Notes: ______________________________

HPG T / A Shocks

SHOCK SHIMS

PART NUMBER	SIZE (mm)	MOQ (minimum order quantity)
415039100	30X .254	5
414888318	30X .203	15
414888319	30X .152	1
414888320	28X .203	5
414888321	28X .152	5
415039000	26X .254	5
414888322	26X .203	5
414888323	26X .152	50
414888324	22 x .203	5
414888325	22 x .152	5
414888326	20X .203	5
414888327	20X .152	5
414888328	20 x .144	5
414888329	18X .203	5
414888330	18X .152	5
414888331	16X .254	10
414888332	16X .203	10
414888333	16X .152	10
415038900	16X .114	10
414888334	15X .254	10
414888335	15X .203	10
414888336	15X .152	10
414888337	15x .114	10
414888338	12X .203	10
414888339	12 x .152	10
415038800	12 x .114	10
414888340	21 x .114	10
414888341	24X .114	10

PISTONS

PART NUMBER	SIZE	MOQ (minimum order quantity)
414888304	0 slit	1
414888305	2 slits	2
414888306	4 slits	1
414888307	6 slits	1

HPG T / A Shock Spare Parts

P / N	DESCRIPTION
414862102	Cylinder rod without bearing front
414861902	Cylinder rod without bearing center
414861502	Cylinder rod without bearing rear
414862103	Cylinder bodywithout bearing front
414925702	Cylinder body without bearing center
414861503	Cylinder body without bearing rear
414562900	Spherical bearing
371905000	Circlip
414888300	Seal carrier assemblywith O-ring
414888301	O-ring for seal carrier
414888302	Rubber cushion
414888303	Compression valve stopper D33 x T4
414888308	Rebound valve stopper D17 x T2
414888309	Washer
414888310	Piston nut with spring lock
414888311	Floating piston with O-ring for 1994 /95 HPG
415038700	Floating piston with O-ring for 1996 HPG
414888312	O-ring for floating piston for all 1994 /95 /96 models
414888313	Gas valve cap ass'y with rubber
414888314	Gas valve ass'y with O-ring
414888315	O-ring for gas valve
414888316	Threaded spring collar
414888317	Threaded jam collar
486067100	Optional MVA shaft for C7 rear shocks
414762500	Spring stopper for MVA use
414956600	96 MX Z T / A Front damper unit
414953900	96 MX Z T / A Center damper unit
414954000	96 MX Z T / A Rear damper unit

SHOCK ABSORBER CHART 1994
TABLEAU DES AMORTISSEURS 1994

PART NUMBER NUMÉRO DE PIÈCES	TYPE	EXTENDED ÉTIRÉ +/-3	SPRING RETAINER CONTACT LONGUEUR ENTRE BAGUES	BUMPER CONTACT AU BUTTOIR	STROKE COURSE	LOCATION	APPLICATION
4[illegible]72 00	326 mm	325.3	239.2	267.7	86.7	CENTER	MACH 1, ALL GT
414 7022 00	254 mm	331	228	254	103	FRONT	ALL SKANDIC, ALL SAFARI
414 7023 00	264 mm	315	237.2	264	83.8	REAR	ALL SKANDIC, ALL SAFARI
414 7641 00	270 mm	270.0	195.0	223.5	75.0	FRONT	MACH 1, ALL GT
414 8128 00	HPG 348 mm	347	236-251		101.4	REAR	G.T.
414 8217 00	HPG 348 mm	387	238-253	139	149	REAR	G.T. XTC
414 8432 00	HPG-MVA 252 mm	347	225-240		83.7	REAR	G.T. SE
414 8527 00	324 mm	324		79	100	FRONT	ALL SUMMIT
414 8557 00	344 mm	344		72	93	FRONT	MACH Z, F.ST, STX, STX (2)
414 8615 00	T / A 348 mm	348	170-260		111.7	REAR	MX-Z
414 8619 00	T / A 319 mm	319	179-256		99	CENTER	MX-Z
414 8621 00	T / A 344 mm	343	187-279	78	101	FRONT	MX-Z
4[illegible] 8625 00	EMULSION 349 mm	319	222-207		101	CENTER	MACH Z
41[illegible] 8661 00	HPG 344 mm	344	235-250	69	93	FRONT	MX, F-Z
414 8677 00	HPG 348 mm	348	246-261		101.5	REAR	ALL SUMMIT
414 8686 00	HPG 348 mm	347	236-251		111.7	REAR	MACH Z, MACH 1, F-Z, F. ST, STX, STX (2), MX
414 8691 00	EMULSION 319 mm	313	207-222		101	CENTER	F-Z, ALL SUMMIT, MX, F.ST, STX, STX (2)

Section 03 CHASSIS PREPARA' 'ION

1995 Shock Absorbers

P/N	TYPE	L EXTENDED	SPRING RETAINER CONTACT	BUMPER CONTACT	STROKE	LOCATION	APPLICATION
414862100	T/A	343 mm	187-279	78	101	FRONT	MX-Z
414925700	T/A				—	CTR	MX-Z
414861500	T/A	348 mm	170-260	—	111.7	REAR	MX-Z
414855700	OIL	344 mm		72	93	FRONT	FORMULA STX LT, MX, GT 470,580, FORMULA SS
414869100	EMUL-SION	319 mm	222-207		101	CTR	MX, FORMULA STX
414868600	HPG	347mm	236-251		111.7	REAR	MX, FORMULA STX
414927200	HPG	—			—	CTR	FORMULA STX LT, GT SE, GT 470,580, ALL SUMMIT
414927000	HPG				—	REAR	FORMULA STX LT, GT 470,580
414866100	HPG	344 mm	235-250	69	93	FRONT	GT SE, MACH Z
414927400	HPG - MVA		—		—	REAR	GT SE
414852700	OIL	324mm	—	79	100	FRONT	ALL SUMMIT
414867700	HPG	348 mm	246-261		101.5	REAR	ALL SUMMIT
414928200	HPG	343 mm	233-248	75.4	98.4	FRONT	FORMULA Z, MACH 1
414925000	HPG	318	207-222	—	92.4	CTR	FORMULA Z, SS, MACH 1, MACH Z,
414924900	HPG				—	REAR	FORMULA Z, SS, MACH 1, MACH Z

DSAS-Chassis Shock Absorbers

FRONT: Most DSAZ-chassis shocks will interchange.

REAR: There are two different shocks used on 95 production vehicles.

414866500 Single seat

414927700 Two-up seat

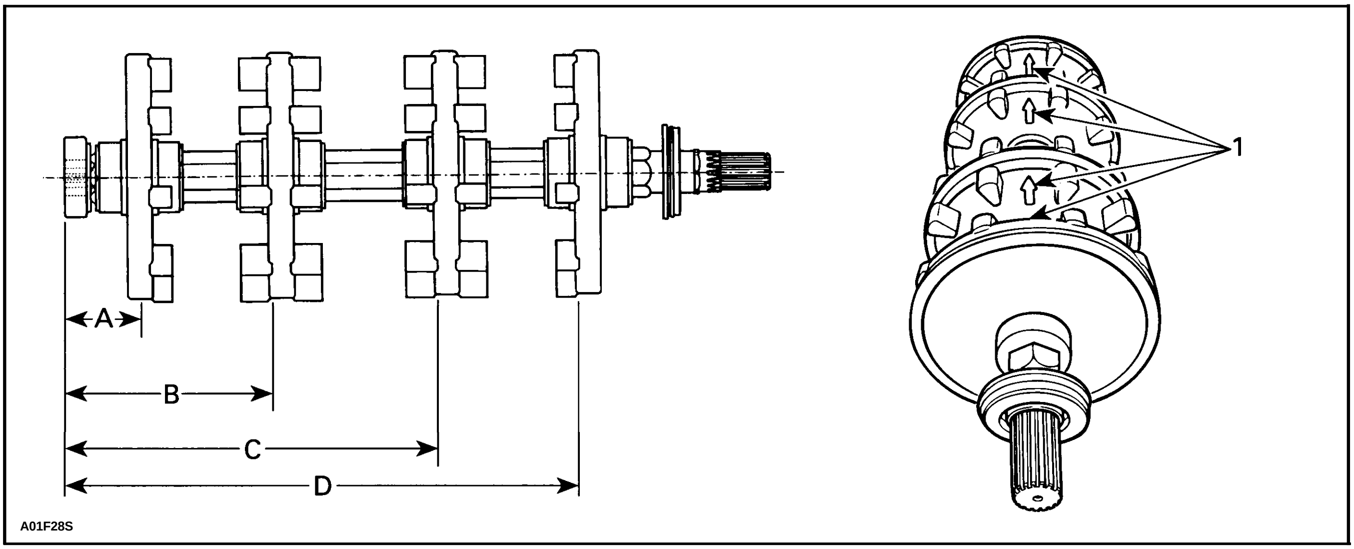
The 4149277 shock is valved stiffer than the 414866500.

CHASSIS SET-UP

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 (2-9/16 in)
B. 159.3 mm (*6-1/4* in)
C. 282.3 mm (11-1/16 in)
D. 375.8 mm (14-3/4 in)

1995/1996 All S Series DSA
1993/96 All F Series DSA

Use a press or special tool P / N 861 725700 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.

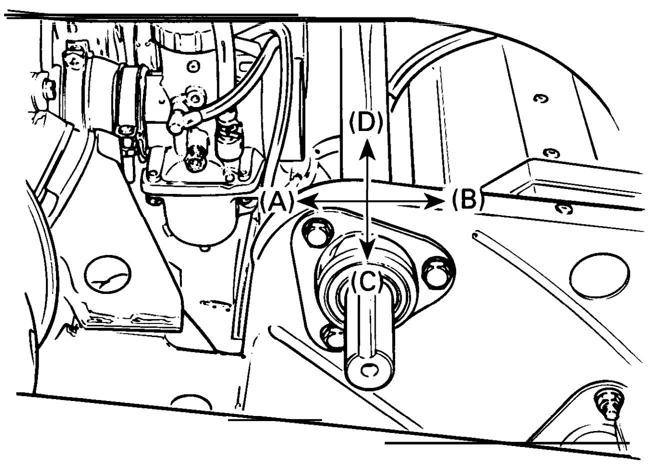
Maximum run out should not exceed 0.5 mm (.020 in). A maximum of 1 mm (.040 in) can be removed from the sprockets to true the diameter.

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.

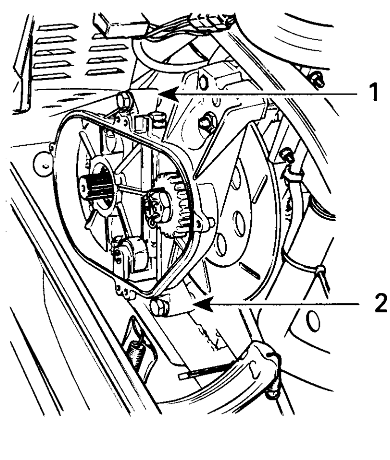


A01D06S

TYPICAL

NOTE : **Shafts will have a tolerance in the bearing housings and the bearings themselves. 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.

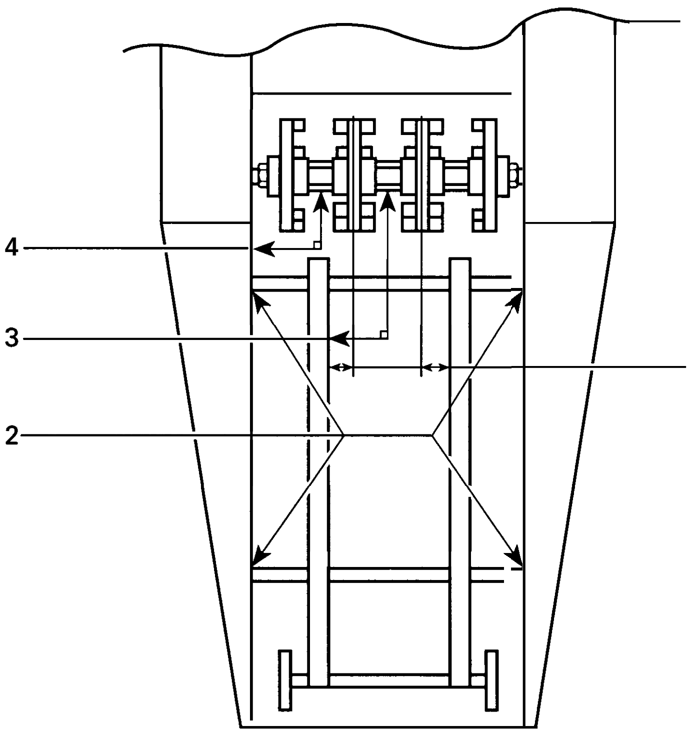


AO1OO7S

TYPICAL

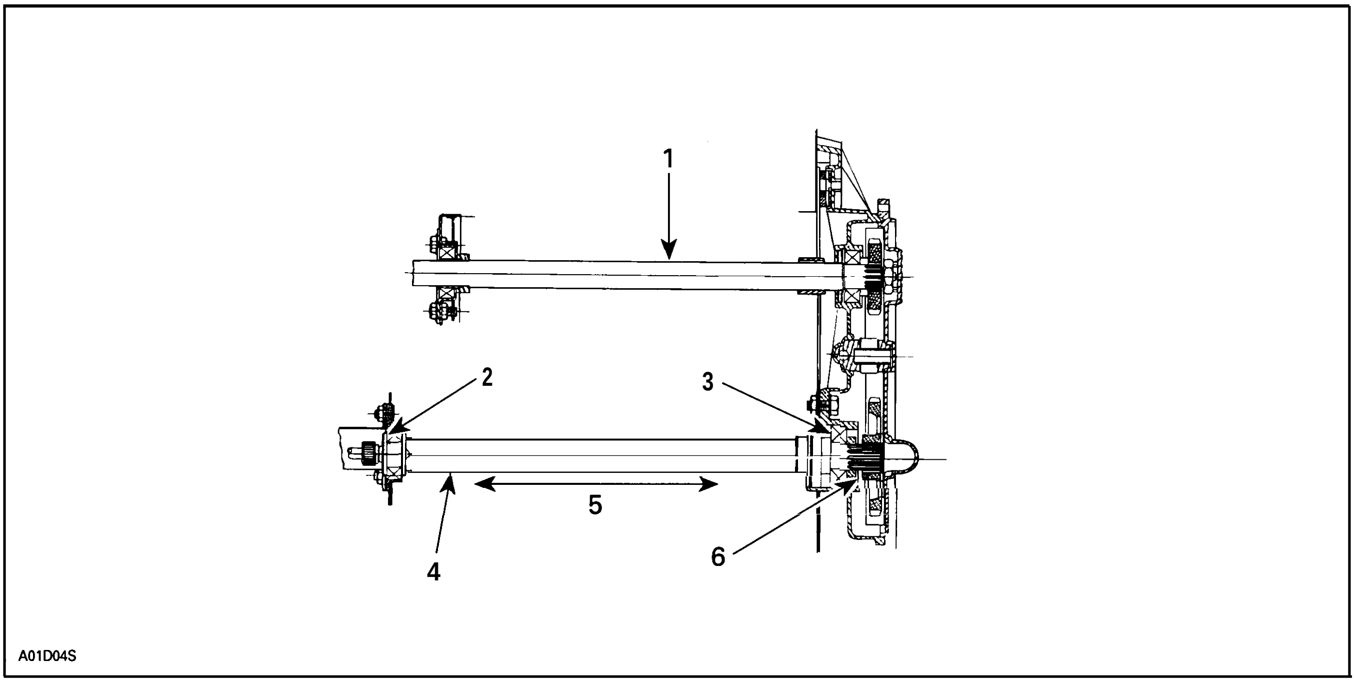
1. **Shim location**
2. Shim location

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 runnerswith drive sprockets. Equal distance both sides. Shim drive axle to reduce end play.
   Maximum end play = .060" (ideal= less than .030")
2. Cut ends oftubesand 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).

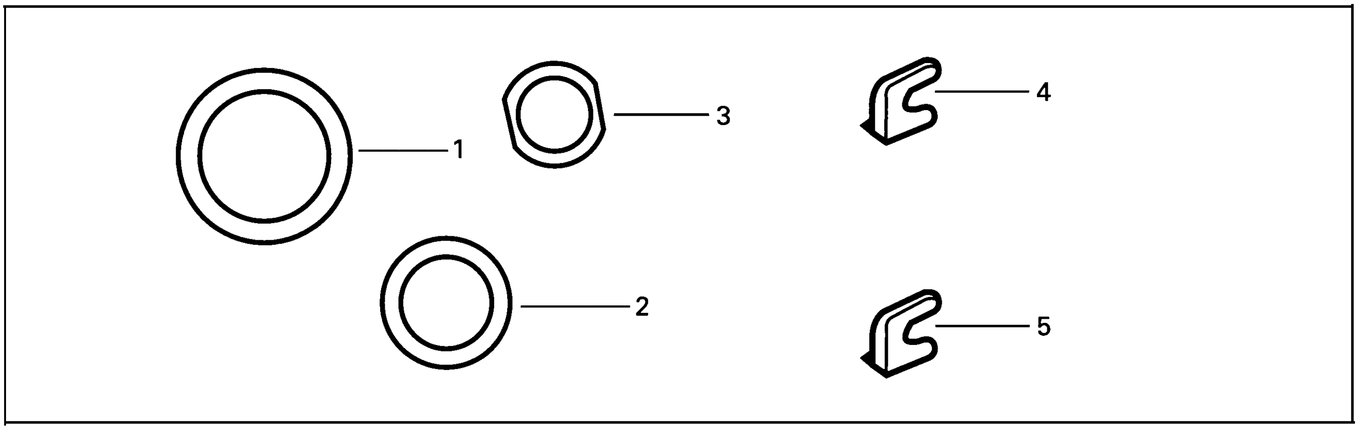


TOP VIEW
1. Countershaft
2. Shim position on end bearing housing side
3. Shim position on chaincase side
4. Drive axle
5. Axial play
6. Shim between sprocket and spacer

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.

o **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.**



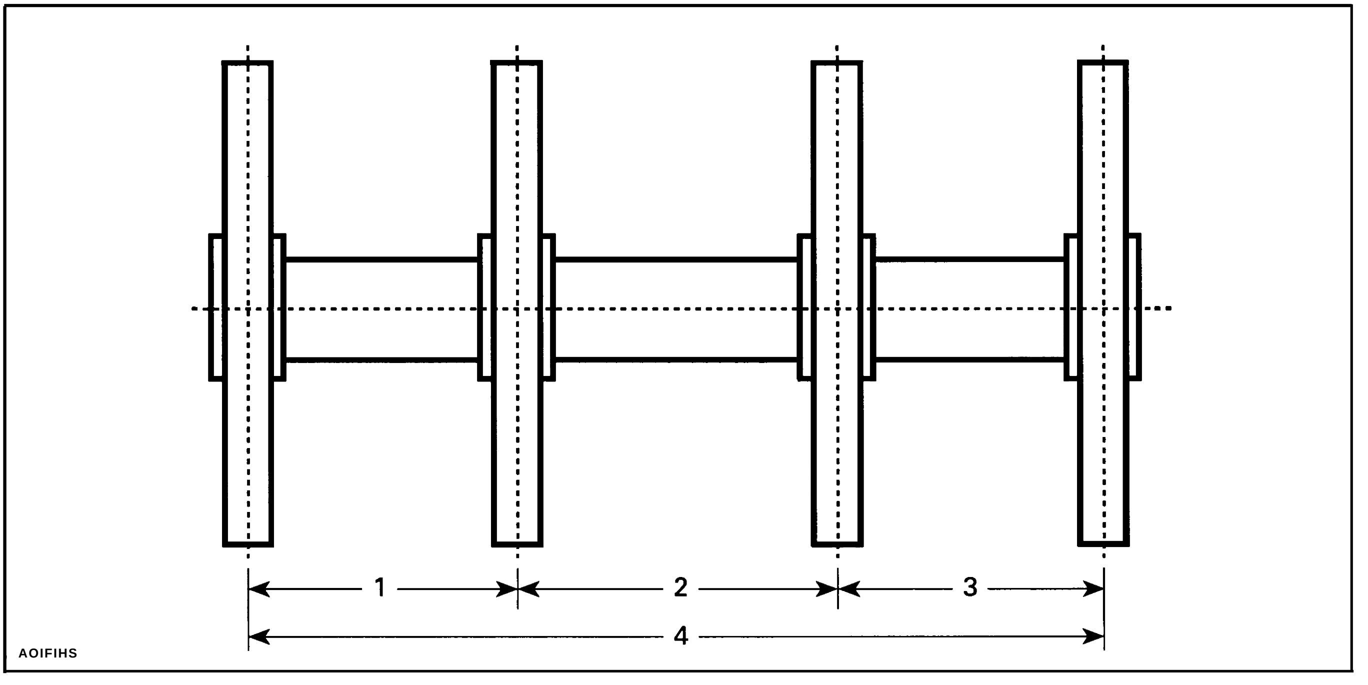
1. 501020500 Shim, Drive Axle End Bearing Housing 1.6 mm (.063 in) Thick
2. 414605300 Shim, Drive Axle Chaincase Side 1.6 mm (.063 in) Thick
3. 506041400 Shim, Drive Axle Chaincase Side 1.6 mm (.063 in) Thick
4. 504030700 Shim, Chaincase Perpendicularity 1 mm (.040 in) Thick
5. 504039800 Shim, Chaincase Perpendicularity O.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.

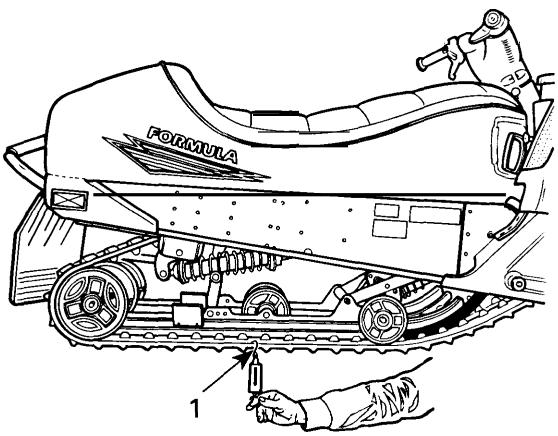


1. 101.5 mm (3-63/64 in)
2. 123 mm (4-27/32 in)
3. 101.5 mm (3-63/64 in)
4. 326 mm (12.83 in)

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.

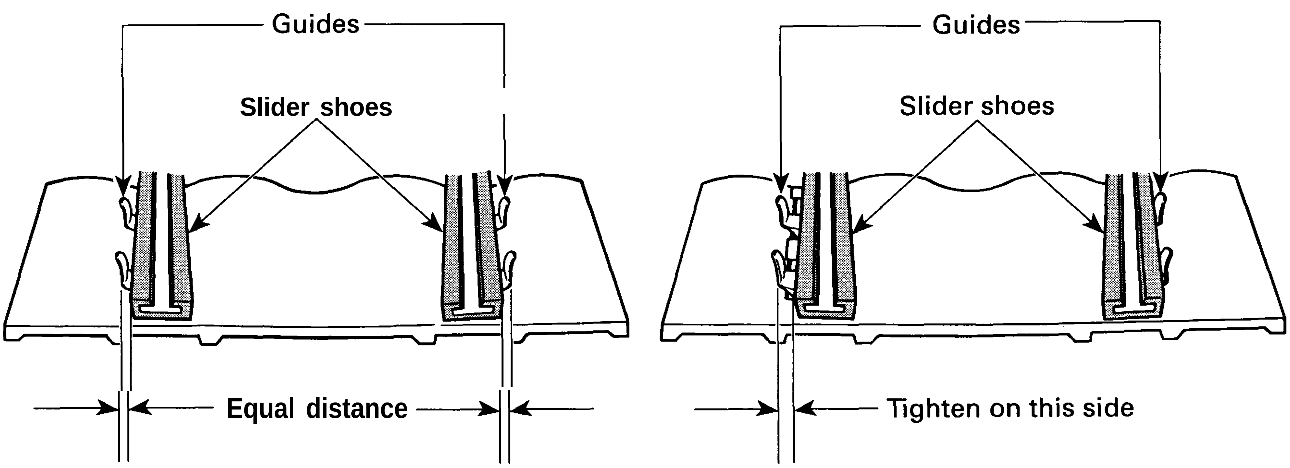
There are grease fittings on all moving parts of the suspension and they should be greased on a weekly basis with a quality, low temperature grease (P/ N 4137061 00).

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



A15F1VS

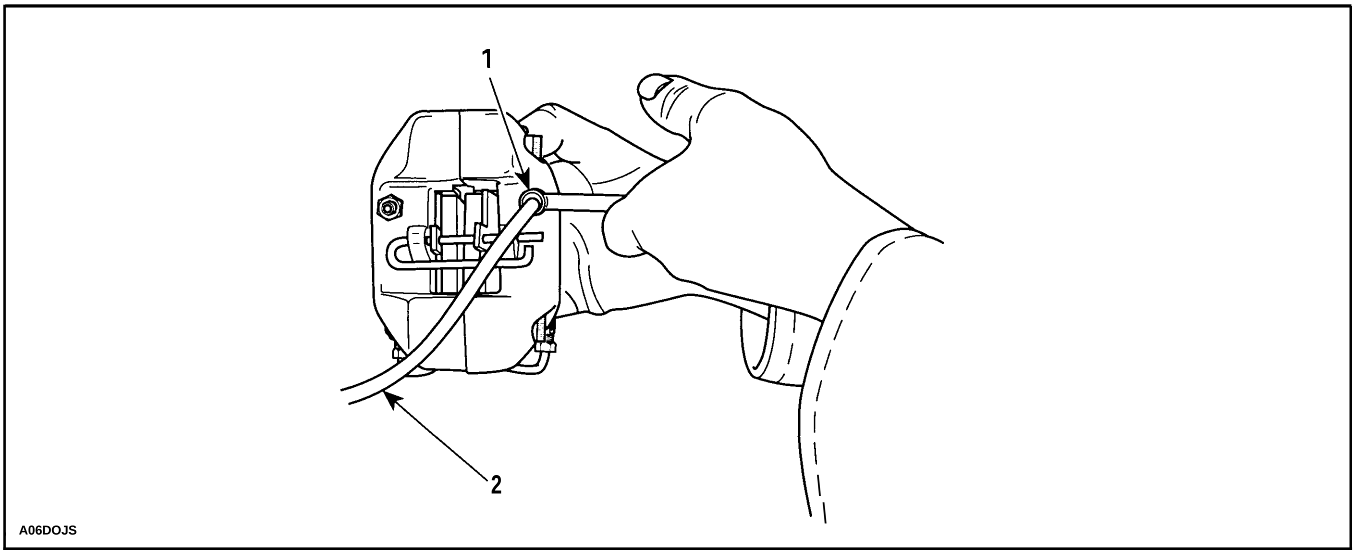
TYPICAL
1. Tension measured with7.3kg(161b)



A01F29S

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.

o **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 in top speed of 8 km / h (5 MPH) on a Formula Mach 1 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 T/A shocks, a spacer can be added internally to limit the extension of the shock.

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

ADJUSTING RIDE HEIGHT

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-2000 & S-2000) chassis.

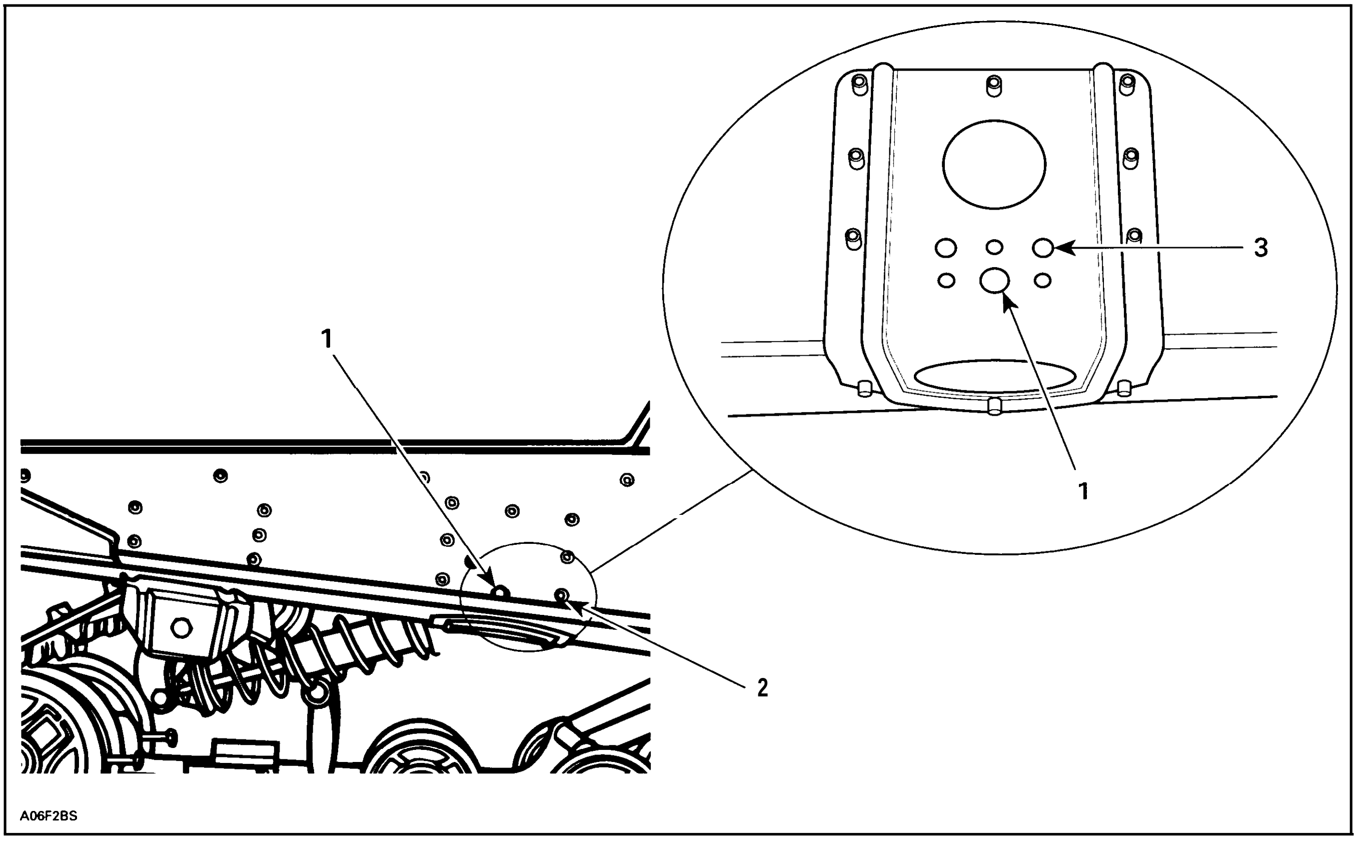
Shorter springs should be used to avoid excessive preload.

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

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

Lowering the Rear Suspension

Rear C-7 Drill the tunnel at the rear shock, front mounting plate. The reinforcing plate is predrilled but the tunnel is not. Use the plate as a template and drill the upper, forward holes on both sides per the illustration. Mount the shock shaft in the new holes. This lowers the rear without altering the spring preload. If a lower ride height is desired, use a limiter strap around the rear arm and the lower cross shaft and compress the suspension. On vehicles with HPG T / A shocks, internal spacers (kit P / N 861 7442 00) can be used to limit the extension stroke. Shorter or softer springs may be used if less preload is desired.



FRONT

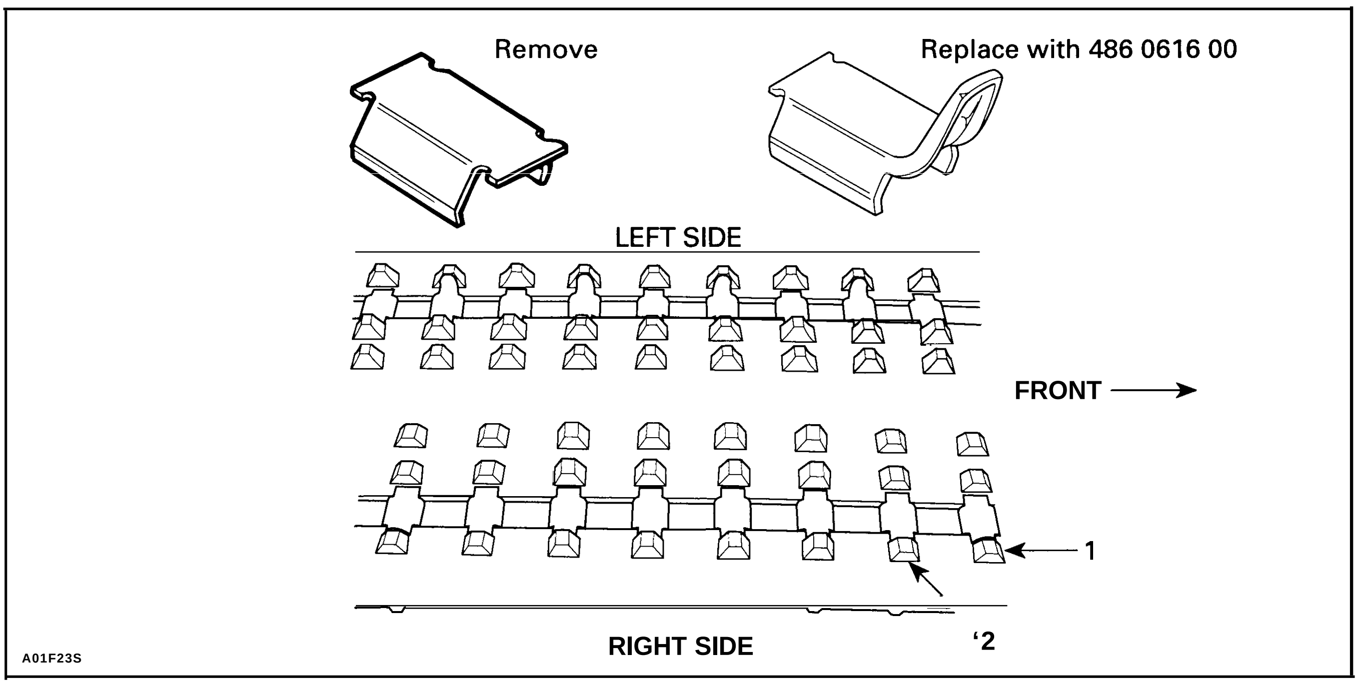
I. Stock
2. Lowered position
3. Use reinforcing plate asatemplateand drill tunnel

Rear Long Travel S chassis	Install a limiter strap on the rear from shock bolt to shock bolt (longer bolts may be required). The length of the strap can be adjusted to obtain the desired ride height Spring preload will be increased.
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 4860562 00) is available for the vehicles with the strap and bolt style. 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 4860616 00) should be installed when oval racing with a heavily studded track. These taller guides help prevent derailing without having to overly tighten the track. When in a turn, the side loads on the guides are extremely high and it is advantageous to reduce the load per guide by adding more of the guides.

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



1. Standard
2. *486061600*

NOTE : These taller guides should only be used when the vehicle is lowered. You must
0 check for clearance on the top of the rear arm. If clearance does not allow, use standard height guide clips.

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.

529028700 Guide clip remover

529028800 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.

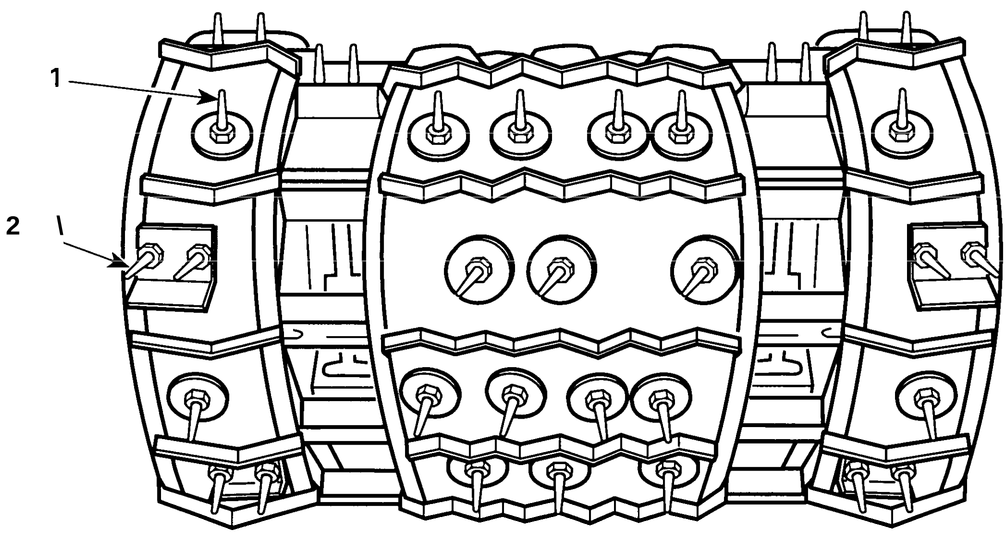
The other thing that must be kept in mind if hooker plates are used is that the studs will be directly in line with the heat exchanger protectors. The protectors must be removed and another system employed to protect the heat exchangers.

Depending upon machine setup, driver weight and driving characteristics, 250 to 300 penetrator studs will be required. The 121 inch Formula 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.

With stud support (P/ N 4860493 00) it is possible to add some studs on cleats.

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



TYPICAL
1. 6 stud row
2. 7 stud row

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

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

Studs that are 20.8 mm to 21.5 mm (.850 to .875 inch) long mounted with square back plates are generally used. 24.5 mm (1 in) picks may be used for maximum penetration, but their use will require the addition of taller heat exchanger protectors (P/N 4148382 00) 2 req'd.

CAUTION : **Check condition of heat exchanger after every race or every 50 hours.**

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

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

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

SLIDER SHOE LUBRICATION

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

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

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

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

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

Lubricant flow can be restricted at each nozzle by placing a Mikuni hex main jet inside each hose (about a #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.

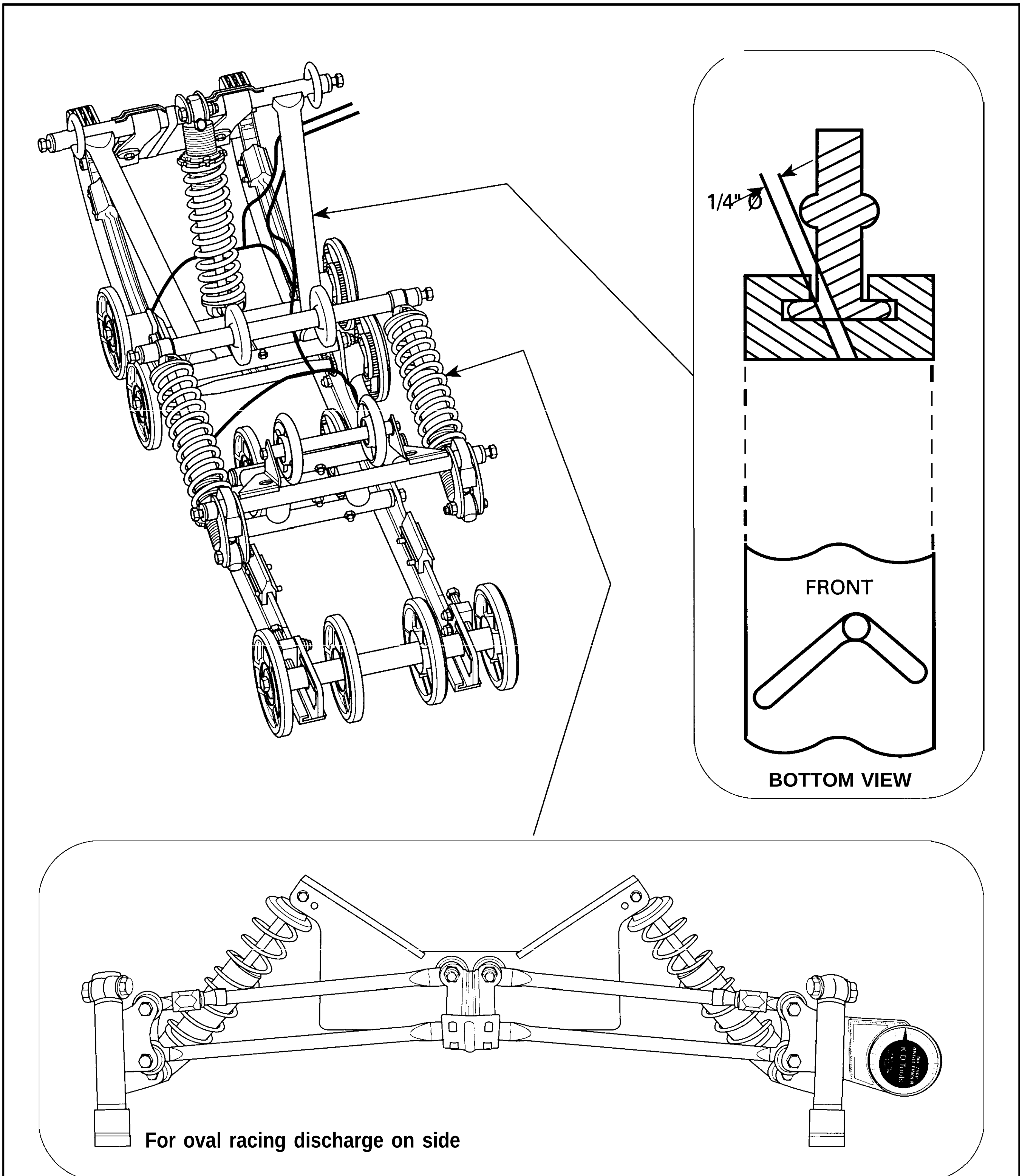
Windshield washer solution at 100% concentration makes an excellent lubricant. If this starts to “slush” at extremely cold temperatures, use a 50 / 50 mix of washer solution and antifreeze.

Parts list:

Fuel pump	**(1)**	**(p/ N 4038004 00)**
Impulse Hose	**(1)**	**(p/ N 4142867 00)(10 ft.)**
Hose Clamp (1/4 D)	**(4)**	**(p/N 4088011 00)**
Fuel Line (1/4” D)	**(1)**	**(p/ N 4148340 00)(25 ft. roll)**
Tee (1/4 x 1/4x 1/4)	**(3)**	**(p/N 4141553 00)**
Spring Clamp (for fuel line)	**@**	**(P/N 4145548 00)**
Shutoff Valve	**(1)**	**(p/N 4145390 00)**
Lube Tank (1 to 1 1/2 gallon)	**(1)**	**N/A**
Roll Pin (1/4” dia. x 1-1/2”)	**(4)**	**N/A**
Locking Tie	**@**	**(p/N 4141152 00) (package of 25)**

If slide lubrication is not allowed, there are *1/4* **inch larger diameter idler wheels available (P/N 503 0996 00) (black aluminum; 141 mm diameter). This reduces the load on the slider shoes.**

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.**



SLIDER SHOE LUBRIFICATION

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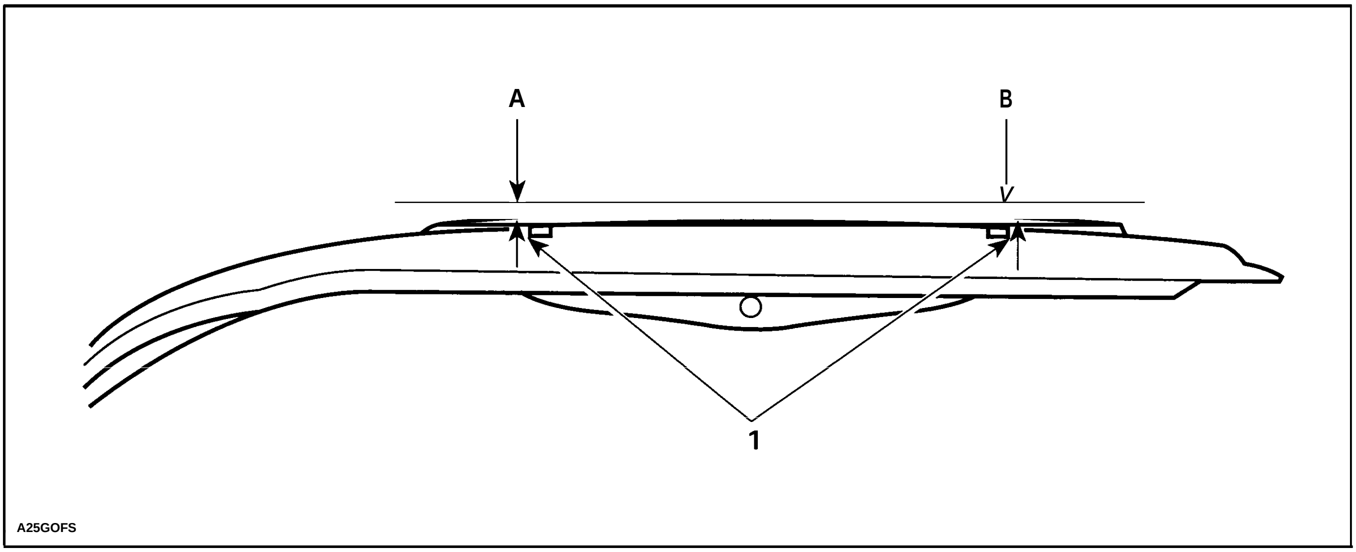
SKIS AND RUNNERS

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



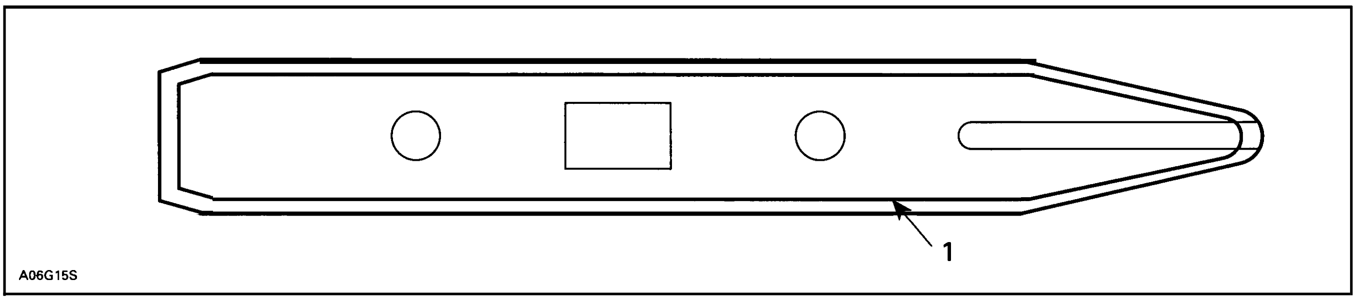
1. Measure here (Ski runner studs)
A 2 mm (3/32 in)
B. 2 mm (3/32 in)

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 8606002 *00).*

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

Steel skis should be used for ice racing with aggressive carbide, as the plastic ski will flex too much. These skis should also be reinforced with-a-dditional welding between the upper and lower sections (see drawing).



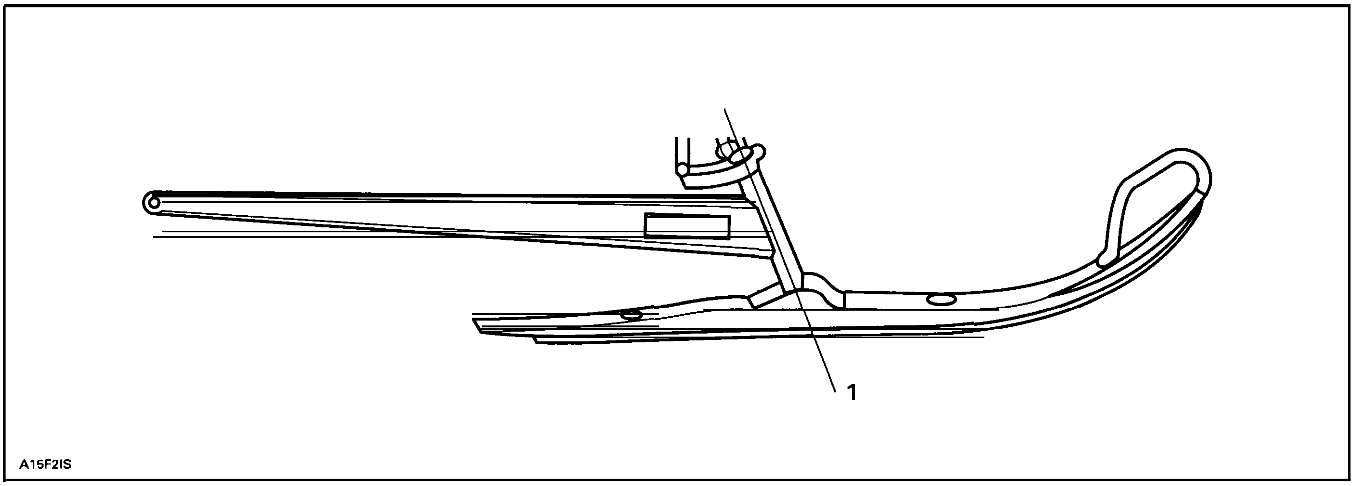
1. Weld 1“ every 1“

If rules allow it, use aluminum twin track skis (P/N 4840278 00) for ice oval or ice LeMans type racing.

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.



1. *122* mm (5")	98 mm (4")
147 mm (6")	122 mm (5")
171 mm (7")	147 mm *(6")*

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

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

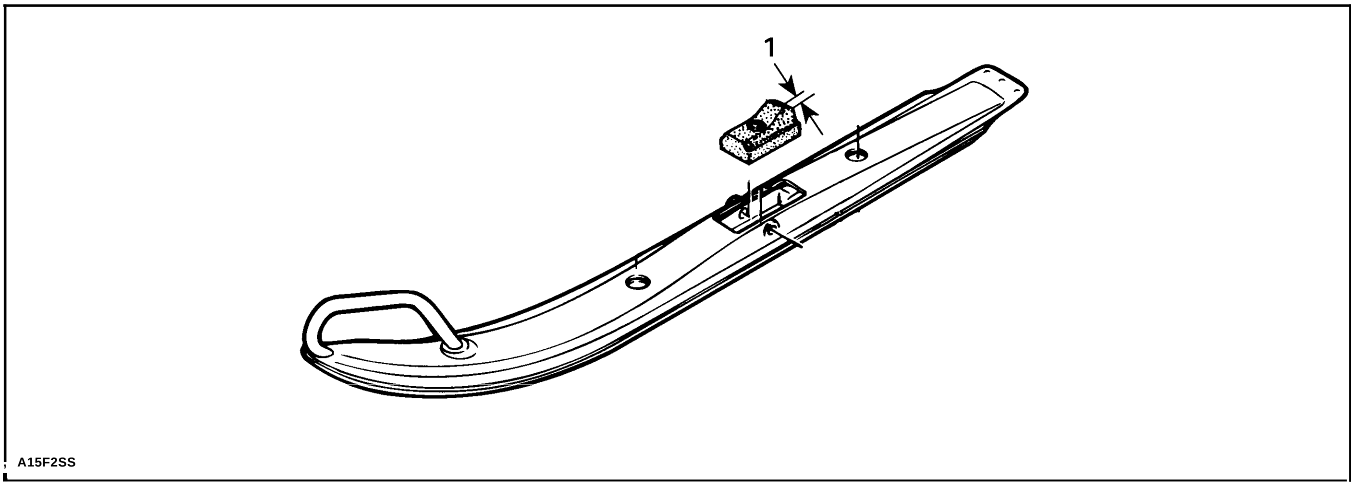
The condition of the skis and runners, as well as their alignment, has an effect on top speed. The ski toe out must be correct; any irregularities in the skis should be removed, and bent or badly worn runners must be replaced.

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.

The amount of pressure exerted on the rear (or heel) of the ski is controlled by the rubber block that fits between the spindle and the ski. Excessive heel pressure results in hard steering. Also, ski drag can be reduced by removing excessive height from the rubber block. This can have a favorable effect on top speed under certain snow conditions. On newer plastic skis there is an adjustable steel L-bracket that controls the amount of pressure on the rear-of the rubber block.

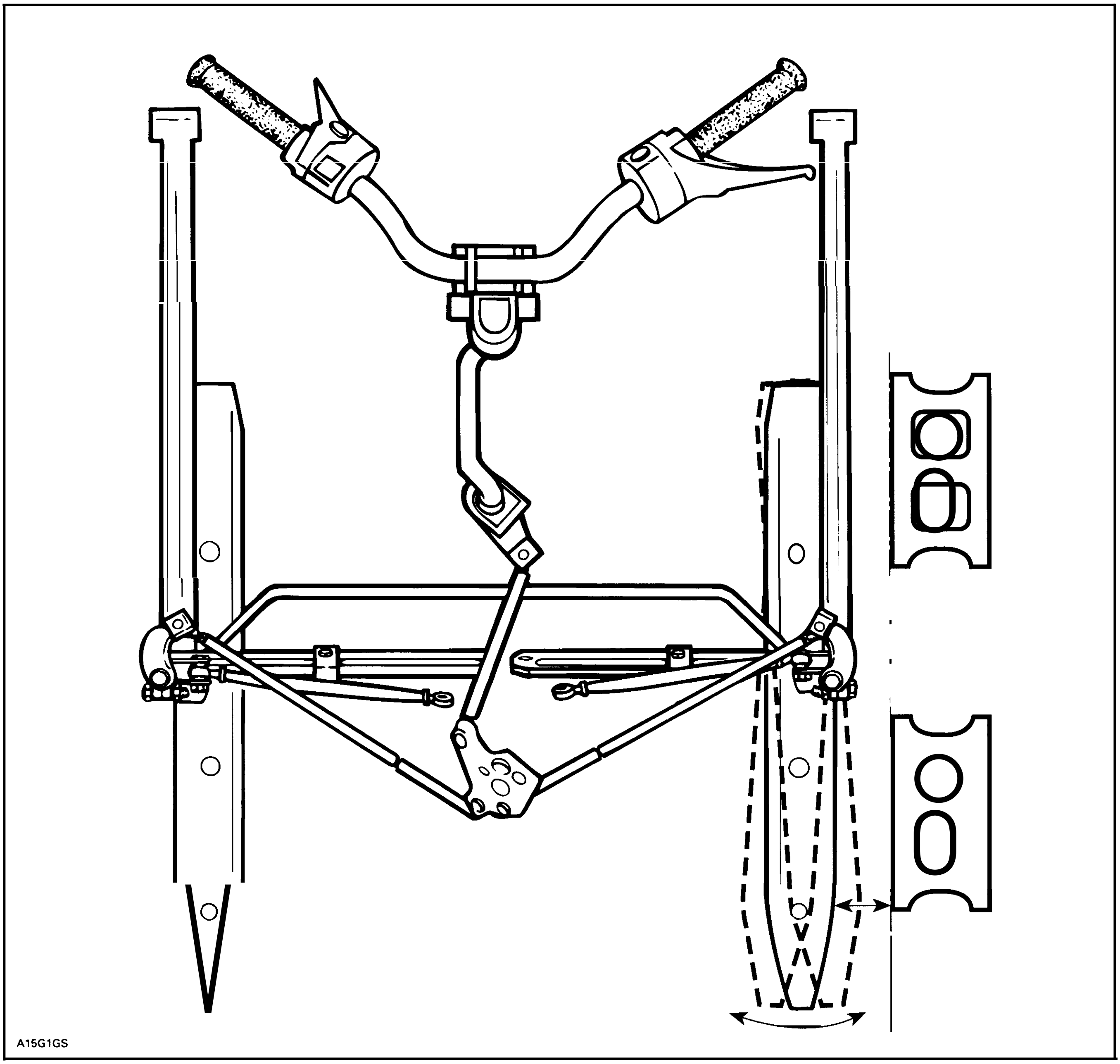


1. 3 **mm (1/8 in)**

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.



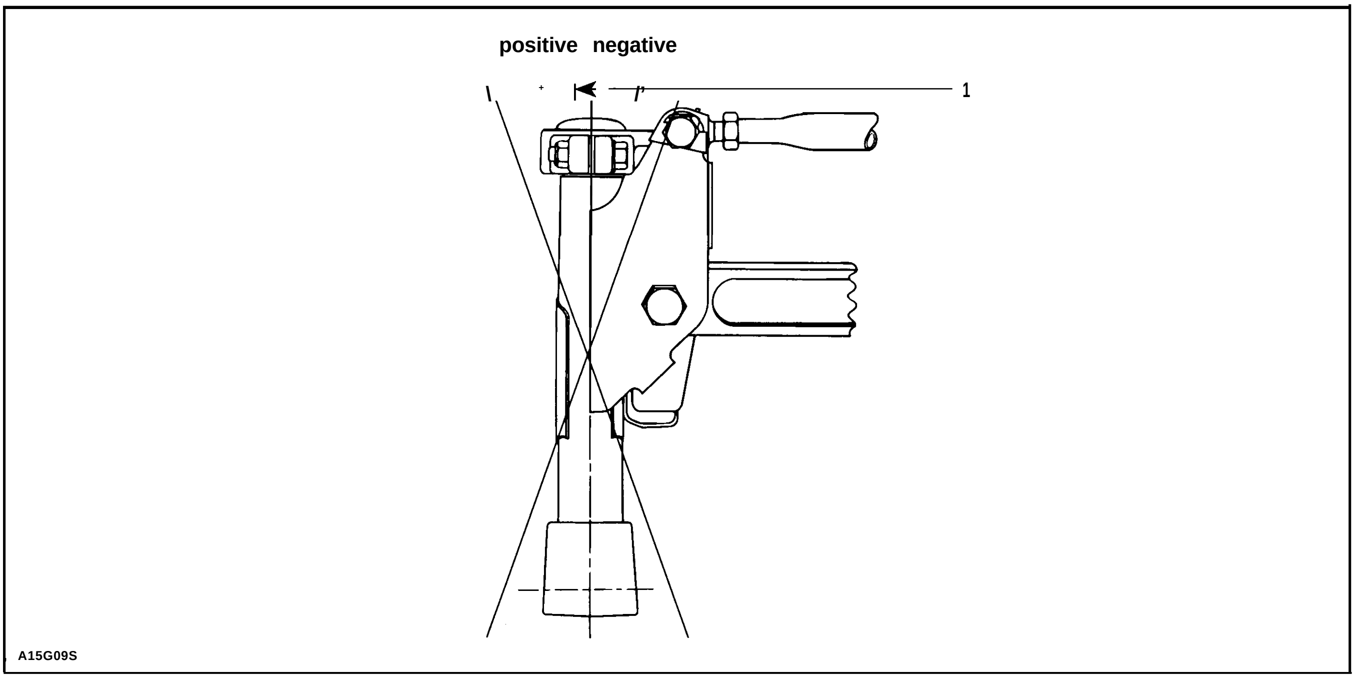
Lift the ski up to its upper travel limit. Using a measuring tape, measure the distances from the front and rear edges of the ski to the concrete block reference. The front and rear measurements must be equal or no more than 1.6 mm (1/16 in) difference if the bump steer adjustment is correct.

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 a cross-country rider most often sets up both ski legs with -1° to -3° camber.

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

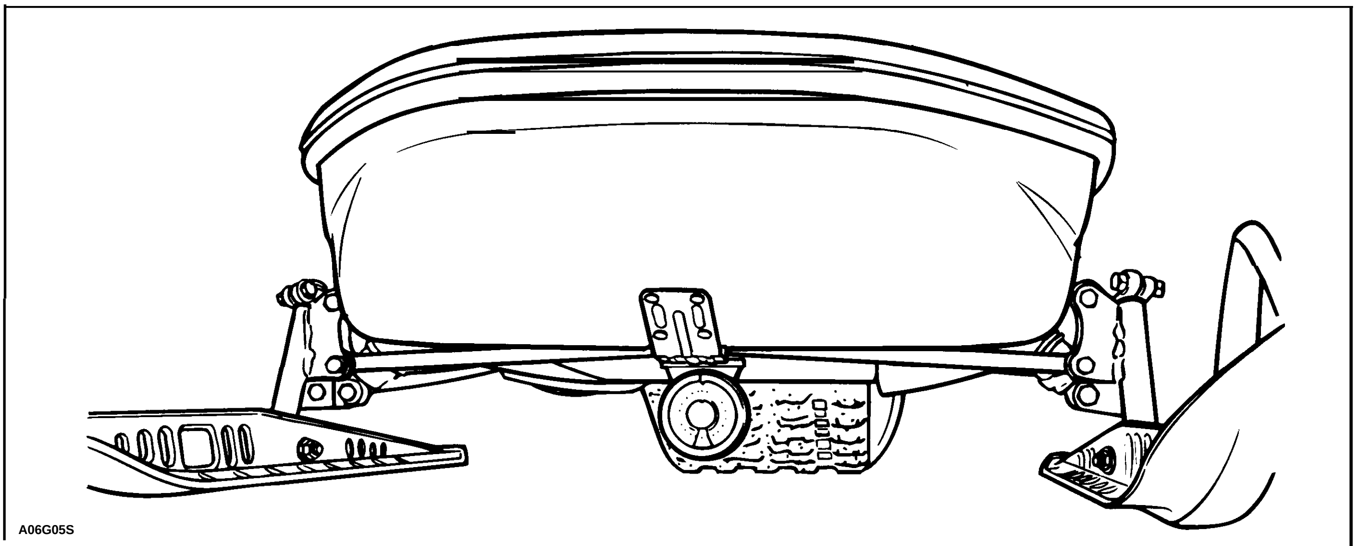
Adjustment is performed by adjusting the length of the upper control arm.

PROCEDURE :

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

o

—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.


A06G05S

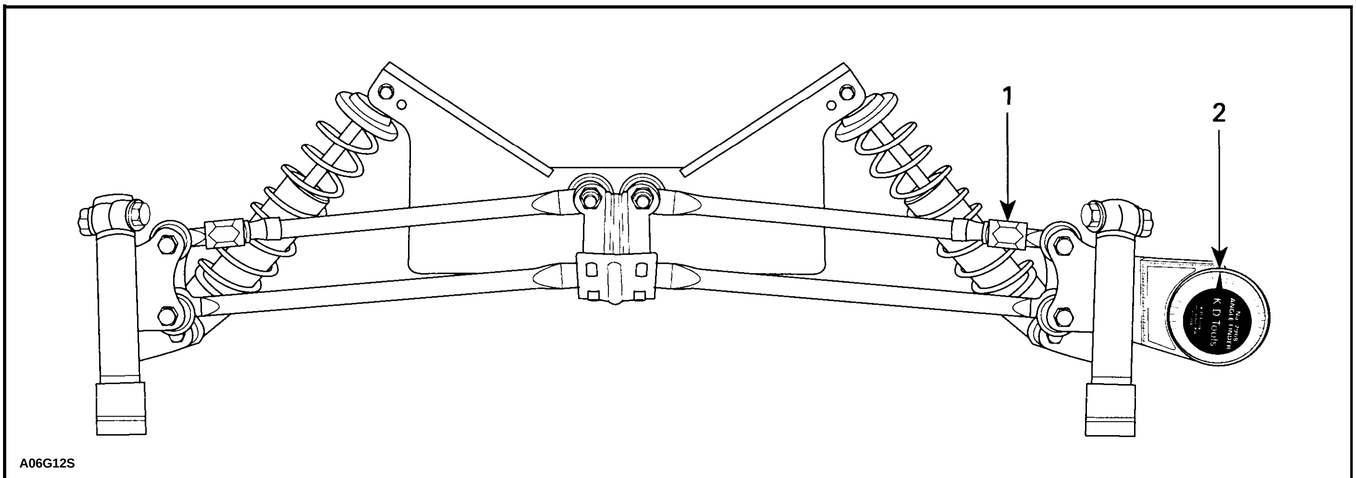
—Place the angle finder on the swing arm near the ski leg housing.

CAUTION : Angle finder must sit square against swing arm. Positioning angle finder against a weld bead or decal may result in a false reading.

—Loosen the lock nuts on the upper control arms.

—Unbolt the upper arm at the ski leg housing. Turn the control arm (or bushing) in or out to achieve the desired camber angle.

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 0° ± 0.5° (vertical)

—Retorque all nuts and bolts to the proper torque.

—Ski toe out must be checked after any camber adjustments.

SKI TOE OUT

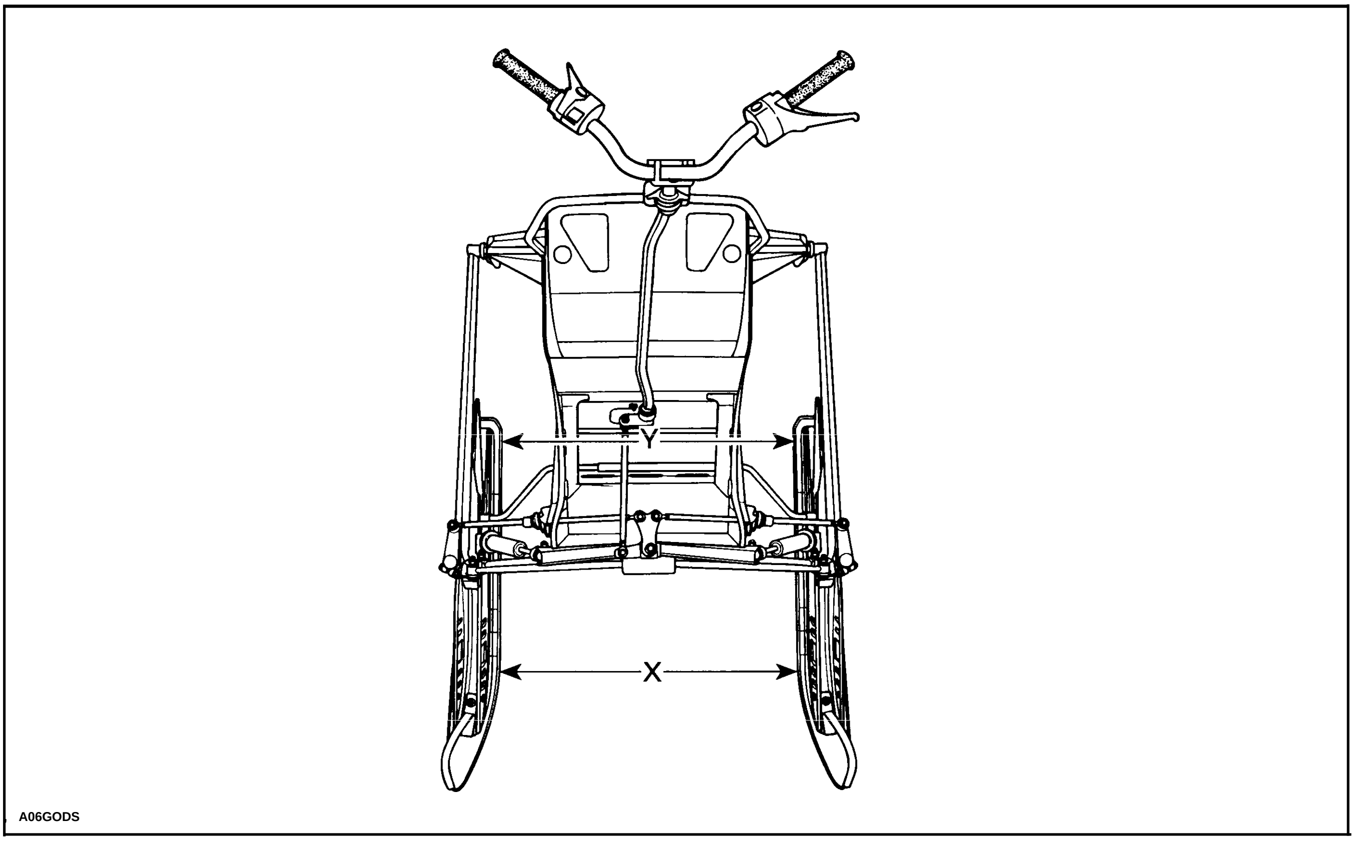
Most oval racers use modified handlebars with loops or angles on the left end. Often a driver prefers a handlebar position that is not horizontal when the skis are in their straight ahead position. This allows a more comfortable driving position when in a corner. Whatever handlebar you prefer should 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 (1 1/16 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 :

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

GUIDE TO HANDLING PROBLEMS

o **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.**

o **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).**
     1. **Sharpen carbide runners.**
     2. **Add more carbide.**
     3. **Shorten limiter strap on center arm.**
     4. **Increase negative camber of ski legs.**
     5. **Increase ski spring** preload.
     6. **Decrease center spring** preload.
   - B. **Rear of machine starts to come around or is loose when entering a corner.**
     1. **Lengthen limiter strap on center arm.**
     2. **Decrease ski spring** preload.
     3. **Decrease negative camber of ski legs.**
     4. **Increase center spring** preload.
     5. **Sharpen/ add track studs.**
   - C. **Inside ski lifts.**
     1. **Reduce the amount of negative camber on the ski legs.**
     2. **Check for free operation of stabilizer bar.**
     3. **Decrease** preload **of ski springs.**
     4. **Shorten limiter strap on center arm.**

II. Problems encountered while going around or exiting a corner.

A. Front end pushes coming out of corner (steering is not precise).

1. Shorten limiter strap on center arm.
2. Decrease center spring preload.
3. Check condition of carbides.
4. Add more carbide.
5. Increase negative camber of ski legs.
6. Increase ski spring preload.
7. Increase rear spring preload.

B. Rear of machine starts to come around or is loose when exiting a corner.

1. Lengthen limiter strap on center arm.
2. Decrease ski spring preload.
3. Increase center spring preload.
4. Decrease negative camber of ski legs.
5. Decrease rear spring preload.

C. Left ski lifts.

1. Shorten limiter strap on center arm.
2. Decrease center spring preload.
3. Check for free operation of stabilizer bar.
4. Increase stabilizer bar diameter or shorten end levers.

III. General handling problems.

A. Machine darts from side to side on straightaway.

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

B. Excess effort required to turn handle bars.

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

IV. Adjusting the suspension for ride and comfort.

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

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

4. Again, measure from the floor to the bottom of the rear grab handle. This dimension should be 1" to 2" (25 mm to 50 mm) less than the fully extended dimension.
5. A) If the vehicle settles more than 2" (50 mm), increase the rear spring preload.
   B) If the vehicle settles less than 1" (25 mm), decrease the rear spring preload.
6. This is a preliminary setting only ! Increase and decrease the preload adjustments to fine tune for your preference.
7. 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.

B. 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, 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.	c % .
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

Table of contents

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

SPEED

1 MPH = 1.61 KPH

POWER

1 HP= 746 WATTS

TORQUE

1 FT-LB = 1.356 N•m (Newton-Meters)

METRIC WEIGHTS AND MEASURE CHART

LINEAR MEASURE

10 Millimeters (mm) = 1 Centimeter
10 Centimeters (cm) = 1 Decimeter
10 Decimeters (din) = 1 Meter
10 Meters (m) = 1 Decameter (dcm)
10 Decameter = 1 Hectometer (hm)
10 Hectometers = 1 Kilometer (km)

AREA MEASURE

100 Sq. mm = 1 Sq. Centimeter
10000 Sq. Centimeters = 1 m^2
100 Sq. Meters = 1 Acre
100 Acres = 1 Hectare (h)
100 Hectares = 1 Sq. Kilometer

WEIGHT

10 Milligrams (mg) = 1 Centigram
10 Centigrams (cg) = 1 Decigram
10 Decigrams (dg) = 1 Gram (g)
10 Grams = 1 Decagram (dag)
10 Decagrams = 1 Hectogram (hg)
10 Hectograms = 1 Kilogram (kg)
1000 Kilograms = 1 Metric Ton (t)

VOLUME / CAPACITY

10 Milliliters (mL) = 1 Centiliter
10 Centiliters (cL) = 1 Deciliter
10 Deciliters (dL) = 1 Liter
10 Liters (L) = 1 Decaliter
10 Decaliters(daL) = 1 Hectoliter
10 Hectoliters (hL) = 1 Kiloliter
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.

1. **If you are in stock classes, know what adjustments are legal.**
2. **Modifications to the power curve of an engine will require recalibration of the transmission.**
3. **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.**
4. **Sloppy engine modification usually results in less power than you had stock.**
5. **Follow the assembly and disassembly procedures outlined in the appropriate** *Shop Manual:*

   1988 Shop Manual - P / N 484055000

   1989 Shop Manual - P / N 484055700

   1990 Shop Manual - P / N *484056000*

   1991 **Shop Manual - P / N** *484057200*

   1993 **Shop Manual - P / N** *484058700*

   1994 **Shop Manual - P / N 484060900**

   1995 Shop Manual - P / N 484061800

   1996 Shop manual part number #s

vol. 1	484062800	Elan, Tundra II LT, Touring E / E LT / LE / SLE Formula S / SL Skandic 380/ 500
vol. 2	484062801	Grand Touring 500 / 580/ SE, Formula SLS / STX / STX LT(2) Summit 500, Mach 1
vol. 3	484062802	MX Z 44o / 583, Formula Z / SS / III / III LT Summit 583 / 670 Mach Z / Z LT Skandic WT

6. **Use the proper octane gasoline for your engine. (Modification may require higher octane.).**
7. **Correct your carburetor jetting for the atmospheric conditions which exist at the time as close as possible to the time you will be competing.**

BASIC ENGINE THEORY

TERMINOLOGY

Cycle : In a combustion engine, a cycle is accomplished when the four (4) phases; intake, compression, ignition and exhaust are complete.

T.D.C. : Top Dead Center: The position of the piston when it reaches the upper limit of its travel inside the cylinder.
- B. T.D.C. : Before Top Dead Center
- A. T.D.C. : After Top Dead Center.

B.D.C .: Bottom Dead Center: The position of the piston when it reaches the lower limit of its travel inside the cylinder.
- B. B.D.C. : Before Bottom Dead Center
- A. B.D.C. : After Bottom Dead Center.

Bore : Diameter of the cylinder.

Stroke: The maximum movement of the piston from B.D.C. to T.D.C. It is characterized by 180° of crankshaft rotation.

Combustion Chamber: Space between cylinder head and piston dome at T.D.C.

Displacement: The volume of the cylinder displaced by the piston as it travels from T.D.C. to B.D.C. The formula is :

$$\frac{\text{Bore* x Stroke}}{4} \text{ x } \pi \quad (\pi = 3.1416)$$

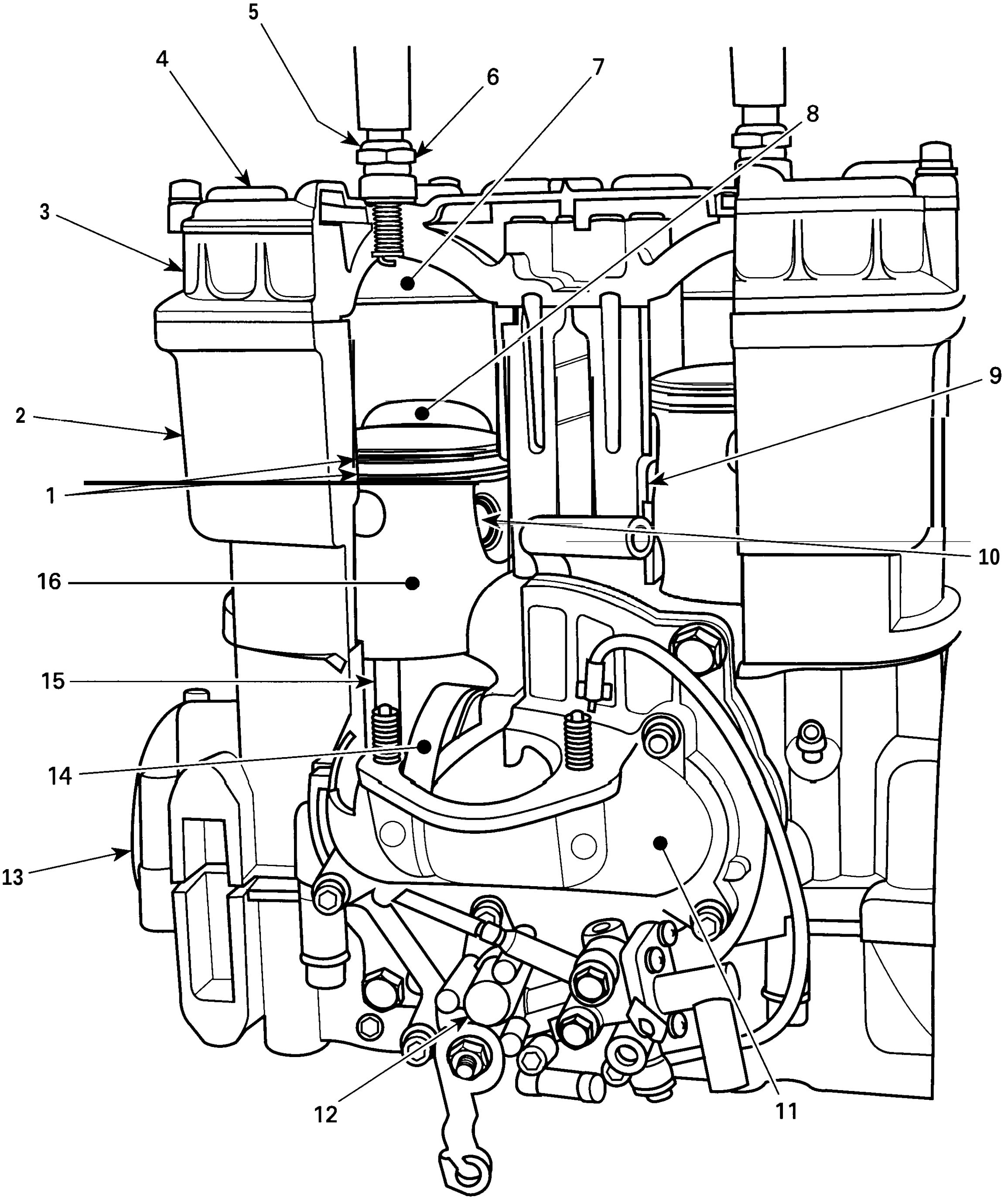
expressed in cc (cubic centimeters)

NOTE: To transfer cc to cubic inches, divide cc by 16.387

o

Compression : Reduction in volume or squeezing of a gas.

BASIC ENGINE COMPONENTS



F01D5DS

1. Rings
2. Cylinder
3. Cylinder head
4. Cylinder head cover
5. Sparkplug
6. Sparkplug
7. Combustion chamber
8. Exhaust port
9. Transfer port
10. Wrist pin
11. Intake port
12. Oil pump
13. Crankcase
14. Crankshaft
15. Connecting rod
16. Piston

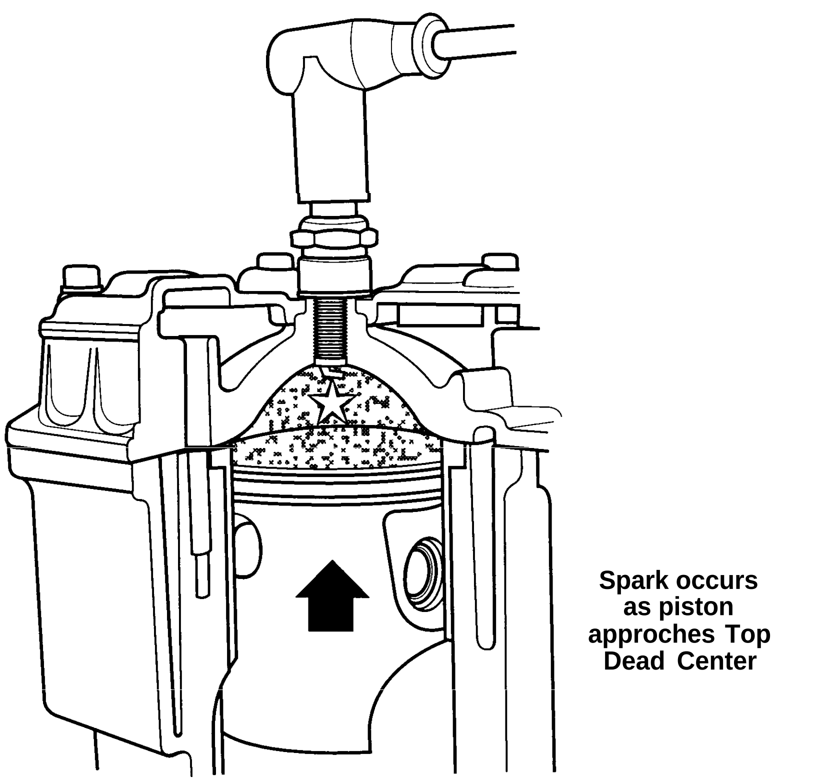
COMBUSTION PROCESS

NORMAL COMBUSTION

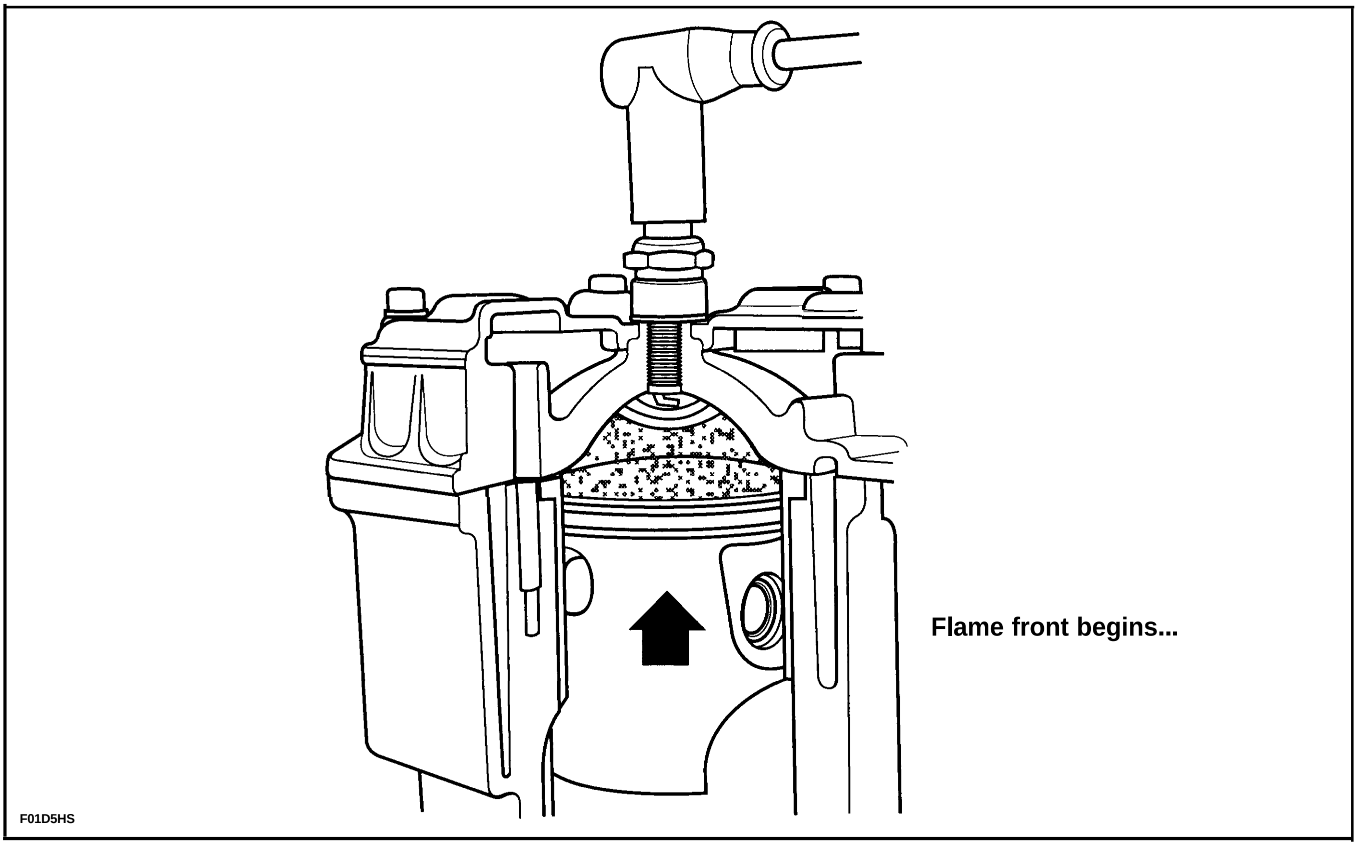
Since the beginning of this study we have spoken of air/fuel mixture combustion rather than explosion. This combustion is a slow then accelerated burning of the mixture within the combustion chamber. Ignition occurs with the firing of the spark plug.

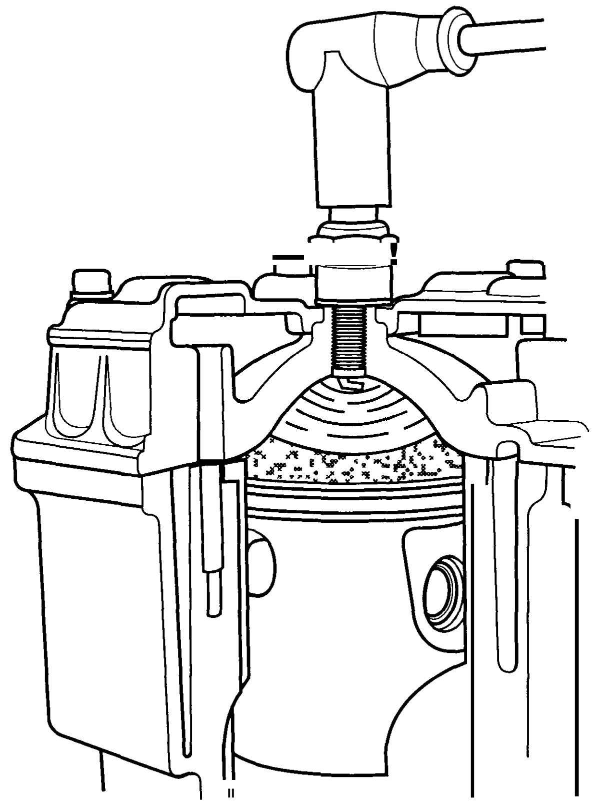
This initial process generates heat and pressure which in turn, is transmitted by conduction to the contiguous portion of the unburned mixture. When this portion has reached the point of self-ignition it starts to burn releasing more pressure and heat.

This burning action, called a flame front, travels at a speed of approximately 30.3 m.(l00 feet) per second until all mixture is burned, thus providing maximum piston thrust.

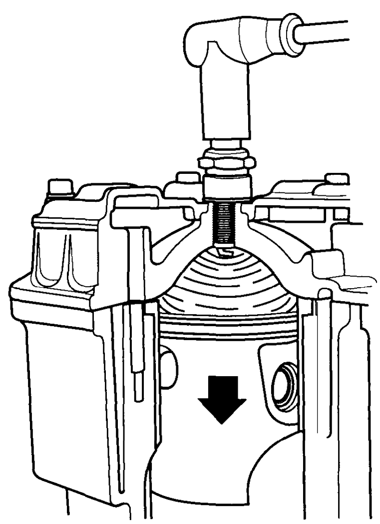


F01D5GS


Flame front begins...
F01D5HS



F01D5IS



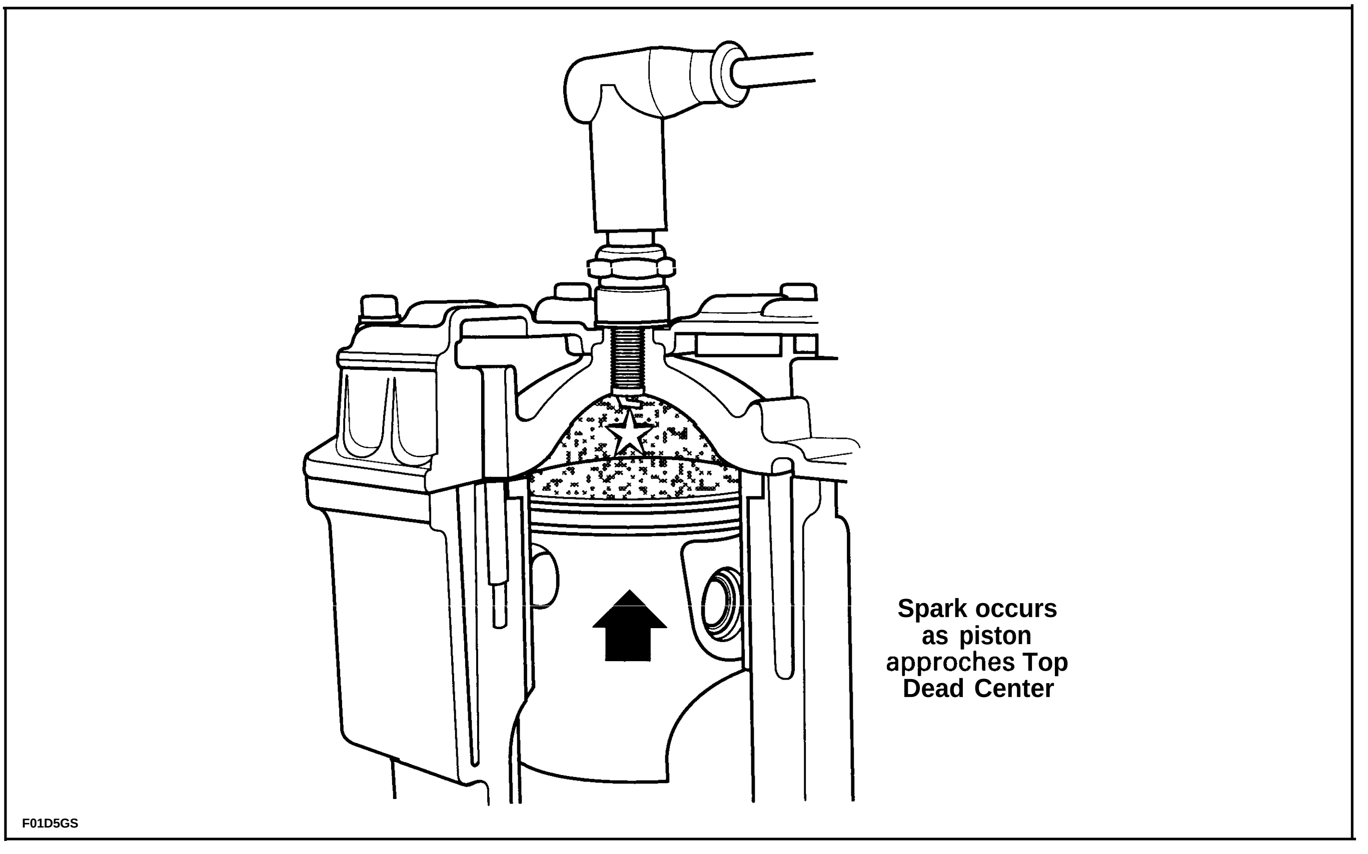
F01D5JS

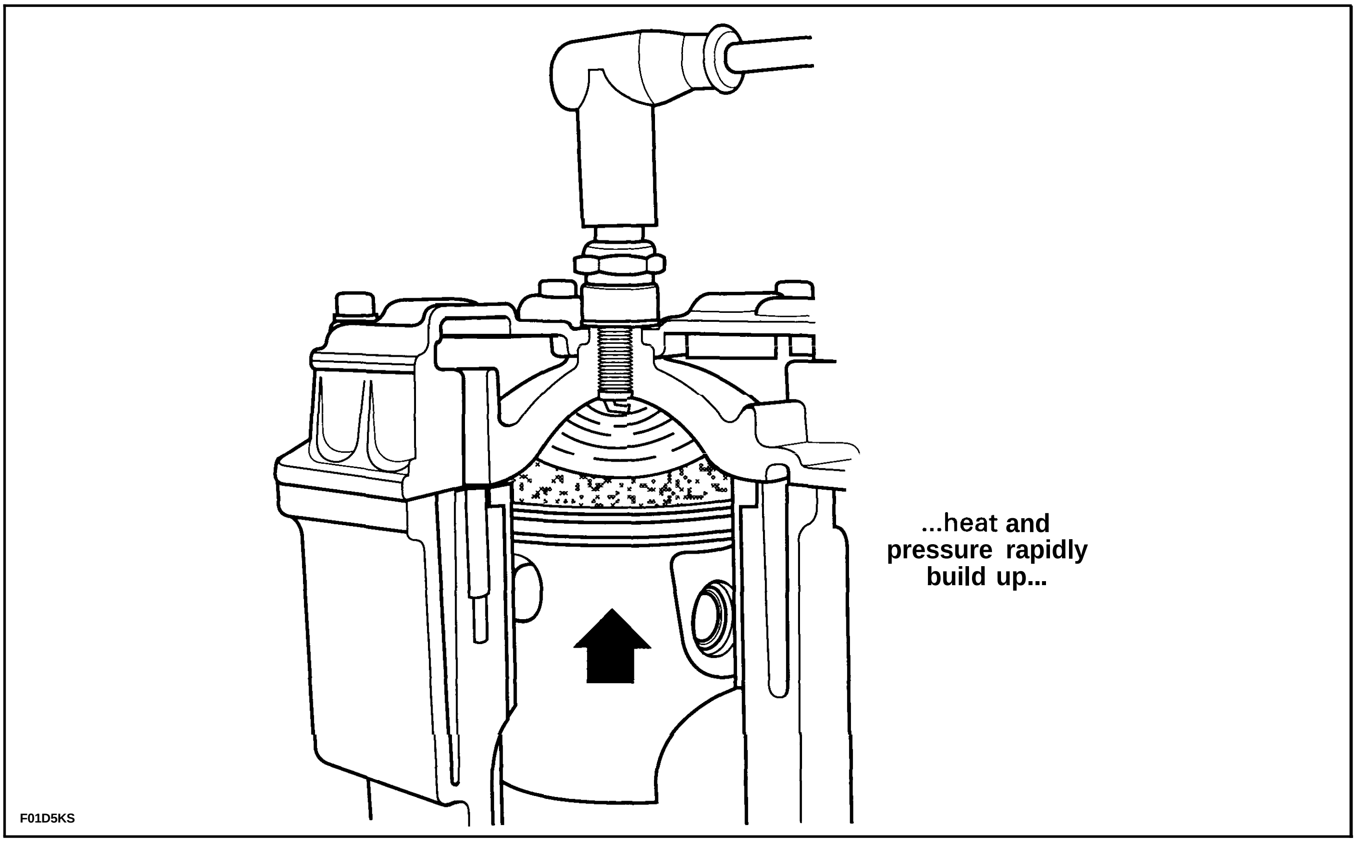
With all operating parameters correct, normal combustion will take place. However, if for some reason the temperature inside the cylinder is increased during combustion, abnormal combustion will occur and lead to serious engine damage.

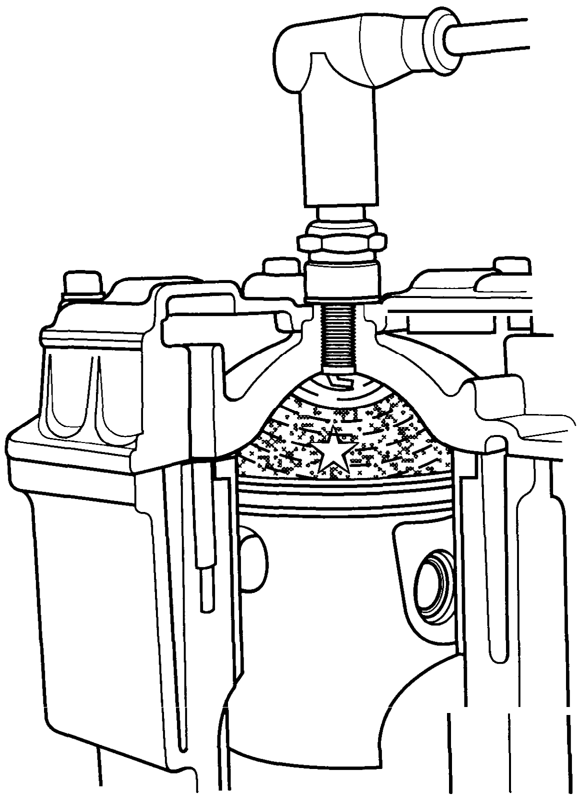
DETONATION

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 cha-mber.



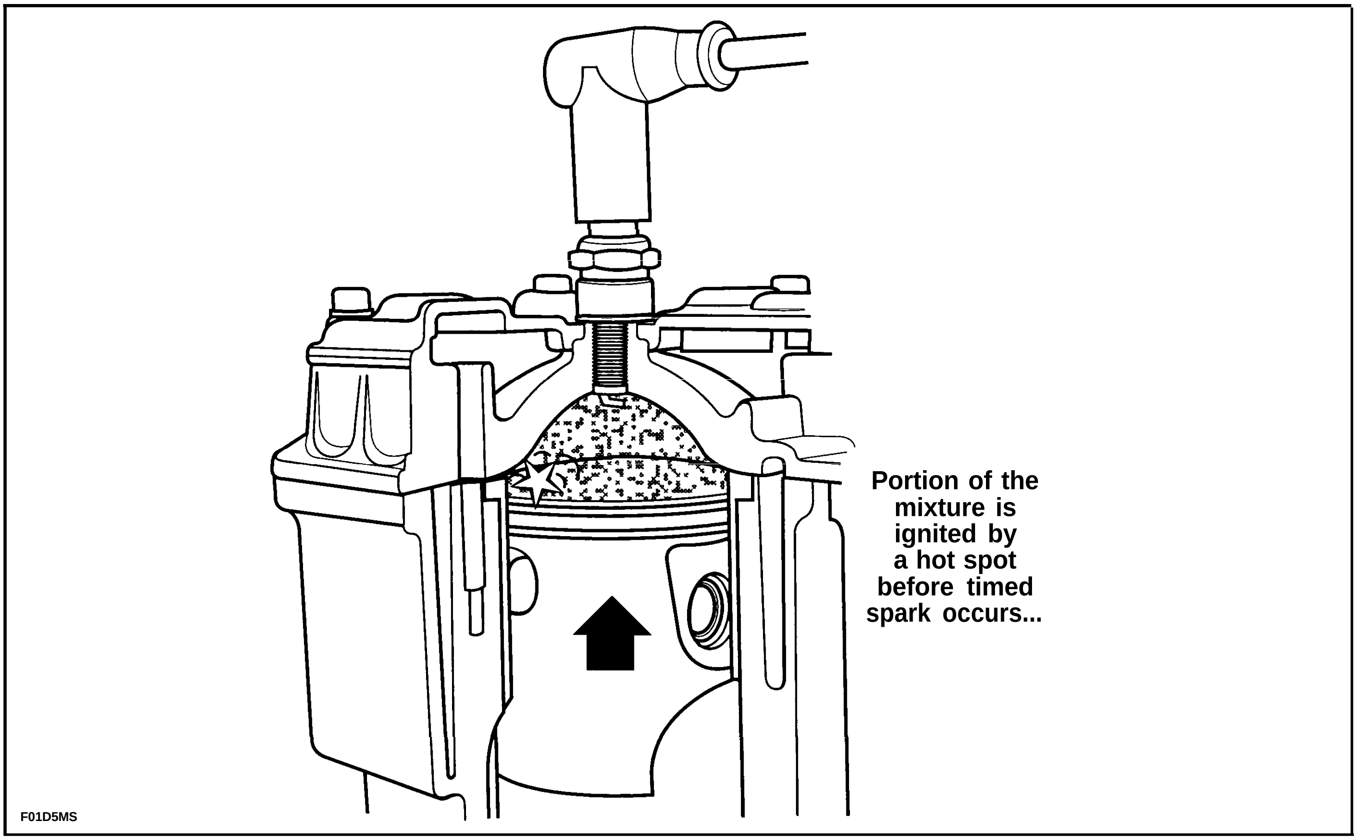

...heat and
pressure rapidly
build up...
F01D5KS

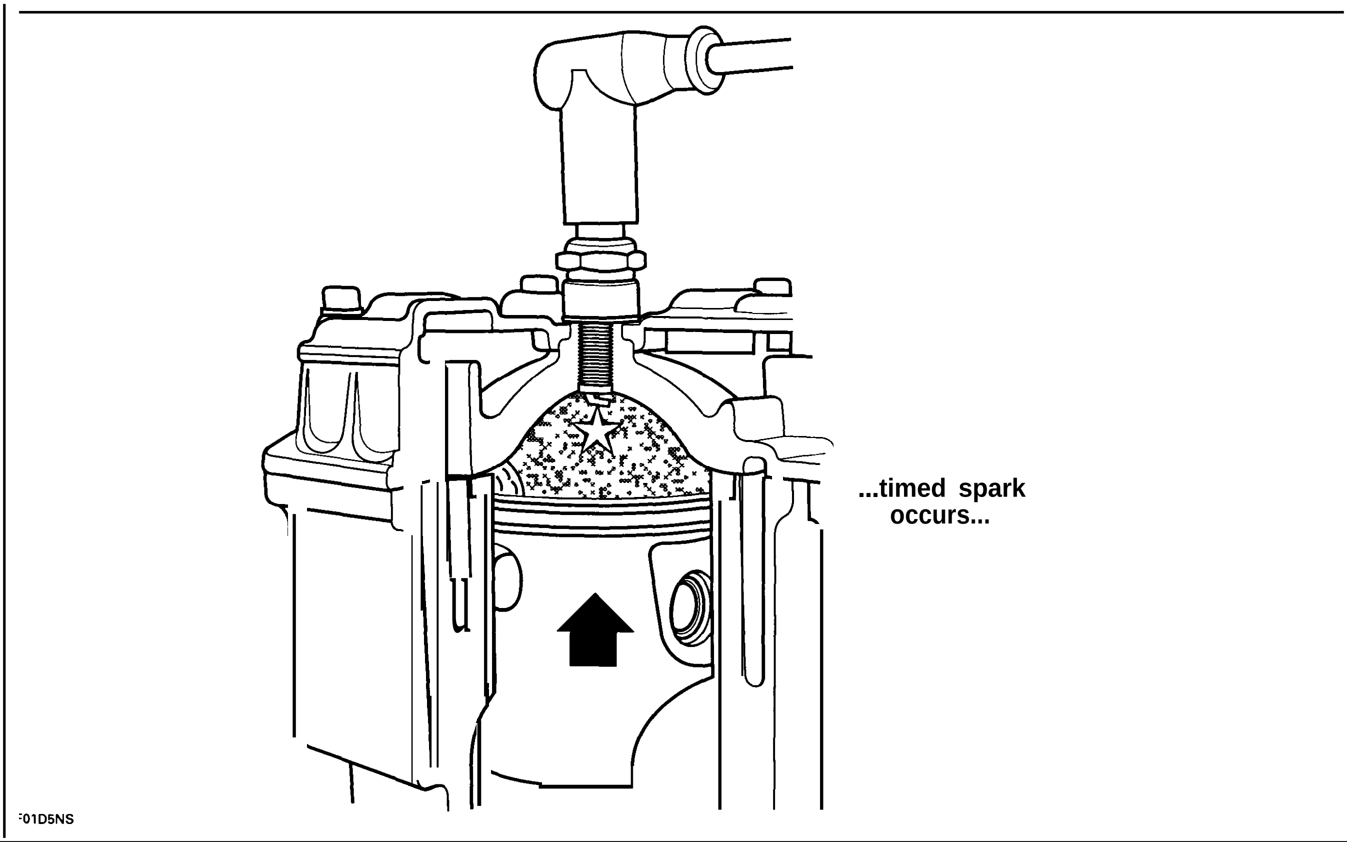


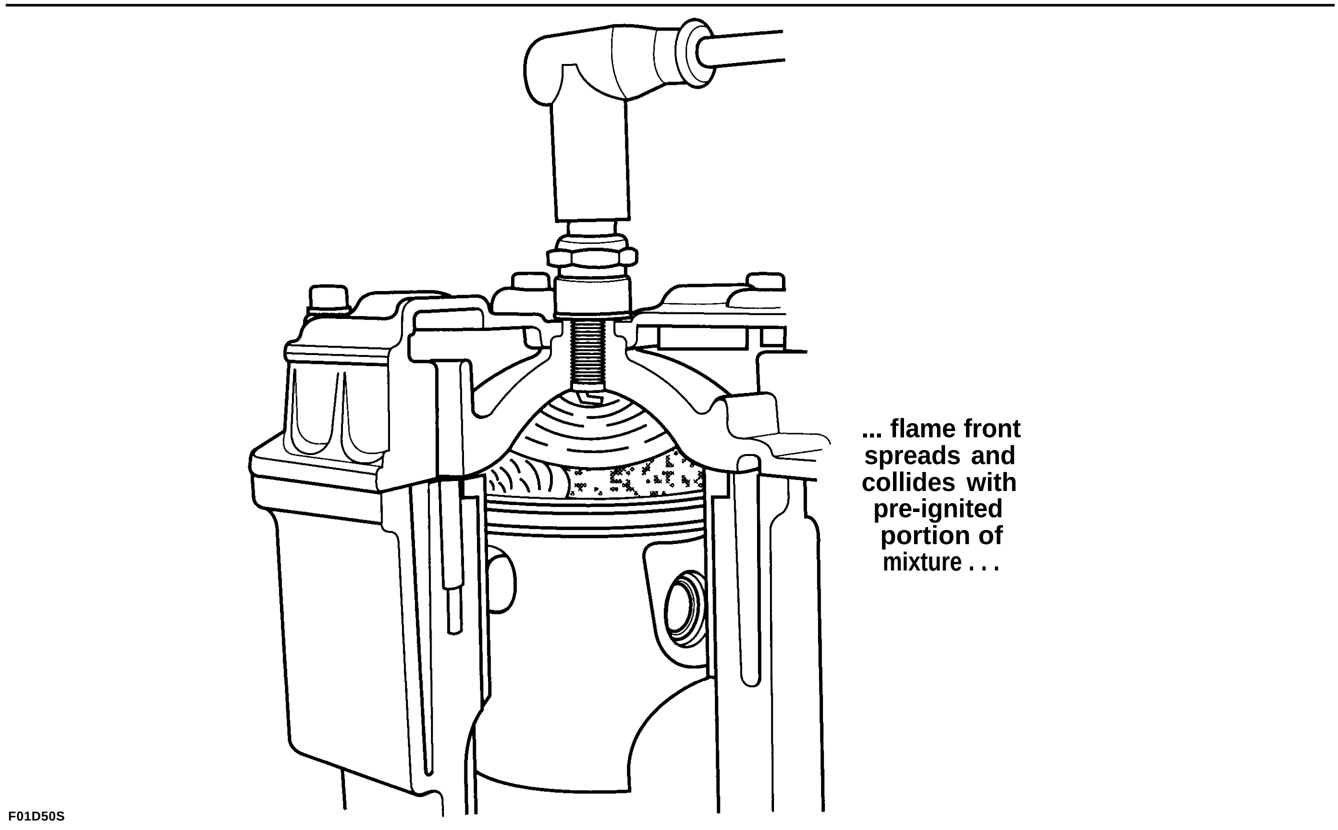
These shock waves can sometimes be heard as "pinging." While these shock waves can be detrimental to the mechanical integrity of the engine, it is the excessive heat that causes most problems in 2-strokes. The piston may expand excessively causing a seizure or the piston may melt. The melting will occur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

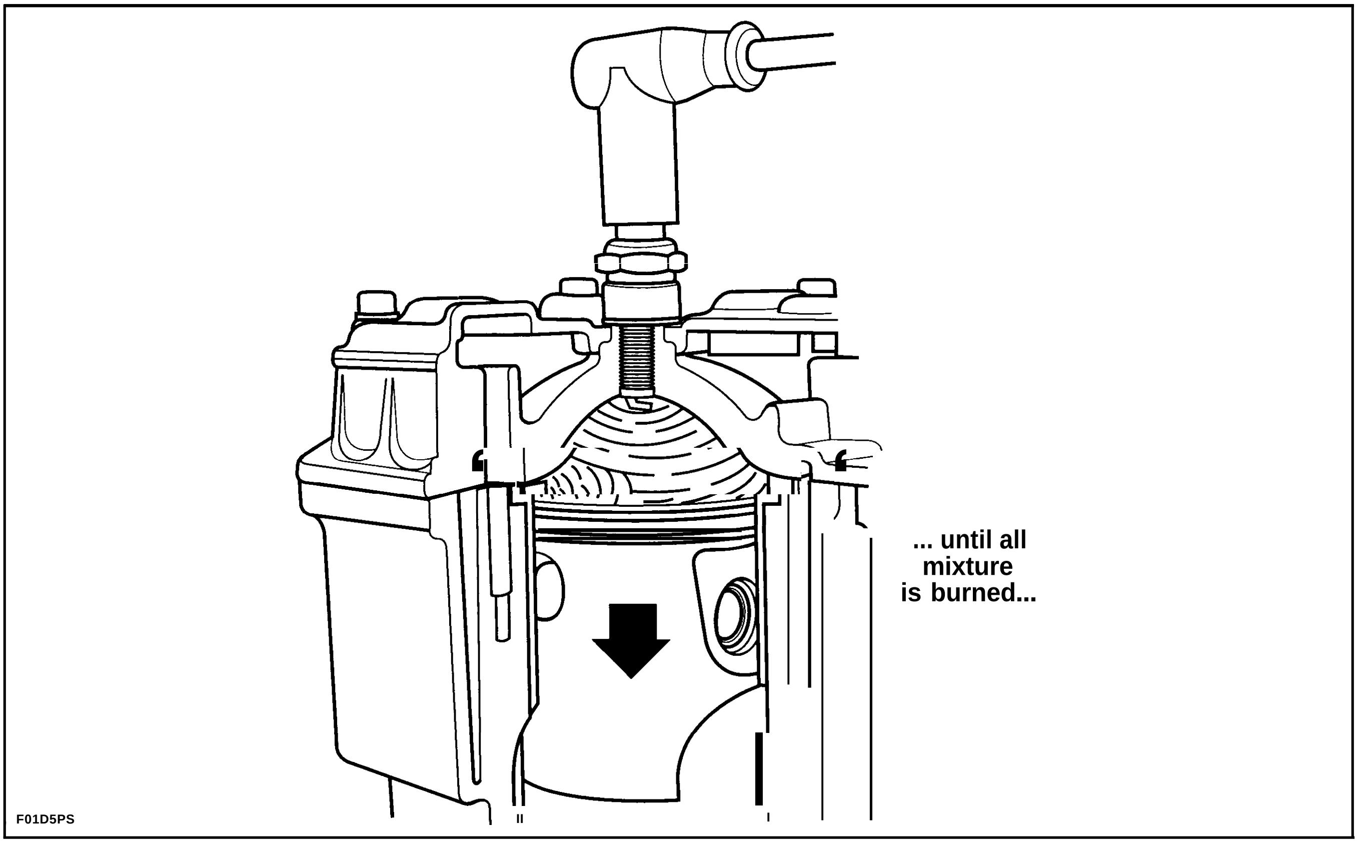
PRE-IGNITION

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.**




...timed spark
occurs...
F01D5NS


... flame front spreads and collides with pre-ignited portion of mixture . . .
F01D50S



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 :

1. Octane of the fuel is too low.

2. Air /fuel mixture is too lean.
- **a. Incorrect jetting**
- **b. Air leaks**
- **c. Varnish deposits in carburetor**
- **d. Malfunction anywhere in fuel system**

3. Spark plug heat range too high.

4. Ignition timing too far advanced
- **a. Initial timing off**
- **b. Ignition component failure**

5. Compression ratio too high.
- **a. Improperly modified engine**
- **b. Deposit accumulation on piston dome or head**

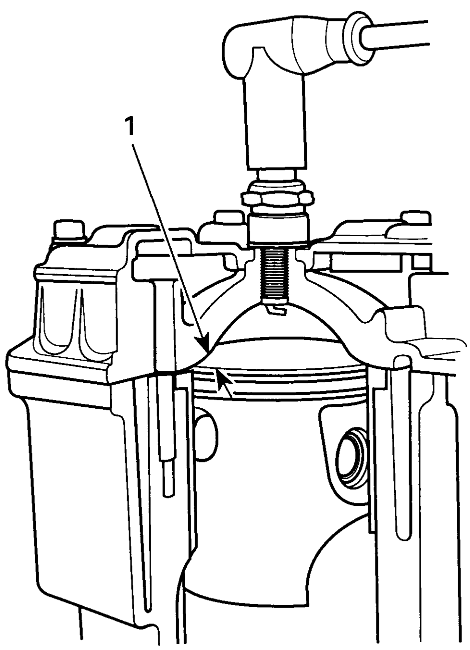
6. Exhaust system restrictions.
   a. Muffler plugged/ restricted
   b. Tailpipe diameter too small
   c. Incorrect design of expansion chamber

7. General overheating
   a. Broken fan belt
   b. Loss of coolant
   c. Lack of snow on heat exchangers

8. 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.



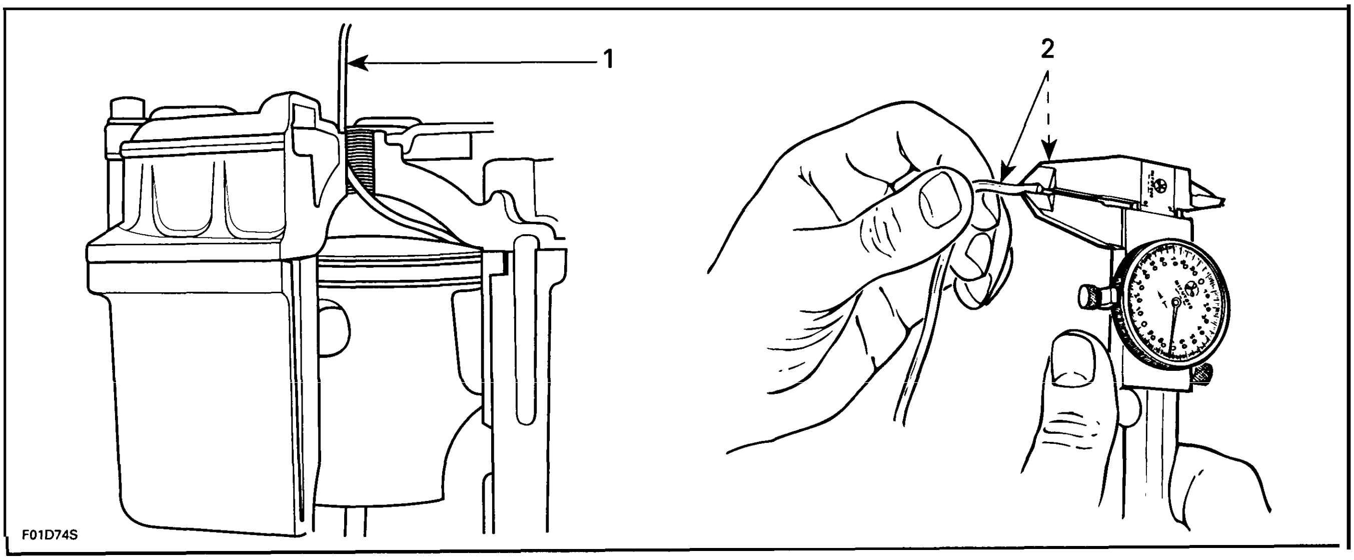
F01D5WS

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

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

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

The solder should be inserted above and in line with the wrist pin.



1. Solder
2. Flattened area

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

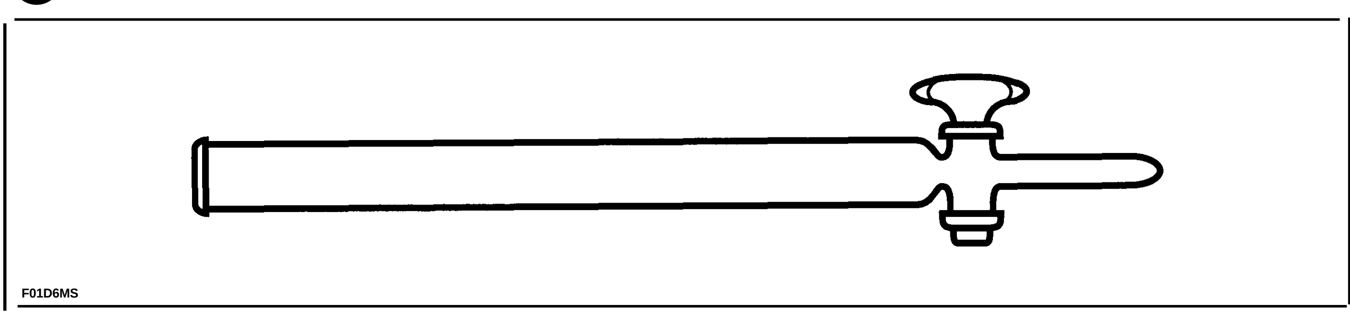
MEASURING A COMPRESSION RATIO

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

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

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

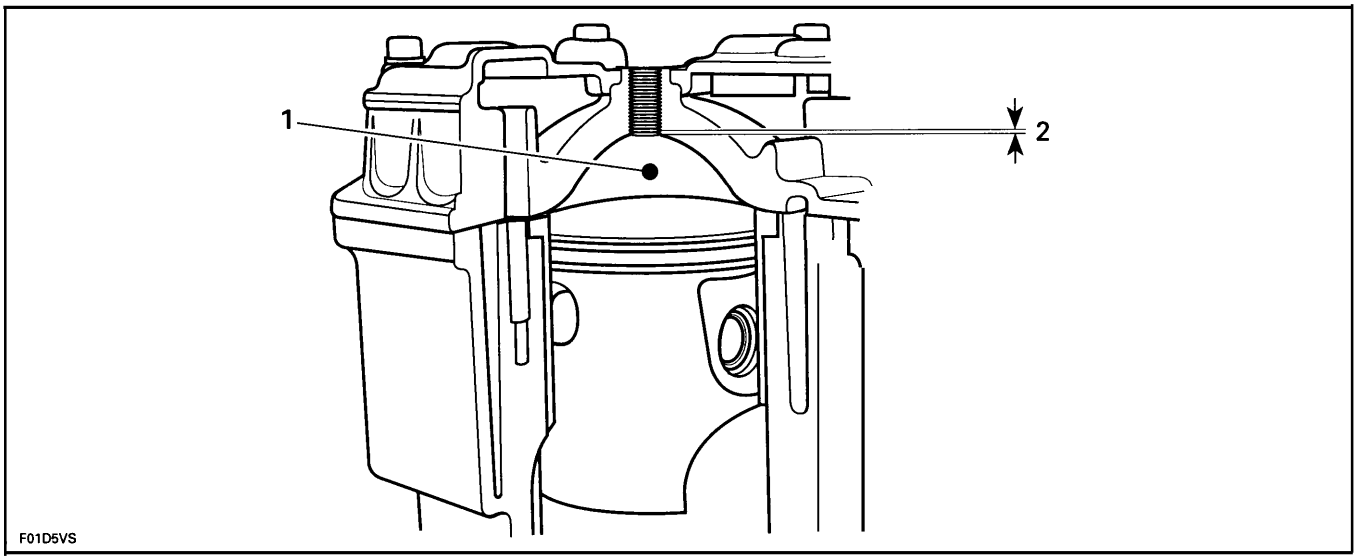
NOTE : Suggested burette, "Canlab no. 8-000/T, or equivalent.



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

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

5. Record the volume which we will note as V_2.



1. Combustion chamber (V_2)
2. Liquid mixture 2threads

NOTE : When the combustion chamber is filled to top of spark plug hole, subtrack 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.

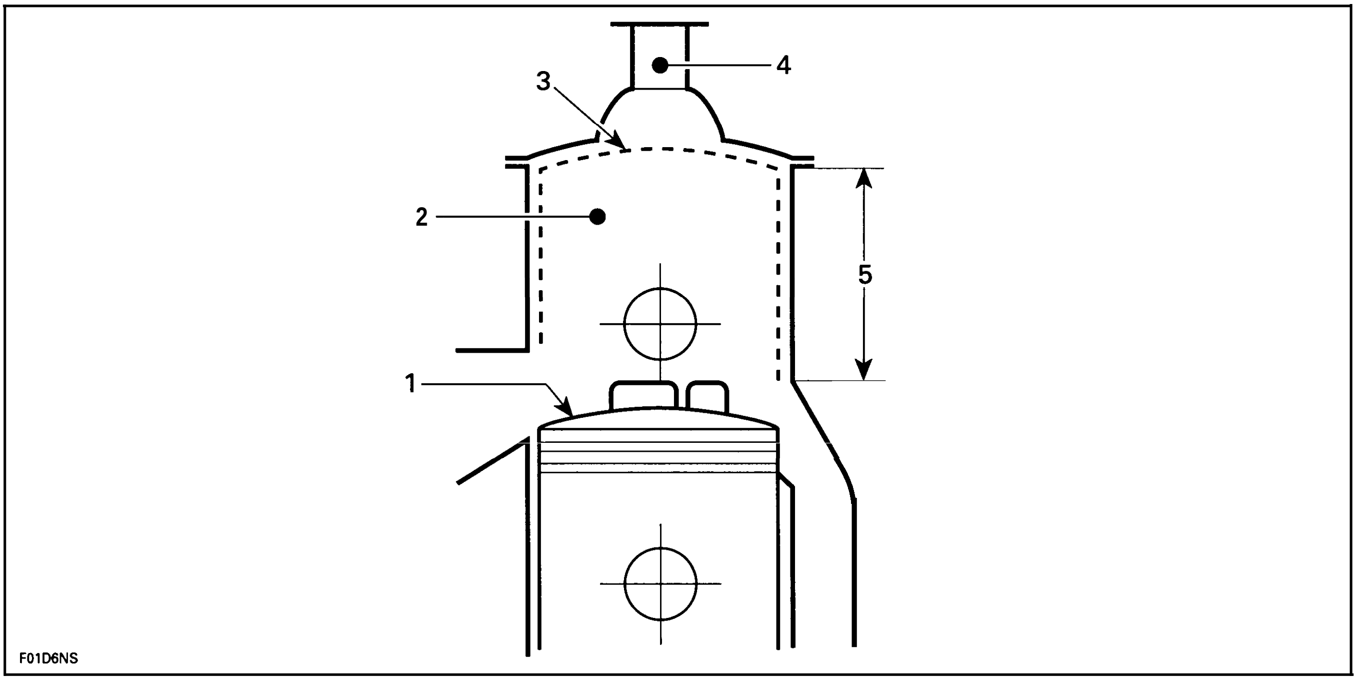
$$C.R. = \frac{V_1 + V_2}{V^*}$$

Where :

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

v, = volume of a cylinder = $\frac{B^* \times S \times \pi}{4}$

V*= minimum combustion chamber volume



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

EXAMPLE :

π = 3.14
B = Bore diameter (cm) = 7.2 (=72 mm)
S = Stroke (cm) = 6.1 (=61 mm)
V_2 **= 21.5 cc**

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

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

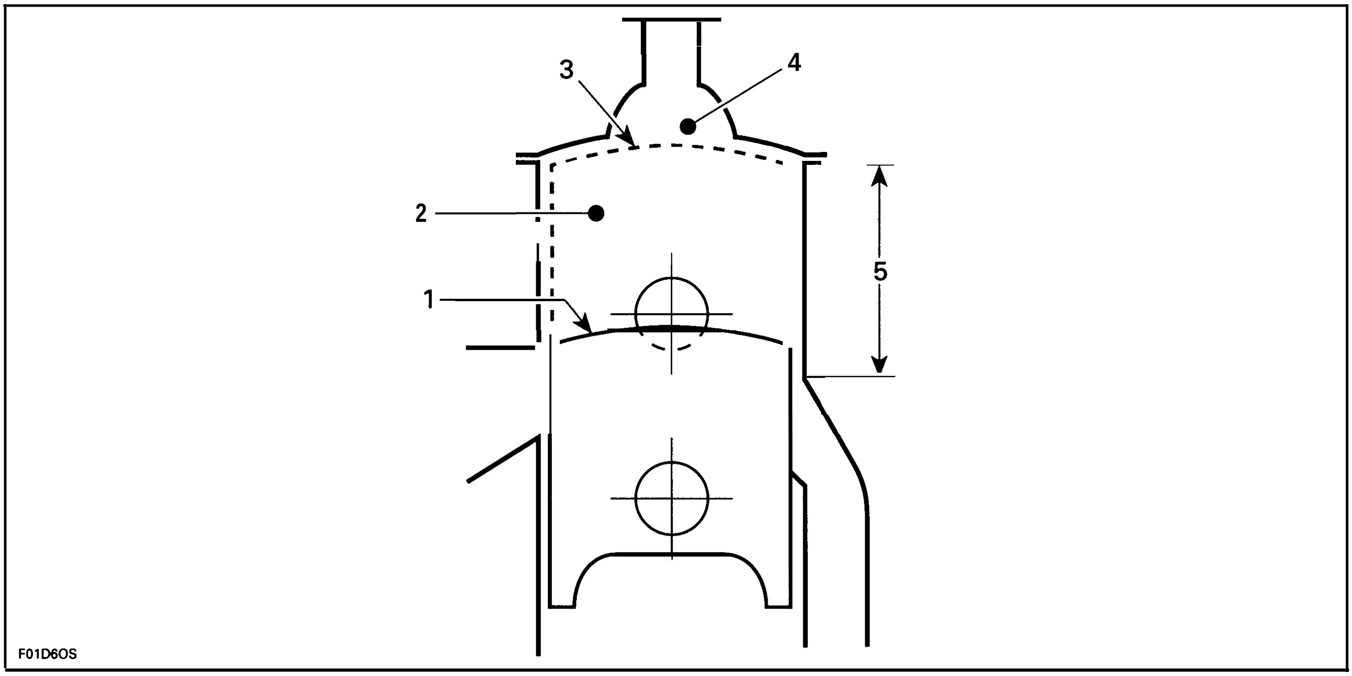
$$C.C.R. = \frac{V_3 + V_2}{V\ *}$$

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. T.D.C.
4. V_2
5. Portion of stroke

EXAMPLE :

π = 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) = $\frac{V_I}{CR_D - 1}$
- V_I = 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

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

$$H = \frac{V_M - V_D}{\pi \times \left(\frac{B}{2}\right)^2} = \frac{21.5\ cc - 19.1\ cc}{3.14 \times \left(\frac{7.2}{2}\right)^2} = .059\ cm = .59\ mm = (.023")$$

OPERATION OF THE RAVE VALVE

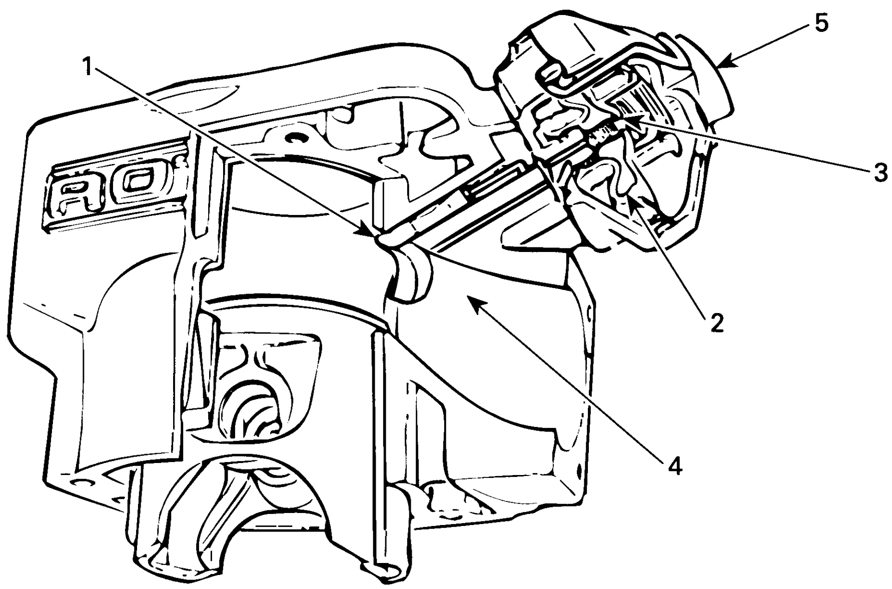
(RAVE = ROTAX ADJUSTABLE VARIABLE EXHAUST)

A) 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.



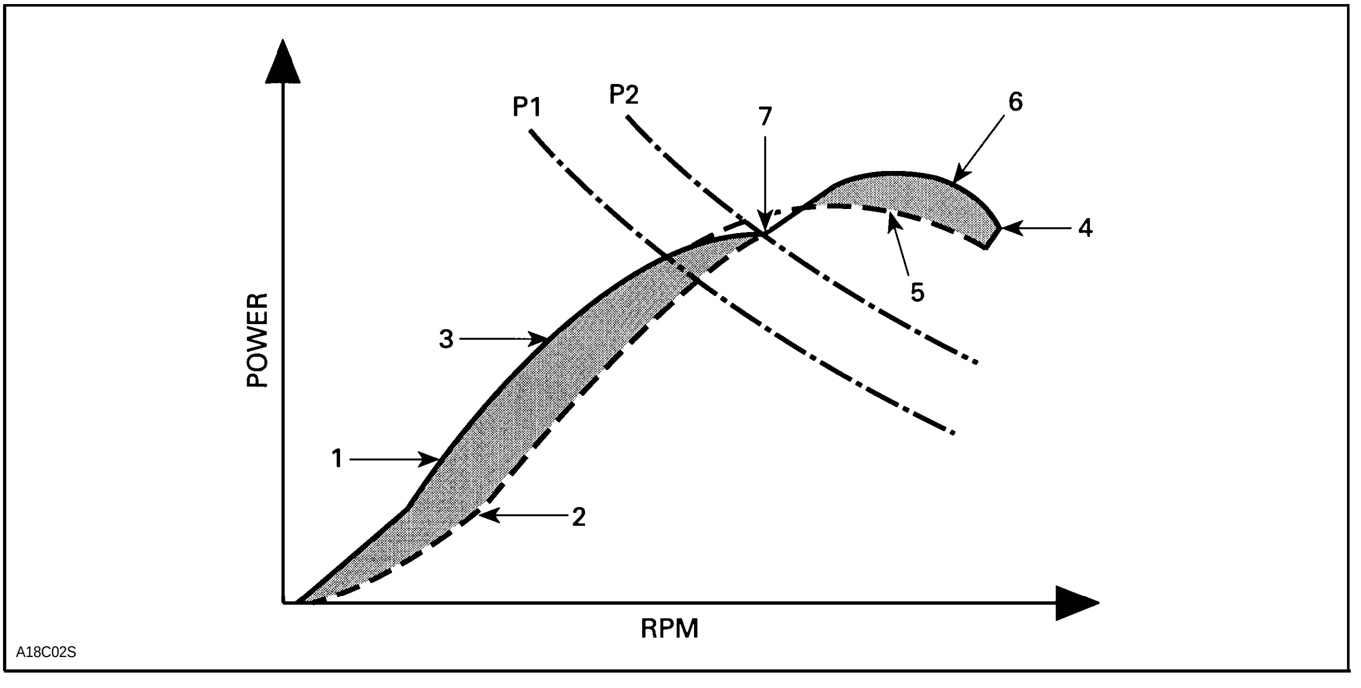
A18C01S

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.

B) OPERATION

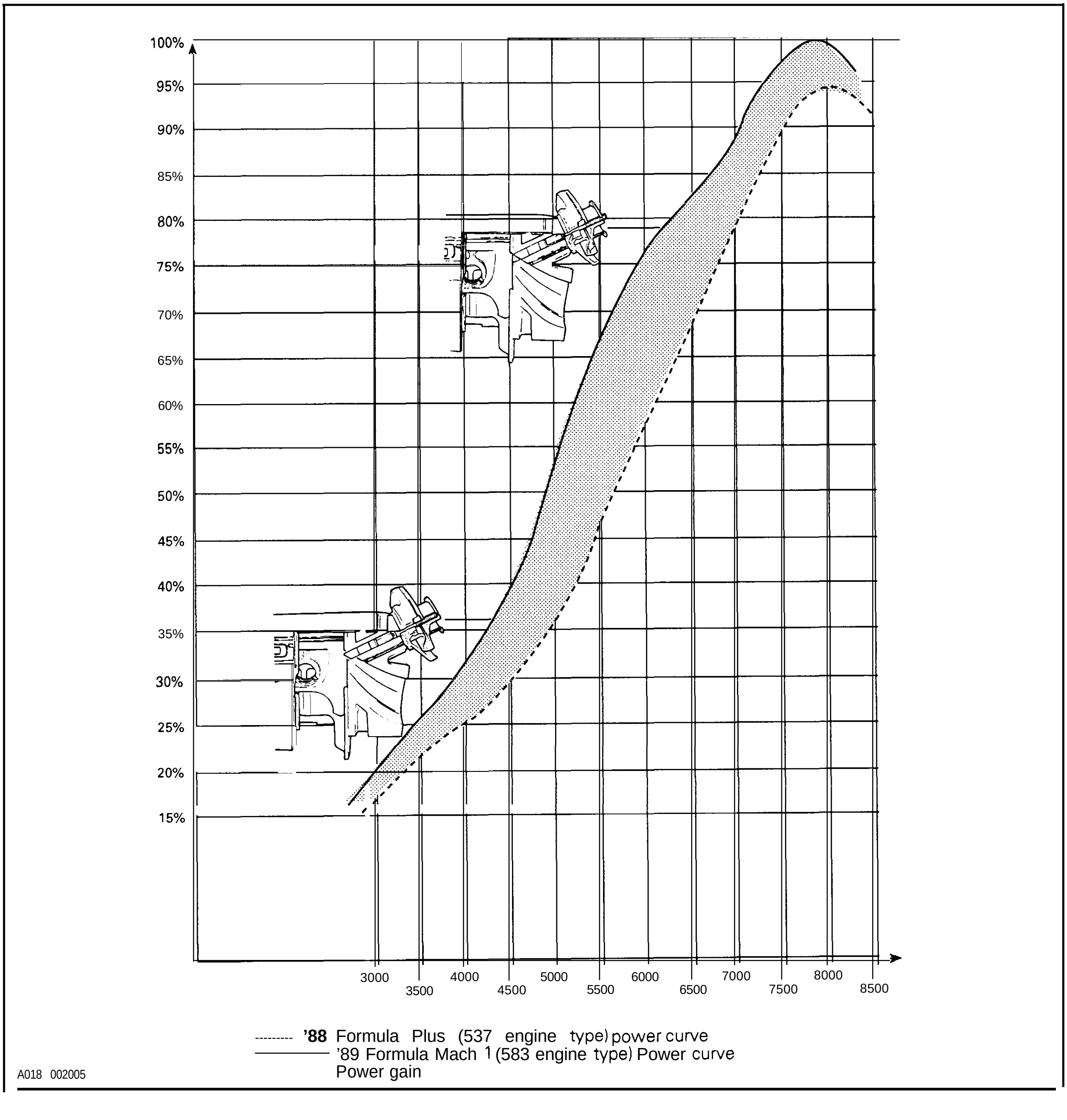
The RAVE valve does not allow an engine to make higher peak horsepower than an engine not so equipped, it can make moving the peak higher practical because of its effect on the rest of the power curve. Item 2 in following illustration is the power curve of an engine with the RAVE valve held fully open 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 PI 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 PI and P2, the useable 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°.

C) 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	Part number	Free length
94	779	420239941	52.5 mm
	670	48	38.0 mm
	583	48	38.0 mm
95	779	420239941	52.5 mm
	670 (one pipe)	46	42.0 mm
	670 (two pipe)	48	38.0 mm
	583	48	38.0 mm
	599	40	48.5 mm x D.8
	454	47	42.0 mm
96	All models same as 95 specs except		
	454	420239945	48.0 mm
Optional		420339942	42.5 mm
		420339944	48.5 mm x D.9

D) MAINTENANCE

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

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

E) BORING PRECAUTION

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

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

F) 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 both exhaust flanges, both 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 8617258 00) in place of the red plastic adjuster On the diaphragm cover so that you can observe the diaphragm movement.

The movement indicator must be turned all the way in to provide maximum spring pre-load. As you begin pressurizing the engine using engine leak tester kit (P/ N 8617256 00), YOU will find the RAVE valve beginning to move at 5 kPa (0.7 psi or 20 inches of water) and the valve will be fully displaced when you reach 10 kPa (1.4 psi or 40 inches of water).

O NOTE : Due to the low pressure conditions when using the leak tester kit (P/N 861 7256 00) to check the RAVE valve operation, install a gauge with a range of 0-200 inches of water (P / N 5290104 00) on leak tester. As reference 6.89 KPa 1 (PSI)= 27.71 inches of water.

G) TROUBLESHOOTING

SYMPTOM	CAUSE	REMEDY
Engine revs 500 to 1000 RPM lower than its maximum operational RPM ; Rave valve does not open at all	1. Bent valve rod 2. Stuck valve 3. Wrong spring tension (too high) 4. Clogged passages 5. Damaged bellows or clamp(s)	Replace Clean Replace Clean 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 2. Adjustment screw too far out 3. Valve stuck open	Replace Turn until it bottoms Clean

OPERATION OF THE ROTARY VALVE

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

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 Dort engine, a greater air/fuel mixture supply can enter the engine and remain in the engine without spitback.

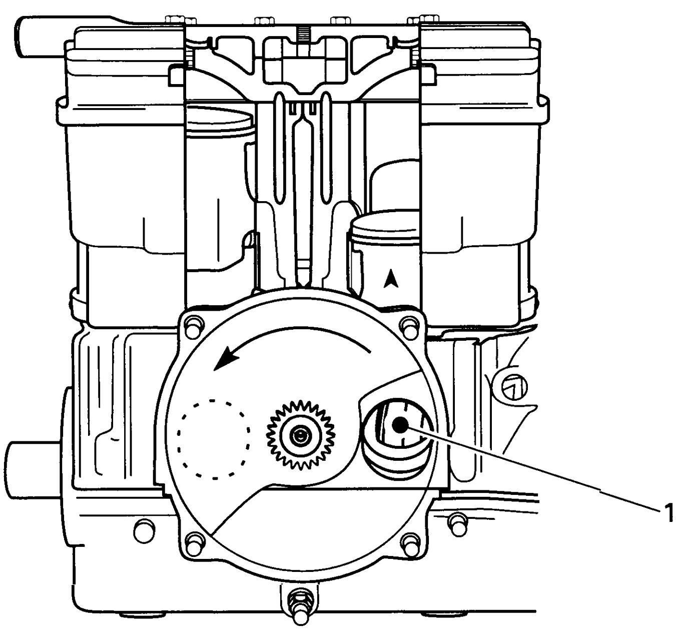
Basically, the rotary valve engine performs the same operation as the ordinary two-stroke engine. The only difference being the location and operation of intake.

1) The intake port is positioned directly in the crankcase.

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

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

INTAKE AND SECONDARY COMPRESSION

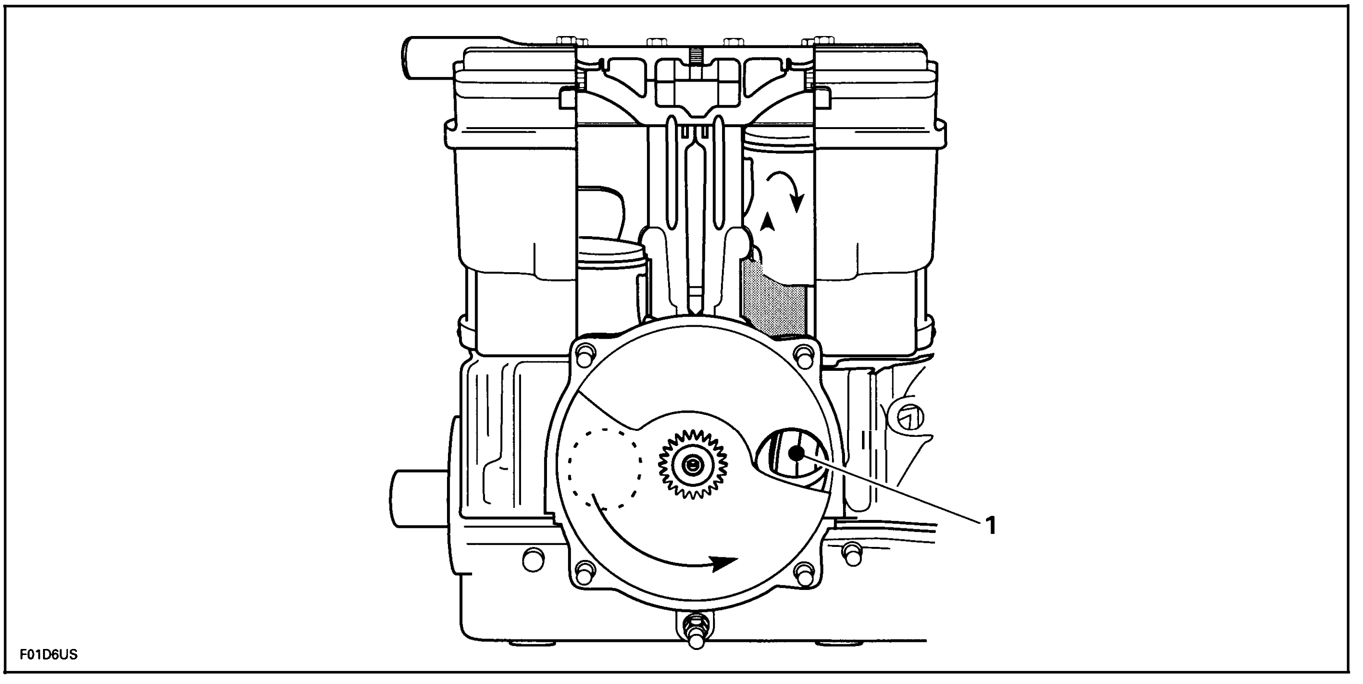


1. Fresh charge from carburetor

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).

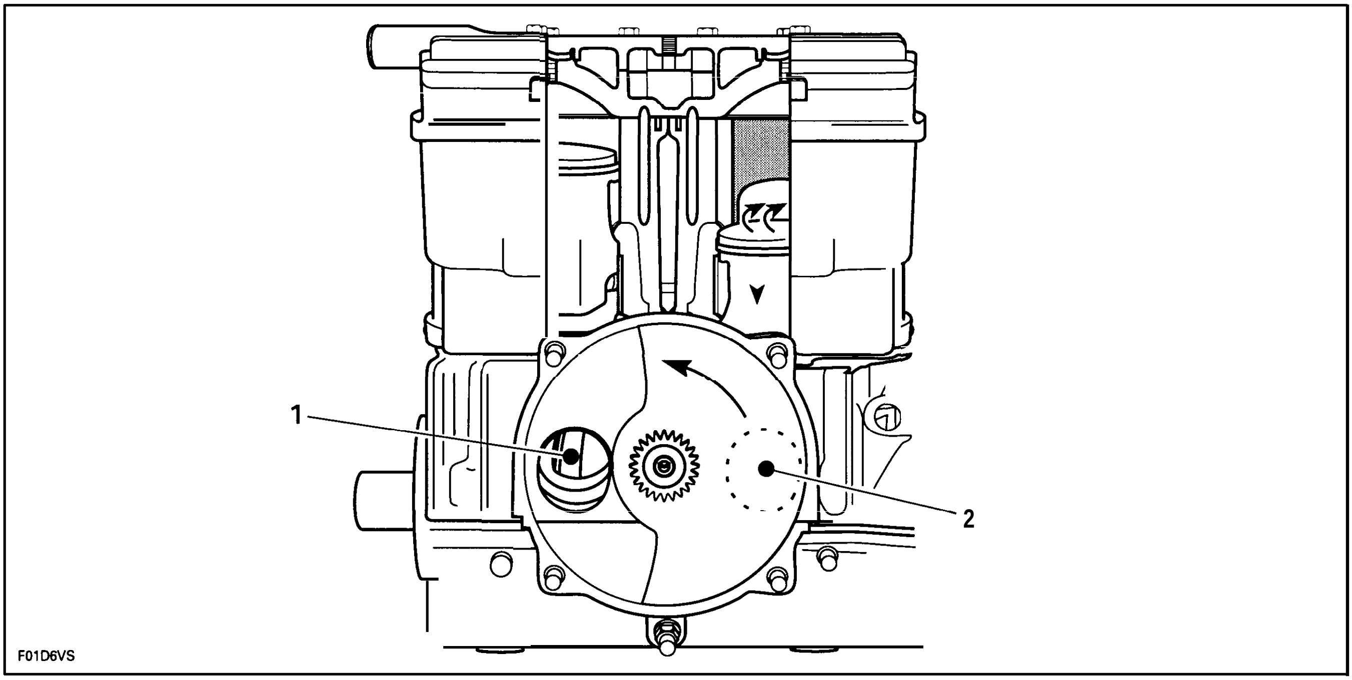
IGNITION AND COMBUSTION



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.

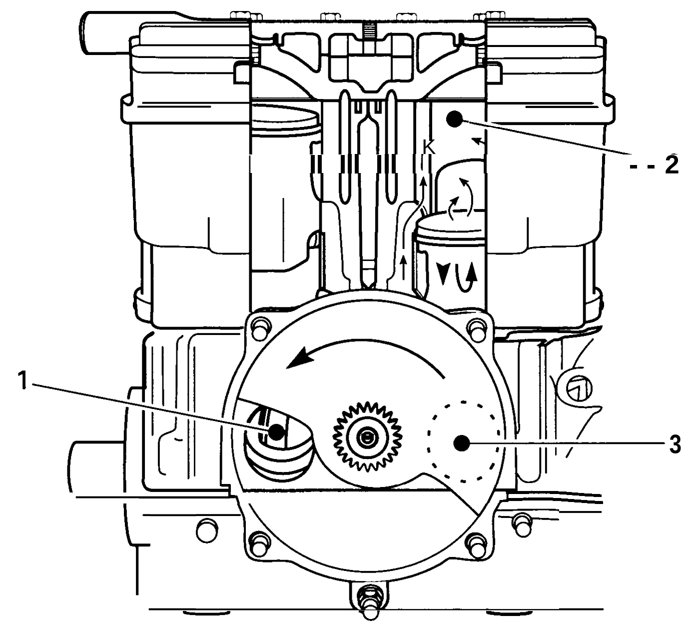
EXHAUST AND PRIMARY COMPRESSION



1. Fresh charge forthe 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 zdownward, and burnt gases are allowed to escape.

TRANSFER

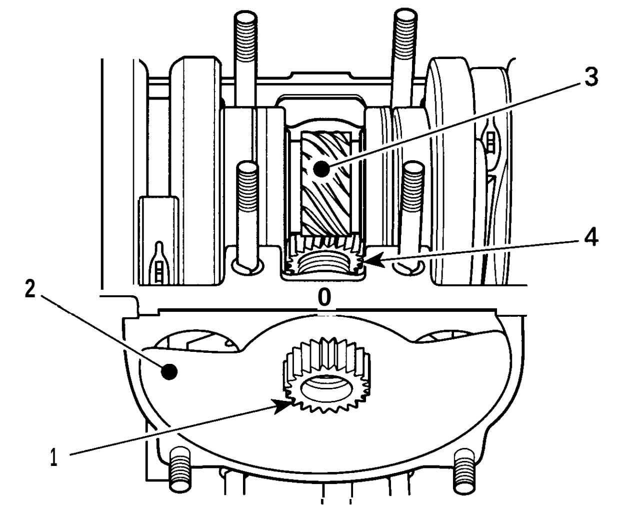


1. Fresh charge for the other cylinder
2. Fresh charge
3. Intake port covered

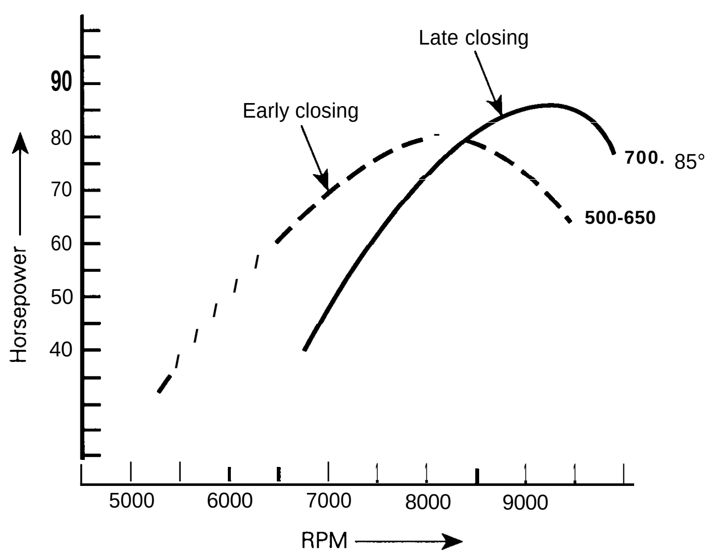
Near the bottom of the downward stroke, the transfer ports are uncovered by the piston, and the compressed air /fuel mixture in the crankcase rushes into the combustion chamber. Piston dome and combustion chamber configuration and muffler back pressures prevent fresh charge (air /fuel mixture) from escaping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

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

1) Intake port directly positioned in the crankcase.

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

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

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

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

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

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

1) Fluid dynamic problems with the use of the induction pipe.

2) The reeds tend to separate air from fuel.

3) 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.

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

5) 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 NPES	VALVE P/N	TIMING opening, closing
1975	245	420924205	140°, 56°
	345	420924205	140°, 56°
1976	245,345	420924205	140°, 56°
	245, 345 (Competition)	420924220	140°, 70°
1977	345	420924200	127°, 48°
	354	420924220	132°, 50°
	444	420924205	140°, 50°
	454	420924207	130°, 80°
1978	345	420924200	127°, 48°
	345 (Cross Country)	420924202	128°, 37°
	354	420924200	132°, 50°
	444	420924205	140°, 50°
	254 (Super Stock)	420924207	137°, 60°
	354 (Super Stock)	420924207	129°, 73°
	454 (Super Stock)	420924207	1 35°, 75°
1979	354	420924200	132°, 52°
	444	420924205	140°, 50°
	254 (Super Stock)	420924207	137°, 65°
	354 (Super Stock)	420924207	132°, 70°
	454 (Super Stock)	420924207	140°, 70°
1980	354	420924200	132°, 52°
	454	420924207	137°, 65°
	464	420924205	1 50°, 49°
1981	354	420924200	132°, 52°
	454	420924207	137°, 65°
	464 (Everest LC)	420924205	1 50°, 49°
	464 (Elite)	420924200	125°, 60°
1982	454	420924207	130°, 50°
	464 (Everest LC)	420924205	150°, 49°
	464 (Elite)	420924200	125°, 60°
1983	464 (Everest LC)	420924205	1 50°, 49°
	534	420924207	140°, 61°
1984	354 (Competition)	420924207	1 30°, 73°
	462	420924205	140°, 51°
	465 (Competition)	420924205	1 50°, 49°
	534	420924207	140°, 610
1985	354 (Competition)	420924207	130°, 73°
	462	420924200	132°, 52°
	537	420924200	132°, 52°

	ENGINE TYPES	VALVE P/N	TIMING opening, closing
1986	467	420924200	132°, 52°
	532	420924200	132°, 52°
	537	420924200	132°, 52°
1987	354 (Competition)	420924207	130°, 73°
	467	420924200	132°, 52°
	537	420924200	132°, 52°
1988	354 (Competition)	420924207	140°, 69°
	467	420924200	132°, 52°
	537	420924200	132°, 52°
1989	354 (Competition)	420924207	140°, 69°
	467	420924200	132°, 52°
	536	420924202	117°, 52°
	583	420924209	140°, 68°
1990	354 (Competition)	420924207	140°, 69°
	467	420924200	132°, 52°
	536	420924202	117°, 52°
	536 (Formula PLUS 500)	420924207	134°, 69°
	583	420924209	140°, 68°
1991	354 (Competition)	420924207	140°, 69°
	467	420924200	132°, 52°
	467 (Formula MX X)	420924209	143°, 66°
	536	420924508	137°, 61°
	536 (Formula PLUS X)	420924207	134°, 69°
	643	420924500	144°, 72°
	643 (Formula MACH 1 X)	420924501	146°, 75°
1992	354 (Competition)	420924207	140°, 69°
	467	420924504	132°, 52°
	582	420924508	129.5°, 69.5°
	583 (Formula PLUS X)	420924502	141 .5°, 69.5°
	643	420924500	144°, 72°
	670 (Mach 1 X)	420924501	146°, 75°
1993	354 (Competition)	420924207	140°, 69°
	467	420924504	132°, 52°
	582	420924508	129.5°, 69.5°
	583 (Plus X)	420924502	141 .5°, 69.5°
	670	420924500	144°, 72°
1994	354 (Competition)	420924207	140°, 69°
	467	420924504	132°, 52°
	467 (MX Z X)	420924502	145°, 65°
	582	420924509	134°, 65°
	583	420924509	134°, 65°
	670	420924500	144°, 72°

	ENGINE NPES	VALVE P/N	TIMING opening	closing
1995	454	420924502	146.8°	65.3°
	467	420924504	132°	52°
	582	420924509	129.5°	69.5°
	583 (Summit)	420924509	134°	65°
	583 (STX, FZ)	420924502	140°	71°
	670 (Summit, SS)	420924500	1 44°	72°
	670 (Mach 1)	420924501	145°	76°

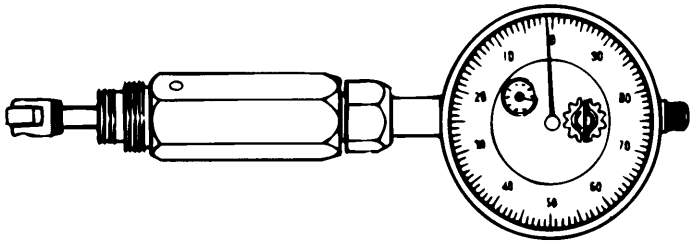
	ENGINE TYPES	VALVE P/N	TIMING opening	closing
1996	MX Z 440	420924502	145°	64°
	Summit 500 Formula SLS Touring 500 Summit 580	420924509	134°	63°
	Formula Z Formula STX Formula STX LT	420924502	140°	71°
	MX Z 583	420924502	139°	70°
	Formula SS GT 670 SE	420924500	145°	71°
	Mach 1	420924501	145°	76°
	Summit 670	420924500	140°	71°

ROTARY VALVE DURATION VS. PART NUMBER

DEGREES OF DURATION	PART NUMBER
1 17°	924202
132°	924200 924504
147°	924205 924508 924509
151°	924207
1 59°	924209 924502
162°	924220
164°	924500
169°	924501

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

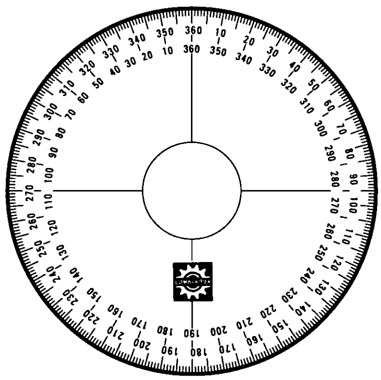
On all engines, use TDC gauge (P/N 4141047 00).



Dial indicator (P/ N 4141047 00)

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

A degree wheel (P/N 4143529 00) is required to measure rotary valve opening and closing angles in relation with MAGneto side piston. Degree wheel will be installed on rotary valve shaft for measurements.



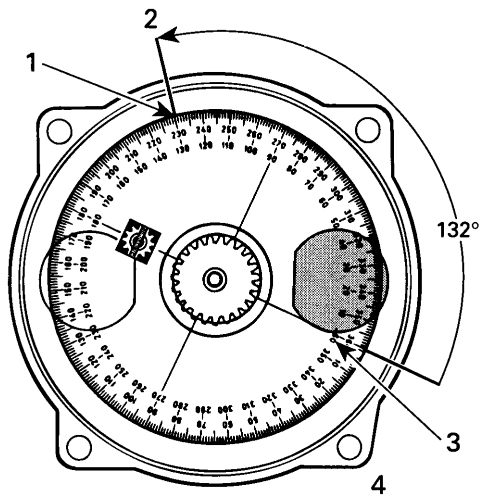
For the following instructions, let's use these specifications as an example :

OPENING : 132° BTDC

CLOSING : 52° BTDC

Proceed as follows:

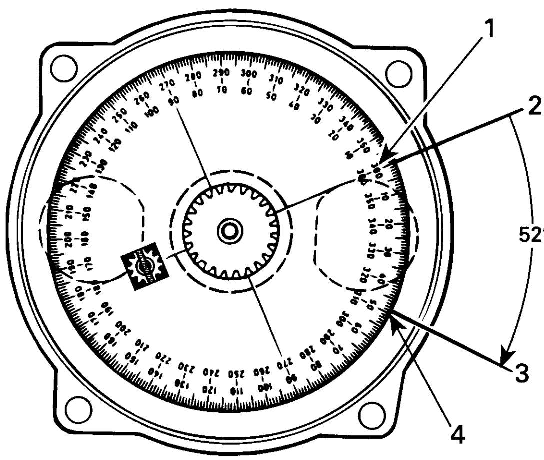
— For opening mark, first align 360° line of degree wheel with BOTTOM of MAGneto side inlet port. Then find 132° line on degree wheel and mark crankcase at this point.



F01D2JS

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.



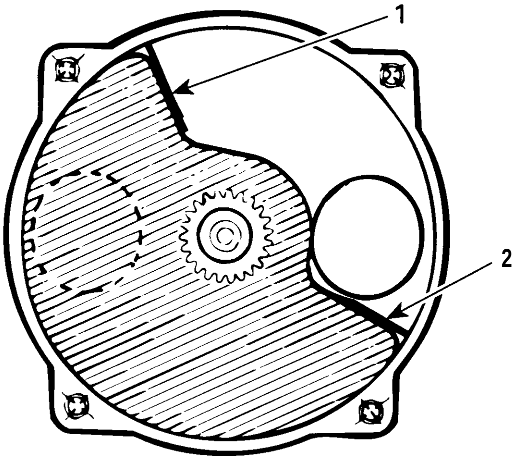
F01D2KS

1. Top of *MAGneto* inlet port
2. Align 360° line of degree wheel here
3. Closing mark
4. Find 52°0n 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 BEA TDC

1. Timing mark
2. Timing mark

O 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.

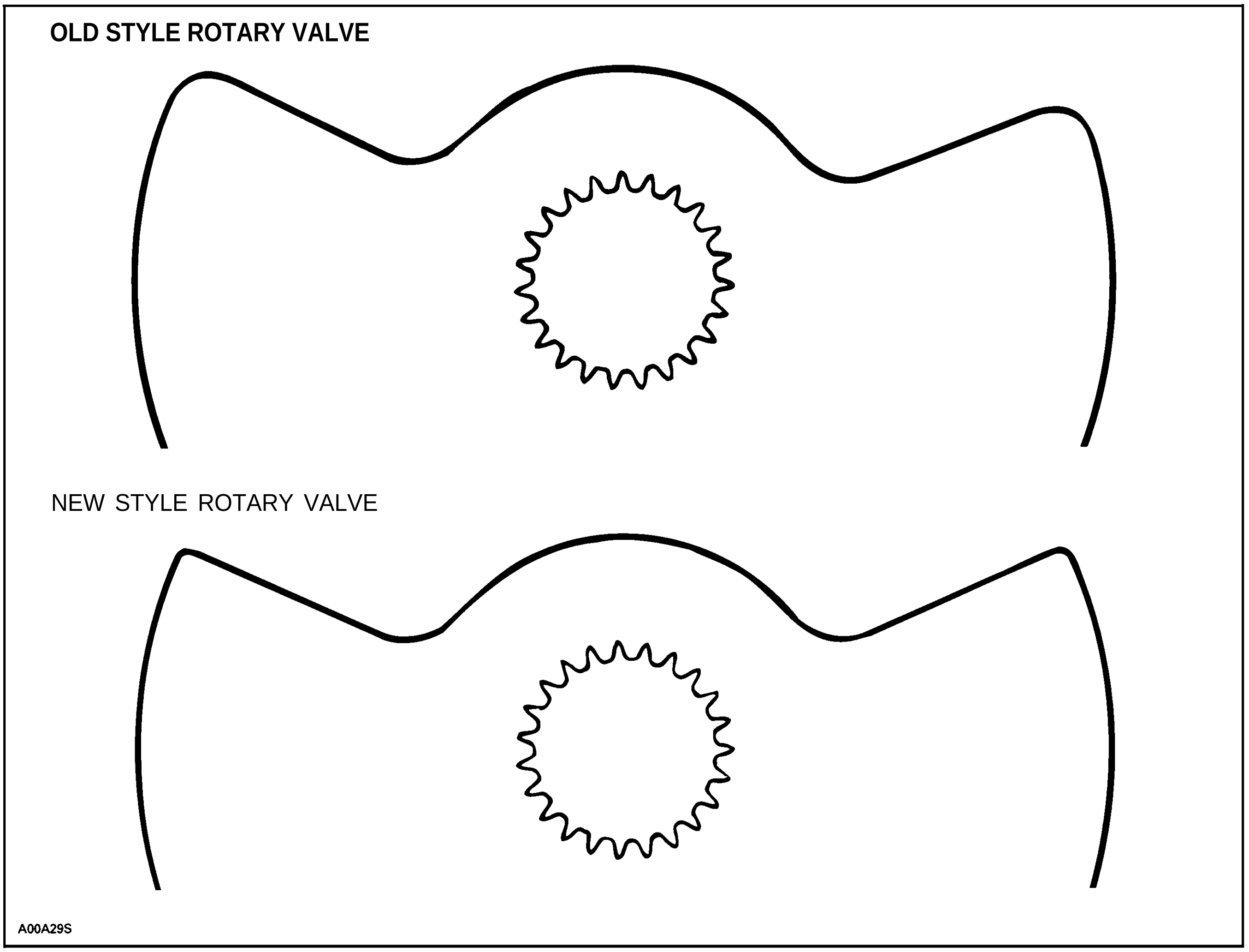
O NOTE : Bombardier Corporation has running changes on rotary valves used in our snowmobile product line. The shape of the leading or trailing edge may not conform to the drawing shown in some technical materiel (example follows).

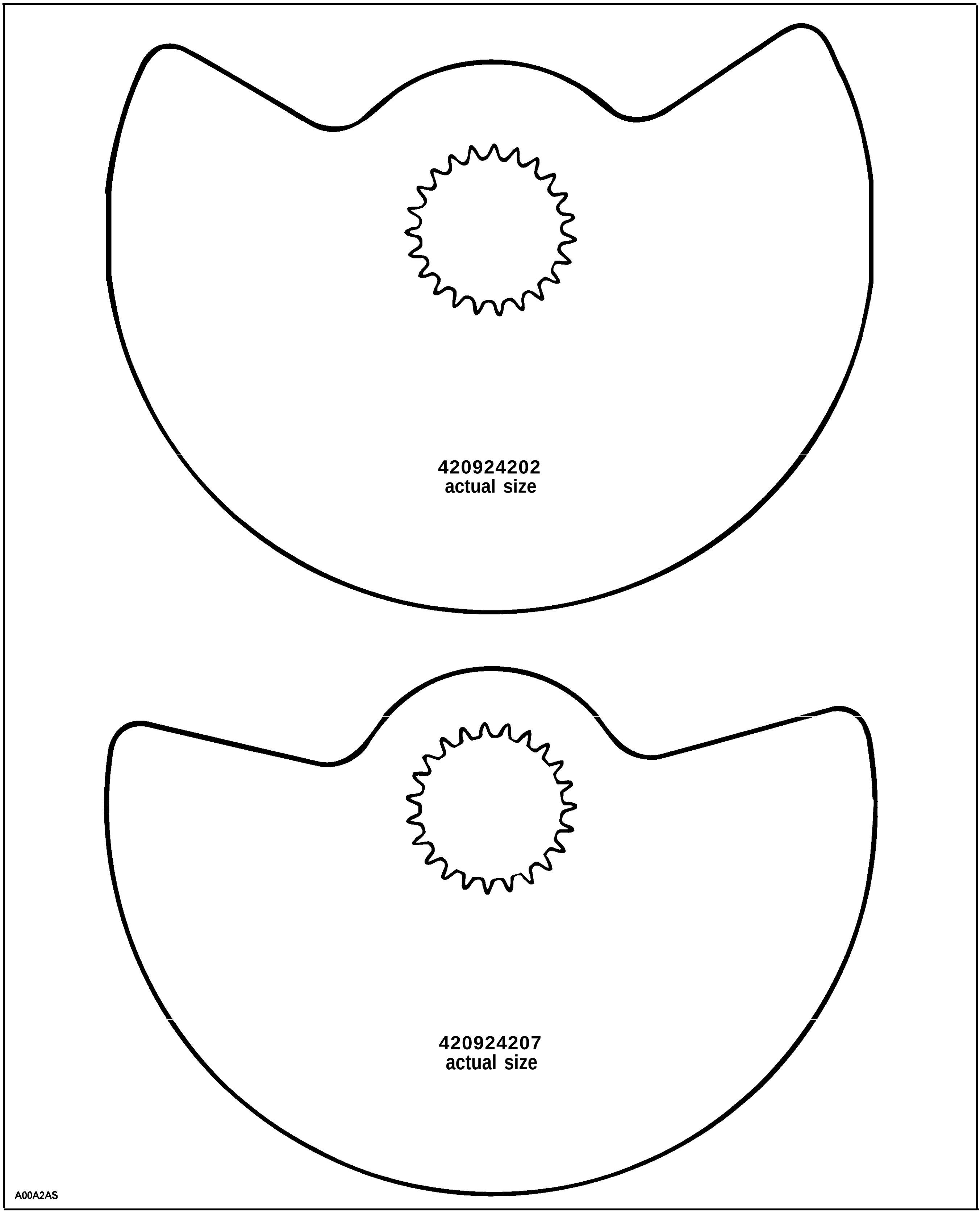
This change is for reliability and does not affect performance in any fashion. The valves are interchangeable, but do carry different part numbers.

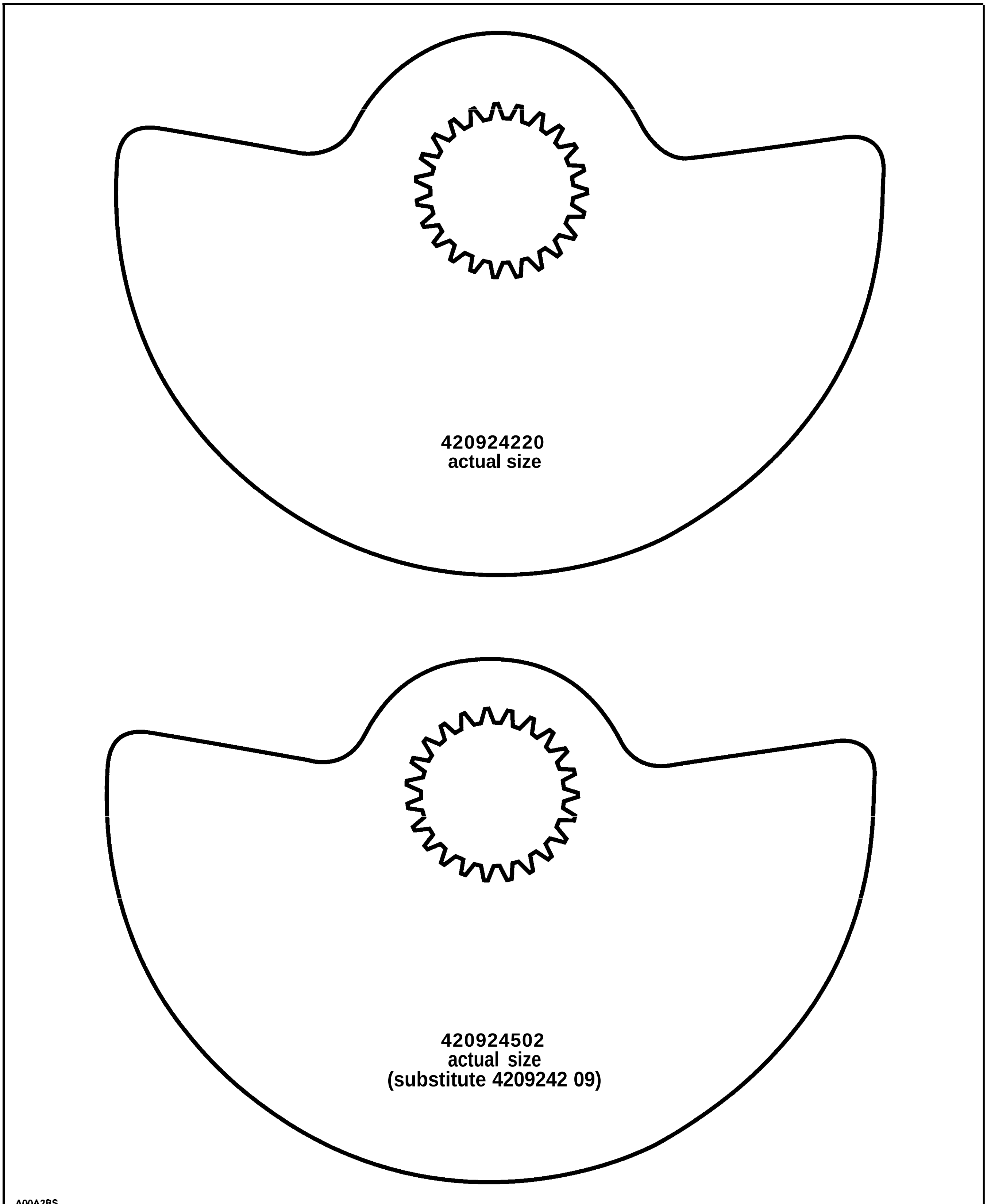
420924200 subs to 420924504

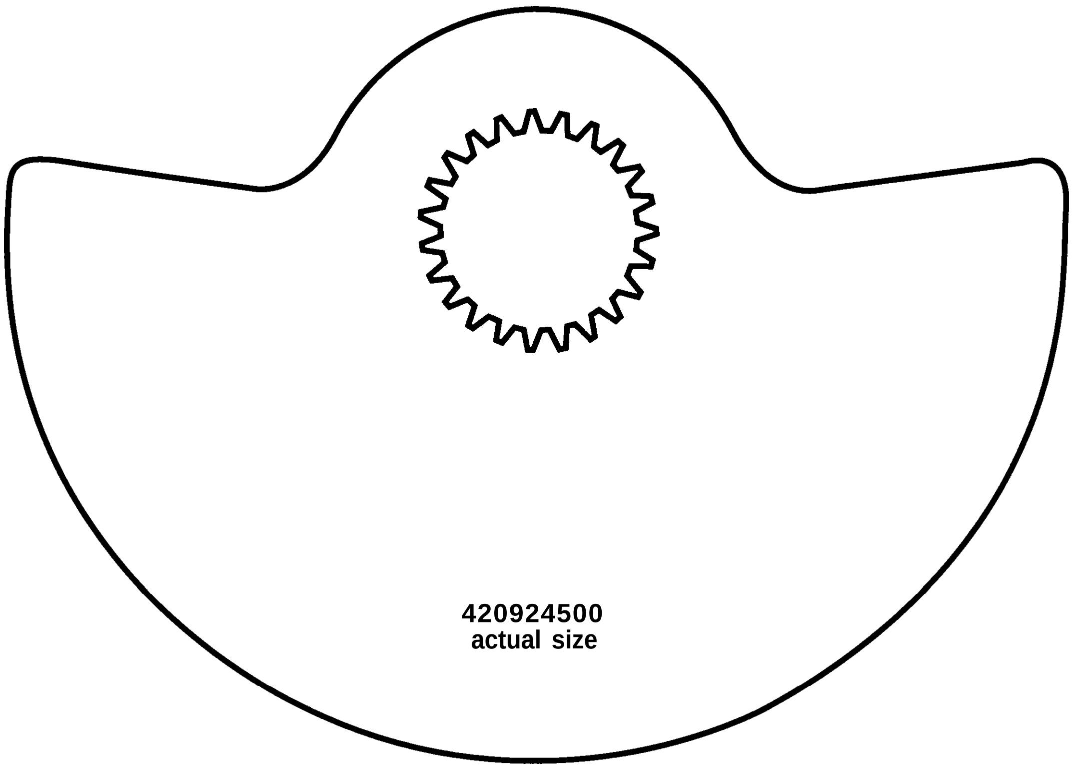
420924205 subs to 420924508

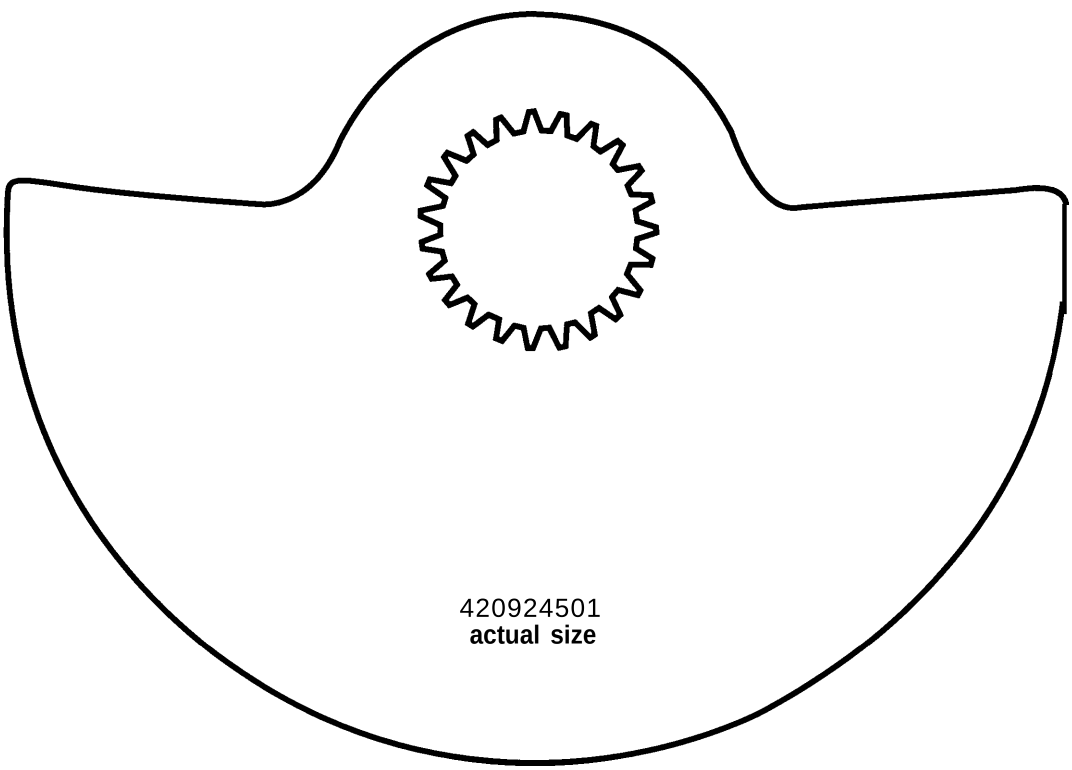
420924209 subs to 420924502



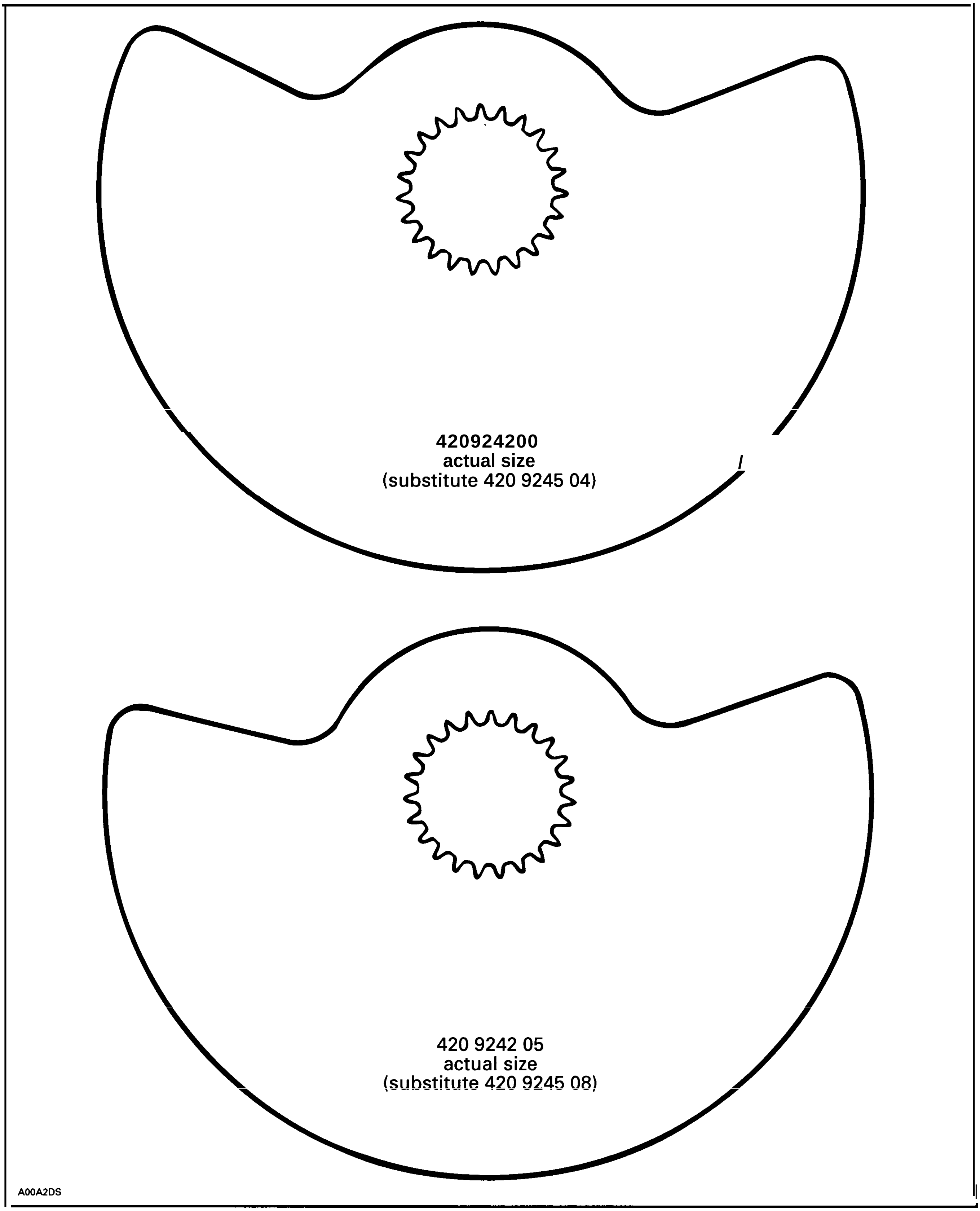

420924202
actual size
420924207
actual size
A00A2AS

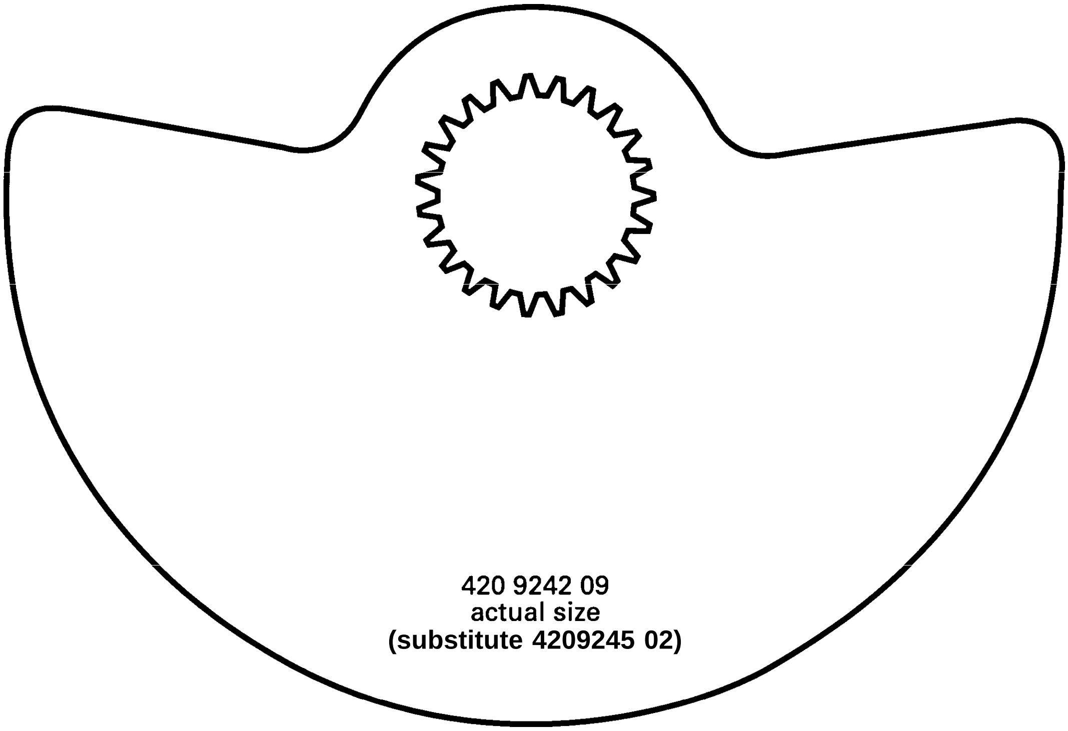

420924220
actual size
420924502
actual size
(substitute 4209242 09)
A00A2BS

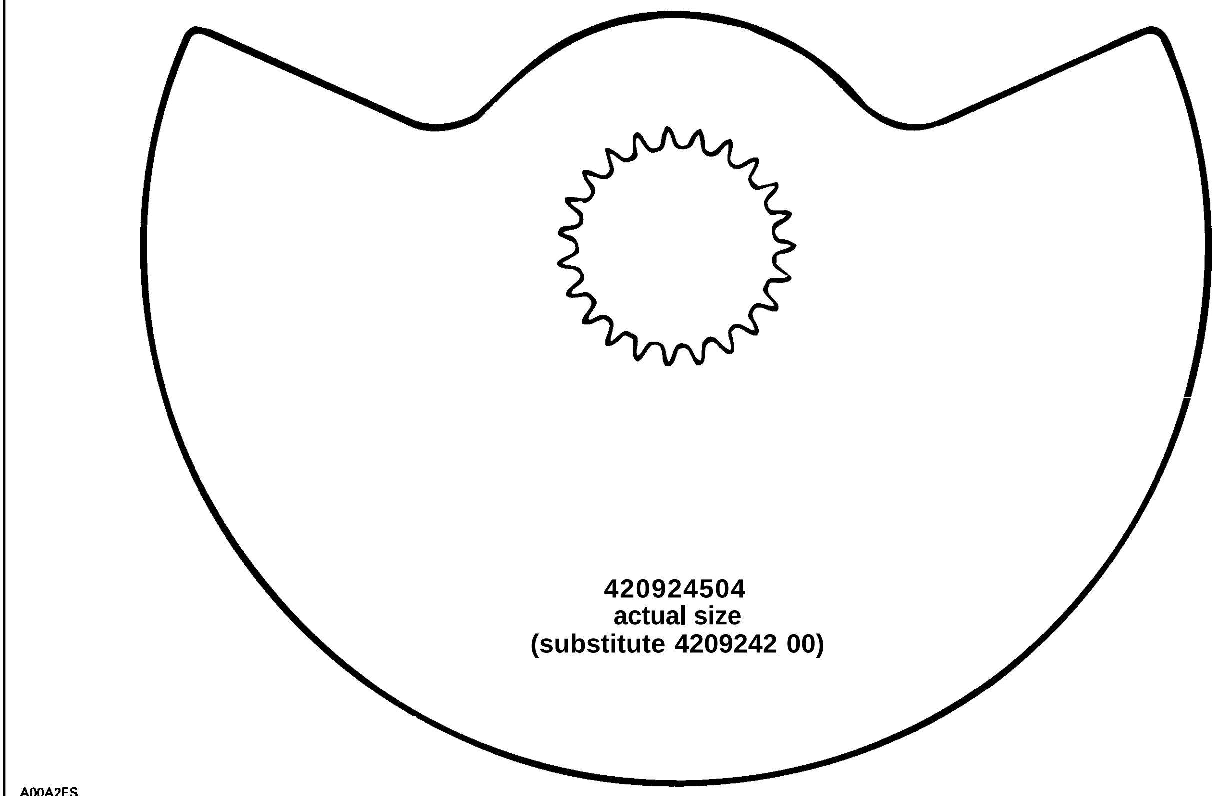


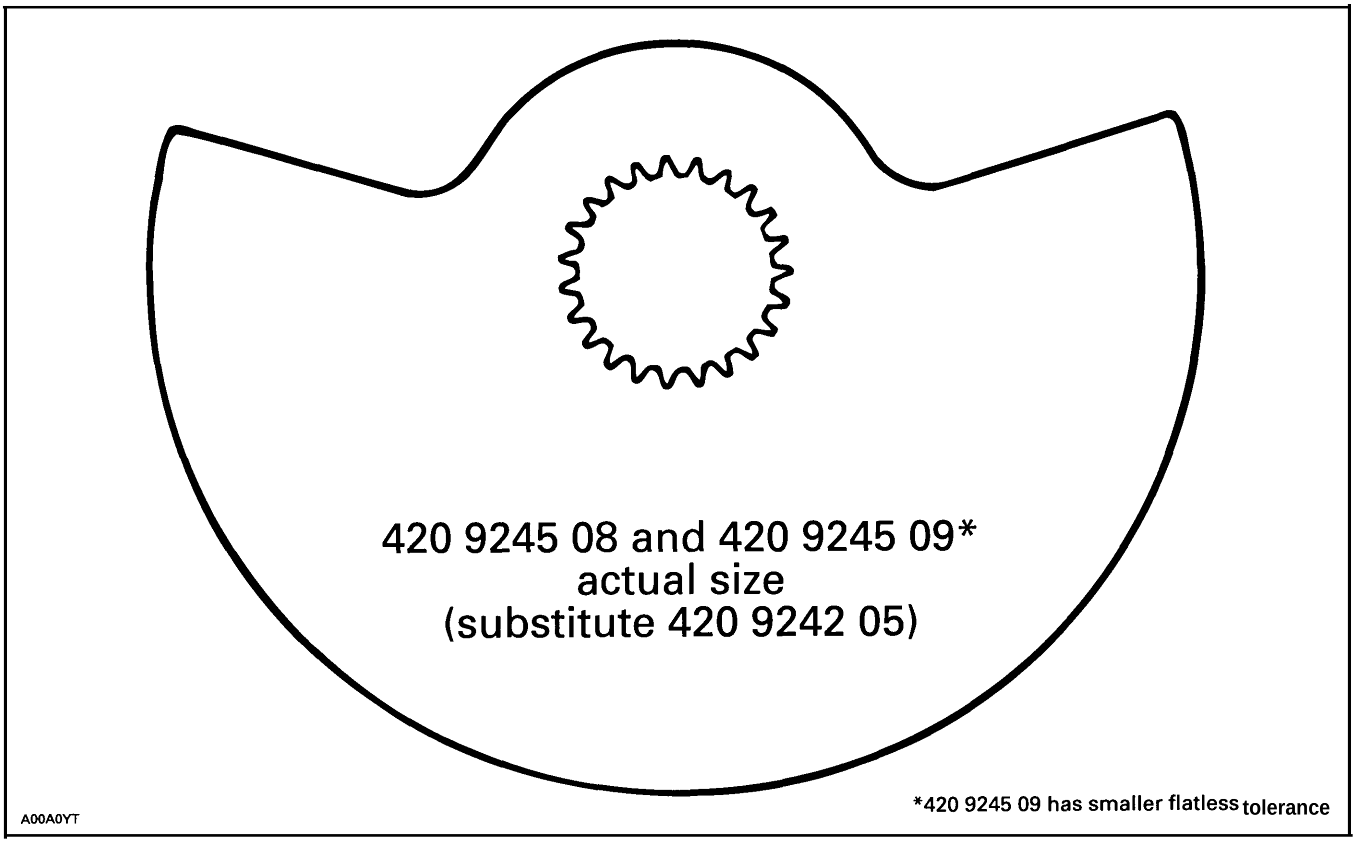


A00A2CS


420924200
actual size
(substitute 420 9245 04)
420 9242 05
actual size
(substitute 420 9245 08)
A00A2DS


420 9242 09
actual size
(substitute 4209245 02)


420924504
actual size
(substitute 4209242 00)
A00A2ES


420 9245 08 and 420 9245 09*
actual size
(substitute 420 9242 05)
A00A0YT
*420 9245 09 has smaller flatless tolerance

BASE GASKET INFORMATION

MODELS : All 1990 to 1992 SAFARI LC / LCE / GLX and all 1989 to 1993 FORMULA Series.

Serial Nos : All Liquid Cooled Engines from 1989 to 1993.

Subject : A) Cylinder Tightening Torque

B) Cylinder/ Base Gasket

C) Cylinder / Base Gasket on 1991 FORMULA PLUS and 1990 FORMULA MACH 1 Models

A) On engines with screw-mounted cylinders, grease must be applied under screw head prior to installation. Tightening torque has been increased to 28-30 N•m (21-22 lbf•ft). This is necessary to ensure good sealing.

NOTE : On engines with stud-mounted cylinders, the tightening torque remains 20-22 N•m (15-16 lbf•ft).

B) A new cylinder/ base gasket has been introduced with increased strength and sealing ability. Refer to the chart on next page.

CAUTION : Proper gasket selection is very important to avoid compression ratio change which can lead to engine severe damage.

C) On Formula MACH 11990 and PLUS 1991 with the 1.0 mm thick gasket (P/N 420931189 and P / N 420931188 respectively), a coat of paste gasket (P/ N 4137027 00) (Loctite 515) must be applied to cylinder and base sealing surface. Primer N (P/ N 4137076 00) should be applied to sealing surface in order to reduce fixture curing time from 1 hour to 15 minutes (full curing time without primer N is 12 hours and 2 hours with primer N). Torque cylinders to the new higher torque.

NOTE : This is a service tip, no warranty applies.

CYLINDER / BASE GASKET CHART

MODEL AND YEAR	ENGINE TYPE	PREVIOUS P / N	THICKNESS	NEW P / N	THICKNESS
Safari LCE / GLX 1990 to 1992	467	420831835	0.6 mm	420931187	0.5 mm
Formula MX 1989 to 1992	467	420931180	0.6 mm	420931187	0.5 mm
Formula MX X 1991	467	420931180	0.6 mm	420931187	0.5 mm
Formula MX 1993	467	—	—	420931187	0.5 mm
Formula MX Z 1993	467	—	—	420931187	0.5 mm
Formula PLUS 1989, 1990	536	420831835	0.6 mm	420931187	0.5 mm
Formula PLUS 5001990	537	420831835	0.6 mm	420931187	0.5 mm
Formula PLUS 1991	536	420931188	1.0 mm	420931188	1.0 mm
Formula PLUS X 1991	537	420931182	1.0 mm	420931183	1.0 mm
Formula PLUS 1992	582	—	—	420931185	0.3 mm
Formula PLUS X 1992	583	—	—	420931185	0.3 mm
Formula PLUS 1993	582	—	—	420931185	0.3 mm
Formula PLUS EFI 1993	582	—	—	420931185	0.3 mm
Formula PLUS X 1993	583	—	—	420931185	0.3 mm
Formula MACH 11989	583	420831837	0.6 mm	420931181	0.5 mm
Formula MACH 11990	583	420831839	1.0 mm	420931189	1.0 mm
Formula MACH 11991	643	420931184	0.6 mm	420931181	0.5 mm
Formula MACH 1 X 1991	643	420931184	0.6 mm	420931181	0.5 mm
Formula MACH 11992	643	—	—	420931185	0.3 mm
Formula MACH 11993	670	—	—	420931230	0.3 mm

0.3 mm = .012 in
0.5 mm = .020 in
0.6 mm = .024 in
1.0 mm = .039 in

1995 BASE GASKETS

454

- Base gasket set 420931365

Includes :

1-420931360	.3 mm
1-420931361	.4 mm
1-420931362	.6 mm

670

- Base gasket set 420931235

Includes :

1-420931230	.3 mm
1-420931231	.4 mm
1-420931233	.5 mm
1-420931232	.6 mm
1-420931234	.8 mm

779

- Base gasket set 420950275

Includes :

1-420950273	.3 mm
1-420950271	.4 mm
1-420950272	.6 mm

1996 BASE GASKETS

454 MX Z

- 494 Formula SLS / Grand Touring 500 Summit 500

P / N 931-360 (0,3)	yellow con rod dot
P/N 931-361 (0,4)	red con rod dot
P / N 931-362 (0,6)	green con rod dot

582 GRAND TOURING 580

- 583 MX Z 583 SUMMIT

P / N 931-185 (0,3 mm)

599 FORMULA III/ FORMULA III LT (1995/1996)

P / N 931-310 (0,4)	red con rod dot (middle rod)
P / N 931-311 (0,6)	green con rod dot (long rod)
P / N 931-312 (0,3)	yellow con rod dot (short rod)

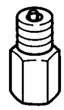
670 FORMULA SS / SUMMIT 670 GRAND TOURING SE/ MACH 1

P / N 931-230 (0,3)	P / N 931-232 (0,6)
P / N 931-231 (0,4)	P / N 931-234 (0,8)
P / N 931-233 (0,5)	

779 MACH Z / MACH Z LT

P / N 950-271 (0,4)	red con rod dot (middle rod)
P / N 950-272 (0,6)	green con rod dot (long rod)
P / N 950-273 (0,3)	yellow con rod dot (short rod)

CARBURETOR MAIN JET CORRECTION CHART



FT / METER	“F / “C							
	-60 / -50	-40 / -40	-20 / -30	-o / -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) :**

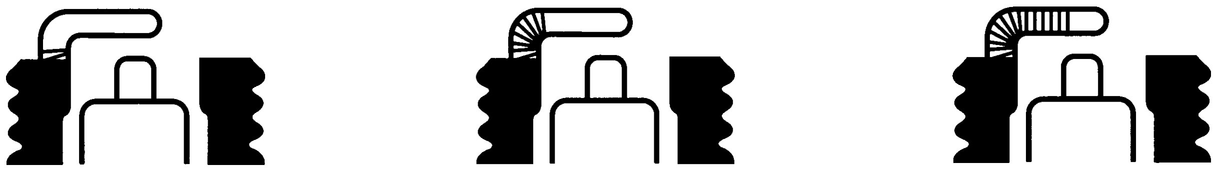
$$250 \times \frac{90.97}{100} = 227; \text{ use 230 jet.}$$

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.

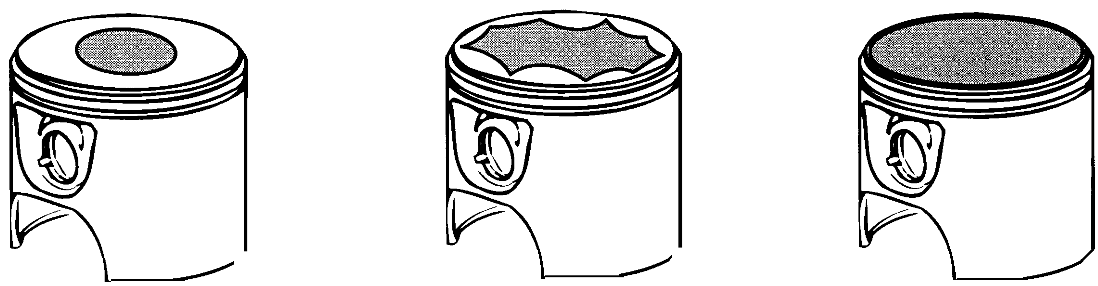
First, a baseline for jetting must be established.

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.



A01C48S

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



A01C49S

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.

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.)

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 :

$$\text{New main jet} = \frac{\text{NEW C. R. A. D. x Baseline M. J.}}{\text{Baseline C. R. A. D.}}$$

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%.

$$\text{The new M.J.} = \frac{1\ 00.9\text{x } 570}{105.4}$$

New M.J. = 600

USEFUL EQUATIONS :

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

$$C.A.P. = B - E$$

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

$$HP = \frac{O.T. \times N}{5252}$$

$$1\ Kw = \frac{HP}{1.34102}$$

$$C.HP = O.HP \times C.F.$$

$$C.T. = O.T. \times C.F.$$

Where :

B = barometer reading (in-Hg)

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

N = Engine RPM

kw= Kilowatts

HP = Horsepower

O.HP = Observed brake horsepower

O.T. = Observed brake torque

C.HP = Corrected brake horsepower

C.T. = Corrected brake torque

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

C.F. = Correction factor

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

g = Grams

Hr = Hour

Lb = Pounds

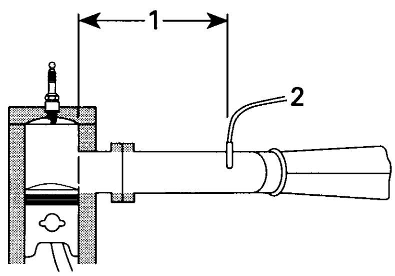
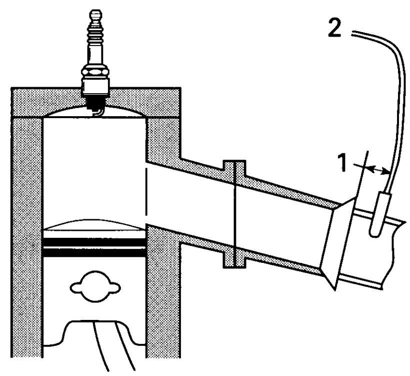
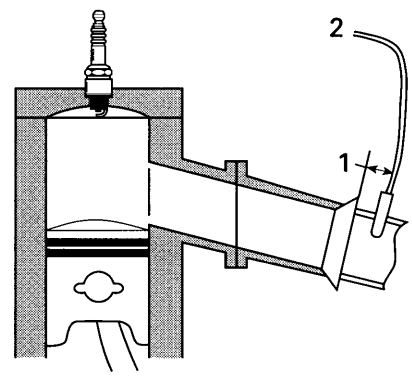
E.G.T. = **Exhaust gases temperature**

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
-Io	.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

Exhaust Gas Temperature Probe Location

TWO CYLINDERS SINGLE PIPE	THREE CYLINDERS THREE PIPES	TWO CYLINDERS TWO PIPES
 A00C3WY	 A00C3XY	 A00C3XY
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

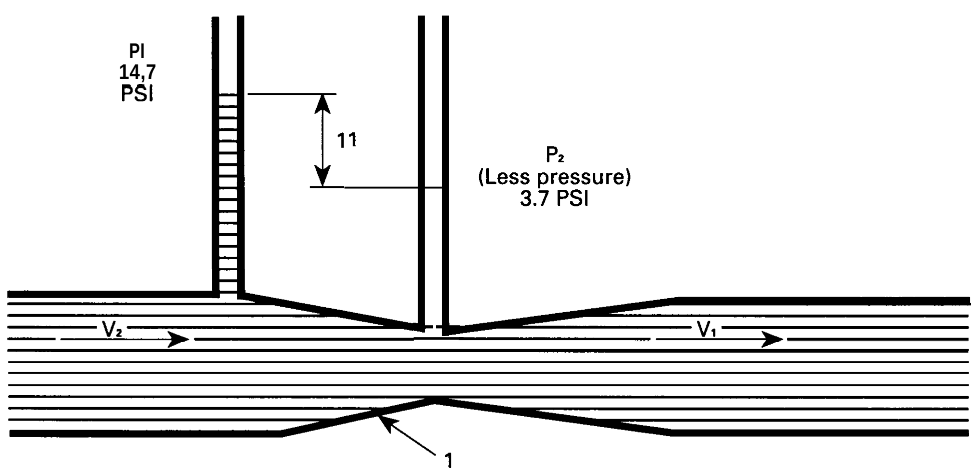
1. 80 mm
2. Probe

1. 35 mm
2. Probe

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

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).



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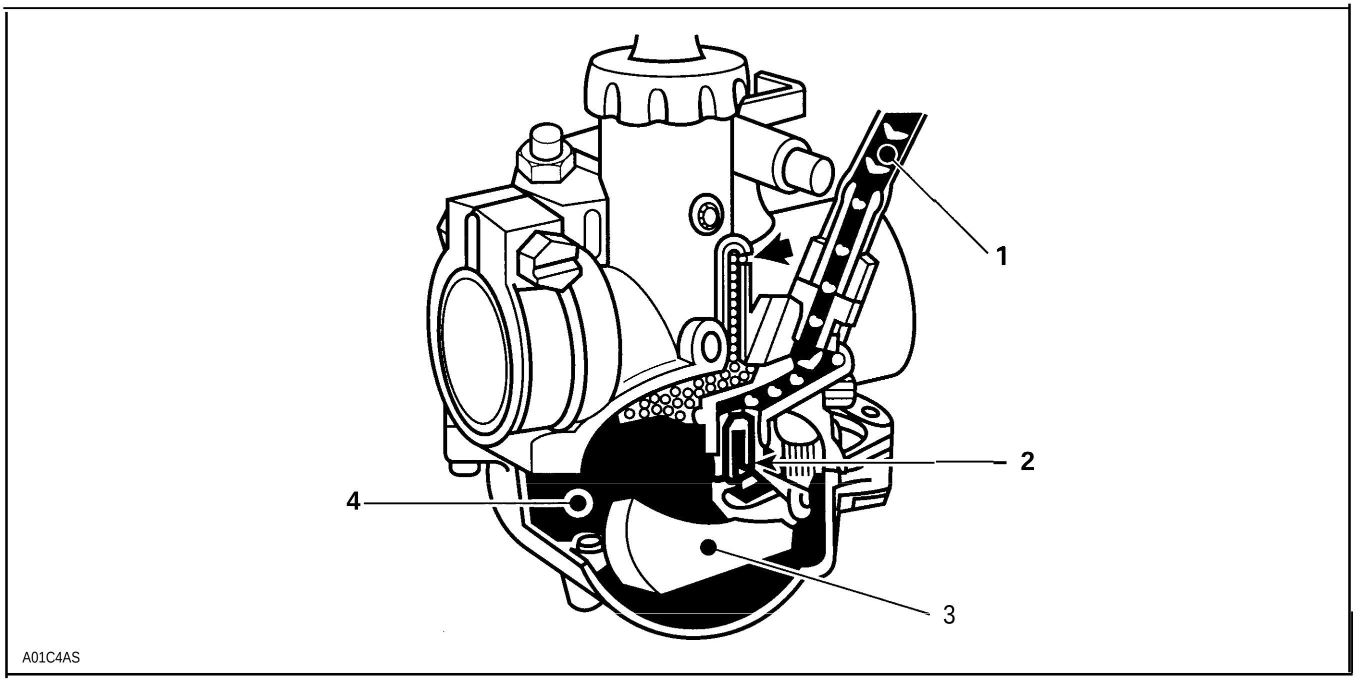
1. Venturi

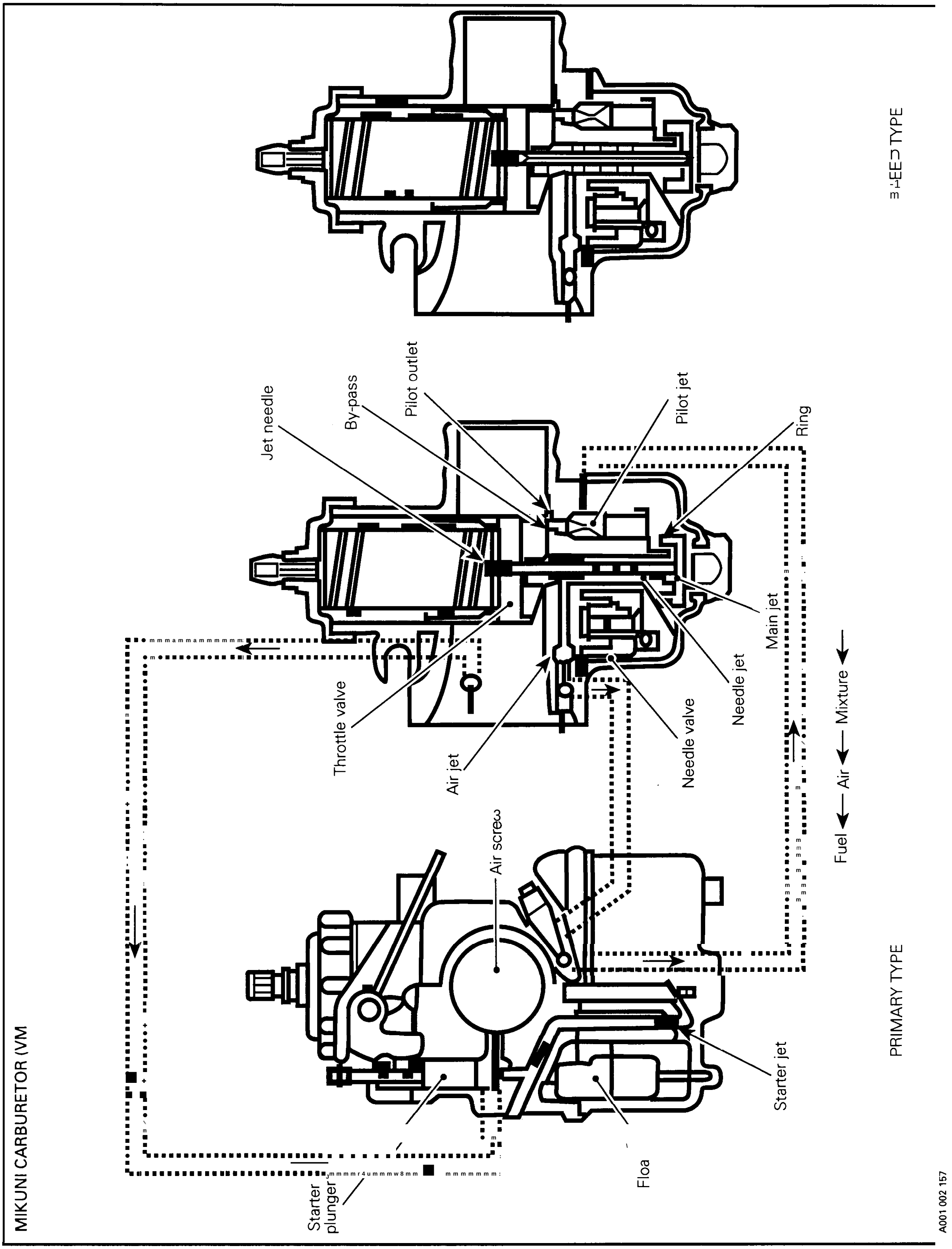
Air entering the bell of the carburetor has a speed of VI and pressure of P1. As the air is forced into the smaller diameter of the venturi, speed increases (V2) but pressure drops (P2).

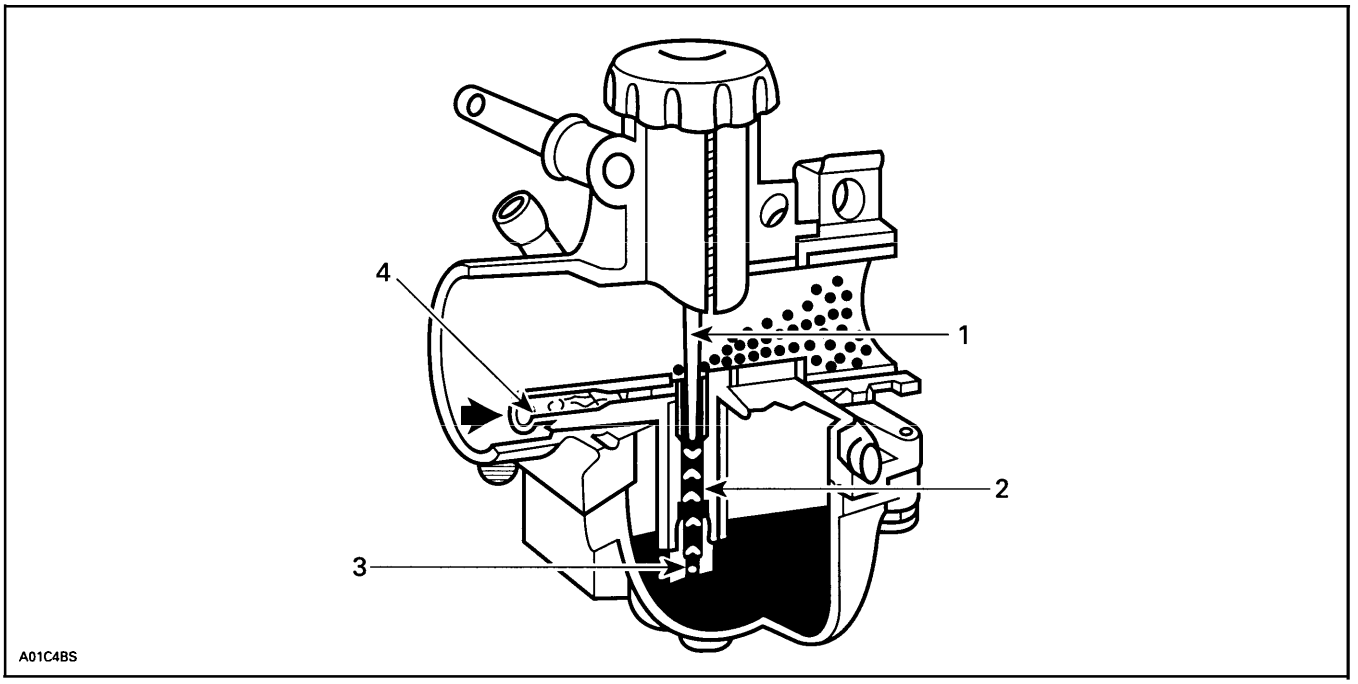
Passages in the carburetor connect the venturi to a reservoir of fuel (float bowl). The float bowl is vented to the atmosphere (P1). PI is greater than P2 so fuel is pushed from the bowl to the venturi via the jets and passages. Varying the size of jets varies the amount of fuel the engine receives. 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 an-d-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


MIKUNI CARBURETOR (VM
Starter plunger
Floa
Starter jet
PRIMARY TYPE
Air scre
Throttle valve
Air jet
Needle valve
Needle jet
Main jet
Jet needle
By-pass
Pilot outlet
Pilot jet
Ring
Fuel
Air
Mixture
A001 002 157



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

LARGE FUEL PUMP PARTS

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

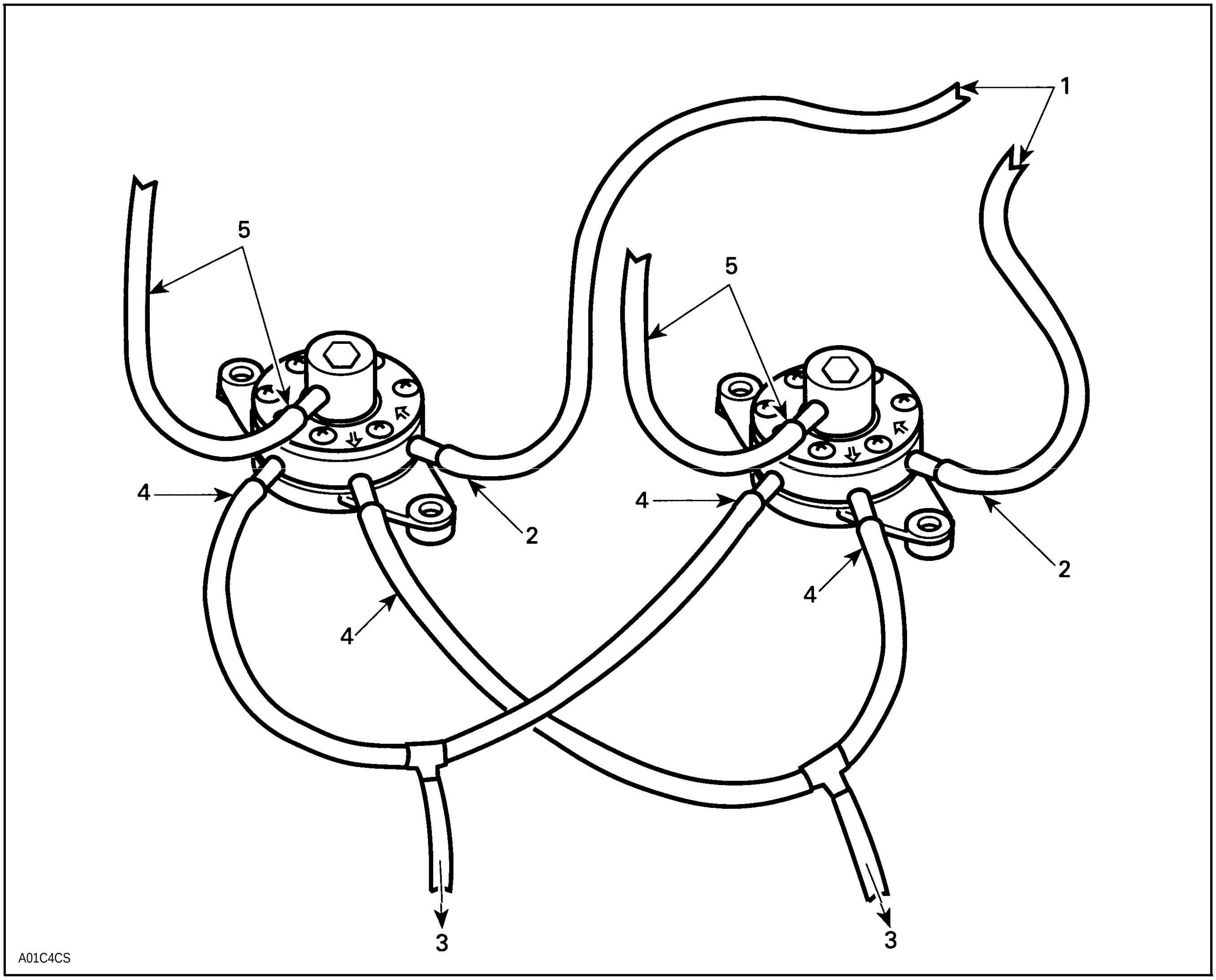
MIKUNI CARBURETORS

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

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

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 maybe 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.



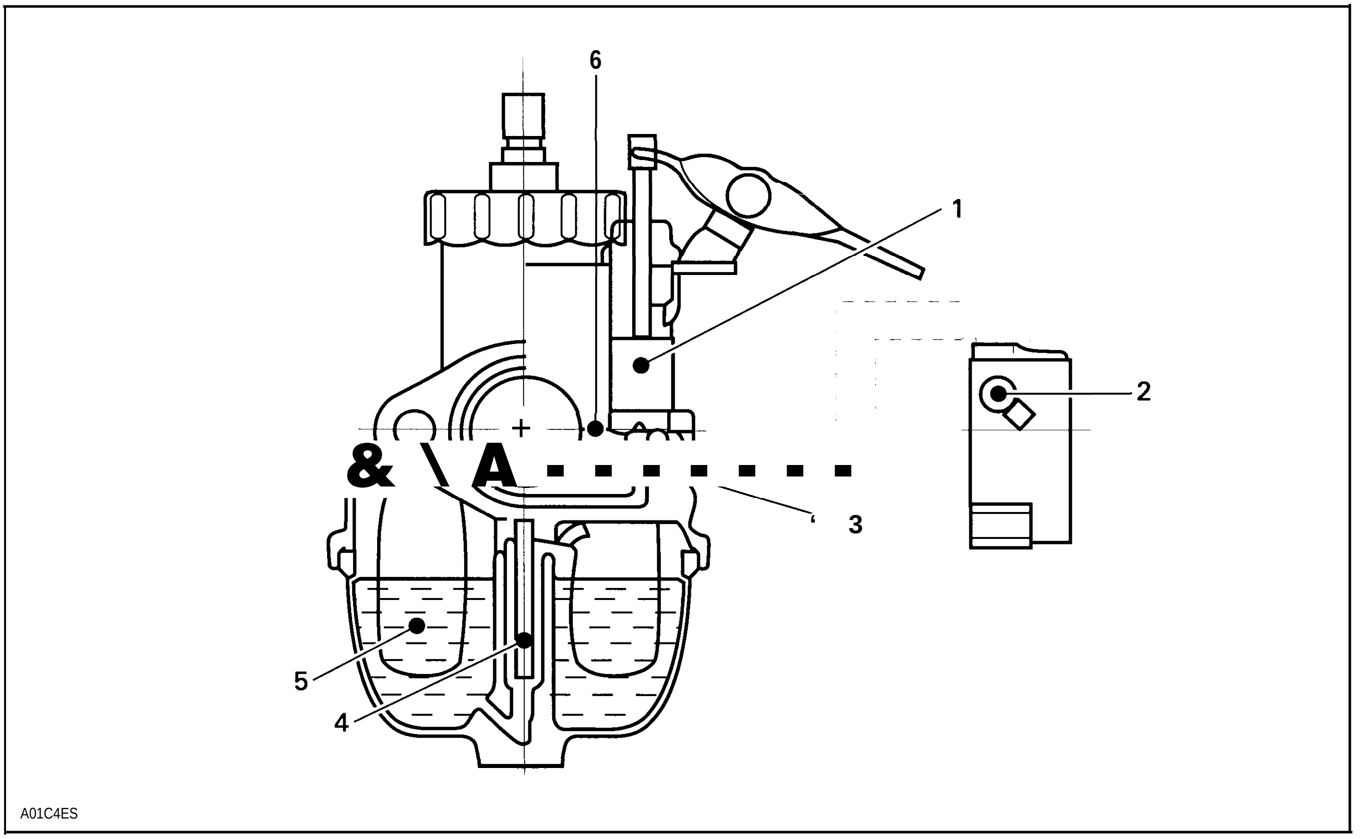
1. From fuel tank
2. Fuel intlet line
3. To carb
4. Fuel outlet line
5. Impulse line

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 vehicules 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.

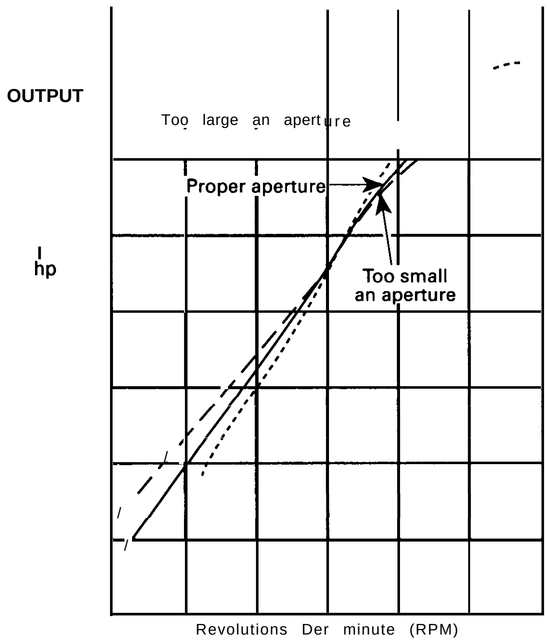
STARTING DEVICE (ENRICHENER)

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.



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.



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SIZE OF MIKUNI CARBURETORS

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

CARBURETOR

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.**

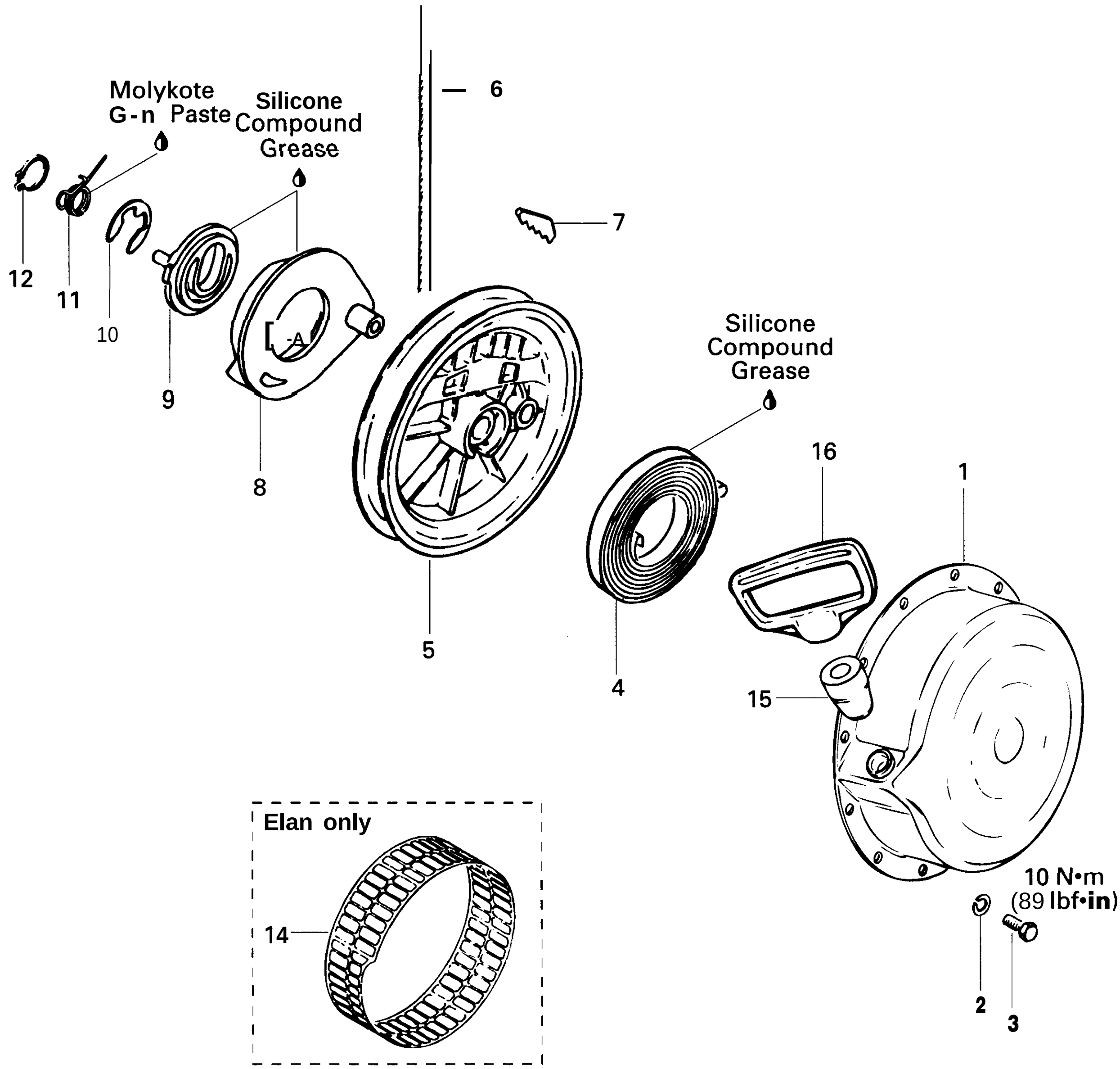
CHECKING AND ADJUSTING FLOAT SYSTEM

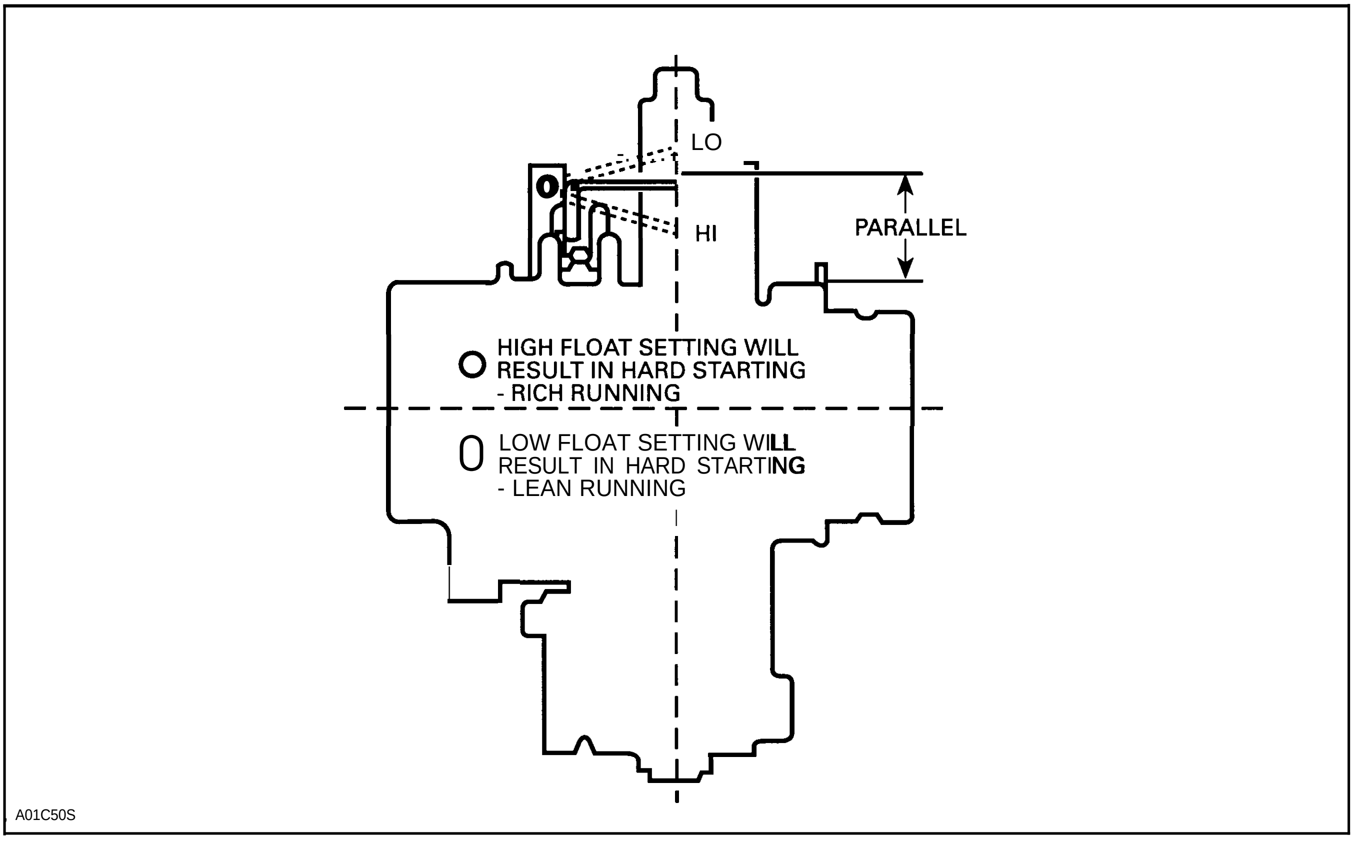
1. **Invert the carburetor and check the alignment between the float arm and the base of the carburetor. The float arm should be parallel to the base.**

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).



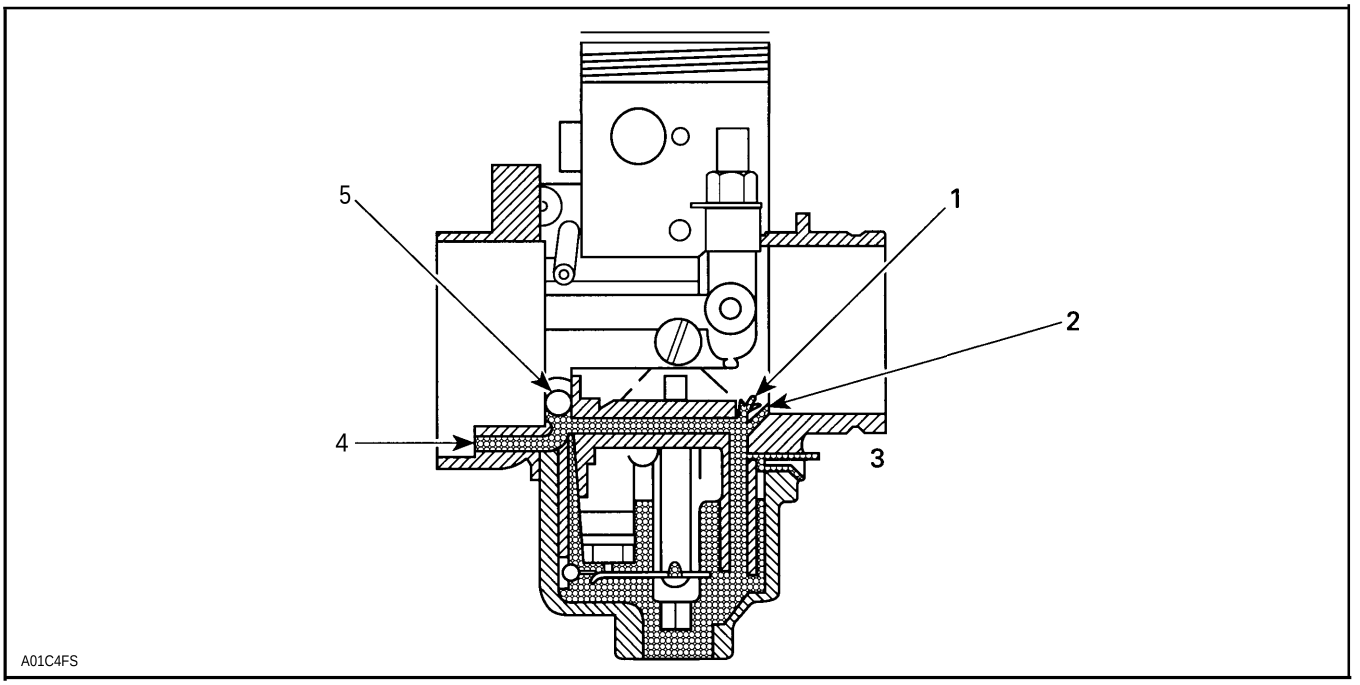


PILOT/ AIR SYSTEM

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

O 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.*

   Turn air screw in or out using l/4-turn increments until engine rpm peaks or reaches its maximum rpm.

   Readjust idle stop screw to return engine to normal idle speed. See pages *low speed fuel system.*

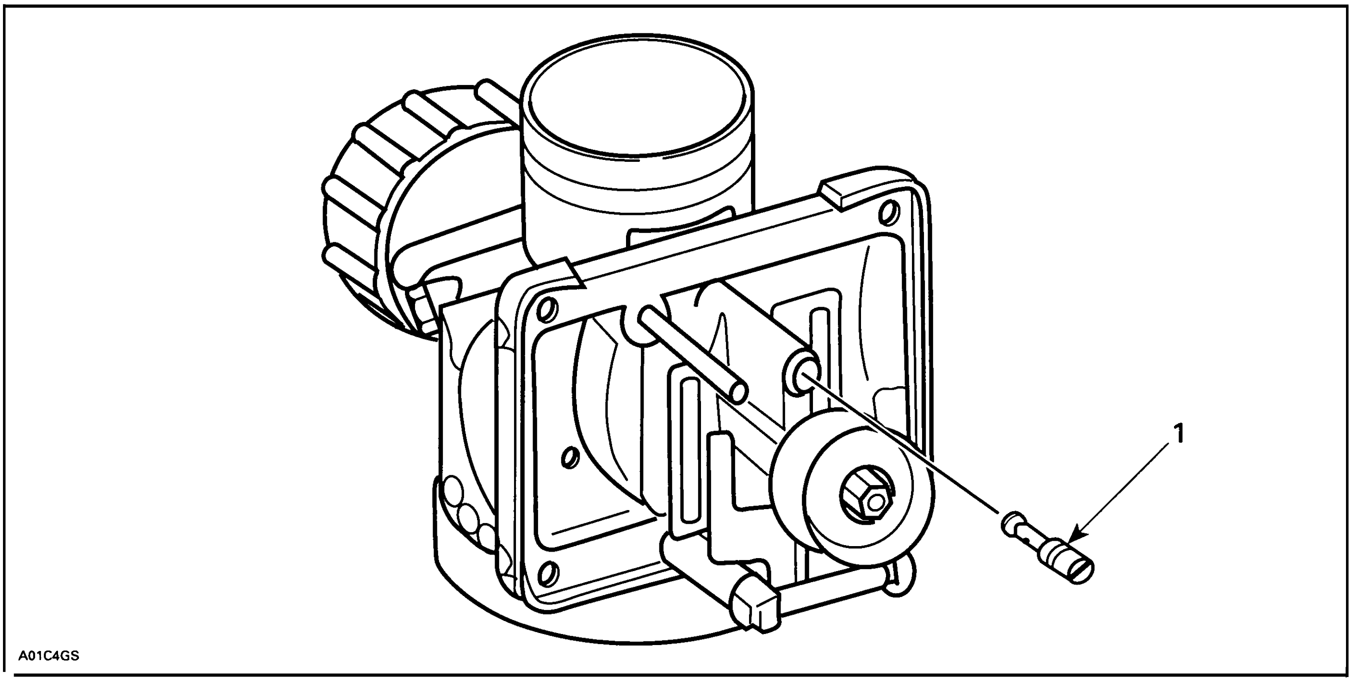
5. Repeat Steps 3 and 4 until engine operates at normal idle speed and air screw is peaked.
6. When air screw is adjusted stop engine. Note the setting of air screw and turn it all the way in. If it takes less than 1 turn, the pilot jet is too small and a larger one must be installed. If it takes more 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 fol lowing points.

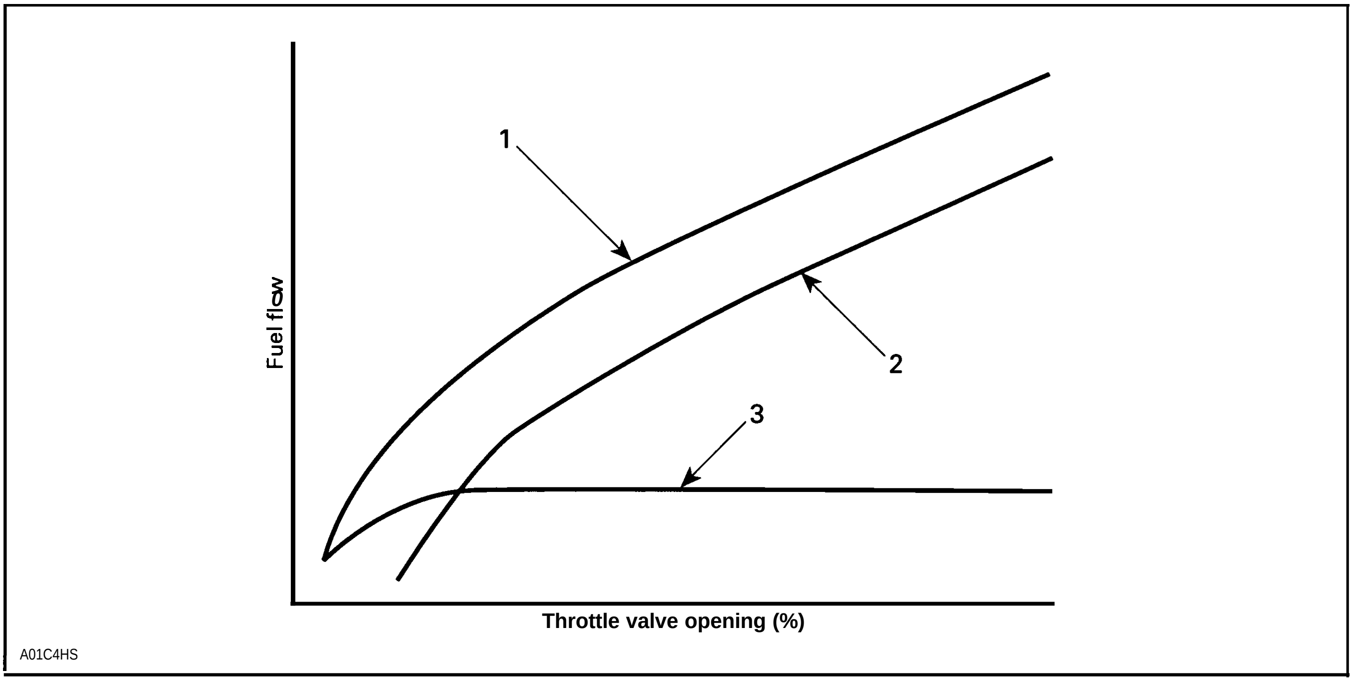
   (1) If there is a certain range in the opening of the air screw where the fast engine revolution can be obtained (for instance, the number of revolutions does not change in the range of 1-1 / 2 to 2.0 turns), it would be better for acceleration to 1-1 / 2 turns.

   (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



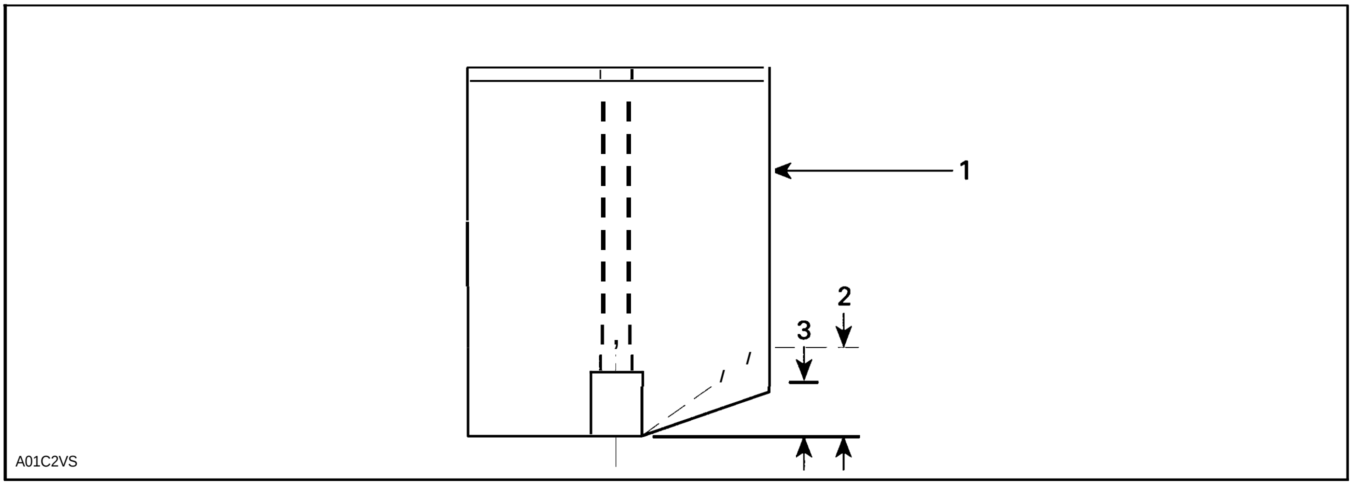
1. Total amount of fuel flow
2. Main fuel system
3. Pilot fuel system

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

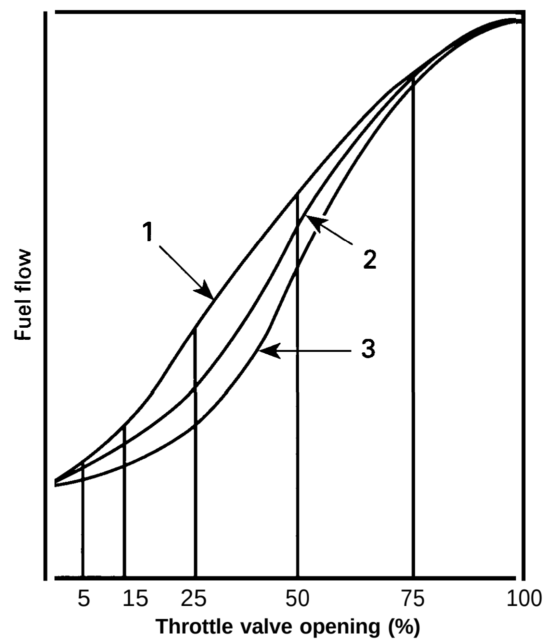
The throttle valve is cut away on the air inlet side to help control the fuel/ air mixture at low and intermediate throttle settings. The size of cutaway also affects acceleration.

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 siezures during sudden throttle closures from large throttle settings.

CHECKING AND SELECTING THROTTLE VALVE



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1. 2.0
2. 2.5
3. 3.0

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.**

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

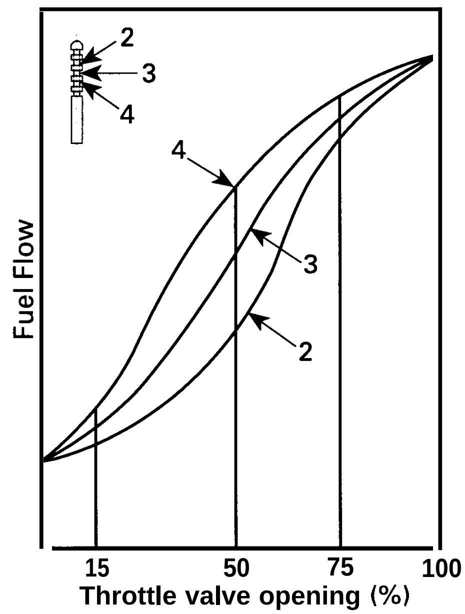
4. **Increase or decrease throttle valve cutaway size in 0.5 steps.**

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.**

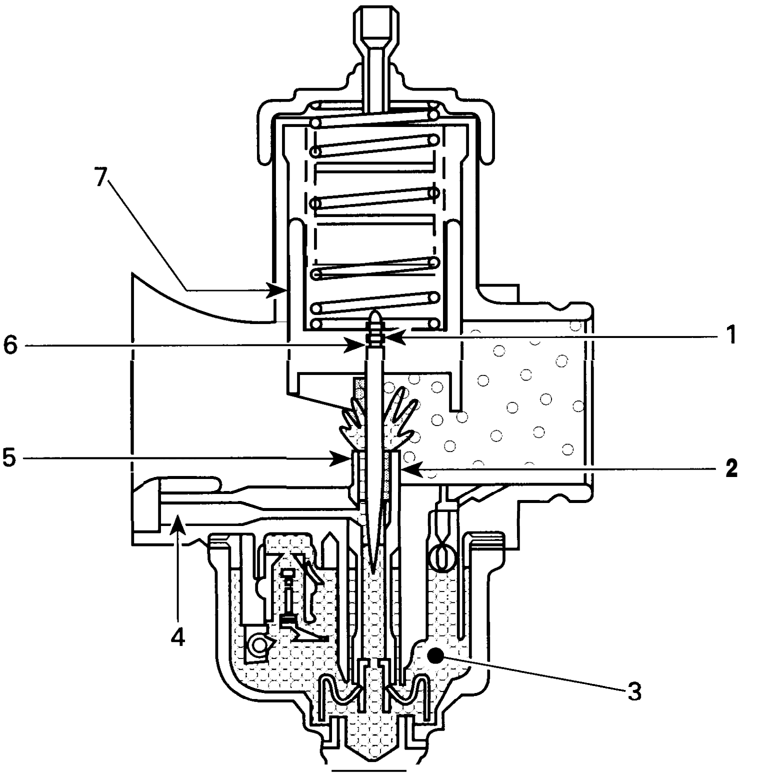
JET NEEDLE

PRINCIPLES OF OPERATION



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

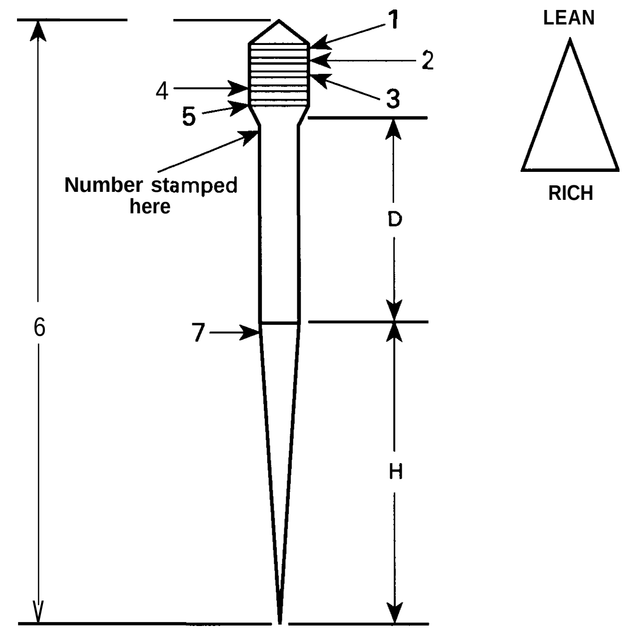
Although the jet needle and needle jet function in the 1/4 to 3/4 throttle range, they also affect the amount of fuel present at wide open throttle. When tuning the jet needle, also check main jet system operation.



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.

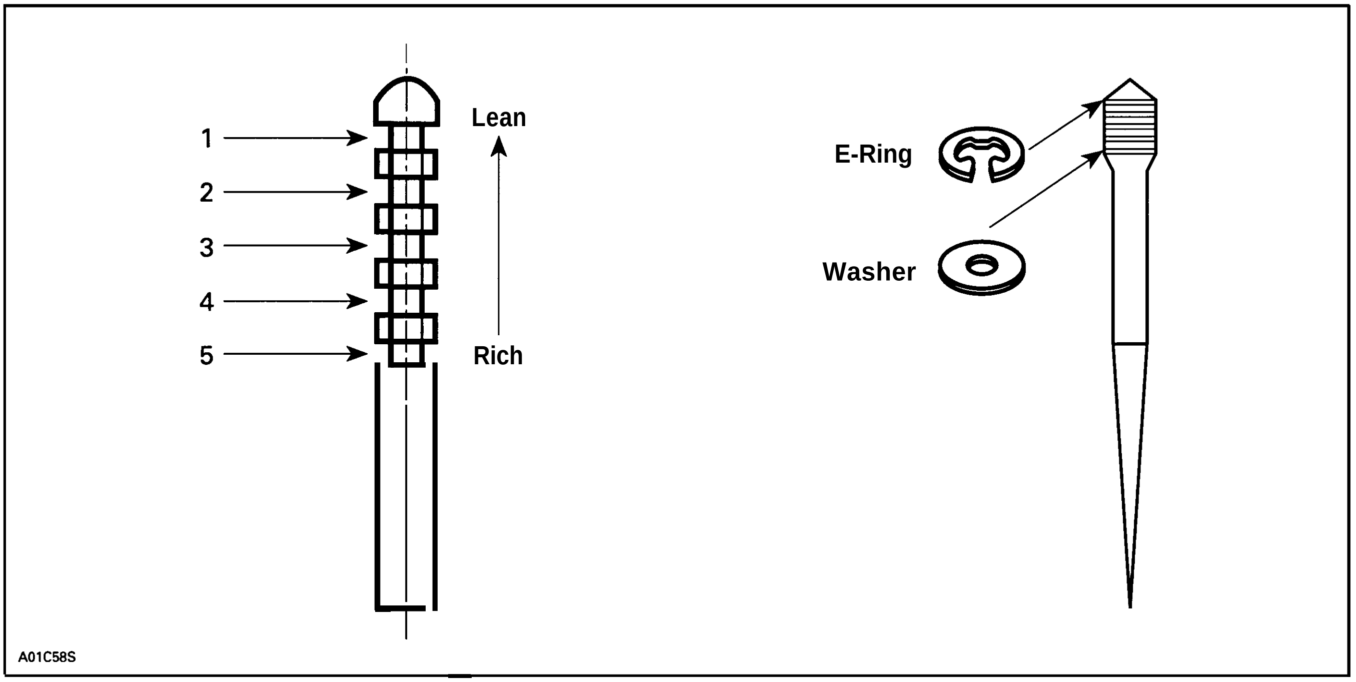
7 - Material, type of coating and start of second taper on needle.

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

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

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

POSITIONING THE E-RING

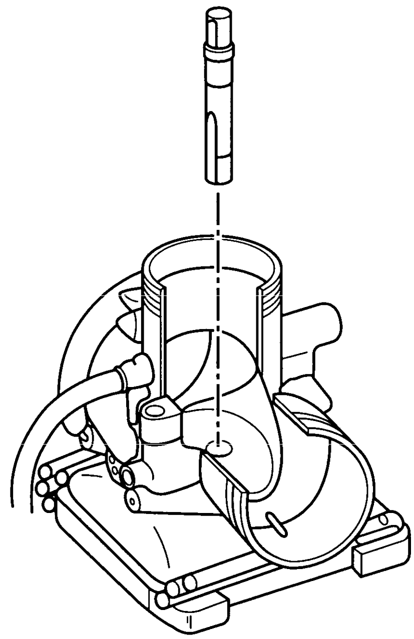


1. Check for a rich or lean setting by examining exhaust manifold. A very light brown or white color indicates a lean mixture. A very dark brown or black color indicates-a rich mixture. The proper color is tan.
2. Move E-ring one groove at a time to correct the fuel/ air mixture.
3. If proper operation 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.

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

NEEDLE JET

PRINCIPLES OF OPERATION



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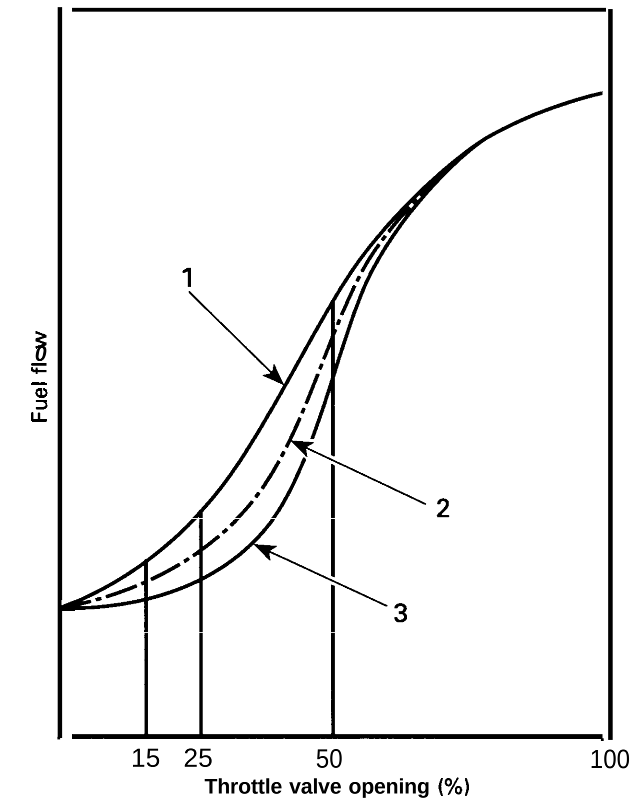
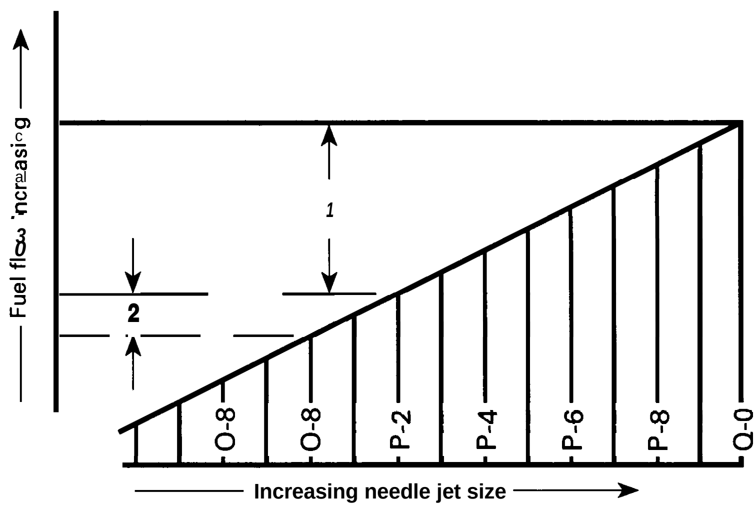
The needle jet works in combination with the jet needle to meter the fuel flow in the mid range.

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.



A01C4JS



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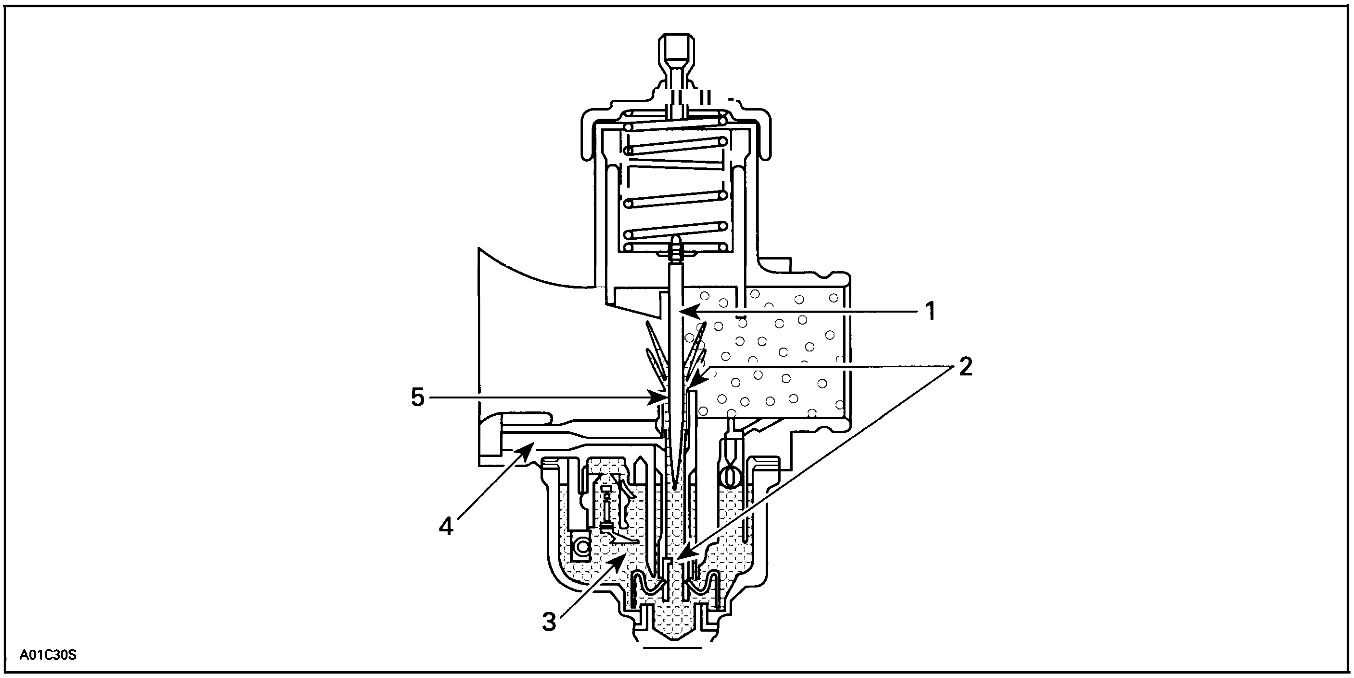
Needle jets are stamped with an alphanumeric code. The letter indicates a major change in fuel flow. P-2, for example, indicates low flow; P-4, greater flow, and so on. The number indicates minor adjustments in fuel flow. The first diagram shows the relationship between the alphanumeric needle jet size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



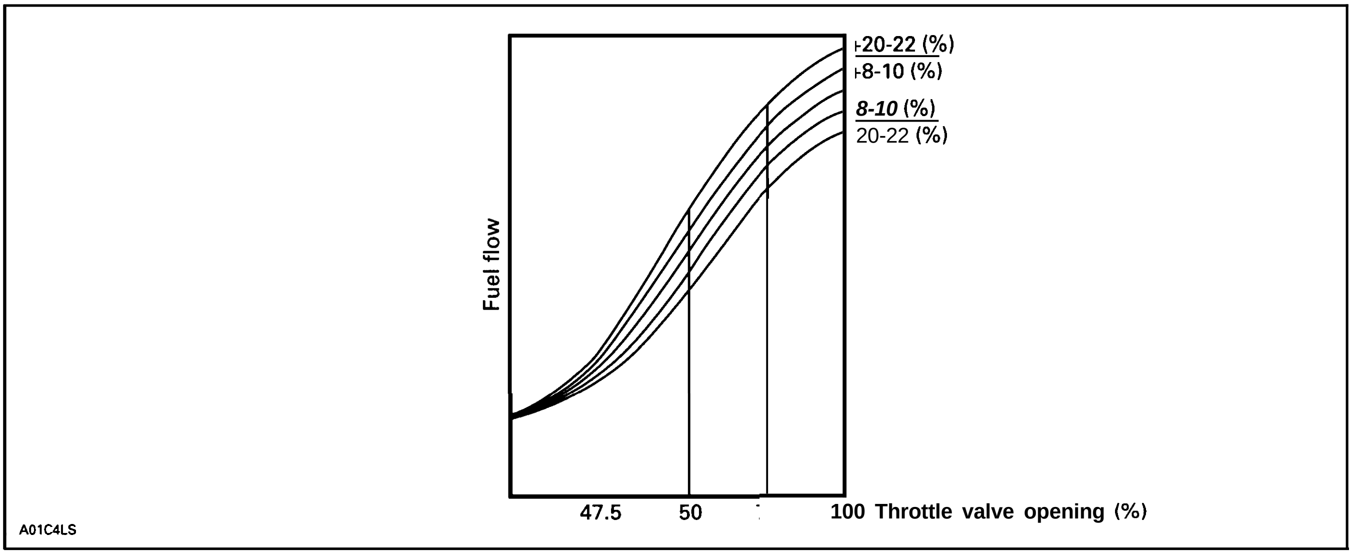
1. Jet needle
2. Metered here
3. Fuel
4. Air
5. Needle jet

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



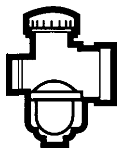
Before operating the snowmobile, make sure all parts, including clutch and drive belt, are in good operating condition.

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.**

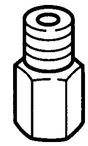
NOTE : Do not change jet sizes by more than one increment (step) at a time.

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.**

NOTE : Rotax rotary valve twin cylinder engines with dual carburetors some times require larger main jets on the magneto cylinder. Fuel particles are fed into the bottom of the carburetors and tend to hug the bottom of the intake port. The rotary valve turns counterclockwise (as viewed from the carburetors) and closes the MAG side port from the bottom up and the PTO side port from the top down. The fuel rich, bottom portion of flow is cut off first on the MAG side, while the lean, top portion of flow is cut off first on the PTO side. This causes the MAG side cylinder to receive less fuel so a richer main jet is installed to compensate. The amount of difference between main jets will vary with engine design. High RPM engines with large carburetors and twin pipes will have more stagger than will lower RPM engines with small carbs and a single pipe. (In some rare applications, generally caused by the direction the single exhaust pipe curves, the PTO side maybe jetted slightly richer than the mag side.)

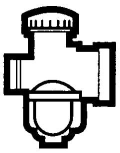


MIKUNI MAIN JET
GICLEUR PRINCIPAL MIKUNI

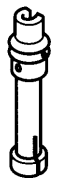


A01C2C

N° MIKUNI NO.	N° BOMBARDIER NO.	N° MIKUNI NO.	N° BOMBARDIER NO.
LEAN PAUVRE ↑		LEAN PAUVRE ↑	
#80	404133100	#300	404101200
#85	404133000	#310	404107800
#90	404132900	#320	404101300
#85	404132800	#330	404101400
#loo	404132000	#340	404104900
#lo5	404132100	#350	404106000
#110	404124100	#360	404106100
#115	404124000	#370	404106200
#120	404123900	#380	404106300
#125	404124800	#390	404106400
#130	404124900	#400	404100900
#135	404130400	#410	404101000
#140	404126600	#420	404107900
#145	404130500	#430	404108000
#150	404120900	#440	404108100
#155	404128700	#450	404106500
#160	404118200	#460	404106600
#165	404119300	#470	404106700
#170	404123800	#480	404106800
#175	404119200	#490	404106900
#180	404112200	#520	404115100
#185	404119500	#540	404114600
#190	404119000	#560	404108400
#195	404119400	#560	404115400
#200	404112300	#590	404108500
#210	404119100	#600	404115500
#220	404111200	#620	404115700
#230	404118900	#640	404115900
#240	404100200	#660	404114700
#250	404100300	#680	404116200
#260	404100600	#700	404114600
#270	404100400	#710	404116400
#280	404100500	#720	404116500
#290	404101100		
↓ RICH RICHE		↓ RICH RICHE	



MIKUNI NEEDLE JET
GICLEUR A AIGUILLE MIKUNI

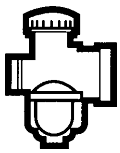


AOIC2D

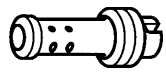
LEAN
PAUVRE

N“ MIKUNI NO.	N“ BOMBARDIER NO.
159 N-2	404147700
159 N-4	404147300
159 N-6	404154300
1590-0	404130200
1590-6	404131000
1590-8	404116900
159 P-o	404107000
159 P-2	404100700
159 P-4	404103600
159 P-6	404110600
159 P-8	404120800
159 Q-o	404110700
159 Q-2	404110800
159 Q-4	404114200
159 Q-8	404132700
166 R-O	404108700
1820-8	404118100
224 AA-0	404133500
224 AA-2	404146300
224 AA-3	404151800
224 AA-4	404147600
224 AA-5	404126700
224 AA-6	404148200
224 AA-7	404152800
224 BB-0	404114000
224 BB-5	404113100
224 CC-0	404116600
2242-5	404127800
2242-8	404148400
4800-4	404152100
4800-6	404148500
4800-8	404148600
480P-O	404133200
480P-2	404131200
480P-4	404131500
480P-6	404146000
480 Q-4	404149100

RICH
RICHE



MIKUNI PILOT JET
GICLEUR DE RALENTI MIKUNI



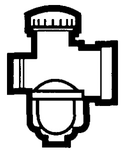
A01C2E

N° MIKUNI NO.		N° BOMBARDIER NO,
	LEAN PAUVRE	
#20	↑	404108600
#25		404110300
#30		404107700
#35		404102700
#40		404109100
#45		404109400
#50		404109500
#55		404113900
#75	↓	404148100
	RICH RICHE	

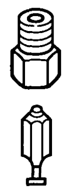
MIKUNI JET NEEDLE
AIGUILLE DE GICLEUR MIKUNI

A01C2F

N° MIKUNI NO.	N° BOMBARDIER NO.	N° MIKUNI NO.	N° BOMBARDIER NO.
6DH2	404110400	6FJ6	404131100
6DH3	404126900	6F9	404109200
6DH4	404101900	6FL14	404114100
6DH7	404111300	7DH2	404113200
6DH8	404124400	7FH01	404133300
6DP1	404118000	7DH3	404127700
6EJ1	404110500	7DL7	404147800
6DHN43	404147100	7EG06	404147200
6DHN44	404149200	8DH2	404139300



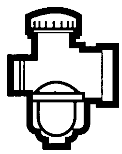
MIKUNI NEEDLE VALVE
POINTEAU MIKUNI



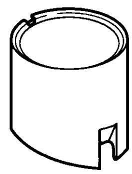
A01C2G

CARBURETOR CARBURATEUR	SIZE GROSSEUR	N° BOMBARDIER NO.
VM 28-242 VM 32-259	1.5	404117700
VM 34-433 VM 34-434	1.2 (v)	404147500
VM 34-400 VM 40-23 VM 40-24 VM 40-48 VM 40-49	2.0	404112600
VM 38-171 VM 38-172 VM 38-214 VM 38-215 VM 38-254 VM 38-255 VM 38-260 VM 38-261	2.0	404131400
VM 38-289 VM 38-290 VM 38-291 VM 38-292 VM 38-293 VM 38-294 VM 40-69	1.5 (v)	404147400
VM 40-67 VM 40-68 VM 40-71 VM 40-72	1.5 (v)	404152300
VM 44-30 VM 44-31	2.0 (v)	404131400
ALL OTHERS TOUS LES AUTRES	1.5	404103200

Viton



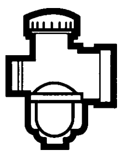
– 1 –
MIKUNI THROTTLE SLIDE CUT-AWAY
DÉCOUPURE DU TIROIR D'ACCÉLÉRATEUR MIKUNI



WITH LATERAL RESTRAINING DEVICE
AVEC DISPOSITIF DE RETENUE LATERAL

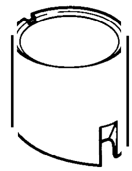
CARBURETOR CARBURATEUR	CUT-AWAY DÉCOUPURE	N° BOMBARDIER NO.
VM 28	2.0	404118300
VM 30	1.5 1.5 2.5 3.0	404109900 4041173000 404117200 4041174000
VM 32	3.0	404130300
VM 34	1.5 2.0 3.0 3.5	404109900 404119600 4041174000 4041171000
VM 38	2.5	404112500
TM 38	3.0	404137700

① Use with packing P/N 404117000
① Utiliser avec la rondelle N/P 404117000



– 2 –

MIKUNI THROTTLE SLIDE CUT-AWAY
DÉCOUPURE DU TIROIR D'ACCÉLÉRATEUR MIKUNI



WITH CENTER RESTRAINING DEVICE
AVEC DISPOSITIF DE RETENUE CENTRAL

CARBURETOR CAR BURATEUR	CUT-AWAY DÉCOUPURE	N“ BOMBARDIER NO.
VM 30	2.5	404128400
VM 34	2.0 2.5	404128600 404128400
VM 38	2.5	404131300
VM 40	2.5 2.5	404113400 404132300

ENGINE 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:

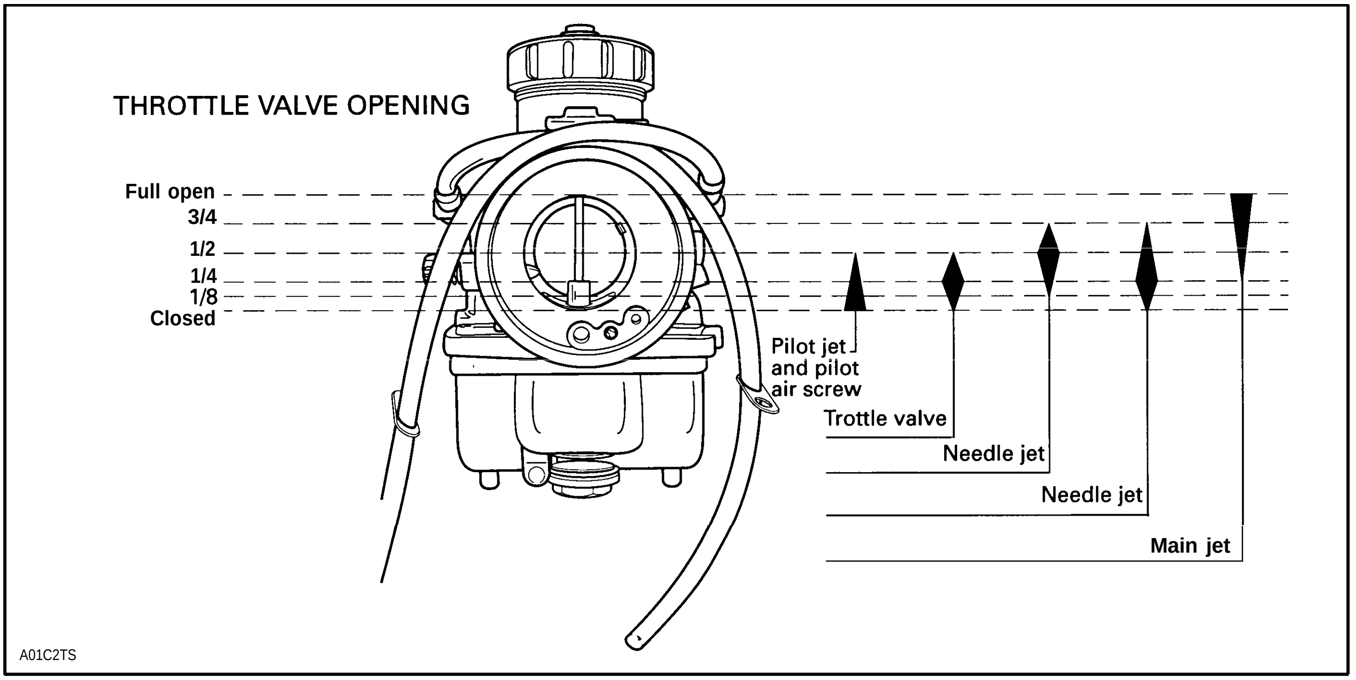
(1) When the air/ fuel mixture is too rich :

- **(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 siezure or scuffing occurs.**

FUNCTIONAL RANGE EFFECTIVENESS IN RELATION TO THROTTLE OPENING



FUEL / OIL RATIO CHARTS

METRIC (S. I.)/MÉTRIQUE (S.I.)

500 mL of oil / d'huile + 25 L of fuel / de carburant = 50 / 1

IMPERIAL /imperial

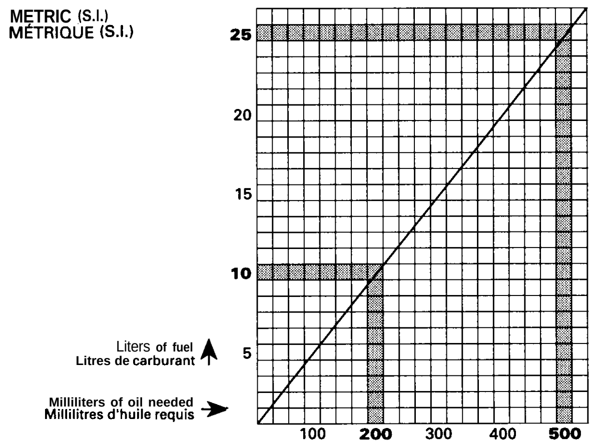
16 oz of oil / d'huile + 5 Imp. gal of fuel / de carburant = 50/1

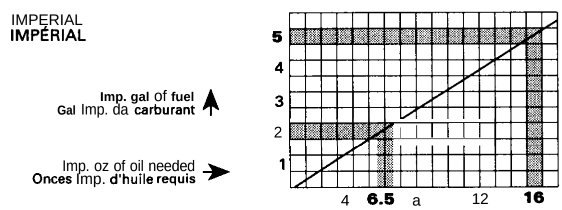
500 mL of oil / d'huile + 5.5 Imp. gal of fuel / de carburant = 50 / 1

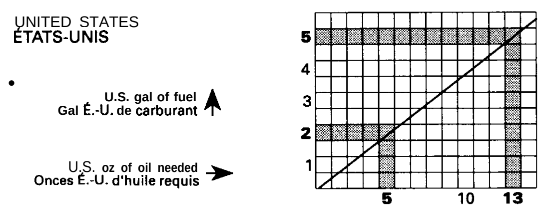
UNITED STATES/ETATS-UNIS

13 Oz of oil / d'huile + 5 U.S./E.-U. gal of fuel / de carburant = 50/'

500 mL of oil / d'huile + 6.6 U.S./E.-U. gal of fuel / de carburant = 50/'







METRIC (S.I.)/MÉTRIQUE (S.I.)

500 mL of oil / d'huile + 20 L of fuel / de carburant = 40/1

IMPERIAL/ IMPÉRIAL

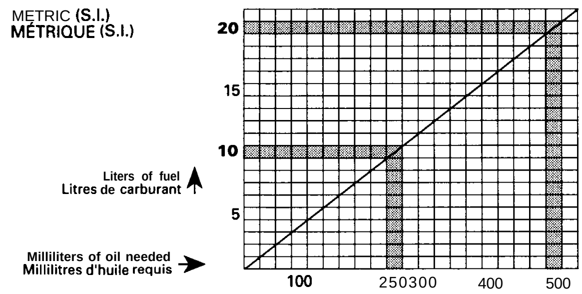
16 oz of oil / d'huile + 4.0 Imp. gal of fuel / de carburant = 40/1

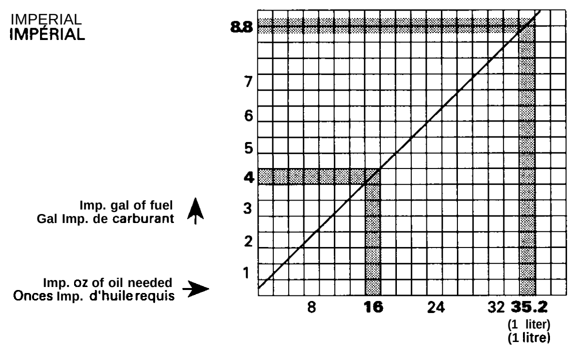
500 mL of oil / d'huile + 4.8 Imp. gal of fuel / de carburant = 40/1

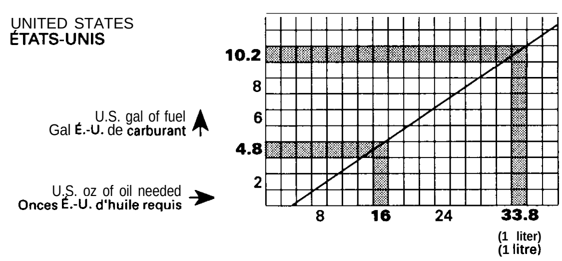
UNITED STATES/ETATS-UNIS

16 oz of oil / d'huile + 5.1 U. S./k. -U. gal of fuel / de carburant = 40/1

500 mL of oil / d'huile + 5.3 U.S. /É.-U. gal of fuel / de carburant = 40/1







METRIC (S. I.)/MÉTRIQUE (S.I.)

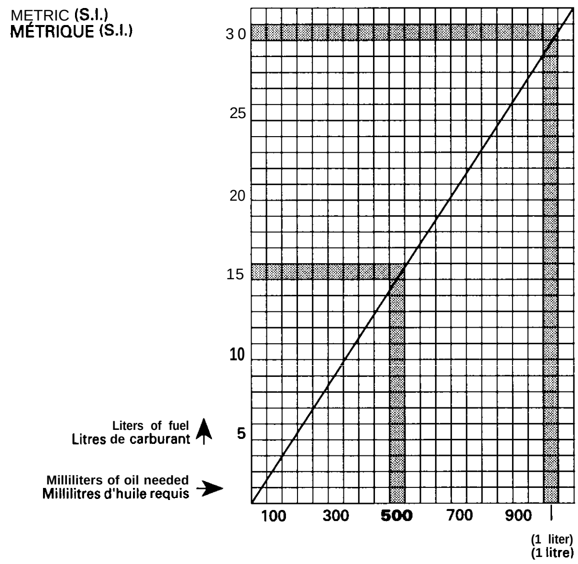
500 mL	of oil / d'huile	+ 15 L	of fuel / de carburant	= 30/1

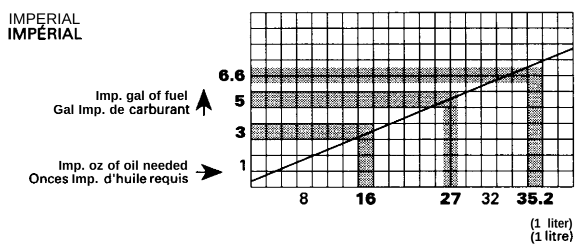
IMPERIAL/ IMPÉRIAL

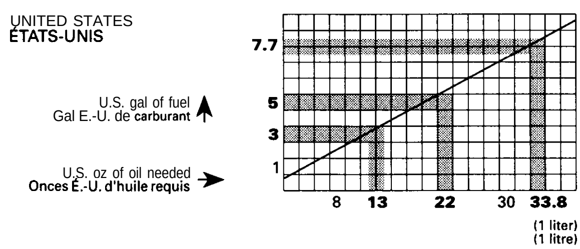
16 oz	of oil / d'huile	+ 3 Imp. gal	of fuel / de carburant	= 30/1
500 mL	of oil / d'huile	+ 3.3 Imp. gal	of fuel / de carburant	= 30/1

UNITED STATES/ETATS-UNIS

13 Oz	of oil / d'huile	+ 3 U.S./E.-U. gal	of fuel / de carburant	= 30/1
500 mL	of oil / d'huile	+ 4 U.S./E.-U. gal	of fuel / de carburant	= 30/1







METRIC (S. I.)/MÉTRIQUE (S.I.)

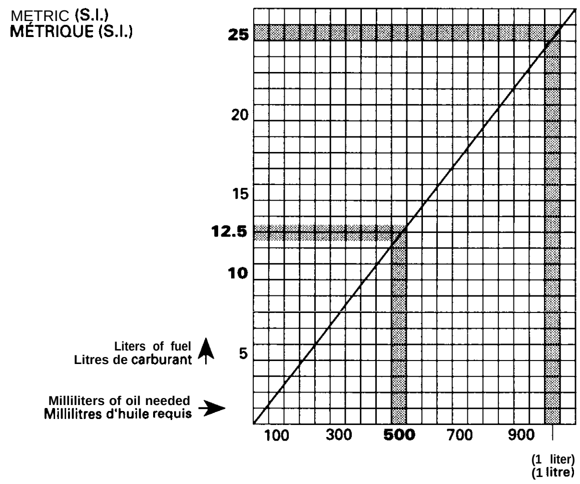
500 mL	of oil / d'huile	+ 12.5 L	of fuel / de carburant	= 25/1

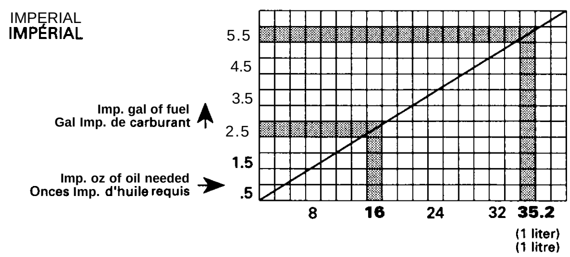
IMPERIAL/ IMPÉRIAL

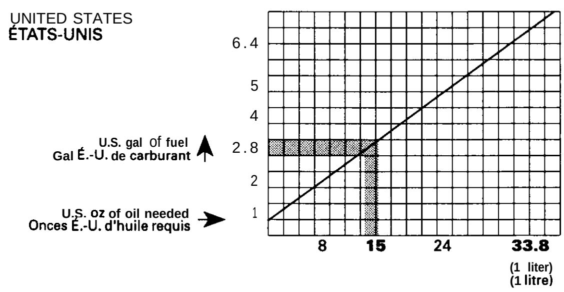
16 oz	of oil / d'huile	+ 2.5 Imp. gal	of fuel / de carburant	= 25/1
500 mL	of oil / d'huile	+ 2,7 Imp. gal	of fuel / de carburant	= 25/1

UNITED STATES/ ETATS-UNIS

15 Oz	of oil / d'huile	+ 2.8 U.S./E.-U. gal	of fuel / de carburant	= 25/ 1
500 mL	of oil / d'huile	+ 3.2 U.S. / É.-U. gal	of fuel / de carburant	= 25/ 1







METRIC (S. I.)/MÉTRIQUE (S.I.)

500 mL of oil / d'huile + 10 L of fuel / de carburant = 20 / 1

IMPERIAL/ IMPÉRIAL

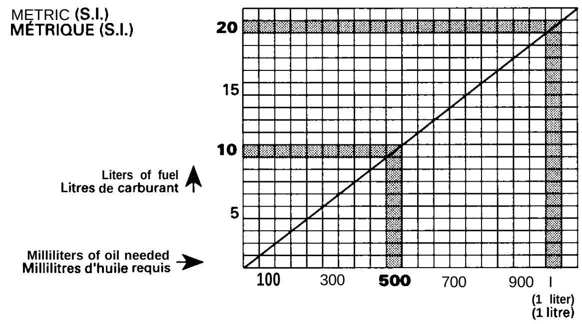
16 oz of oil / d'huile + 2 Imp. gal of fuel / de carburant = 20 / 1

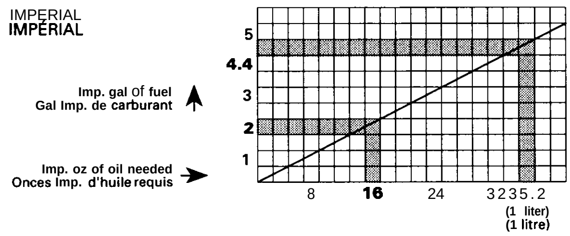
500 mL of oil / d'huile + 2.2 Imp. gal of fuel / de carburant = 20 / 1

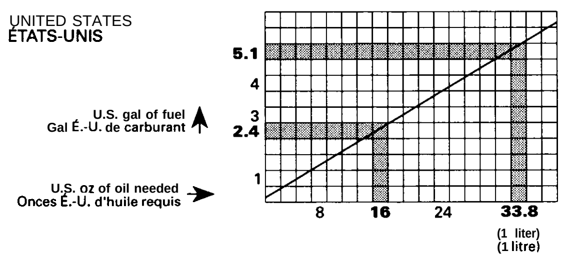
UNITED STATES/ ETATS-UNIS

16 oz of oil / d'huile + 2.4 U.S./E.-U. gal of fuel / de carburant = 20/1

500 mL of oil / d'huile + 2.6 U.S./E.-U. gal of fuel / de carburant = 20/1







H.A.C. HIGH ALTITUDE COMPENSATOR

THEORY

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

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

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

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

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

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

APPLICATION

The carburetors must be adapted for use with the H.A.C. There must be a connection to provide venturi pressure and the air jet main opening is plugged. A small hole is drilled into the top of the air jet passageway. 1994 models use much richer carburetor jets because the H.A.C. is providing reduced float bowl pressures (thus leaner mixtures) at all temperatures and altitudes.

Example :

	583 H.A.C. SUMMIT	583 STX
Main Jet	490/490	340/350
Needle jet	480 Q-4	480 P-6
Pilot jet	75	35

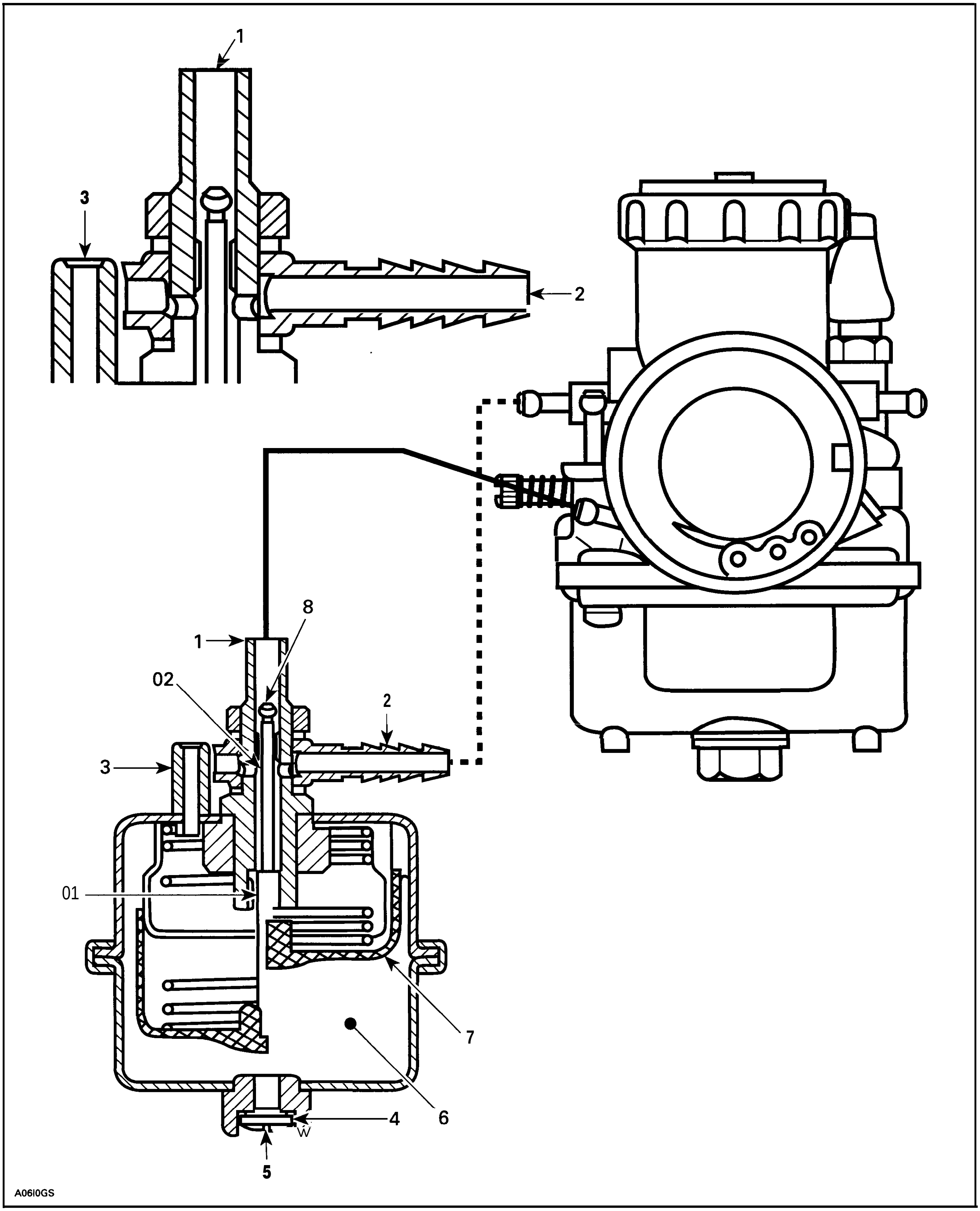
The vent tube on connection 3 is routed to the atmosphere below the carburetors. This is to help prevent snowdust ingestion, and provides a drain for any excess fuel in the system from a machine tip over.

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

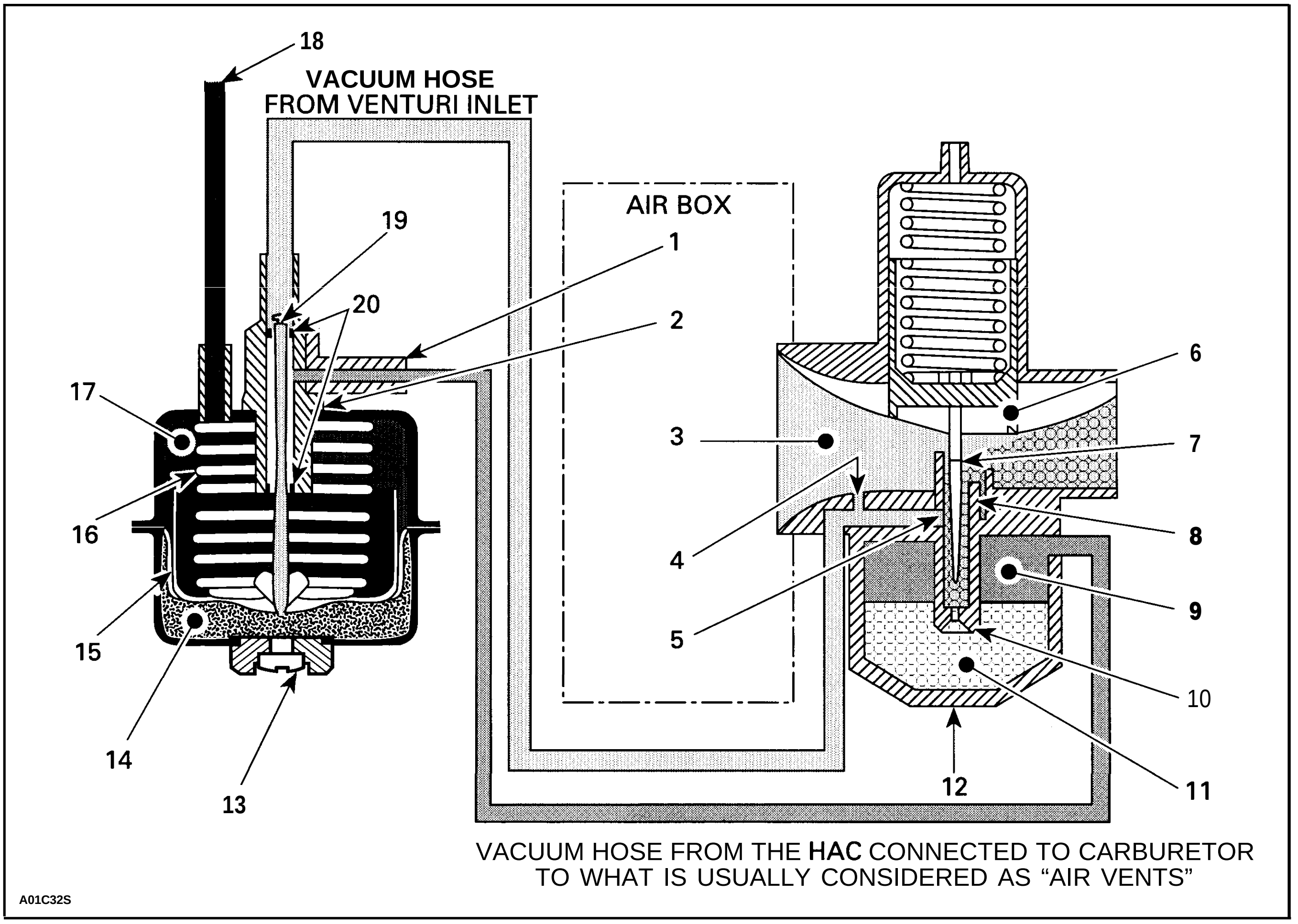
Hose lengths from the carburetor to H.A.C. should not be altered. Shorter hoses will not affect the calibration significantly, but care must be used to avoid kinking of the hoses. Too long of a hose will cause a rich condition, because of reduced signal strength. While the H.A.C. units are identical between the 583 and 467, on the '94 models, different hose routings are used because the 34 mm carburetors have 90° fittings for the vent tubes, while the 38 mm carburetors exit straight out.

TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE
Lean Mixture	1) Plugged hole in air jet inlet 2) H.A.C. frozen
Rich Mixture	1) H.A.C. connection to atmosphere is plugged 2) Leakage in H.A.C. to carburetor tube 3) Leak in H.A.C. sealed chamber 4) H.A.C. frozen


1
3
2
8
1
02
2
3
01
7
6
4
5
A06I0GS

3.4 HAC Operation



1. Carburetor vacuum hoses manifold
2. Choke jets manifold
3. Vacuum generated by the engine induction
4. Idle air by-pass (very small hole)
5. Hac venturi vacuum inlet from needle jet diffuser
6. Throttle slide
7. Jet needle
8. Needle jet
9. Pressured room controlled by hac
10. Main jet
11. Float bowl fuel
12. Carburetor float bowl
13. Sealed room plug
14. Sealed room
15. Diaphragm
16. Diaphragm return spring
17. Atmospheric pressured room
18. Atmospheric pressure
19. Vacuum jet needle (attached to diaphragm base)
20. Vacuum choke jet

IGNITION SYSTEMS, SPARK PLUGS

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

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

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

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

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

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

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

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

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

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

Starting with most 1990 Ski-Doo models, a Nippondenso CDI system with only one generating coil was introduced. This system is identified by having only two wires running from the stator plate to the CD box. The two generating coil system has three wires. This system functions the same as the dual generating coil system but has the following differences :

1. The timing retards more at high RPM's. (See graph.)
2. The voltage drops at high RPM's. (See graph.) Up to 7500 RPM, it produces higher voltage.
3. The resistance value of the generating coil is different. (See *Shop Manual*.)
4. The CD box and high tension coil are also different and have different testing and resistance values. (See *Shop Manual*.)

There is also a racing version of the two generating coil Nippondenso CDI. It is used on the twin track oval racers. The function is similar to the other Nippondenso CDI but has an additional red wire from the generating coils to the CD box. The CD box circuitry is different and uses this signal from the generating coils to significantly retard the ignition timing at high RPM's. (See graph.)

The main advantage of this system is to allow a lot of ignition advance at low RPM (which significantly increases low RPM H. P.) but retards at high RPM to prevent the engine from going into detonation. This helps regain "lost" low RPM H.P. on engines that have been modified for maximum H.P. at high RPM.

	PART NUMBER
354 twin track complete magneto assembly	486014300
CD box only	486014400
Ignition coil only	486014500

Use of the racing ignition system requires a new keyway position on the MAG end of the crankshaft. All three of these systems are referred to a 4 pole systems.

Ignition timing is adjusted on these ignitions by rotating the stator plate. To advance the timing, rotate the stator opposite to the direction of crankshaft rotation. Always use blue loctite an the stator plate screws.

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 779 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. The timing curve is the same as the two cylinder version. See the graph to view the actual timing curve.

TACHOMETER SELECTION

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

4 PULSE TACHOMETERS

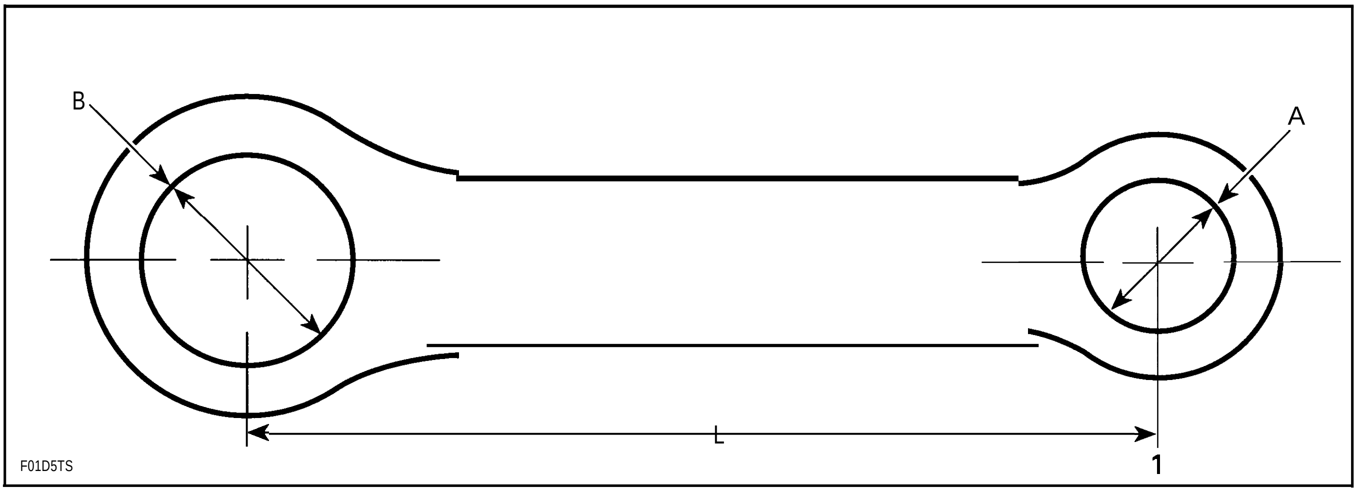
- Bosch breaker points
- **Bosch CDI polar fire, '72-'78**
- **Bosch CDI racing, '79-'82**
- **ND dual and single generating coil, 4 pole, '81-'95**
- **ND 4 pole racing**

(ND = Nippondenso)

6 PULSE TACHOMETERS

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

ROTAX CONNECTING RODS



1. Rod Length Center to Center
**A. All 22 mm (0.866") except 670
24 mmm (0.945") &
59918 mm (0.708")**

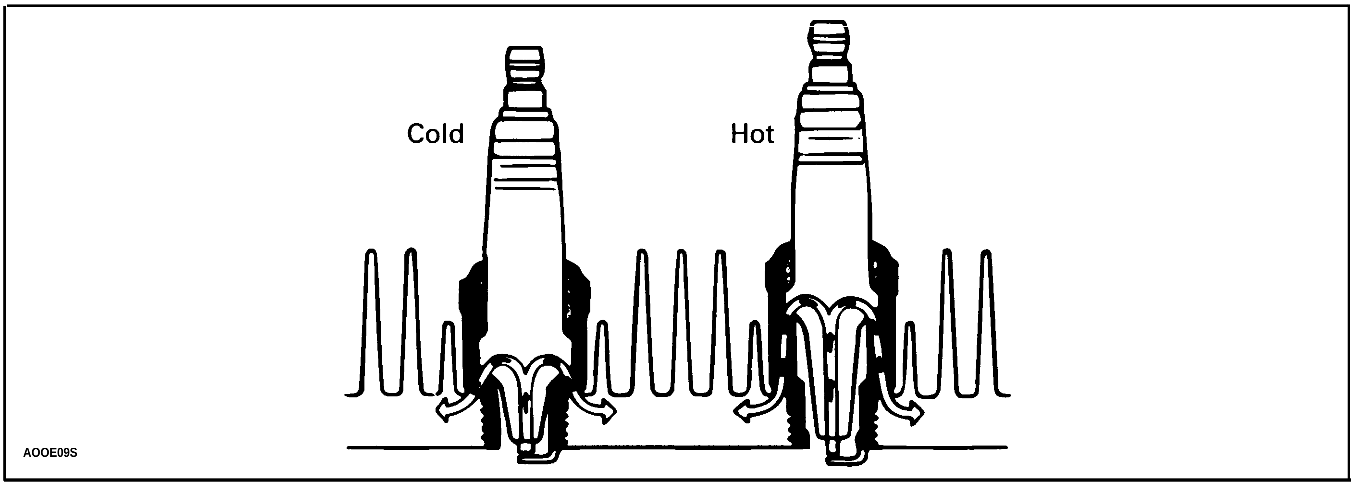
ENGINE TYPE	STROKE mm (in)	LENGTH mm (in)
- 253	**61 (2.402)**	**115 (4.527)**
377	**61 (2.402)**	**115 (4.527)**
447	**61 (2.402)**	**115 (4.527)**
- 247 **(fan cooled)**	**66 (2.598)**	**132 (5.196)**
640 (fan cooled)	**70 (2.756)**	**132 (5.196)**
670	**70 (2.756)**	**132 (5.196)**
- 277	**66 (2.598)**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

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.



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.

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

DESIGN SYMBOLS USED ON NGK SPARK PLUGS

First letter prefix for thread and hexagon size

Letter	Thread size	Hexagon size
A	18 mm	25.4 mm
B	14 mm	20.6 mm
C	10 mm	16.0 mm
D	12 mm	18.0 mm
F	7/8 in-18	23.8 mm
G	PF 1/2 in-14	23.8 mm

Second and third letter prefix for construction feature, except single prefix

Letter	Construction feature
B	Hexagon size 20.6 mm
C	Hexagon size 16.0 mm
G	Hexagon size 23.8 mm
L	Compact type (SHORTY)
M	Compact type (BANTAM)
P	Projected ineulator nose type
R	Resistor type
S	Shielded type
U	Surface discharge type

Heat rating number

Number	
2	Hotter type
4	
5	
6	
7	Ordinary plug
8	
	(85)
9	
	(95)
10	
	(105)
	Racing plugs
11	
12	
13	Coder type
14	

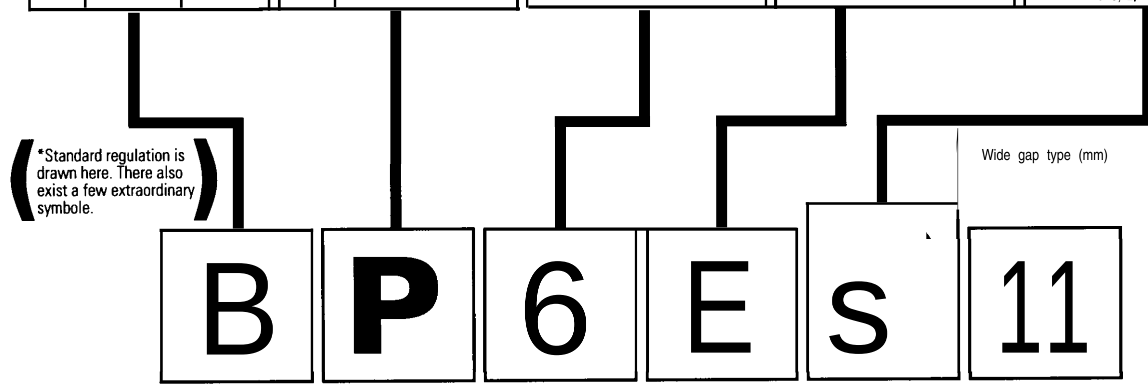
First letter suffix for thread: reach

Letter	Thread reach
None	12,0 mm (thread dia. 18 mm) 9.5 mm (thread dia. 14 mm) 22.5 mm (thread dia. PF 1/2 in-14 mm) 16,0 mm (thread dia. 7/8 in-18mm)
L	11.2 mm
H	12.7 mm (racing type 18.0 mm)
E	19.0 mm (racing type 18.0 mm)
F	Conical seat type A -F 10.9 MM B - F 11.2 MM BM - F 7.8 MM BE - F 17.5 MM

Second letter suffix for construction feature, etc.

Letter	Construction feature, etc.
A	-Specials
B	-Special plug for Honda vehicles
C	-Competition type
G	-Racing plugs, center electrode of nickel alloy
GV	-Racing plugs, center electrode of precious metal
N	-Racing plugs, nickel electrode
P	-Racing plugs, platinum ground electrode
R	-Shielded resistor plugs
S	-Copper core center electrode (Super)
V	-Center electrode of precious metal
W	-Tungsten electrode
X	-Series gap plugs
Y	-V-Grooved center electrode

Multiple ground electrodes type
K 2 T 3
M 2 Q 4
Others Expect for above letters, there are special plugs of J, L, Z, etc.



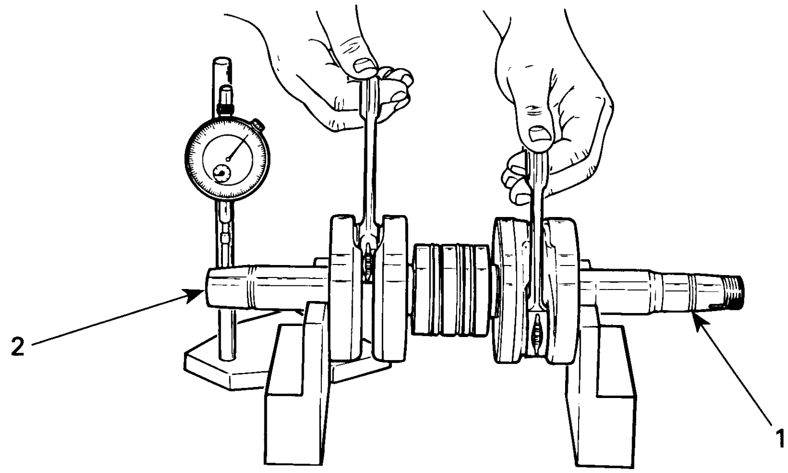
A01E1GS

STOCK CLASS PREPARATION

O **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.

O

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

1995 AND 1996 IGNITION TIMING (BTDC) @ 6000 RPM

454	467	582	583	670	779	599	494
1.48 mm (.058 in)	2.08 mm (.082 in)	2.18 mm (.086 in)	1.75 mm (.069 in)	1.93 mm (.076 in)	2.11 mm (.083 in)	2.18 mm (.086 in)	1.81 mm (.071 in)

11. Synchronize carburetors so that they open precisely together and ensure that the cutaways of the slides clear the inlet bores of the carburetors. After carb adjustment, adjust oil injection pump.
12. On RAVE valve-equipped engines, check for free movement of the RAVE valve mechanism. Check the passageways between valve piston and exhaust port for any carbon buildup.

    Adjust RAVE preload. It is better to have the valve open a little earlier than later.
13. Use non resistor spark plugs—B9ES, B9EV, B10ES, B10EV of heat range required.
14. Use premium fuel 93 octane.

O NOTE : Be careful not to use too much deicer or gasohol fuels. The tech inspectors fuel meter doesn’t particularly care for alcohol in your gasoline.

15. Tie wrap ignition wire connectors together.
16. Adjust carburetors for atmospheric conditions. (See carbu retion section.)
17. Break in a new engine before racing it. Performance can be gained by getting some run time on the engine. Ten hours of break-in is recommended.

NOTES REGARDING ENGINE MODIFICATION

1. Tunnel porting

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

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

Tunnel porting should be done on y by accomplished engine modifiers.

2. Porting

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

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

Revision: 11
Date: 95-08-30

MIKUNI
CARBURETTOR CALIBRATION
ROTAX PRODUCTION 1995
BOMBARDIER MODELS 1996

<< ATTENTION >> *The preliminary ca ratio for prototype test use only*

ENGINE	#BOMBARDIER	MODEL	CARBURETTOR	IDLE ±0.1	R.P.M.	M.J.	J.N.	C.A.	P.J.	A.S. ±1/16	V.S.	N.J.	S.J.	FLOAT LEVEL ±1	STATUS	
247	403-1125	Elan	VM28-470A	1.5	1100-1300	160	6DP1-3	2.0	30	1.5	1.5	O-8 (182)	N/A	17.3	FINAL	
277	403-1223	Tundra II LT	VM34-443	1.3	1100-1300	190	6DH4-2	2.5	40	1.0	1.5	O-8 (159)	N/A	23.9	FINAL	
377	403-1257	Skandic 380, Formula S Touring E, Touring E LT	VM30-188 PTO/MAG	1.3	1500-1800	140	6DP9-3	2.5	40	1.25	1.5	P-0 (159)	N/A	23.9	FINAL FINAL	
443	403-1235	Touring LE	M34-46 PTO M G	1.8	1500-1800	180	6DH2-3	2.5	40	[2.25]	1.5	P-1 (159)	1.2	23.9	FINAL	
				1.8	1500-1800	180	6DH2-3	2.5	40	[2.25]	1.5	P-1 (159)	1.2	23.9	FINAL	
454	403-1238	MX Z	VM34-469 PTO	1.8	1600-1800	230	6FJ43-2	2.5	40	[0.5]	1.5(V)	P-8 (159)	N/A	23.9	FINAL	
	403-1253		VM34-470 MAG	1.8	1600-1800	210	6FJ43-2	2.5	40	[0.5]	1.5(V)	P-8 (159)	N/A	23.9	FINAL	
494	403-1239	Formula SLS	VM38-311 PTO, MAG	1.8	1700-1900	320	6FEY1-3	2.5	45	[1.75]	1.5(V)	P-7 (480)	N/A	18.1	FINAL	
		Grand Touring 500		1.8	1700-1900	320	6FEY1-3	2.5	45	[1.75]	1.5(V)	P-7 (480)	N/A	18.1	FINAL	
494	403-1262	Summit 500	VM38-313 HAC PTO	2.0	1700-1900	400	6FEY1-3	2.5	75	[2.0]	1.5(V)	Q-0 (480)	N/A	19.6	FINAL	
	403-1263		VM38-314 HAC MAG	2.0	1700-1900	400	6FEY1-3	2.5	75	[2.0]	1.5(V)	Q-0 (480)	N/A	19.6	FINAL	
503	403-1236	Skandic 500/Touring SLE	VM34-465 PTO	1.5	1500-1800	190	6DH2-3	2.5	40	1.25	1.5	P-0 (159)	1.5	23.9	FINAL	
	403-1237	Formula SL	VM34-466 MAG	1.5	1500-1800	180	6DH2-3	2.5	40	1.25	1.5	P-0 (159)	1.5	23.9	FINAL	
503	403-1276	Skandic WT	VM32-269	1.3	1500-1800	220	6DH8-4	3.0	25	1.5	1.5	O-0 (159)	N/A	23.9	FINAL	
582	403-1260	Grand Touring 580	VM38-317 PTO	1.5	1800-2000	360	6DHN44-4	2.5	40	1.25	1.5(V)	O-4 (480)	N/A	18.1	FINAL	
	403-1261		VM38-318 MAG	1.5	1800-2000	370	6DHN44-4	2.5	40	1.25	1.5(V)	O-4 (480)	N/A	18.1	FINAL	
583	403-1267	Formula STX	VM38-325 PTO	1.6	1800-2000	320	6DHN44-3	[illegible]	40	1.5	1.5(V)	P-0 (480)	N/A	18.1	FINAL	
	403-1268	Formula STX LT (2)	VM38-326 MAG	1.6	1800-2000	330	6DHN44-3	[illegible]	40	1.5	1.5(V)	P-0 (480)	N/A	18.1	FINAL	
583	403-1258	Summit 583	VM38-319 HAC PTO	2.3	1800-2000	330	6BGY15-2	2.5	75	[1.5]	1.5(V)	Q-6 (480)	N/A	19.6	FINAL	
	403-1259		VM38-320 HAC MAG	2.3	1800-2000	320	6BGY15-2	2.5	75	[1.5]	1.5(V)	Q-6 (480)	N/A	19.6	FINAL	
583	403-1266	Formula Z	VM40-83	1.8	1800-2000	340	7DL7-3	2.5	45	[1.5]	1.5(V)	AA-2 (224)	N/A	18.1	FINAL	
583	403-1254	MXZ 583	VM40-76 PTO	1.5	1800-2000	270	7ECY1-3	2.5	45	1.875]	1.5(V)	AA-2 (224)	N/A	18.1	FINAL	
	403-1255		VM40-77 MAG	1.5	1800-2000	260	7ECY1-3	2.5	45	1.875]	1.5(V)	AA-2 (224)	N/A	18.1	FINAL	
599	403-1241	Formula III	VM36-172 PTO	1.2	1800-2000	330	6DEY2-3	2.5	50	[1.5]	1.5(V)	P-0 (286)	1.5	18.1	FINAL	R
	403-1242		VM36-173 CENTER	1.2	1800-2000	320	6DEY2-3	2.5	55	[1.5]	1.5(V)	P-0 (286)	1.5	18.1	FINAL	R
	403-1243		VM36-174 MAG	1.2	1800-2000	330	6DEY2-3	2.5	50	[1.5]	1.5(V)	P-0 (286)	1.5	18.1	FINAL	R
670	403-1277	Formula L	VM40 PTO	1.9	1800-2000											
	403-1278		VM40 MAG	1.9	1800-2000											
670	403-1264	Mach I	VM44-32 PTO	2.25	1800-2000	420	7EGO6-3	2.5	35	1.5	2.0 (V)	AA-7 (224)	N/A	18.1	FINAL	
	403-1265		VM44-33 MAG	2.25	1800-2000	400	7EGO6-3	2.5	35	1.5	2.0 (V)	AA-7 (224)	N/A	18.1	FINAL	
670	403-124	Formula SS	VM40-79 PTO	1.9	1800-2000	360	7EDY1-3	2.5	50	[2.25]	1.5(V)	AA-3 (224)	N/A	18.1	FINAL	
		Grand Touring SE		1.9	1800-2000	360	7EDY1-3	2.5	50	[2.25]	1.5(V)	AA-3 (224)	N/A	18.1	FINAL	
670	403-1246	Summit 670	VM40-81 HAC PTO	2.3	1800-2000	380	7DPI1-3	2.5	75	[2.25]	1.5(V)	AA-2 (224)	N/A	19.6	FINAL	
	403-1247		VM40-82 HAC MAG	2.3	1800-2000	370	7DPI1-3	2.5	75	[2.25]	1.5(V)	AA-2 (224)	N/A	19.6	FINAL	
779	403- 56	Mach Z	TM-38 C152 PTO	1.4	1700-1800	380	8AGY1-41-3	2.0	40	[4.5]	1.5(V)	O-4 (327)	1.5	20.0	FINAL	
			TM-38 C152 CENTER	1.4	1700-1800	370	8AGY1-41-3	[illegible]	45	[4.0]	1.5(V)	O-4 (327)	1.5	20.0	FINAL	
			TM-38 C152 MAG	1.4	1700-1800	380	8AGY1-41-3	[illegible]	45	[3.5]	1.5(V)	O-4 (327)	1.5	20.0	FINAL	

V = VITON TYPE
[x.xx] = FINE THREAD (20°, 0.5 mm PITCH) (10°, 0.5 mm pitch for TM 38 only)

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. 174 ft/sec.2)
R = radius of the center of mass from the
axis of rotation measured in feet

This formula can be converted for easier application in our use to F = (.00034084) WRN^2

where : F = centrifugal force in pounds
W = weight in pounds
R = radius the weight rotates at in feet
N = RPM

As the formula illustrates, we can control the size of the centrifugal force by varying the size of the weight we are rotating and by varying the radius of the circle we rotate the weight around. The largest influence on the force, however, is the rotational speed because the force increases with the square of this speed. This is important to realize when one begins working with high RPM competition engines. Use and control of this centrifugal force is discussed in the following sections.

Each engine will produce its minimum horsepower at a particular RPM. Power will decrease at engine speeds on either side of the peak power RPM. The usable width of the power band will dictate where the clutch must be calibrated to keep the engine performing at its peak. In the power curve the mildly-tuned engine has its peak horsepower of 64 at 5800 RPM and has a usable power band width of 1500 RPM. The race tuned engine produces its peak of 92 horsepower at 9300 RPM, but only has a usable power band width of 400 RPM. The race engine will have to have a much more accurately calibrated clutch to be able to keep the engine running within a 400 RPM range compared to the 1500 RPM wide range of the mildly-tuned engine.

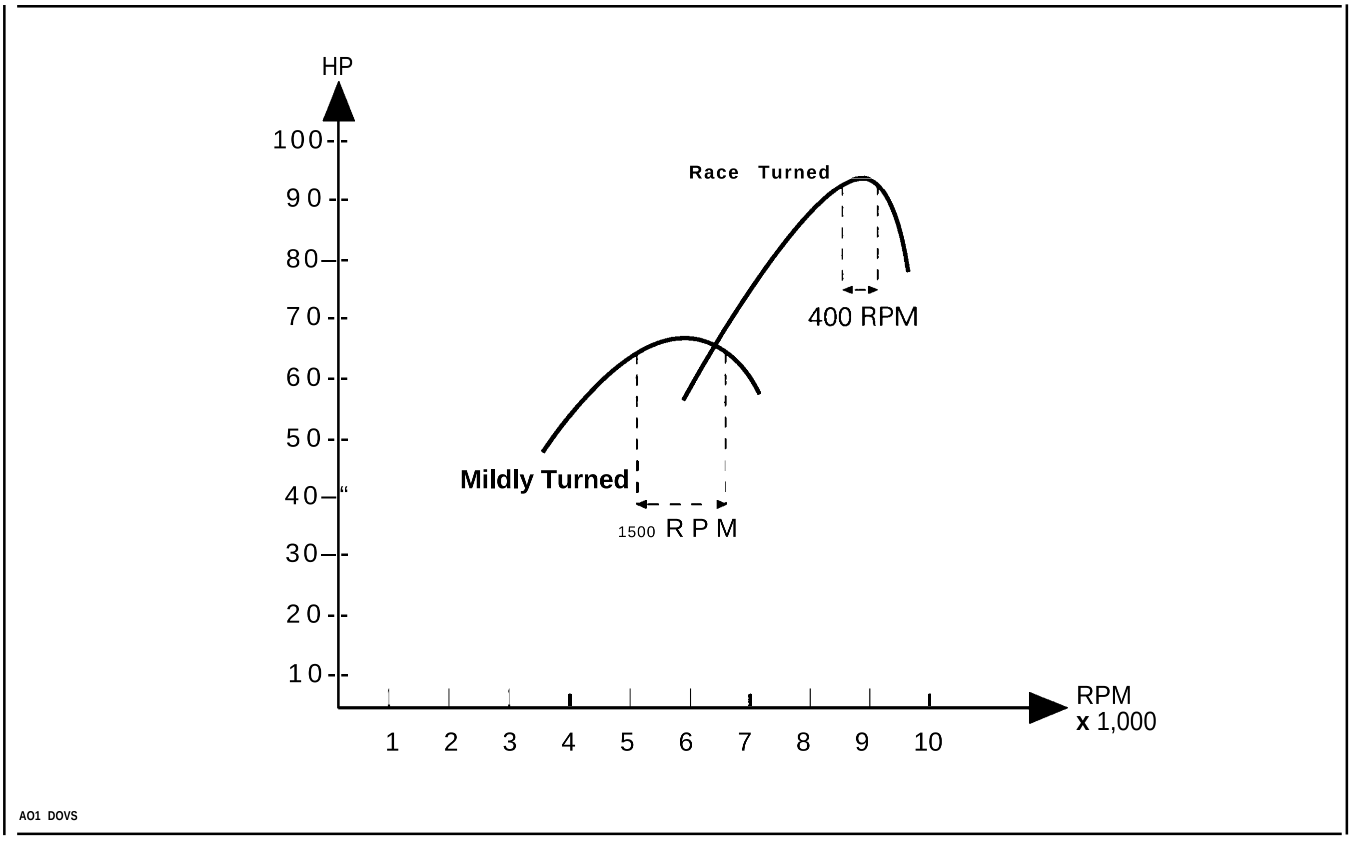
The goal of clutch calibration is to keep the engine, at full throttle at its peak horsepower RPM and, at the same time, to select the highest possible gear ratio as dictated by the load on the drive axle. The speed diagram illustrates what the goal of good clutch calibration is.

In the speed diagram, the inclined line labelled “low ratio” indicates the vehicle speed at each RPM when locked into the 3.8:1, “low gear” ratio. At 8000 RPM, the vehicle speed would be just under 20 MPH if held in this ratio. The “high ratio” line compares vehicle speed with engine RPM when the transmission is locked into the .8:1 “high gear”. At this ratio, the vehicle speed would be just under 80 MPH when the engine is turning 8000 RPM. In calibrating the clutches, the objective will be to maintain as horizontal a line as possible between the low ratio and high ratio lines. This transition line or ″shift speed” must be as close as possible to the engine peak horsepower RPM.

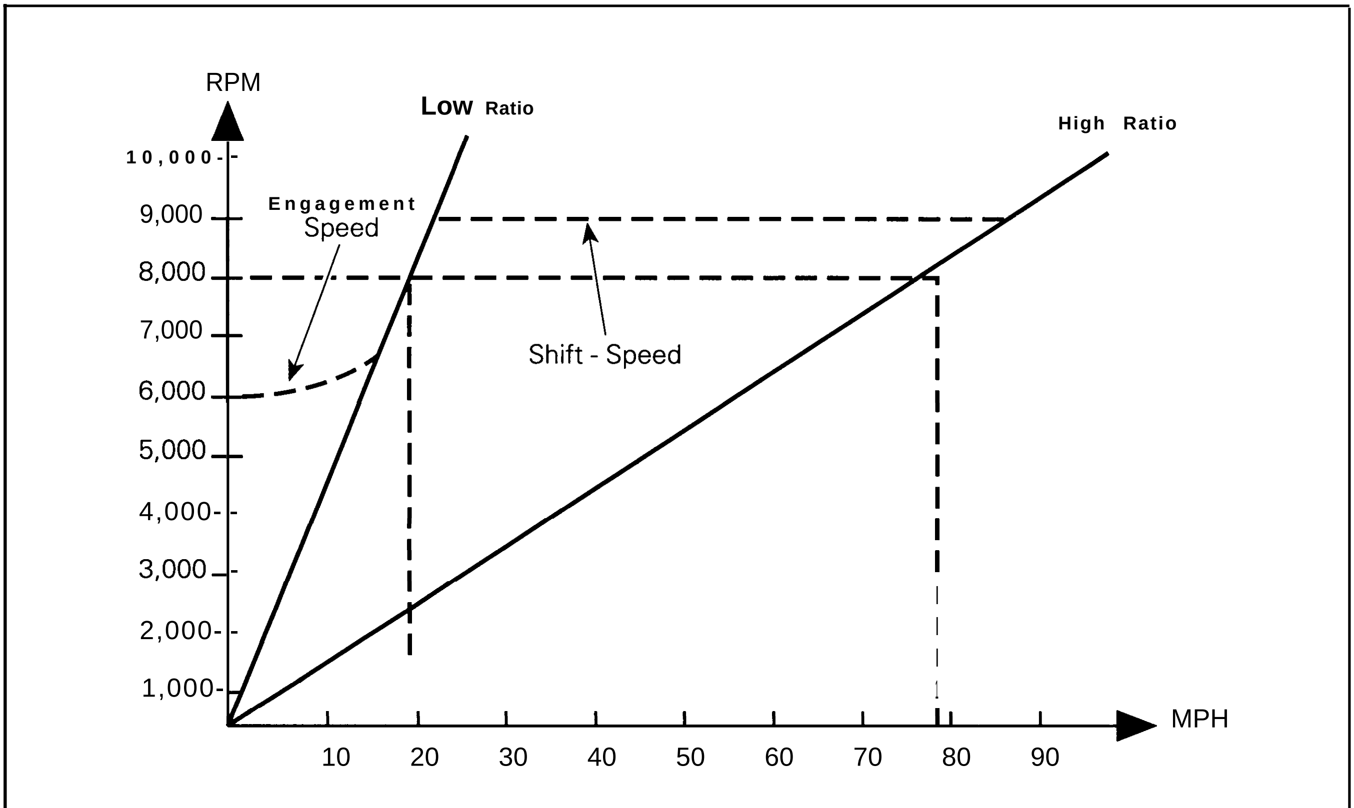
Engagement speed of the clutch is always set as low as possible to avoid track slippage and to prolong drive belt life. The clutch must be engaged at an RPM that is high enough, however, that the engine will be producing enough horsepower to overcome drag and allow acceleration without bogging. In the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



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EFFECTS OF THE DRIVE PULLEY LEVER ARM, ROLLER AND ROLLER PIN WEIGHT

As you have seen in the formula defining centrifugal force, the force increases directly with the weight of the components involved. If you want to increase the centrifugal force, therefore, the shift force, it is a simple matter to increase the weight of the pressure levers. If the overall RPM is too high, a heavier lever arm or roller pin could be installed. The opposite would apply if the RPM is too low.

The major factor controlling centrifugal force is engine RPM. Because the force increases with the square of this speed, you can quickly have too much force if heavy weights are used on a clutch fitted to a high RPM engine. Because of this relationship, you will find heavy weights used on low RPM, high torque engine types and much lighter weights used on the high RPM engines.

The effect of the weights will always be greater at high RPM, and at higher ratios. This is true because of the relation of the force to the square of the engine speed. Also the radius from the axis of rotation to the center of mass of the counterweights increases as the roller is allowed to move down the ramps. As this radius increases, the centrifugal force increases directly. Addition of weight will affect engagement speed very little compared to the effect the weight will have at mid-range to top speed.

Minor changes in weight are accomplished by using various weight roller pins. The effects of adding weight are illustrated in the following illustration. The three curves show the engine RPM increasing from engagement speed (4000 RPM) to about 6500 RPM which is achieved at about 30 MPH. From this point on, if calibration is accurate, there is no change in engine RPM as the vehicle speed increases. From the machine standing at rest to about 30 MPH, belt slippage and other factors are involved that allow the engine to get “on the power”.

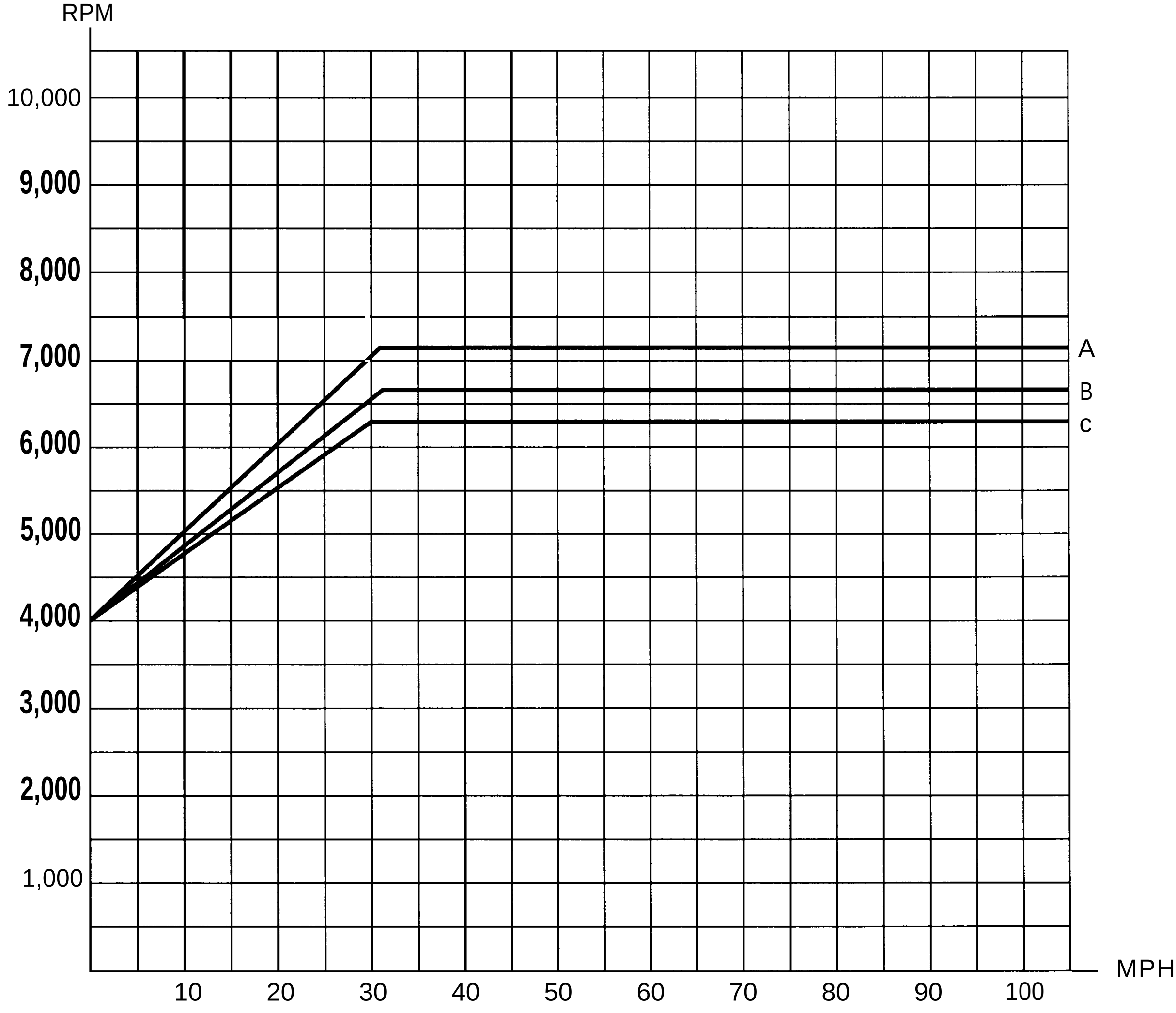
Curve “A” shows a clutch set up with three 10-gram type roller pins. This amount of weight will govern the engine to 7200 RPM and allow engagement of the clutch at 4000 RPM.

Curve “B” illustrates the effect of exchanging the three 10-gram pins for three 14-gram roller pins. The additional weight has virtually no effect on engagement speed but pulls the peak RPM of the engine down to 6800 RPM.

Curve “C” illustrates the effect of using three 16-gram roller pins. Again, the additional weight has little effect on the engagement RPM but further reduces the top RPM to 6400 RPM. For example, by adding 2 grams per arm for a total weight increase of 6 grams on an engine turning at around 7500 RPM, there would be about a 200 RPM decrease in full power engine speed—approximately the same effect as going 1 “clicker” position lower.

On a high RPM race engine like our twin track and Formula III sleds, it may only take a 1 gram, increase per arm to see a 200 RPM decrease in peak operating RPM.

DRIVE CLUTCH ROLLER PINS



A: 10- **gram roller pins**
B : 14- **gram roler pins**
C: 16- **gram roller pins**

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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 4860378 00) 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.**

Light aluminum lever arm	37.9 grams	N/A
Heavy aluminum arm	39.1	420448455
Magnesium lever arm	27.3	486037800
Solid steel roller pin	16.4 (black) 16.8 (white)	504259600
Hollow steel roller pin	10.3	420429140
Threaded steel roller pin	10.3	504260600
Solid aluminum roller pin	5.9	xxx Xxxx xx
Threaded aluminum pin	3.8	504260300
Allen set screw 1/4” -28 N.F. x 1/4”	0.9	365202000
Steel roller	9.8	420429132
Aluminum roller	4.1	860411800 (kit)

COMBINATION WEIGHT

Alum. Lever	Steel Roller	Solid steel pin		66.8 grams
Alum. Lever	Steel Roller	Threaded steel	+ 4 set screws	64.2
Alum. Lever	Steel Roller	Threaded steel	+ 3 sets	63.3
Alum. Lever	Steel Roller	Threaded steel	+ 2 sets	62.4
Alum. Lever	Steel Roller	Threaded steel	+ 1 set	61.5
Alum. Lever	Alum. Roller	Solid steel pin		61.2
Alum. Lever	Steel Roller	Hollow steel pin		60.4
Alum. Lever	Alum. Roller	Threaded steel	+ 4 sets	58.4
Alum. Lever	Steel Roller	Threaded alum.	+ 4 sets	57.6
Alum. Lever	Alum. Roller	Threaded steel	+ 3 sets	57.5
Alum. Lever	Steel Roller	Threaded alum.	+ 3 sets	56.7
Alum. Lever	Alum. Roller	Threaded steel	+ 2 sets	56.6
Alum. Lever	Steel Roller	Solid alum. pin		560
Alum. Lever	Steel Roller	Threaded alum.	+ 2 sets	55.8
Alum. Lever	Alum. Roller	Threaded steel	+ 1 set	55.7
Mag. Lever	Steel Roller	Solid steel pin		55.0
Alum. Lever	Steel Roller	Threaded alum.	+ 1 set	54.9
Alum. Lever	Alum. Roller	Hollow steel pin		54.8
Alum. Lever	Steel Roller	Threaded alum. pin		54.0
Mag. Lever	Steel Roller	Threaded steel	+ 4 sets	52.0
Alum. Lever	Alum. Roller	Threaded alum.	+ 4 sets	51.7
Mag. Lever	Steel Roller	Threaded steel	+ 3 sets	51.1
Alum. Lever	Alum. Roller	Threaded alum.	+ 3 sets	50.8
Alum. Lever	Alum. Roller	Solid alum. pin		50.4
Mag. Lever	Steel Roller	Threaded steel	+ 2 sets	50.2
Alum. Lever	Alum. Roller	Threaded alum.	+ 2 sets	49.9
Mag. Lever	Alum. Roller	Solid steel pin		49.4
Mag. Lever	Steel Roller	Threaded steel	+ 1 set	49.3
Alum. Lever	Alum. Roller	Threaded alum.	+ 1 set	49.0
Mag. Lever	Steel Roller	Hollow steel pin		48.6

Alum. Lever	Alum. Roller	Threaded alum. pin		48.2
Mag. Lever	Alum. Roller	Threaded steel	+ 4 sets	46.5
Mag. Lever	Alum. Roller	Threaded steel	+ 3 sets	45.6
Mag. Lever	Steel Roller	Threaded alum.	+ 4 sets	45.5
Mag. Lever	Alum. Roller	Threaded steel	+ 2 sets	44.7
Mag. Lever	Steel Roller	Threaded alum.	+ 3 sets	44.6
Mag. Lever	Steel Roller	Solid alum. pin		44.3
Mag. Lever	Alum. Roller	Threaded steel	+ 1 set	43.8
Mag. Lever	Steel Roller	Threaded alum.	+ 2 sets	43.7
Mag. Lever	Alum. Roller	Hollow steel pin		42.9
Mag. Lever	Steel Roller	Threaded alum.	+ 1 set	42.8
Mag. Lever	Steel Roller	Threaded alum. pin		41.9
Mag. Lever	Alum. Roller	Threaded alum.	+ 4 sets	40.0
Mag. Lever	Alum. Roller	Threaded alum.	+ 3 sets	39.1
Mag. Lever	Alum. Roller	Solid alum. pin		38.5
Mag. Lever	Alum. Roller	Threaded alum.	+ 2 sets	38.2
Mag. Lever	Alum. Roller	Threaded alum.	+ 1 set	37.3
Mag. Lever	Alum Roller	Threaded alum. pin		36.4

EFFECTS OF THE RAMP PROFILE ON THE SHIFT FORCE

The shift force is the component or part of the centrifugal force that is used to actually move the sliding half of the drive pulley. This force is applied to the sliding half at the three lever arm pivot points (following illustration item 49). The ramp profiles are used to control the size of this shift force.

As the clutch rotates around the center line of the crankshaft, the axis of rotation, centrifugal forces begin building and act on the center of mass of the lever arm, roller combination trying to pull the lever away from the axis of rotation. The center of mass of the lever arm assembly is the point where all the centrifugal force acts (following illustration item 70).

The ramp provides an angled surface for the roller to push against and the angle of the ramp at the point of contact with the roller determines how much of the centrifugal force is translated into axial force. The axial force pushes the sliding half in and the remainder of the centrifugal force is unused and absorbed by the integrity of the sliding half. A steeper ramp angle gives less shift force, while a smaller angle gives more shift force.

As you can see in following illustration, the angle of the ramp varies constantly from start to finish. The angle varies to achieve the proper axial force to transmit a given amount of torque through the drive belt at each diameter of the pulley.

As discussed before, the centrifugal force generated by the lever arm assembly increases at higher ratios. This is why the ramp profile is much steeper at the high ratio end. This reduces the shift force in order to maintain the correct load on the belt.

Remember, it is the angle of the ramp at the point of roller contact that will help determine the shift force at any given ratio. Think of the ramp profile as a hill that the roller must climb. A small angle or hill can be overcome easily thus providing a faster shift out to a higher ratio which will lower the engine RPM. If the hill is steeper (the ramp angle is larger) the roller will not be able to climb it as quickly thus staying in a lower ratio longer which will keep the engine RPM higher.

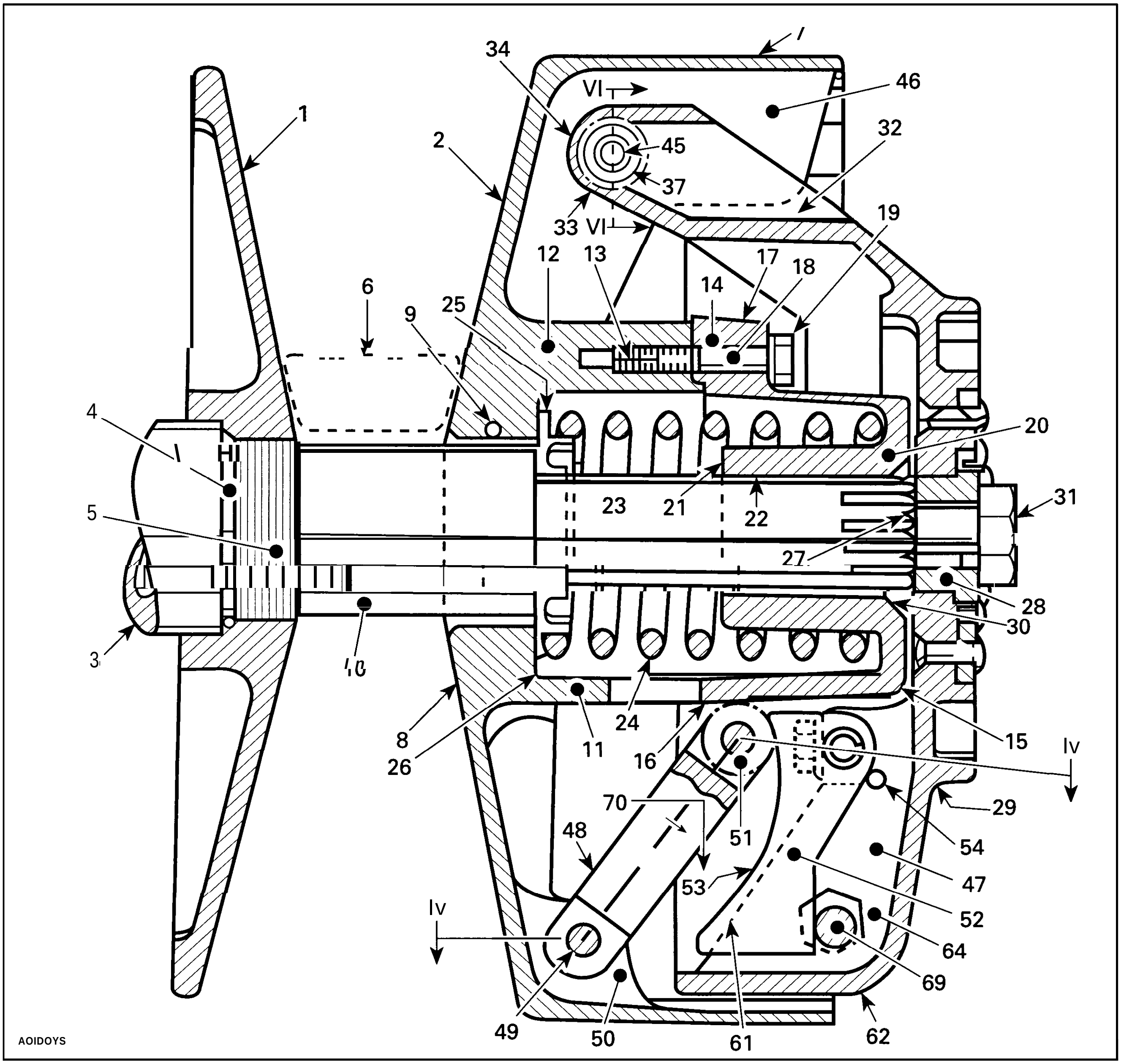
Note that at engagement and very low ratios, many ramp angles actually go “downhill”. These are generally used on engines with good low RPM power. Engines with narrower power bands and less low RPM power will usually have a flatter angle at engagement and low speed. A ramp with a small “bump” at engagement is used to raise the engagement RPM. Again, the steeper the “hill” the roller must overcome, the higher the RPM will be before the clutch shifts out. If the spring selection cannot give the desired engagement RPM, then use a ramp with a bump or grind a notch at the point where the roller sits at engagement. Of course if the shift profile was good at higher ratios, then you would want to use a ramp with only changes at the low speed area.

Also, a thicker or taller ramp will provide higher RPM than a thinner ramp with the same profile because the lever arm assembly is “tucked in” further by the taller ramp.

The TRA clutch allows you to “fine tune” the ramp profile by using the adjusters provided (following illustration item 69) . The adjusters are cams which allow you to raise and lower the outer end of the ramp through six different positions. Moving the ramp end toward the lever arm makes the ramp angles steeper, thereby raising engine speed and slowing the upshift. As the ramp is adjusted away from the lever arm, the engine speed is lowered and the upshift is faster.

In clinical condition such as on a dynamometer, moving the adjusters up will result in a 150 to 200 RPM increase with each position change. Lowering the adjuster positions will result in a decrease of 150 to 200 RPM with each number. On the snowmobile, however, depending on the operating conditions, a change of one adjuster position may not show up on the tachometer, but the shift speed of the pulley will have changed. The upshift or downshift, depending on which way you moved the adjusters, will be faster and your acceleration rate and top speed will have changed. When using the TRA adjusters, the acceleration rate and speed should be checked as well as the engine RPM.

On the DSA chassis and with the new driven pulley bushing material, the friction in the driven pulley and chassis is reduced, thus a one position change on the TRA adjuster will usually result in a RPM change.

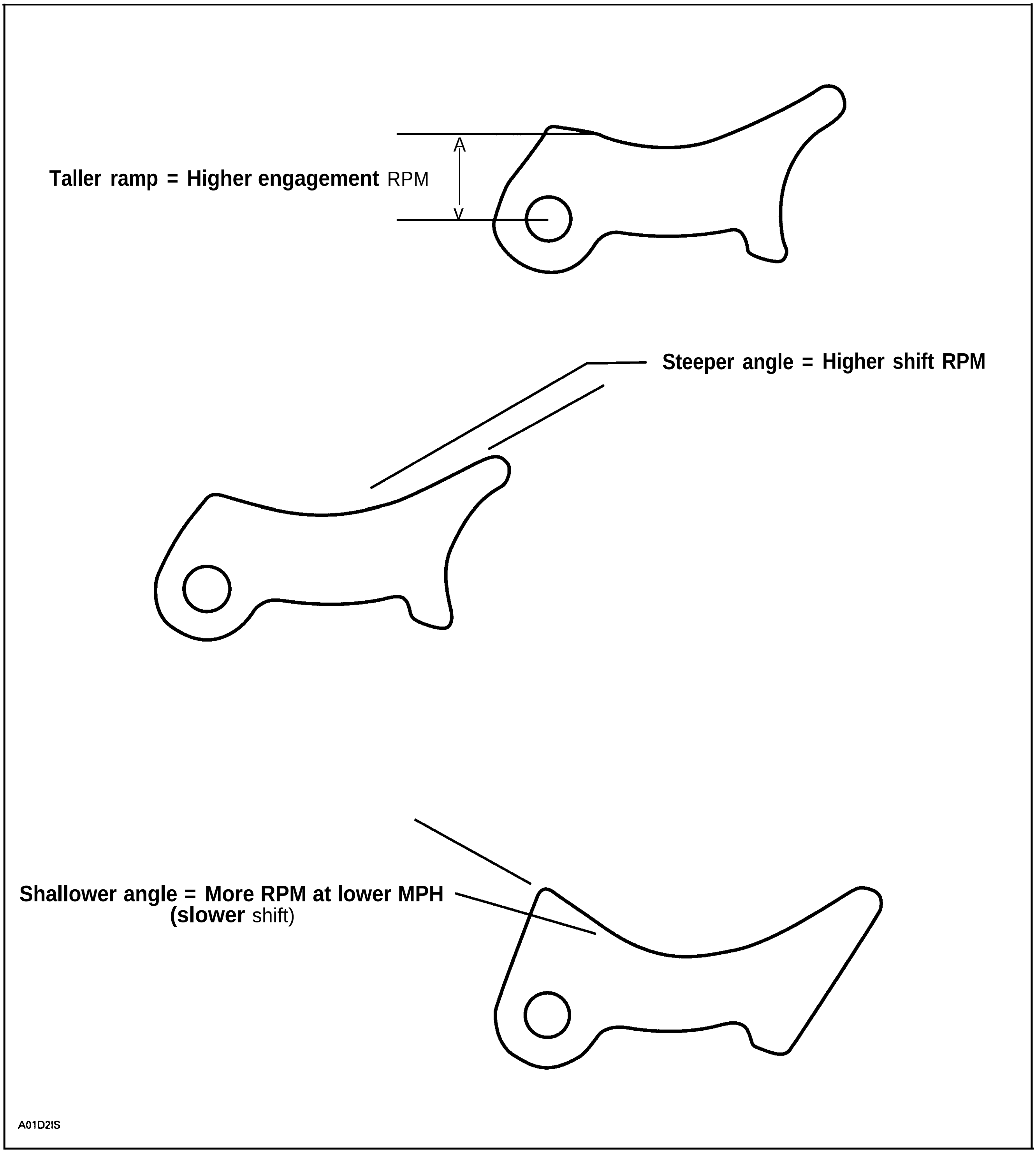


For drag racing and radar running, it is usually better to try to go as low as possible on the adjusters without dropping the engine peak RPM too much as this will give the vehicle its fastest acceleration and top speed.

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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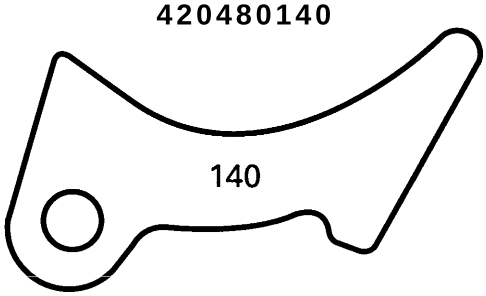

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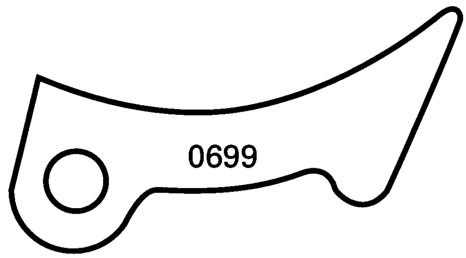

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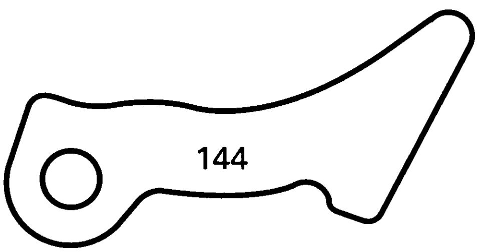

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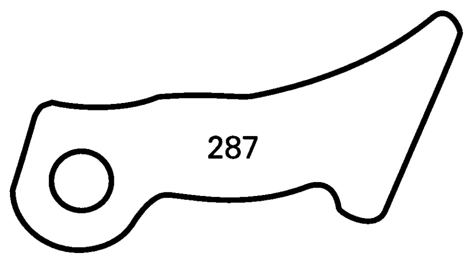

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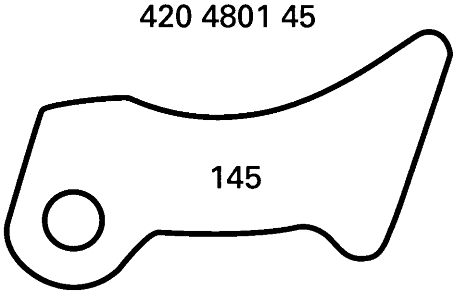

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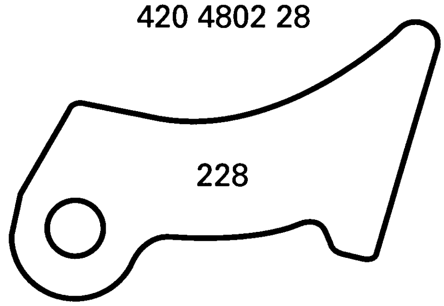

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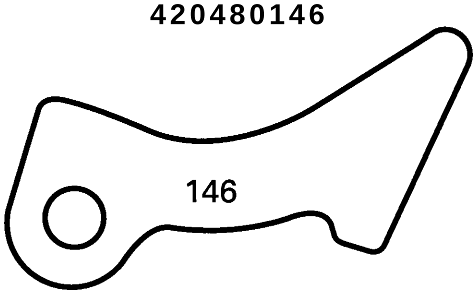

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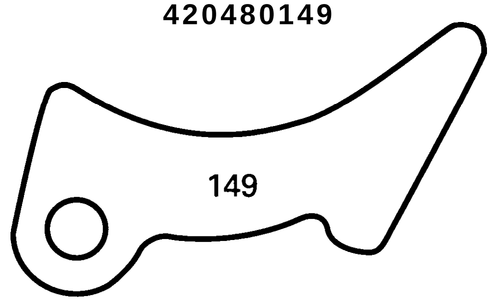

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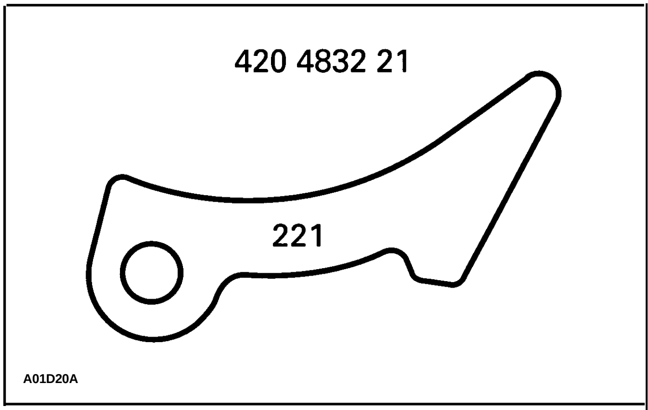
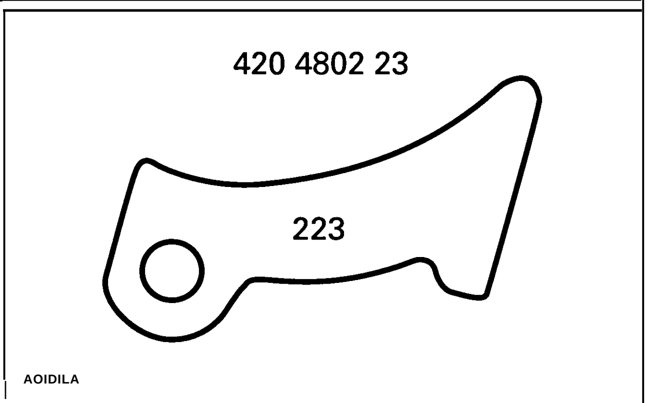
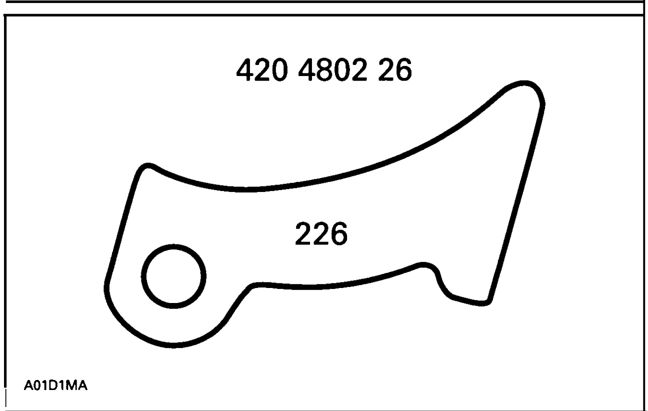
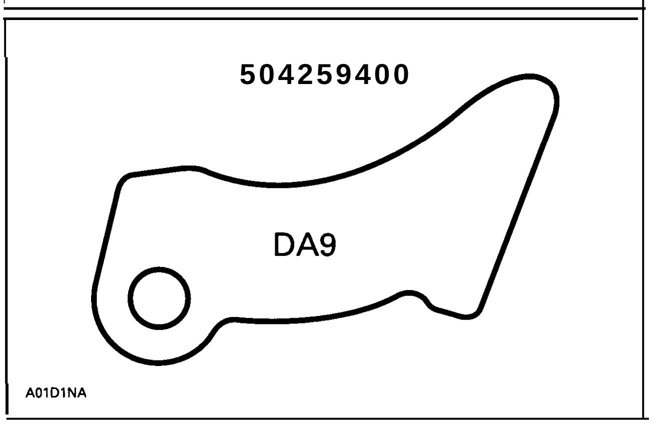
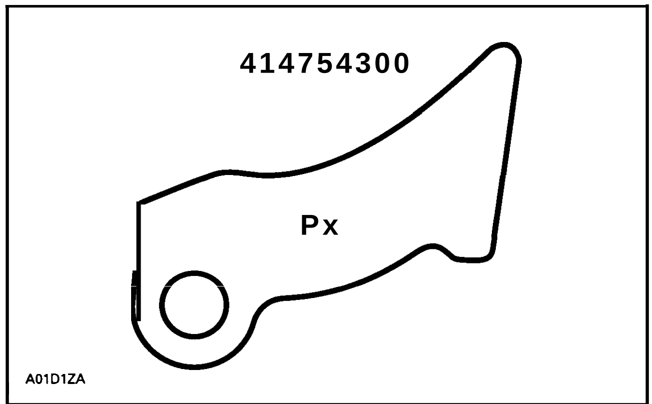
TRA RAMP PROFILES

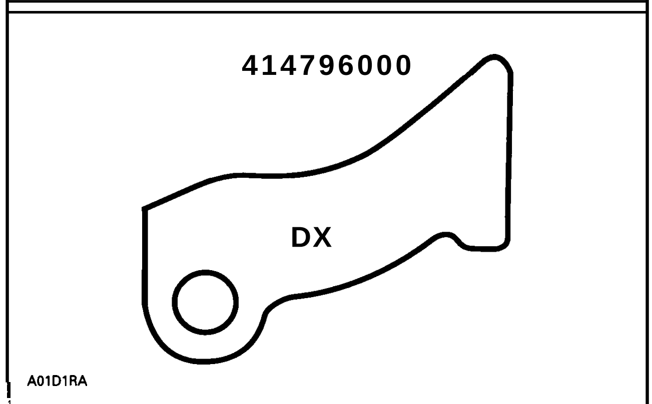


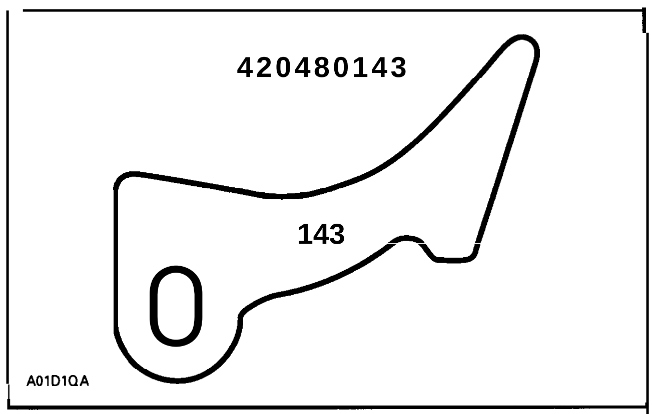


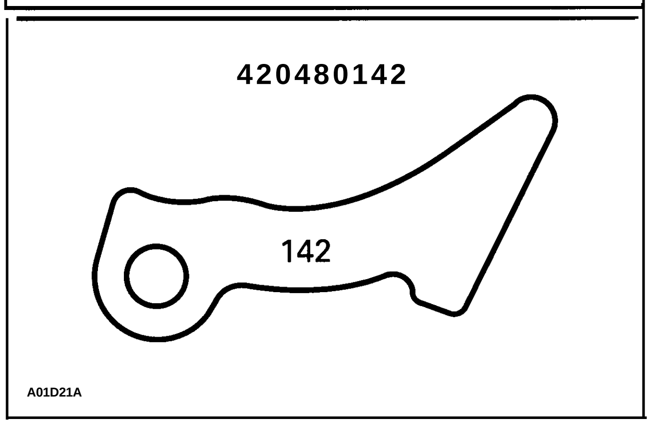












TRA RAMP PROFILES

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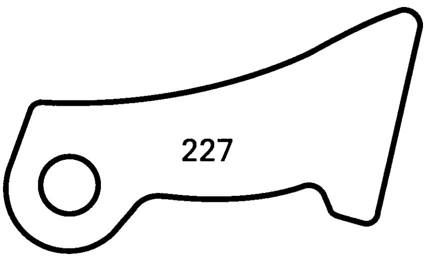

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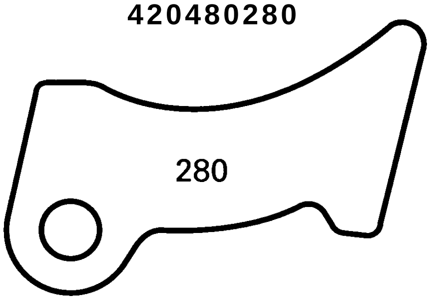

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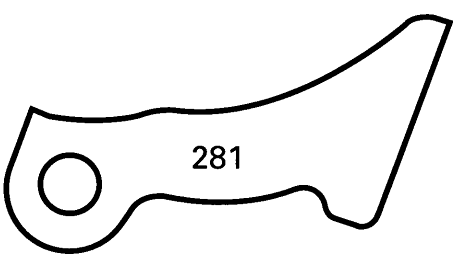

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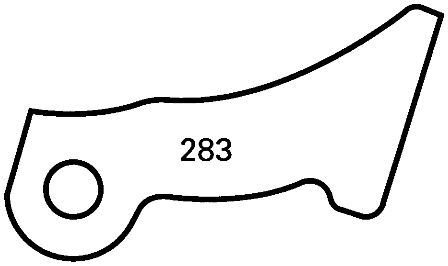

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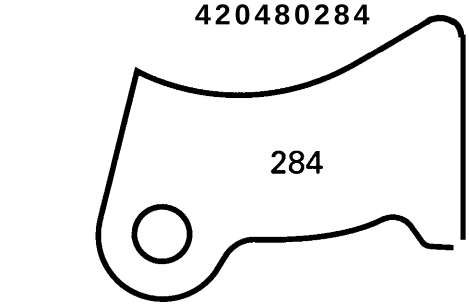

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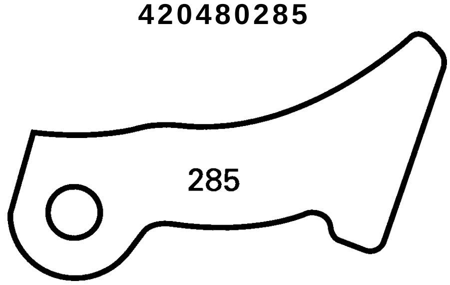

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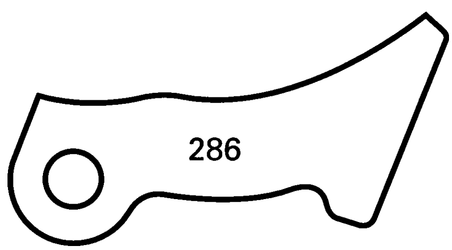

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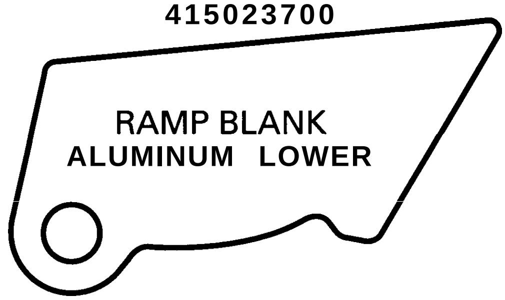

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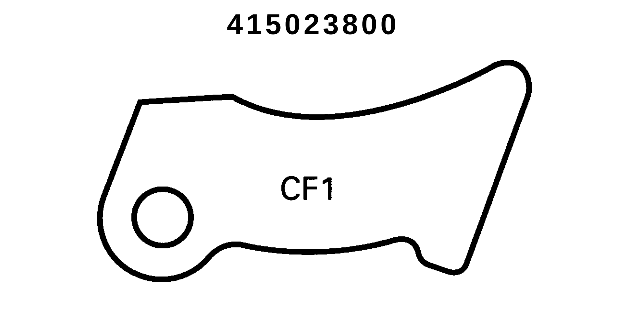
TRA RAMP PROFILES



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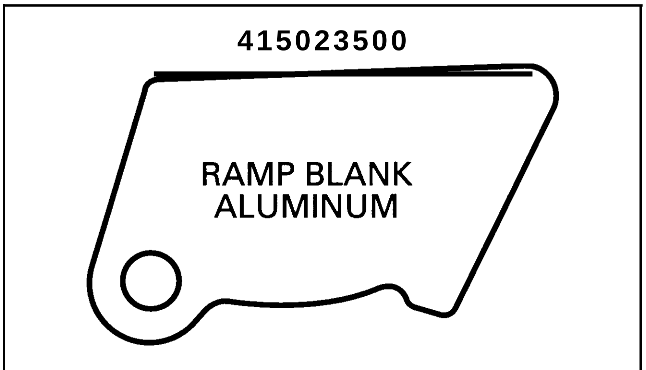

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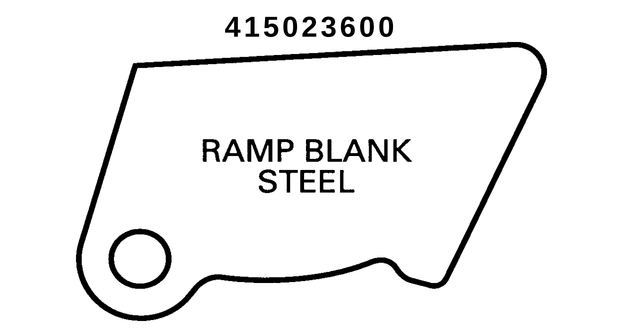

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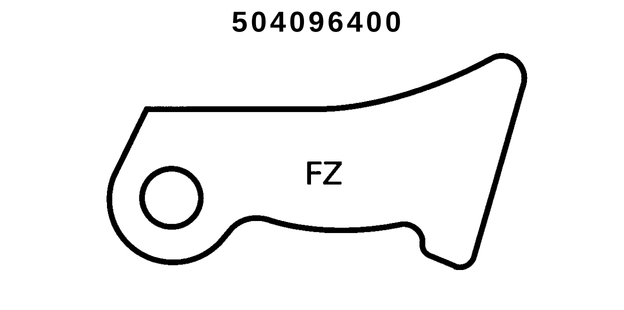


A01D29A

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 our TRA clutches, 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.

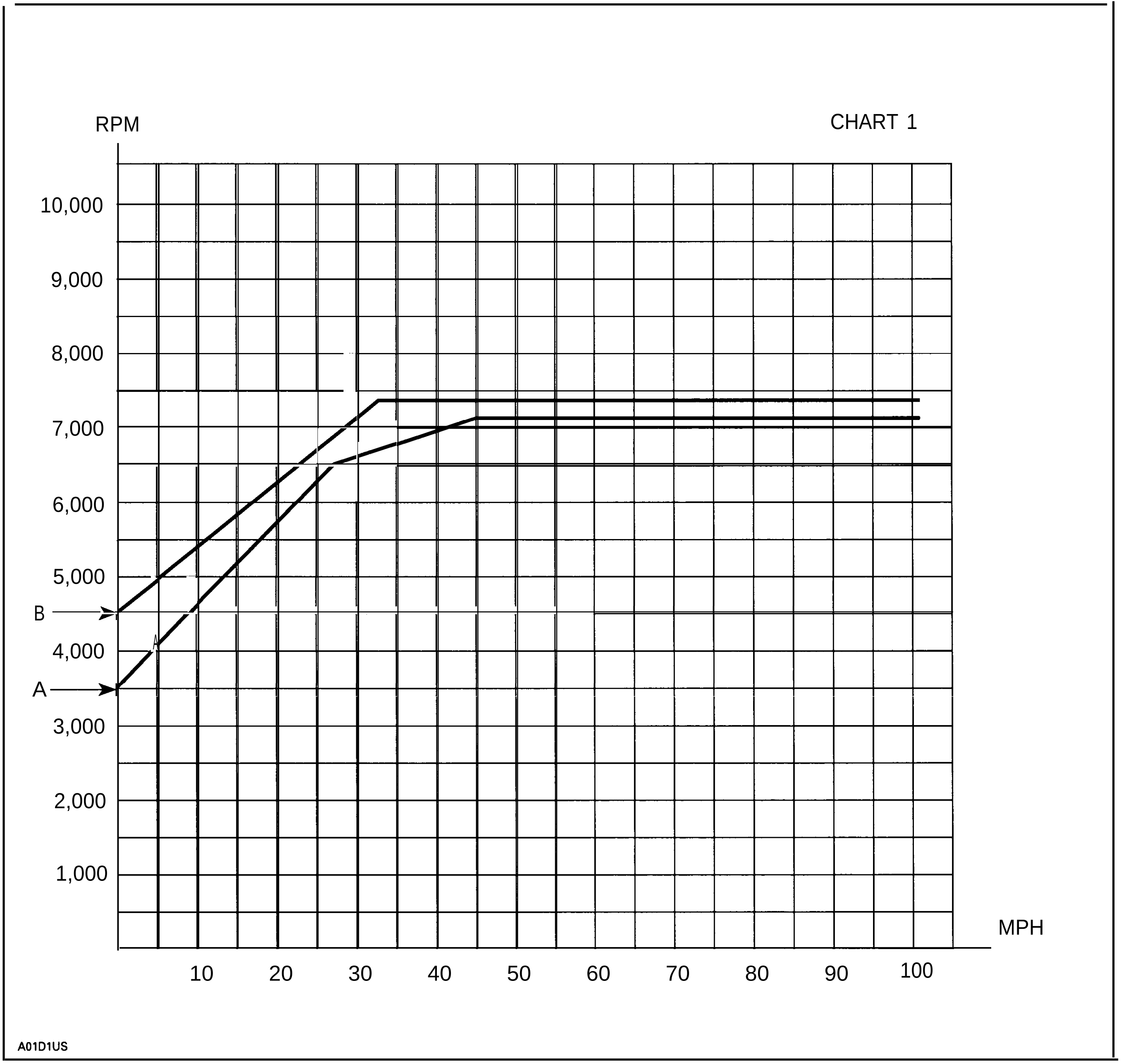
As you look through the spring chart, you will see that springs are available with equal pressures at 74 mm (2.9 in), but very different pressures at 41 mm (1.6 in). You will also note varying pressures at 74 mm (2.9 in) and equal pressures at 41 mm (1.6 in). Simply by working with the spring charts, 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 of311 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 pressureof311 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.

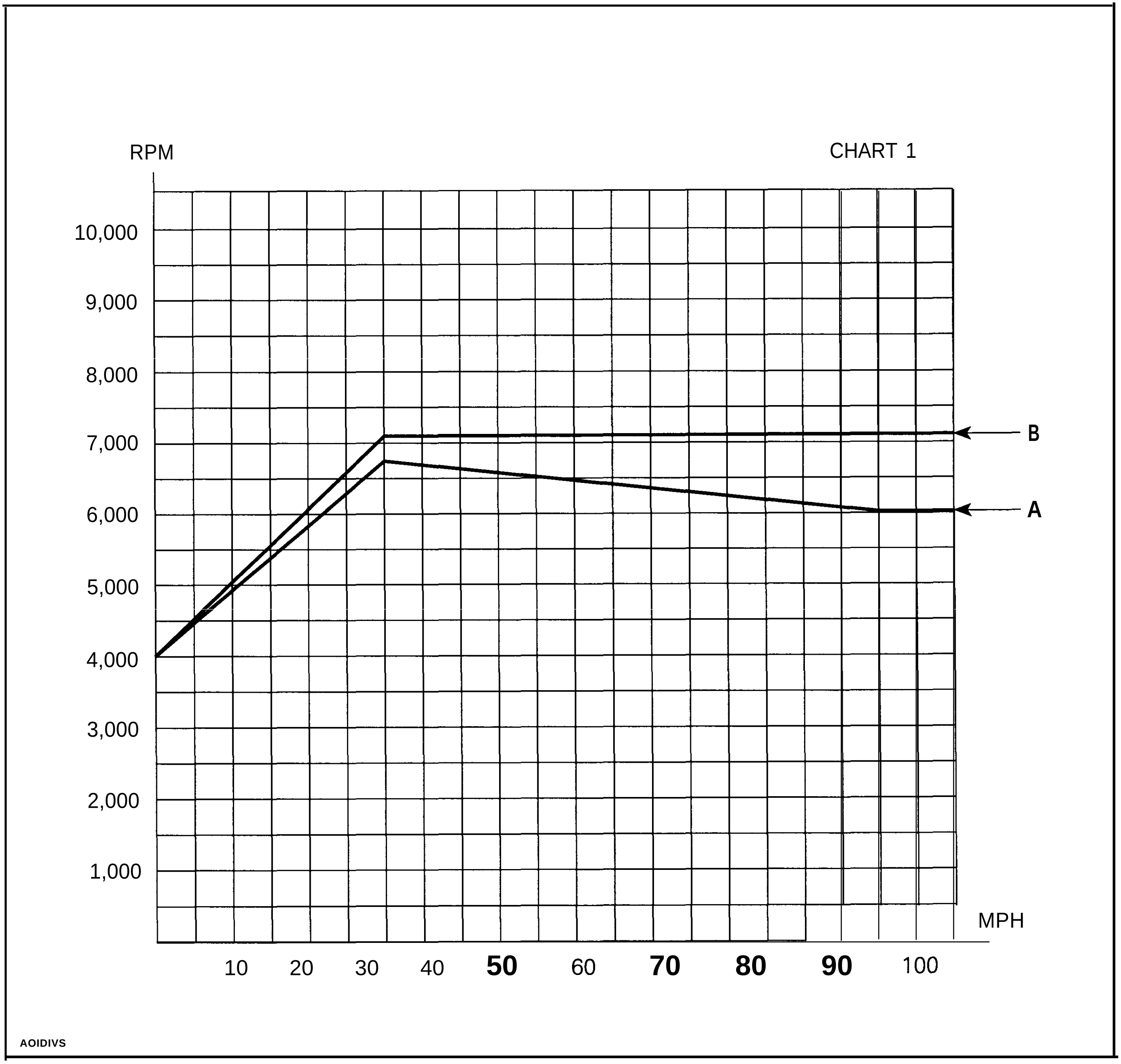
DRIVE CLUTCH SPRING
(effect at engagement)



	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)



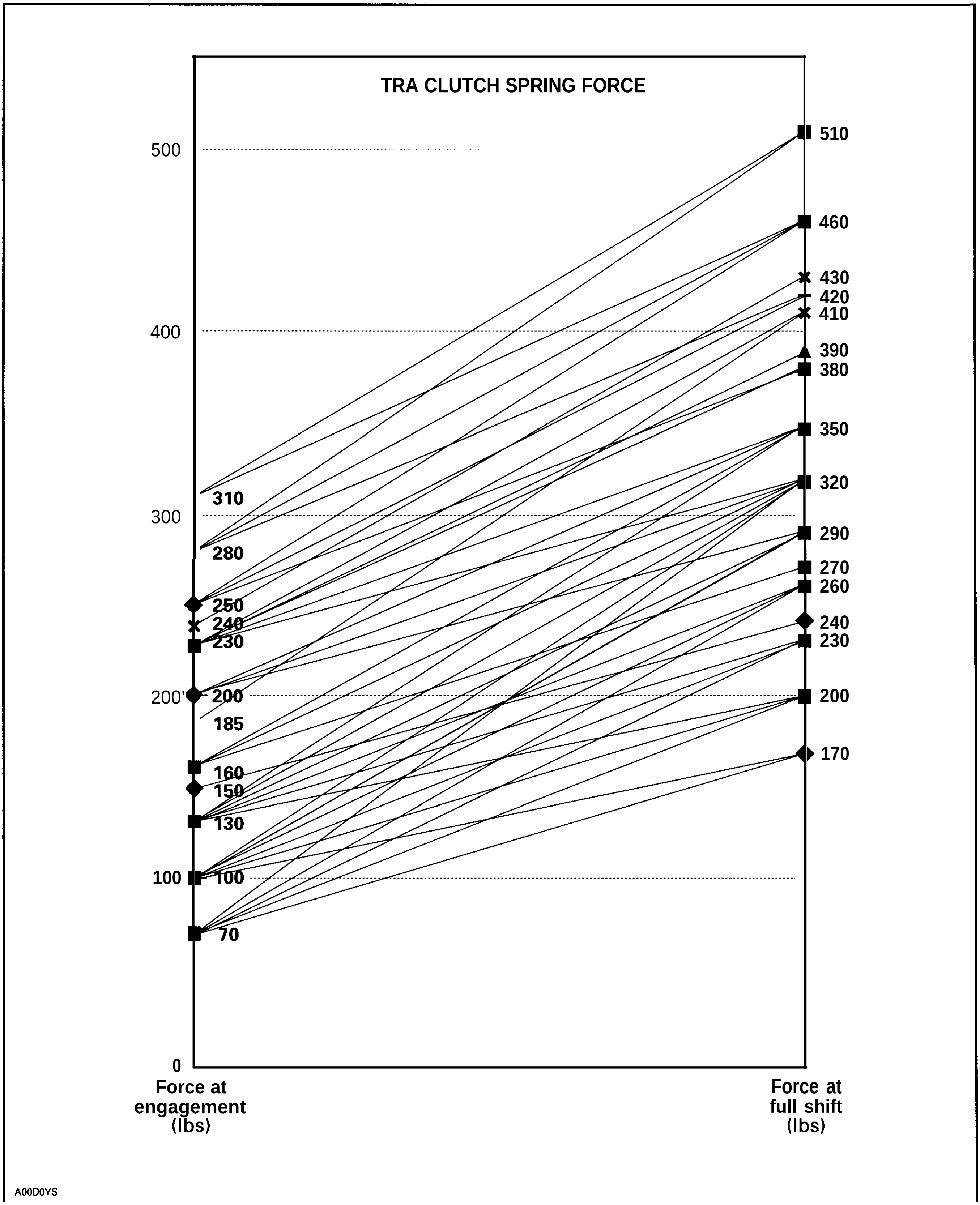
	Load at 74 mm (2.9in)	Load at 41 mm (1.6in)
A	311 N (70 lb)	756 N (170 lb)
B	311 N (70 lb)	1157 N (260 lb)

TRA SPRING CHART

FORCE @(pounds) 74 mm -41 mm	FORCE @(Newton) 74 mm -41 mm	PART NO. BOMBARDIER	COLOR CODE	FREE LENGHT (mm)	WIRE DIA. (mm)	NO OF COILS
70-170	311-756	414689800	RED-RED	96,3	5,0	5,3
70-230	311-1023	414817500	RED-YELLOW	87,9	5,6	5,0
70-260	311-1157	414689200	RED-GREEN	85,9	6,0	5,3
70-290	311-1290	414691500	RED-BLUE	84,1	6,0	4,8
70-320	311-1423	414701000	RED-PURPLE	83,1	6,3	5,0
100-170	445-756	414993000	YELLOW-RED	121,1	4,88	7,1
100-200	445-890	414689700	YELLOW-ORANGE	105,7	5,25	6,2
100-230	445-1023	414748600	YELLOW-YELLOW	100,3	5,4	6,6
100-260	445-1157	414742100	YELLOW-GREEN	94,0	6,0	6,1
100-290	445-1290	414818000	YELLOW-BLUE	90,7	6,0	5,3
100-320	445-1423	414678400	YELLOW-PURPLE	88,4	6,3	5,5
130-200	579-890	414639000	BLUE-ORANGE	135,5	4,88	7,25
130-230	579-1023	414689500	BLUE-YELLOW	115,1	5,25	6,8
130-260	579-1157	414817700	BLUE-GREEN	105,7	5,6	5,8
130-290	579-1290	414689400	BLUE-BLUE	99,8	6,0	6,1
130-320	579-1424	414817800	BLUE-PURPLE	96,6	6,17	6,6
130-350	579-1557	414916300	BLUE-PINK	93,5	6,3	5,6
150-240	667-1068	414605600	WHITE	128,7	5,25	7,25
160-270	712-1201	414605500	YELLOW	122	5,25	6,4
160-320	712-1423	414817900	PURPLE-PURPLE	105,7	6,0	6,1
160-350	712-1557	414949500	PURPLE-PINK	101,8	6,17	6,6
200-290	890-1290	414768200	GREEN-BLUE	147,4	5,25	7,4
200-320	890-1423	414762800	GREEN-PURPLE	126,7	5,72	7,11
200-350	890-1557	414756900	GREEN-PINK	118	5,72	6,38
230-320	1023-1423	414754200	PINK-PURPLE	154,7	5,25	7,02
230-350	1023-1557	415019200	PINK-PINK			
230-380	1023-1690	414991400	PINK-WHITE	124,5	5,94	7,1

TRA SPRING CHART

PART #	Load at 74 mm (2.9 in) N (lb)±5%	Load at 41 mm (1.6 in) N (lb)±5%	Color Code
415019500	823 (185)	1824 (410)	BLACK
486054700	1023 (230)	1557 (350)	NEW PINK-PINK OLD RED-BLUE
415019300	1023 (230)	1690 (380)	NEW PINK-WHITE OLD RED-WHITE
415019600	1023 (230)	1725 (390)	GREEN
415019700	1023 (230)	1824 (410)	RED
415019800	1067 (240)	1913 (430)	BLUE
415019400	1112 (250)	1690 (380)	WHITE / GREEN
415020000	1112 (250)	1868 (420)	ORANGE
415019900	1112 (250)	2064 (460)	PINK
415020100	1245 (280)	1868 (420)	GREEN-GREEN
415020200	1245 (280)	2064 (460)	RED-RED
415020300	1245 (280)	2268 (510)	BLUE-BLUE
415020400	1379 (310)	2064 (460)	PINK-PINK
415020500	1379 (310)	2268 (510)	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 (lbs)
Force at full shift (lbs)
A00D0YS

EFFECTS OF THE DRIVEN PULLEY SPRING

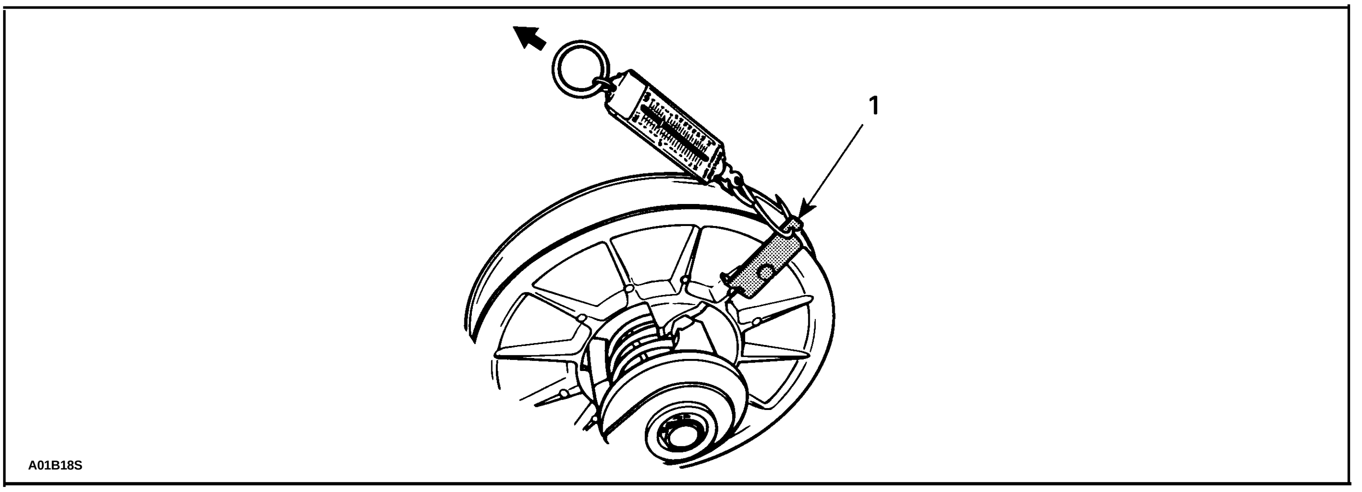
The driven pulley spring is needed to keep the plastic slider buttons in contact with the cam and to provide enough side force on the belt in the low gear position to allow initial acceleration while the torque rises to a point where the torque sensing cam begins to take over. At full load, the driven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

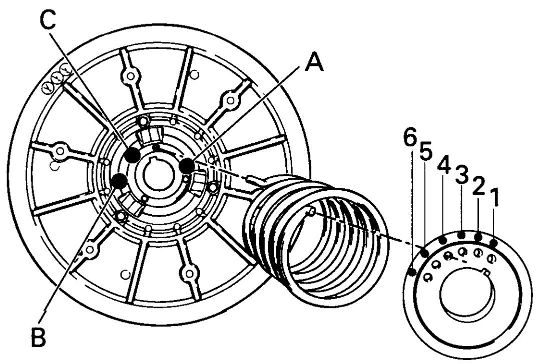
The preload figure given in our specifications is quoted in kg (lb) of force for each machine, not in inch-pounds or foot-pounds of torque. A figure given in units of torque would require multiplying the radius of the pulley by the pull recorded on the scale. Our figures are quoted for each pulley size 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 (P/N 529 006500)

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) .



We have three different driven pulley springs available that fit the Formula and Blizzard 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	414338500
Orange	.187 in	414505800
Beige	.207 in	414558900

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.

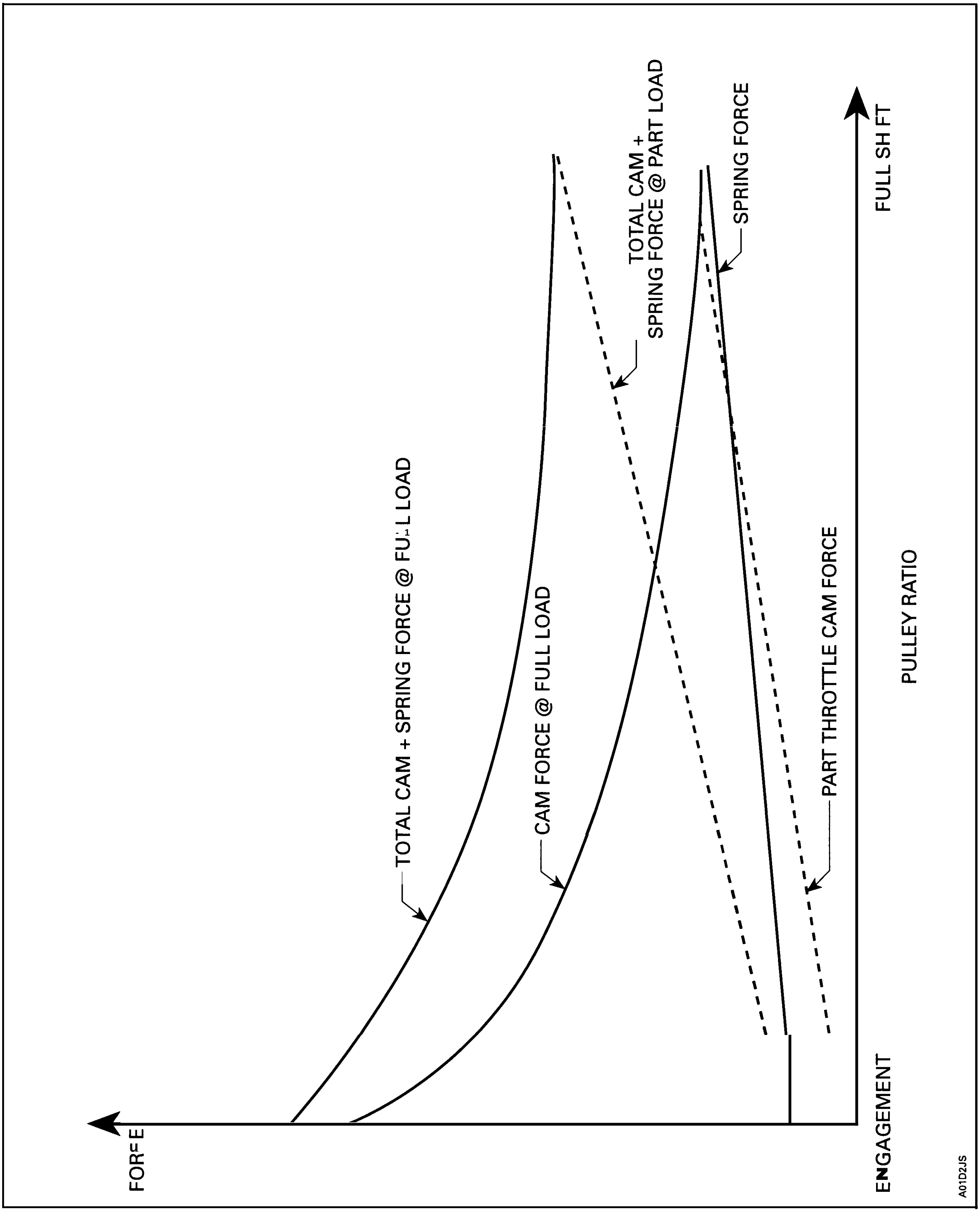
Remember the drive pulley signals or controls the upshift of the transmission while the driven pulley signals the downshift largely because of the effect of the cam.

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.

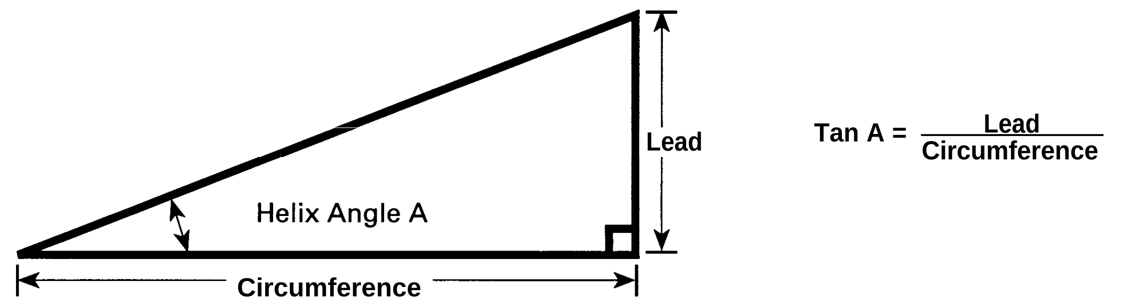
Multi-angle cams are sometimes used by racers needing a good holeshot. They generally work best on vehicles where no track spin is encountered. As a vehicle idles on the starting line, the exhaust temperature cools thus slightly lowering the optimum HP RPM of the engine. Because of this, a steeper (larger) 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 @ FU L LOAD
CAM FORCE @ FULL LOAD
TOTAL CAM +
SPRING FORCE @ PART LOAD
SPRING FORCE
PART THROTTLE CAM FORCE
FULL SH FT
PULLEY RATIO
ENGAGEMENT
FOR E
A01D2JS

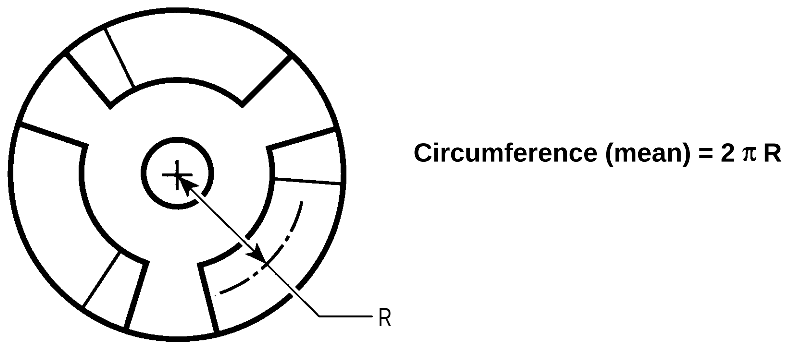
Driven pulley cams are helices. A helix is measured in " lead" . Lead is the distance a point moves along the axis of rotation in one revolution of the helix. (Screw threads are a helix.)

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



AOIDIWS

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



AOIDIXS

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

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" x TAN 44°

L = 9.72 x .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 x Tan A

Where :

L = Lead

C = Circumference on outside diameter

A = Cam angle on outside diameter

O **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 (1 1.0 in)**

Example :

A Ski-Doo 44° cam will measure about 40.5° at the outside diameter.

L = $C_{(outside)}$ **x Tan** $A_{(outside)}$

L = 11.00" x TAN 40.5°

L = 9.39 inches of lead

Inches of lead are directly comparable.

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

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

$$A_{(MEAN)} = 44° = \text{SKI-DOO } 44° \text{ cam.}$$

To simplify things, just remember that if you measure a Ski-Doo cam at the outside circumference the angle will be about 4° less than the specification (mean circumference).

Many after-market cams are measured at the outside circumference. By adding 4° you can compare them to Ski-Doo cams.

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 44o cam (spring rate and preload being equal).

DRIVEN PULLEY CAMS

1979-1988	87.8 mm diameter	1/4 inch keyway
P/N	CAM ANGLE	USED ON (sea-level)
504128200	44°	1986 PLUS; 1987-88 MX, PLUS

1989-1993 EXCEPT 93 MACH Z 1994 ALL PRS CHASSIS	87.8 mm DIAMETER	8 mm KEYWAY
P/N	CAM ANGLE	USED ON
540135500	36°	1991-93 MX
540137400	40°	1993 MX-Z
504134800	44°	1989-90,92-93 PLUS; 93 PLUS-X 1991-94 MACH 1; 1994 GRAND TOURING
504136300	50°	1989 MACH 1; 1991 PLUS
504139000	53°	1990 MACH I

1993 MACH Z 1994 ALL DSA CHASSIS	88.9 mm DIAMETER	8 mm KEYWAY
NOTE : These cams are 1 mm larger diameter than previous designs and also have an extended center steel sleeve.		
P/N	CAM ANGLE	USED ON
504092100	40°	1994 MX, ST
504091300	44°	1994 MX-Z, SUMMIT 470,583
504140000	47°	
504140100	50°	1993 MACH Z; 1994 MX-ZX, STX, FZ SUMMIT 670, MACH Z

NOTE : All 88.9 mm diameter cams are interchangeable.

1995 ALL DSA	88.9 mm DIAMETER	8 mm KEYWAY	
P/N	MULTI-ANGLE CAM ANGLE	P/N	CAM ANGLE
415021100	44°-400	415022800	30°
415021200	46°-420	415022900	32°
415021300	48°-400	415023000	34°
415021400	48°-440	415023100	36°
415021500	50°-360	415022700	38°
415021600	50°-400	504092100	40°
415021700	50°-440	415022500	42°
415021800	54°-400	504096000	44°
415021900	54°-440	415023200	46°
415022000	54°-460	504140900	47°
415022100	54°-480	415022400	48°
415022200	58°-440	504096100	50°
415023400	58°-480	415022300	52°
		415021000	54°
		415022600	56°
		415023300	58°

O **NOTE : 1995 cams have more surface area to support large bushing.**

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.

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 antiseize 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 strickly 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.

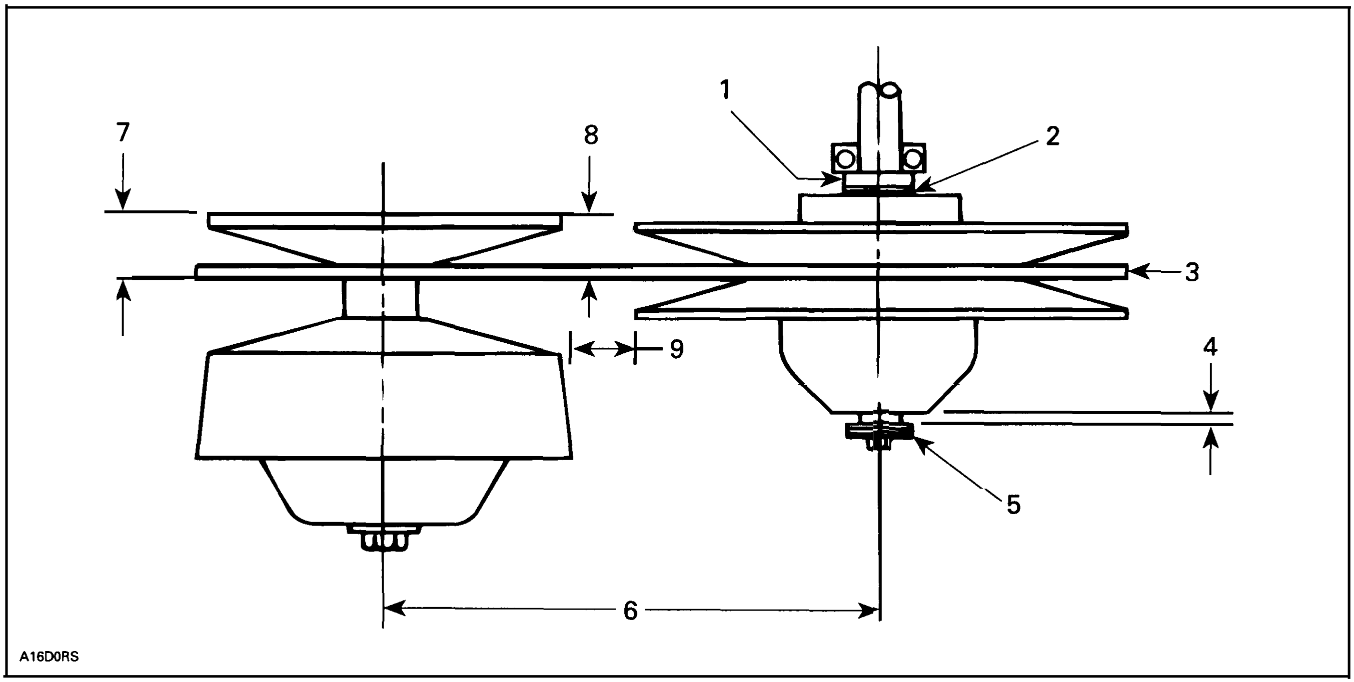
Drive belts can vary +/- 6 mm (1/4 in) length from belt to belt. Because of this manufacturing tolerance, we recommend measuring your drive belts and marking their length on the outer cover. Try to use only belts that are the same length while racing to keep your clutch set up as consistent as possible.

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.

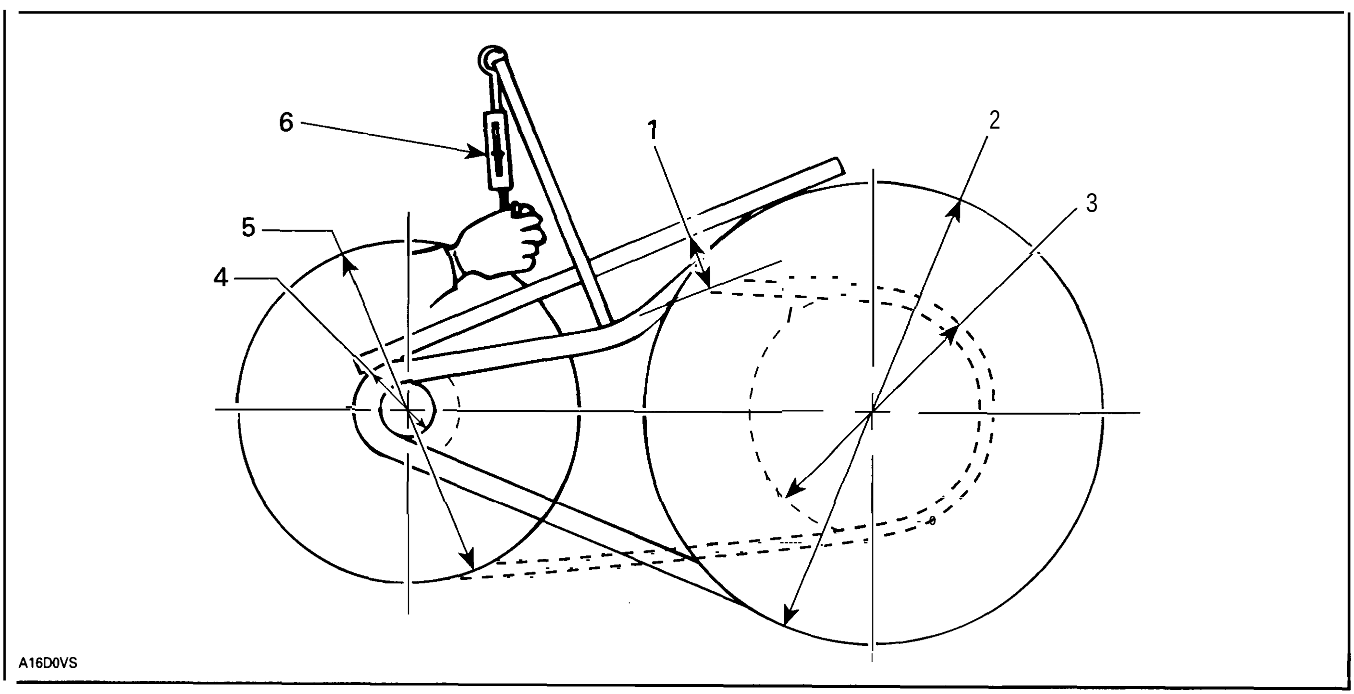
Be careful not to bend sharply or coil up these new hard compound drive belts since they are much more prone to cracking in cold weather than earlier belts.

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



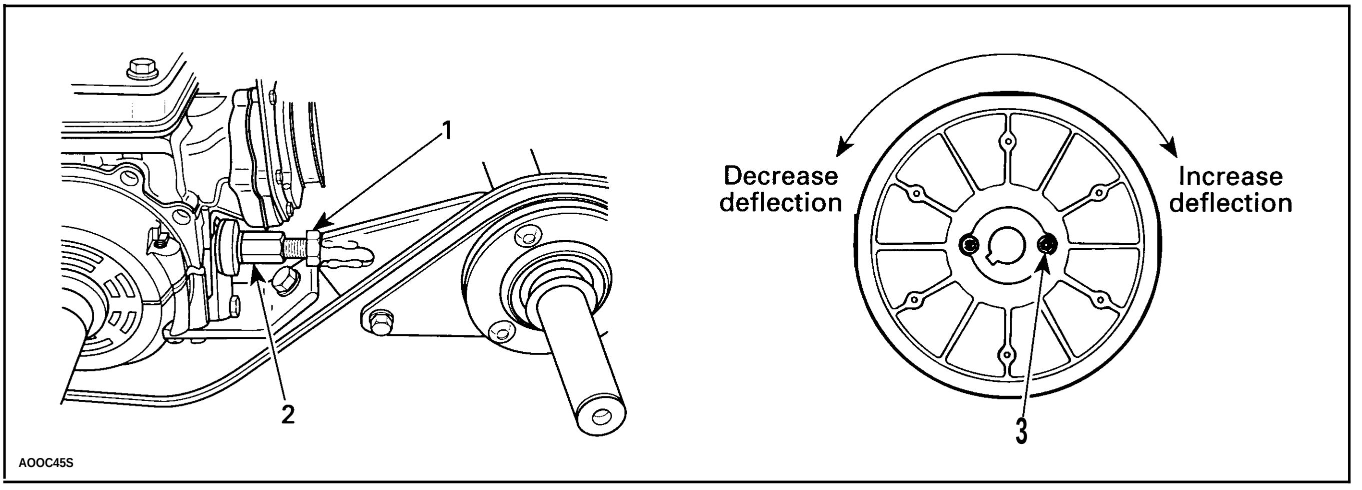
1. Sleeve (Note: no clearance ti this side of driven pulley)
2. 2 shims (504-1082-00)
3. Use straight bar (.375 in x 19 in)
4. DSA : O-1 mm (0-.040 in)
5. Shim as required to achieve clearance
6. PRS = 268.3 (10-9/16 in)
   DSA = 257.5 (10-9/64 in)
7. Y = X + 1.5 mm (.060 in)
8. X = PRS : 36.0 mm (1.460 in)
   DSA : 35.0 mm (1 .380 in)
9. Z = PRS : 27.0 mm ("1.060 in)
   DSA : 16.5 mm (.650 in)



Proper belt deflection and alignment are extremely important. Included is a page on proper alignment procedures and deflection measurement methods for your use.

Do not forget about the torque limiter rod on Formula models. This bolt is located between the jackshaft and the engine on the left side. It should be lightly snugged after the proper alignment and center to center distances have been set.

NOTE : Do not overtighten, it will misalign pulleys.



TYPICAL

1. Jam nut
2. Adjuster
3. Allen screw with jam nut

The driven pulley has one, two or three (depending upon the year) set screws on the fixed half that are used for setting belt deflection. These 3 mm Allen screws can be moved in or out to open or close the sheaves to lower or raise the drive belt in the driven pulley to achieve the correct deflection.

It is best to accurately align the pulleys and then shim the driven clutch tight. Some feel it is better to let it "float" and align itself. But this doesn't happen in a dynamic situation when there is load on the belt. If you have a lot of float in the driven and you back off the throttle and the pulley misaligns, when power is applied again, the pulley will stay misaligned because of the force on the countershaft. Shimming the driven pulley tightly to the jackshaft bearing also helps to positively position the jackshaft and its left side bearing.

CHAINCASE GEARING

Contrary to popular belief, small gear changes do not directly affect top speed as long as the clutches are functioning properly. Gearing one or two teeth taller on the top will not generally make the vehicle any faster on top end unless the clutches are fully shifted out and the engine is starting to overrev.

With the TRA clutch, we have about 20 percent more shift ratio available compared to previous designs. Because of this, we have been able to lower the gearing in our chaincase considerably. For example: ’85 Plus square shaft = 26/38 gearing; ’86 Plus with TRA = 20/38. Yet, we still have the same overall top gear ratio because of the 0.8:1 top ratio of the TRA clutch.

This gives us better belt life by allowing our clutches to “slip” for a shorter period of time at engagement. It also provides more torque to the drive axle for acceleration.

Most snowmobiles are geared on the “high” side from the factory. They are usually geared for 8-16 km (5-10 MPH) more than they would reach in average conditions. Because of this, the belt does not seem to go all the way to the top of the drive clutch. This is a normal situation. Snowmobiles run under widely varying conditions. If all snowmobiles were geared to attain a full shift under average conditions and then the vehicle were run on a perfectly smooth frozen suface, it would easily shift out to its geared top speed. Since the drag is so low under these conditions, the engine would begin to over-rev, eventually lose power, possibly damage the engine, and you will not achieve top speed.

There are other factors involved here also. As clutches shift through their range, the efficiency with which they transmit power decreases as the clutch ratio exceeds about 1.5:1. Efficiency also drops as belt speed (RPM) increases. For optimum chaincase performance ensure that you use the synthetic chain case oil.

The following chart illustrates the effects of increased R.P.M. on delivered horsepower. As motor R.P. M. is raised to attain higher maximum horsepower, efficiency of both the drive and driven clutch drop considerably. This loss will often exceed the horsepower gained from the installation of aftermarket exhausts or engine modifications. The only way extra horsepower can increase your snowmobile performance is if it reaches the track.

CRANKSHAFT H.P. (DYNO H. P.)	ENGINE R.P.M.	CLUTCH EFFICIENCY	H.P. TO TRACK (USEABLE H. P.)
115	7800	84.8%	97.5
115	8000	83.9%	96.5
115	8200	83. 1%	95.6
115	8400	82.3%	94.6
115	8600	81.470	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 drag racers and 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

Pitch of external drive track= 1.966 in

Number of teeth on external drive sprocket= 11

Number of teeth on internal drive sprocket= 9

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

Example : 1995 Formula Z - gearing 25/44 peak power at 7800 RPM

$$\frac{7800}{.83} \times \frac{25}{44} \times \frac{(2.52 \times 91}{12} \times \frac{60}{5280} = 115 \text{ MPH}$$

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 tem-perature 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

1993	S / L SPROCKETS
MX	22 x 44
MX II	22 x 44
MX XTC R	22 x 44
*MX **Z**	24X 44
PLUS	25X 44
PLUS II	25X 44
PLUS E	25X 44
PLUS XTC	23X 44
GRAND TOURING	25X 44 W
PLUS EFI	25X 44
PLUS X	25X 44 W
MACH 1	**26X 44 W**
MACH 111	**26X 44 W**
MACH 1 XTC	**25X 44 W**
***MACH Z**	**25X 40 W**

1994	“L SPROCKETS
MX*	**23X 44**
FORMULA ST*	**23X 44**
MX Z*	**23X 44 W**
FORMULA STX*	**25X 44**
FORMULA STX(2)*	**25X 44**
GR. **TOURING XTC**	**23X 44 W**
GRAND TOURING	**25X 44 W**
FORMULA Z*	**25X 44**
MACH 1	**26X 44 W**
GR. TOURING SE	**26X 44 W**
MACH Z*	**25X 40 W**
SUMMIT 470’	**22** x 44
SUMMIT 583*	**22x** 44
W = WIDE	
*** = CHASSIS F2000** (DSA)	

1996	S / L SPROCKETS
MACH 1	**26X 44**
SUMMIT 500	22x 44
FORMULA SLS	25X 44
FORMULA Z	25X 44
FORMULA SS	26X 44
MX **Z** 440	23X 44
SUMMIT 583	22x 44
MX Z 583	25X 44
FORMULA III	25X 44
FORMULA III LT	23X 44
SUMMIT 670	23X 44
MACH Z	26X 44
MACH Z LT	25X 44

OMBARDIER SKI-DOO—1995 MODELS
TR NSMISSION SYSTEM SPECIFICATI

ÉLAN	247	570 0411 00	I.B.C.	BLUE	417 1143 00	417 1145 00 (6X)	417 1145 00	2000-2200	5000-5300	ÉLAN	BLACK	8 ± 1,5	40,4	10	25		9(50)
TUNDRA II LT	277	414 8276 00	I.B.C.	TURQUOISE	417 1143 00	N/A	417 1145 00 (2X)	3000-3200	6700—7000	SAFARI	WHITE	8 ± 1,5	37,8	14	25	62(SIMPLE)	8(50)
MX	467	414 8287 00	T.R.A.	BLUE/YELLOW	420 480 228	420 429 140	4	3400-3600	7300-7500	FORMULA	BEIGE	13,5 ± 1,5	44	23	44	72(11)	9(64)
FORMULA STX	583	414 8607 00	T.R.A.	BLUE/GREEN	420 480 228	420 429 140	4	3400-3600	7800—8000	FORMULA	BEIGE	13,5 ± 1,5	50	25	44	74(11)	9(64)
FORMULA STX LT	583	414 8607 00	T.R.A.	YELLOW/GREEN	420 480 228	420 429 140	3	3100-3300	7800—8000	FORMULA	BEIGE	13,5 ± 1,5	44	23	44	72(11)	9(64)
SUMMIT 583	583	414 8607 00	T.R.A.	VIOLET/VIOLET	420 480 228	420 429 140	4	3700-3900	7800-8000	FORMULA	BEIGE	13,5 ± 1,5	44	23	44	72(11)	9(64)
SUMMIT 670	670	414 9182 00	T.R.A.	YELLOW	420 480 283	420429 140	5	3800—4000	7500—7700	FORMULA	BEIGE	13,5 ± 1,5	47	25	44	74(13)	9(64)
GT 470	467	414 8287 00	T.R.A.	BLUE	420 480 228	420 429 220	5	3400-3600	7300-7500	FORMULA	ORANGE	13,5 ± 1,5	44	23	44	72(11)	9(64)
GT 580	582	414 8607 00	T.R A	YELLOW/RED	420 480 228	420 429 140	3	3100-3300	7200-7400	FORMULA	BEIGE	13,5 ± 1,5	50	25	44	74(11)	9(64)
GT SE	670	414 9182 00	T.R.A.	YELLOW/ORANGE	420 480 280	420 429 140	3	3400-3600	7600-7800	FORMULA	BEIGE	13,5 ± 1,5	47	25	44	74(13)	9(64)
FORMULA Z	583	414 8607 00	T.R.A.	YELLOW	420 480 228	420 429 140	4	3700-3900	7800-8000	FORMULA	BEIGE	13,5 ± 1,5	50	25	44	74(11)	9(64)
FORMULA SS	670	414 9182 00	T.R.A.	BLUE/GREEN	420 480 280	420 429 140	3	3400-3600	7600-7800	FORMULA	BEIGE	13,5 ± 1,5	47	26	44	74(13)	9(64)
SKANDIC 380 R	377	414 8833 00	I.B.C.	VIOLET (79)	417 1143 00	417 1144 00 (6X)	417 1145 00	2800—3000	6700—7000	MACH Z	ORANGE	10,5 ± 1,5	44	21	44	72(11)	9(64)
SKANDIC 500 R	503	414 8833 00	T.R.A.	RED/GREEN	420 480 284	420 429 140	4	2900-3100	6900-7200	MACH Z	ORANGE	10,5 ± 1,5	44	21	44	72(11)	9(64)
TOURING E	377	414 8833 00	I.B.C.	VIOLET (79)	417 1143 00	417 1144 00 (6X)	417 1145 00	2800-3000	6700-7000	MACH Z	ORANGE	10,5 ± 1,5	44	21	44	72(11)	9(64)
FORMULA S	377	414 8833 00	I.B.C.	VIOLET (89)	417 1143 00	417 1144 00 (6X)	417 1145 00	3000—3200	6700—7000	MACH Z	ORANGE	10,5 ± 1,5	44	21	44	72(11)	9(64)
TOURING LE	377	414 8833 00	I.B.C.	VIOLET (79)	417 1143 00	417 1144 00 (6X)	417 1145 00	2800-3000	6700-7000	MACH Z	ORANGE	10,5 ± 1,5	44	21	44	72(11)	9(64)
TOURING SLE	503	414 8833 00	T.R.A.	RED/GREEN	420 480 284	420 429 140	4	2900-3100	6900-7200	MACH Z	ORANGE	10,5 ± 1,5	44	21	44	72(11)	9(64)
FORMULA SL	503	414 8833 00	T.R.A.	BLUE/GREEN	420 480 284	420 429 140	3	3500-3700	6900-7200	MACH Z	ORANGE	10,5 ± 1,5	44	22	44	72(11)	9(64)
MACH 1	670	414 9182 00	T.R.A.	PINK/WHITE	420 480 285	420 429 220	3	4400-4600	8100-8300	FORMULA	BEIGE	13,5 ± 1,5	47	26	44	74(13)	9(64)
MACH Z	779	414 9182 00	T.R.A.	GREEN/VIOLET	420 480 286	420 429 220	4	4000—4200	8100—8300	MACH Z	BEIGE	13,5 ± 1,5	50	26	44	74(13)	9(64)
MX Z	454	414 8607 00	T.R.A.	PINK/WHITE	420 480 283	420 429 140	3	4300—4500	7800—8100	FORMULA	BEIGE	13,5 ± 1,5	44	23	44	72(13)	9(54)

SPROCKET / CHAIN CHART (cent'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
44	2.10 72	2.00 72	1.91 72	1.83 74	1.76 74	1.69 74

CHAINS		
LINKS	NARROW	WIDE
68	412106000	—
70	412105900	412106800
72	412105500	412106700
74	412105800	412106900

NARROW SPROCKETS		TEETH	WIDE SPROCKETS	
STEEL	POWDER		STEEL	POWDER
504074700	504056000	22	504083500	504091100
504078400	504087800	23	504085400	504091000
504078600	504056100	24	504139700	504090900
504084100	504085200	25	—	504084300
—	504055900	26	—	504085300
	504056200	40		504089000
—	504057300	44	–	504085500
504076500	504088200	44R	–	504084400
504071800	—	17	—	—
—	504070100	18	–	—
—	414680500	19	—	—
504074800	—	20	—	—
504084000		21		—

All chain and sprockets silent type, 3/8'' pitch

Upper sprockets are l''shaft, 15splines.

Lower sprockets arel l/8'' shaft, 17 splines.

O NOTE : Specialized race vehicles (Fl, etc...) use a 1" - 15 splines upper sprocket, but these area different splinedesign andare noninterchangeable.

FORMULA (INTERNAL DRIVE SPROCKET)
SPROCKET COMBINATION/GEAR RATIO/CHAIN LENGTH
MAXIMUM TOP SPEED (MPH)

	17/38	17/40	17/44	18/38	18/40	18/44	19/38	19/40	19/44	20/38	20/40	20/44	21/38	21/40	21/44
	2.23	2.35	2.58	2.11	2.22	2.44	2.00	2.10	2.31	1.90	2.00	2.20	1.80	1.90	2.09
	66	68	70	68	68	70	68	68	72	68	70	72	68	70	72
6500	62.5	59.3	53.9	66.1	62.8	57.1	69.8	66.3	60.3	73.5	69.8	63.5	77.1	73.3	66.6
6600	63.4	60.2	54.8	67.1	63.8	58.0	70.9	67.3	61.2	74.6	70.9	64.4	78.3	74.4	67.7
6700	64.4	61.2	55.6	68.2	64.8	58.9	71.9	68.4	62.1	75.7	71.9	65.4	79.5	75.5	68.7
6800	65.3	62.1	56.4	69.2	65.7	59.7	73.0	69.4	63.1	76.9	73.0	66.4	80.7	76.7	69.7
6900	66.3	63.0	57.3	70.2	66.7	60.6	74.1	70.4	64.0	78.0	74.1	67.4	81.9	77.8	70.7
7000	67.3	63.9	58.1	71.2	67.7	61.5	75.2	71.4	64.9	79.1	75.2	68.3	83.1	78.9	71.8
71	68.2	64.8	58.9	72.2	68.6	62.4	76.2	72.4	65.8	80.3	76.2	69.3	84.3	80.1	72.8
7200	69.2	65.7	59.7	73.2	69.6	63.3	77.3	73.5	66.8	81.4	77.3	70.3	85.5	81.2	73.8
7300	70.1	66.6	60.6	74.3	70.6	64.1	78.4	74.5	67.7	82.5	78.4	71.3	86.6	82.3	74.8
7400	71.1	67.5	61.4	75.3	71.5	65.0	79.5	75.5	68.6	83.6	79.5	72.2	87.8	83.4	75.9
7500	72.1	68.5	62.2	76.3	72.5	65.9	80.5	76.5	69.6	84.8	80.5	73.2	89.0	84.6	76.9
7600	73.0	69.4	63.1	77.3	73.5	66.8	81.6	77.5	70.5	85.9	81.6	74.2	90.2	85.7	77.9
7700	74.0	70.3	63.9	78.3	74.4	67.7	82.7	78.6	71.4	87.0	82.7	75.2	91.4	86.8	78.9
7800	74.9	71.2	64.7	79.4	75.4	68.5	83.8	79.6	72.3	88.2	83.8	76.1	92.6	87.9	80.0
7900	75.9	72.1	65.6	80.4	76.4	69.4	84.8	80.6	73.3	89.3	84.8	77.1	93.8	89.1	81.0
8000	76.9	73.0	66.4	81.4	77.3	70.3	85.9	81.6	74.2	90.4	85.9	78.1	95.0	90.2	82.0
8100	77.8	73.9	67.2	82.4	78.3	71.2	87.0	82.6	75.1	91.6	87.0	79.1	96.1	91.3	83.0
8200	78.8	74.8	68.0	83.4	79.3	72.0	88.1	83.7	76.0	92.7	88.1	80.1	97.3	92.5	84.1
8300	79.7	75.8	68.9	84.4	80.2	72.9	89.1	84.7	77.0	93.8	89.1	81.0	98.5	93.6	85.1
8400	80.7	76.7	69.7	85.5	81.2	73.8	90.2	85.7	77.9	95.0	90.2	82.0	99.7	94.7	86.1
8500	81.7	77.6	70.5	86.5	82.2	74.7	91.3	86.7	78.8	96.1	91.3	83.0	100.9	95.8	87.1
8600	82.6	78.5	71.4	87.5	83.1	75.6	92.4	87.7	79.8	97.2	92.4	84.0	102.1	97.0	88.2
8700	83.6	79.4	72.2	88.5	84.1	76.4	93.4	88.8	80.7	98.3	93.4	84.9	103.3	98.1	89.2
8800	84.6	80.3	73.0	89.5	85.1	77.3	94.5	89.8	81.6	99.5	94.5	85.9	104.4	99.2	90.2
8900	85.5	81.2	73.9	90.5	86.0	78.2	95.6	90.8	82.5	100.6	95.6	86.9	105.6	100.4	91.2
9000	86.5	82.2	74.7	91.6	87.0	79.1	96.6	91.8	93.5	101.7	96.6	87.9	106.8	101.5	92.3
9100	87.4	83.1	75.5	92.6	87.9	80.0	97.7	92.8	84.4	102.9	97.7	88.8	108.0	102.6	93.3
9200	88.4	84.0	76.3	93.6	88.9	80.8	98.8	93.9	85.3	104.0	98.8	89.8	109.2	103.7	94.3
9300	89.4	84.9	77.2	94.6	89.9	81.7	99.9	94.9	86.3	105.1	99.9	90.8	110.4	104.9	95.3
9400	90.3	85.8	78.0	95.6	90.8	82.6	100.9	95.9	87.2	106.3	100.9	91.8	111.6	106.0	96.4
9500	91.3	86.7	78.8	96.6	91.8	83.5	102.0	96.9	88.1	107.4	102.0	92.7	112.8	107.1	97.4
9600	92.2	87.6	79.7	97.7	92.8	84.3	103.1	97.9	89.0	108.5	103.1	93.7	113.9	108.2	98.4
9700	93.2	88.5	80.5	98.7	93.7	85.2	104.2	99.0	90.0	109.6	104.2	94.7	115.1	109.4	99.4
9800	94.2	89.5	81.3	99.7	94.7	86.1	105.2	100.0	90.9	110.8	105.2	95.7	116.3	110.5	100.5
9900	95.1	90.4	82.2	100.7	95.7	87.0	106.3	101.0	91.8	111.9	106.3	96.6	117.5	111.6	101.5
10000	96.1	91.3	83.0	101.7	96.6	87.9	107.4	102.0	92.7	113.0	107.4	97.6	118.7	112.8	102.5

NOTE : CLUTCH RATIO IS 1 TO 1

FORMULA (INTERNAL DRIVE SPROCKET)
SPROCKET COMBINATION/GEAR RATIO/CHAIN LENGTH
MAXIMUM TOP SPEED (MPH)

	22/38	22/40	22/44	23/38	23/40	23/44	24/38	24/40	24/44	25/38	25/40	25/44	26/38	26/40	26/44
	1.72	1.81	2.00	1.65	1.74	1.91	1.58	1.66	1.83	1.52	1.60	1.76	1.46	1.54	1.69
	70	70	72	70	70	72	70	70	74	70	72	74	70	72	74
6500	80.8	76.8	69.8	84.5	80.3	73.0	88.2	83.8	76.1	91.8	87.3	79.3	95.5	90.7	82.5
6600	82.1	78.0	70.9	85.8	81.5	74.1	89.5	85.1	77.3	93.3	88.6	80.5	97.0	92.1	83.8
6700	83.3	79.1	71.9	87.1	82.7	75.2	90.9	86.3	78.5	94.7	89.9	81.8	98.5	93.5	85.0
6800	84.6	80.3	73.0	88.4	84.0	76.3	92.2	87.6	79.7	96.1	91.3	83.0	99.9	94.9	86.3
6900	85.8	81.5	74.1	89.7	85.2	77.5	93.6	88.9	80.8	97.5	92.6	84.2	101.4	96.3	87.6
7000	87.0	82.7	75.2	91.0	86.4	78.6	95.0	90.2	82.0	98.9	94.0	85.4	102.9	97.7	88.8
7100	88.3	83.9	76.2	92.3	87.7	79.7	96.3	91.5	83.2	100.3	95.3	86.6	104.3	99.1	90.1
7200	89.5	85.1	77.3	93.6	88.9	80.8	97.7	92.8	84.3	101.7	96.6	87.9	105.8	100.5	91.4
7300	90.8	86.2	78.4	94.9	90.2	82.0	99.0	94.1	85.5	103.1	98.0	89.1	107.3	101.9	92.6
7400	92.0	87.4	79.5	96.2	91.4	83.1	100.4	95.4	86.7	104.6	99.3	90.3	108.7	103.3	93.9
7500	93.3	88.6	80.5	97.5	92.6	84.2	101.7	96.6	87.9	106.0	100.7	91.5	110.2	104.7	95.2
7600	94.5	89.8	81.6	98.8	93.9	85.3	103.1	97.9	89.0	107.4	102.0	92.7	111.7	106.1	96.5
7700	95.7	91.0	82.7	100.1	95.1	86.4	104.4	99.2	90.2	108.8	103.4	94.0	113.2	107.5	97.7
7800	97.0	92.1	83.8	101.4	96.3	87.6	105.8	100.5	91.4	110.2	104.7	95.2	114.6	108.9	99.0
7900	98.2	93.3	84.8	102.7	97.6	88.7	107.2	101.8	92.5	111.6	106.0	96.4	116.1	110.3	100.3
8000	99.5	94.5	85.9	104.0	98.8	89.8	108.5	103.1	93.7	113.0	107.4	97.6	117.6	111.7	101.5
8100	100.7	95.7	87.0	105.3	100.0	90.9	109.9	104.4	94.9	114.5	108.7	98.8	119.0	113.1	102.8
8200	102.0	96.9	88.1	106.6	101.3	92.1	111.2	105.7	96.1	115.9	110.1	100.1	120.5	114.5	104.1
8300	103.2	98.0	89.1	107.9	102.5	93.2	112.6	107.0	97.2	117.3	111.4	101.3	122.0	115.9	105.3
8400	104.4	99.2	90.2	109.2	103.7	94.3	113.9	108.2	98.4	118.7	112.8	102.5	123.4	117.3	106.6
8500	105.7	100.4	91.3	110.5	105.0	95.4	115.3	109.5	99.6	120.1	114.1	103.7	124.9	118.7	107.9
8600	106.9	101.6	92.4	111.8	106.2	96.6	116.7	110.8	100.7	121.5	115.4	104.9	126.4	120.1	109.1
8700	108.2	102.8	93.4	113.1	107.4	97.7	118.0	112.1	101.9	122.9	116.8	106.2	127.8	121.5	110.4
8800	109.4	104.0	94.5	114.4	108.7	98.8	119.4	113.4	103.1	124.3	118.1	107.4	129.3	122.9	111.7
8900	110.7	105.1	95.6	115.7	109.9	99.9	120.7	114.7	104.3	125.8	119.5	108.6	130.8	124.2	113.0
9000	111.9	106.3	96.6	117.0	111.1	101.0	122.1	116.0	105.4	127.2	120.8	109.8	132.3	125.6	114.2
9100	113.2	105.7	97.7	118.3	112.4	102.2	123.4	117.3	106.6	128.6	122.2	111.0	133.7	127.0	115.5
9200	114.4	108.7	98.8	119.6	113.6	103.3	124.8	118.6	107.8	130.0	123.5	112.3	135.2	128.4	116.8
9300	115.6	109.9	99.9	120.9	114.8	104.4	126.2	119.8	108.9	131.4	124.8	113.5	136.7	129.8	118.0
9400	116.9	111.0	100.9	122.2	116.1	105.5	127.5	121.1	110.1	132.8	126.2	114.7	138.1	131.2	119.3
9500	118.1	112.2	102.0	123.5	117.3	106.7	128.9	122.4	111.3	134.2	127.5	115.9	139.6	132.6	120.6
9600	119.4	113.4	103.1	124.8	118.6	107.8	130.2	123.7	112.5	135.6	128.9	117.1	141.1	134.0	121.8
9700	120.6	114.6	104.2	126.1	119.8	108.9	131.6	125.0	113.6	137.1	130.2	118.4	142.5	135.4	123.1
9800	121.9	115.8	105.2	127.4	121.0	110.0	132.9	126.3	114.8	138.5	131.5	119.6	144.0	136.8	124.4
9900	123.1	116.9	106.3	128.7	122.3	111.1	134.3	127.6	116.0	139.9	132.9	120.8	145.5	138.2	125.6
10000	124.3	118.1	107.4	130.0	123.5	112.3	135.6	128.9	117.1	141.3	134.2	122.0	146.9	139.6	126.9

NOTE : CLUTCH RATIO IS 1 TO 1

FORMULA (INTERNAL DRIVE SPROCKET)
SPROCKET COMBINATION/GEAR RATIO/CHAIN LENGTH
MAXIMUM TOP SPEED (MPH)

	17/38	17/40	17/44	18/38	18/40	18/44	19/38	19/40	19/44	20/38	20/40	20/44	21/38	21/40	21/44
	2.23	2.35	2.58	2.11	2.22	2.44	2.00	2.10	2.31	1.90	2.00	2.20	1.80	1.90	2.09
	66	68	70	68	68	70	68	68	72	68	70	72	68	70	72
6500	75.2	71.5	65.0	79.7	75.7	68.8	84.1	79.9	72.6	88.5	84.1	76.5	93.0	88.3	80.3
6600	76.4	72.6	66.0	80.9	76.9	69.9	85.4	81.1	73.7	89.9	85.4	77.6	94.4	89.7	81.5
6700	77.6	73.7	67.0	82.1	78.0	70.9	86.7	82.4	74.9	91.2	86.7	78.8	95.8	91.0	82.7
6800	78.7	74.8	68.0	83.3	79.2	72.0	88.0	83.6	76.0	92.6	88.0	80.0	97.2	92.4	84.0
6900	79.9	75.9	69.0	84.6	80.3	73.0	89.3	84.8	77.1	94.0	89.3	81.2	98.7	93.7	85.2
7000	81.0	77.0	70.0	85.8	81.5	74.1	90.6	86.0	78.2	95.3	90.6	82.3	100.1	95.1	86.5
7100	82.2	78.1	71.0	87.0	82.7	75.2	91.9	87.3	79.3	96.7	91.9	83.5	101.5	96.5	87.7
7200	83.3	79.2	72.0	88.3	83.8	76.2	93.2	88.5	80.5	98.1	93.2	84.7	103.0	97.8	88.9
7300	84.5	80.3	73.0	89.5	85.0	77.3	94.4	89.7	81.6	99.4	94.4	85.9	104.4	99.2	90.2
7400	85.7	81.4	74.0	90.7	86.2	78.3	95.7	91.0	82.7	100.8	95.7	87.0	105.8	100.5	91.4
7500	86.8	82.5	75.0	91.9	87.3	79.4	97.0	92.2	83.8	102.1	97.0	88.2	107.3	101.9	92.6
7600	88.0	83.6	76.0	93.2	88.5	80.5	90.3	93.4	84.9	103.5	98.3	89.4	108.7	103.2	93.9
7700	89.1	84.7	77.0	94.4	89.7	81.5	99.6	94.6	86.0	104.9	99.6	90.6	110.1	104.6	95.1
7800	90.3	85.8	78.0	95.6	90.8	82.6	100.9	95.9	87.2	106.2	100.9	91.7	111.5	106.0	96.3
7900	91.5	86.9	79.0	96.8	92.0	83.6	102.2	97.1	88.3	107.6	102.2	92.9	113.0	107.3	97.6
8000	92.6	88.0	80.0	98.1	93.2	84.7	103.5	98.3	89.4	109.0	103.5	94.1	114.4	108.7	98.8
8100	93.8	89.1	81.0	99.3	94.3	85.7	104.8	99.6	90.5	110.3	104.8	95.3	115.8	110.0	100.0
8200	94.9	90.2	82.0	100.5	95.5	86.8	106.1	100.8	91.6	111.7	106.1	96.4	117.3	111.4	101.3
8300	96.1	91.3	83.0	101.7	96.6	87.9	107.4	102.0	92.7	113.0	107.4	97.6	118.7	112.8	102.5
8400	97.2	92.4	84.0	103.0	97.8	88.9	108.7	103.2	93.9	114.4	108.7	98.8	120.1	114.1	103.7
8500	98.4	93.5	85.0	104.2	99.0	90.0	110.0	104.5	95.0	115.8	110.0	100.0	121.6	115.5	105.0
8600	99.6	94.6	86.0	105.4	100.1	91.0	111.3	105.7	96.1	117.1	111.3	101.2	123.0	116.8	106.2
8700	100.7	95.7	87.0	106.6	101.3	92.1	112.6	106.9	97.2	118.5	112.6	102.3	124.4	118.2	107.4
8800	101.9	96.8	88.0	107.9	102.5	93.2	113.9	108.2	98.3	119.8	113.9	103.5	125.8	119.5	108.7
8900	103.0	97.9	89.0	109.1	103.6	94.2	115.1	109.4	99.4	121.2	115.1	104.7	127.3	120.9	109.9
9000	104.2	99.0	90.0	110.3	104.8	95.3	116.4	110.6	100.6	122.6	116.4	105.9	128.7	122.3	111.2
9100	105.3	100.1	91.0	111.5	106.0	96.3	117.7	111.9	101.7	123.9	117.7	107.0	130.1	123.6	112.4
9200	106.5	101.2	92.0	112.8	107.1	97.4	119.0	113.1	102.8	125.3	119.0	108.2	131.6	125.0	113.6
9300	107.7	102.3	93.0	114.0	108.3	98.4	120.3	114.3	103.9	126.7	120.3	109.4	133.0	126.3	114.9
9400	108.8	103.4	94.0	115.2	109.5	99.5	121.6	115.5	105.0	128.0	121.6	110.6	134.4	127.7	116.1
9500	110.0	104.5	95.0	116.4	110.6	100.6	122.9	116.8	106.2	129.4	122.9	111.7	135.9	129.1	117.3
9600	111.1	105.6	96.0	117.7	111.8	101.6	124.2	118.0	107.3	130.7	124.2	112.9	137.3	130.4	118.6
9700	112.3	106.7	97.0	118.9	112.9	102.7	125.5	119.2	108.4	132.1	125.5	114.1	138.7	131.7	119.8
9800	113.4	107.8	98.0	120.1	114.1	103.7	126.8	120.5	109.5	133.5	126.8	115.3	140.1	133.1	121.0
9900	114.6	108.9	99.0	121.3	115.3	104.8	128.1	121.7	110.6	134.8	128.1	116.4	141.6	134.5	122.3
10000	115.8	110.0	100.0	122.6	116.4	105.9	129.4	122.9	111.7	136.2	129.4	117.6	143.0	135.9	123.5

NOTE : CLUTCH RATIO IS 0.83, INCLUDE FULL OVERDRIVE OF T.R.A.

FORMULA (INTERNAL DRIVE SPROCKET)
SPROCKET COMBINATION/GEAR RATIO/CHAIN LENGTH
MAXIMUM TOP SPEED (MPH)

	22/38	22/40	22/44	23/38	23/40	23/44	24/38	24/40	24/44	25/38	25/40	25/44	26/38	26/40	26/44
	1.72	1.81	2.00	1.65	1.74	1.91	1.58	1.66	1.83	1.52	1.60	1.76	1.46	1.54	1.69
	70	70	72	70	70	72	70	70	74	70	72	74	70	72	74
6500	97.4	92.5	84.1	101.8	96.7	87.9	106.2	100.9	91.7	110.7	105.1	95.6	115.1	109.3	99.4
6600	98.9	93.9	85.4	103.4	98.2	89.3	107.9	102.5	93.2	112.4	106.7	97.0	116.9	111.0	100.9
6700	100.4	95.4	86.7	104.9	99.7	90.6	109.5	104.0	94.6	114.1	108.4	98.5	118.6	112.7	102.4
6800	101.9	96.8	88.0	106.5	101.2	92.0	111.1	105.6	96.0	115.8	110.0	100.0	120.4	114.4	104.0
6900	103.4	98.2	89.3	108.1	102.7	93.3	112.8	107.1	97.4	117.5	111.6	101.4	122.2	116.1	105.5
7000	104.9	99.6	90.6	109.6	104.2	94.7	114.4	108.7	98.8	109.2	113.2	102.9	123.9	117.7	107.0
710	106.4	101.0	91.9	111.2	105.6	96.0	116.0	110.2	100.2	120.9	114.8	104.4	125.7	119.4	108.6
7200	107.9	102.5	93.2	112.4	107.1	97.4	117.7	111.8	101.6	122.6	116.4	105.9	127.5	121.1	110.1
7300	109.4	103.9	94.4	114.3	108.6	98.7	119.3	113.3	103.0	124.3	118.1	107.3	129.2	122.8	111.6
7400	110.9	105.3	95.7	115.9	110.1	100.1	120.9	114.9	104.4	126.0	119.7	108.8	131.0	124.5	113.1
7500	112.4	106.7	97.0	117.5	111.6	101.4	122.6	116.4	105.9	127.7	121.3	110.3	132.8	121.1	114.7
7600	113.9	108.2	98.3	119.0	113.1	102.8	124.2	118.0	107.3	129.4	122.9	111.7	134.6	127.8	116.2
7700	115.4	109.6	99.6	120.6	114.6	104.2	125.8	119.5	108.7	131.1	124.5	113.2	136.3	129.5	117.7
7800	116.9	111.0	100.9	122.2	116.1	105.5	127.5	121.1	110.1	132.8	126.1	114.7	138.1	131.2	119.3
7900	118.3	112.4	102.2	123.7	117.5	106.9	129.1	122.7	111.5	134.5	127.8	116.1	139.9	132.9	120.8
8000	119.8	113.9	103.5	125.3	119.0	108.2	130.7	124.2	112.9	136.2	129.4	117.6	141.6	134.6	122.3
8100	121.3	115.3	104.8	126.9	120.5	109.6	132.4	125.8	114.3	137.9	131.0	119.1	143.4	136.2	123.9
8200	122.8	116.7	106.1	128.4	122.0	110.9	134.0	127.3	115.7	139.6	132.6	120.6	145.2	137.9	125.4
8300	124.3	118.1	107.4	130.0	123.5	112.3	135.6	128.9	117.1	141.3	134.2	122.0	146.9	139.6	126.9
8400	125.8	119.5	108.7	131.6	125.0	113.6	137.3	130.4	118.6	143.0	135.9	123.5	148.7	141.3	128.4
8500	127.3	121.0	110.0	131.1	126.5	115.0	138.9	132.0	120.0	144.7	137.5	125.0	150.5	143.0	130.0
8600	128.8	122.4	111.3	134.7	128.0	116.3	140.5	133.5	121.4	146.4	139.1	126.4	152.3	144.6	131.5
8700	130.3	123.8	112.6	136.3	129.4	118.7	142.2	135.1	122.8	148.1	140.7	127.9	154.0	146.3	133.0
8800	131.8	125.2	113.9	137.8	130.9	119.0	143.8	136.6	124.2	149.8	142.3	129.4	155.8	148.0	134.6
8900	133.3	126.7	115.1	139.4	132.4	120.4	145.5	138.2	125.6	151.5	143.9	130.9	157.6	149.7	136.1
9000	134.8	128.1	116.4	141.0	133.9	121.7	147.1	139.7	127.0	153.2	145.6	132.3	159.3	151.4	137.6
9100	136.3	129.5	117.7	142.5	135.4	123.1	148.7	141.3	128.4	154.9	147.2	133.8	161.1	153.1	139.1
9200	137.8	130.9	119.0	144.1	136.9	124.4	150.4	142.8	129.9	156.6	148.8	135.3	162.9	154.7	140.7
9300	139.3	132.4	120.3	145.7	138.4	125.8	152.0	144.4	131.3	158.3	150.4	136.7	164.7	156.4	142.2
9400	140.8	133.8	121.6	147.2	139.9	127.1	153.6	145.9	132.7	160.0	152.0	138.2	166.4	158.1	143.7
9500	142.3	135.2	122.9	148.8	141.3	128.5	155.3	147.5	134.1	161.7	153.6	139.7	168.2	159.8	145.3
9600	143.2	136.6	124.2	150.4	142.8	129.9	156.9	149.0	135.5	163.4	155.3	141.1	170.0	161.5	146.8
9700	145.3	138.0	125.5	151.9	144.3	131.2	158.5	150.6	136.9	165.1	156.9	142.6	171.7	163.1	148.3
9800	146.8	139.5	126.8	153.5	145.8	132.6	160.2	152.2	138.3	166.8	158.5	144.1	173.5	164.8	149.8
9900	148.3	140.9	128.1	155.1	147.3	133.9	161.8	153.7	139.7	168.5	160.1	145.6	175.3	166.5	161.4
10000	149.8	142.3	129.4	156.6	148.8	135.3	163.4	155.3	141.1	170.2	161.7	147.0	177.0	168.2	152.9

NOTE : CLUTCH RATIO IS 0.83, INCLUDE OVERDRIVE OF T.R.A.

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 O 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 maitain 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 (l-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.
   - O **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. :	
	P.T.O.	MAG.	Carburetion notes:	
Main Jet				
Needle Jet				
Jet Needle				
E-Clip Position				
Slide Cutaway				
Pilot Jet				
Drive Pulley			Clutching notes:	
LeverArm/PinType				
Pin Weight				
Ramp Identification				
T.R.A. Adjuster Position				
Spring Identification				
Spring Pressure @ Engagement				
Spring Pressure @ Full Shift				
Engagement RPM				
Shift RPM				
Drive BeltIdentification				
Driven Pulley				
Cam Identification				
Spring Identification				
Spring Preload and Location				
Chaincase Gearing				

	L.H.	R.H.	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

IHIGH PERFORMANCE PARTS

DESCRIPTION	PART NUMBER
Magnesium Clutch Lever	420448452 (3)
Driven Pulley Windage Plate	504136700 (OUTER) 504137000 (INNER)
Screw for Windage Plate	732601067 (12)
Extension Bushing (Formula 1) (For double driven pulley large bushings)	486019700
High Revolution Tachometer	486037100 (4 PULSES) 486052100 (6 PULSES)
Tachometer Holder (Formula 1)	486003000
Low Friction Bearing (replace P / N 405 40450(	486047200
Master Cylinder	486045200
Brake Pad Insulator Kelsey-Hayes	486042400
Brake Pad Kelsey-Hayes	486023800
Support for Stud on Track (2” angle plate)	486049300
High Grip Spark Plug Cap	278000237
Throttle Handle (44 mm-metal-twin track)	486026400 or 414487100 Plastic
Housing	486026500 or 414441100 Plastic
Magneto Assembly (12 V, 160 W) (Race)	486014300
CDI Box	486014400
Carburetor Intake Bell	486015700
44 mm Carburetor MAG (Mach I-X 1991)	403112300
44 mm Carb PTO (Mach I-X 1991)	403112200
Handle bar (Twin track)	486024200

DESCRIPTION	PART NUMBER
Formula 1 Ski (Aluminum)	486027800
Small Fuel Tank	486049400
Mechanical Temperature Gauge	486037300
Fiberglass Gas or Lube Tank	486049500
15” X 121” High Profile Track	570205400
Stabilizing Bar Assembly 3/4”	580604500 (Kit)
Shorter Limiter Strap (DSA nylon with screw type system)	486056200
Skid-Plate 1996 S-2000 -1996	861749700 Black
Skid-Plate 1996 S-2000 -1996	8617498 00 Yellow
Skid-Plate 1996 S-2000 -1996	861753400 Red
Clear Fuel Tank 1995 MXZ	486067000
Clear Fuel Tank 1996 MXZ	572077701
SC10 Front Arm Quick Adj Assly	861754700
UHMW Ski Skin - MXZ 94/95/96	486067300

HIGH PERFORMANCE CENTERS

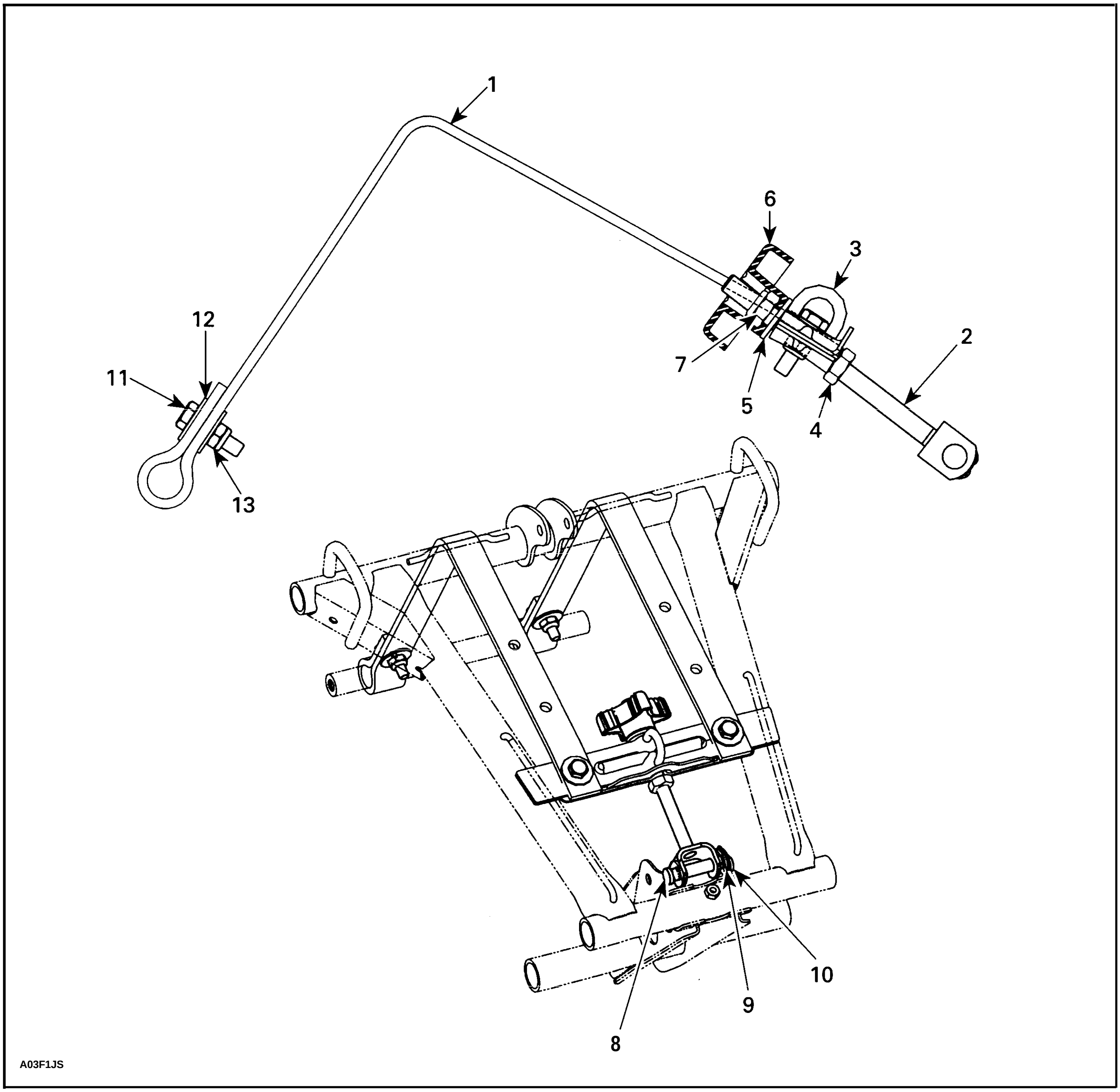
FAST INC
1040 South Hwy 53
Eveleth, MN
55734-9604
Tel : 218-744-2101
Fax : 218-744-5872

Larry's Small Engine
RR 4
Orangeville (Ontario)
L9W 2ZI
Tel : (519) 941-1517
Fax : (519) 941-3353

Bombardier Corp.
7575 Bombard er Court
P.O. Box 8035
Wausau, Wisconsin
Tel : 715-842-8886
Fax: 715-848-3455

USEFUL PUBLICATIONS

DESCRIPTION	PART NUMBER
Shop Manuals for 1995	484061800
Shop Manuals x 3 for 1996 vol. 1 — 484062800 — Elan, Tundra II LT, Touring E / E LT / LE / SLE Formula S / SL Skandic 380/ 500 vol. 2 — 484062801 — Grand Touring 500 / 580/ SE, Formula SLS / STX / STX LT(2) Summit 500, Mach 1 vol. 3 — 484062802 — MX Z 440 / 583, Formula Z / SS / III / III LT Summit 583 / 670 Mach Z / Z LT Skandic WT	
Racer Handbook for 1995	484062000
Specification Booklet 90/ 95	480135100
Specification Booklet 90/ 96	480140000
Part #'s / Sketch of SC10 Quick Adj Assly	861754700



COMPLETE ASSEMBLY FOR 1996 MXZ - FORMULA Z - FORMULA SS

1.	Courroie 25	(2)
2.	Attache courroie solide	(1)
3.	Limiteur	(1)
4.	Écrou	(1)
5.	Rondelle	(1)
6.	Poignée	(1)
7.	Écrou élastique	(1)
8.	Axe de goupille	(1)
9.	Rondelle	(1)
10.	Goupille	(1)
11.	Boulon hex MB x 30	(4)
12.	Rondelle	(6)
13.	Écrou élastique MB	(1)

TECHNICAL DATA

SUPPLEMENT **FOR MODEL** **FORMULA** SLS **1996**

		MODEL: FORMULA @ S 1996					
	RACING NPE	*- GRASS DRAGS -*					
	Maximum horsepower ❑	**RPM**		**7700**			
ROTARY VALVE	**Rotary valve**	**Part number**					
		Timing	**opening**				
			closing				
CARBuRETTOR	Carburettor type			**VM38**			
				PTO	MAG	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*			
	Gaz grade			**Super** unleaded		**Super unleaded**	
DRIvE RATIO	**Drive ratio**			22-44			
	Chain			links **(412 00)**		**links** (412 **00)**	
	Drive pulley	Type of drive pulley		TRA		TRA	
		Ramp identification		*CF1*			
		Calibration screw position		3			
		Spring color		*PU/PU 760/320*			
		Clutch engagement	**RPM**	**4700**			
		Pin		***Steel threded + 2 set screws***			
		Lever		*Std. aluminum*			
	Driven pulley	Spring	Color	*Beige*			
			Preload kg (lb)	***19 lbs (B-6)***			
		Cam	Angle	Angle 54° - 48°			
	Drive belt		Part number	8607			
	Calibration **done at temperature of**			**25°**			

■ 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.

SLS96

TECHNICAL DATA

SUPPLEMENT FOR MODEL FORMULA MX Z 583 1996

MODEL: FORMULA MX Z 583 1996							
	RACING TYPE			- GRASS DRAGS -			
	Maximum horsepower ❑	RPM		7750			
ROTARY VALVE	Rotary valve	Part number		502			
		Timing	opening	140°			
			closing	71°			
CARBURETTOR	Carburettor type						
				PTO	MAG	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				
	Gaz grade			Super unleaded		Super unleaded	
DRIVE RATIO	Drive ratio			22-44			
	Chain			links (412 00)		links (412 00)	
	Drive pulley	Type of drive pulley		TRA		TRA	
		Ramp identification		286			
		Calibration screw position		2			
		Spring color					
		Clutch engagement	RPM	4600			
		Pin		Steel threded + 1 set screws			
		Lever					
	Driven pulley	Spring	Color				
			Preload kg (lb)	16 lbs			
		Cam	Angle	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.

SLS96

TECHNICAL DATA

SUPPLEMENT FOR MODEL FORMULA 1111995

	MODEL: FORMULA III 1995								
	RACING TYPE			***- GRASS DRAGS -***					
	Maximum horsepower *		**RPM**	**8300**					
	Carburetor type			3 x VM-36			3 x VM-		
C				PTO	CENTRE	MAG	PTO	CENTRE	MAG
A	**Main iet**			**260**	**250**	**260**			
R	Needle			6DHZ46	6DHZ46	6DHZ46			
B	Needle clip position			5	5	5			
U	Slide cut-away			2.5	2.5	2.5			
R	Pilot Jet			40	40				
E	Needle jet			P-3 (480)	P-3 (480)	P-3 (48$			
T	Air screw adjustment		+/- 1/8 turn	1 turn	1 turn	1 turn			
T	Needle valve			1.5 *v*	1.5 *v*	*1.5 v*			
O	Idle speed		RPM	*2000*	*2000*	*2000*			
R	**P we e**								
	Ga g ade			**Supe eaded**			**S pe leaded**		
	D e a			**24 44 2 38**					
D	**C a**			**4 k 68 k**			**k**		
R	Drive pulley	**p d p**		RA			RA		
I v		Ramp identification		CF1					
E		Calibration screw position		4					
		Spring color		250-460 Pink					
		Clutch engagement	RPM	*4900*					
R		**Pin**		*** Solid steel**			**combined = 67 gr**		
A		Lever		*Std. aluminum			(		
T	Driven pulley	Spring	Color	Beige					
I			**Preload** kg	A-6					
0			**(lb)**	17 **lbs**					
		Cam	Angle	54-44 degrees			(504)		
	Drive belt		Part number	9182					
	Calibration done at temperature of			**30** degrees C					

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TECHNICAL DATA

SUPPLEMENT FOR MODEL FORMULA MACH I 1995

MODEL: FORMULA MACH 1 1995

RACING TYPE - *GRASS DRAGS* -

	Maximum horsepower *	RPM		8100			
ROTARY VALVE	Rotary valve	Part number					
		Timing	opening				
			closing				
CARBURETTOR	Carburetor type			2 x *VM-44*		2 x *VM-*	
				PTO	MAG	PTO	MAG
	Main jet			**320**	**300**		
	Needle			*7EG06*	*7EG06*		
	Needle clip position			5	5		
	Slide cut-away			2.5	2.5		
	Pilot Jet			35	35		
	Needle jet			AA-7 (224)	AA-7 (224)		
	Air screw adjustment		ñ 1/8 turn	*11/4 turn*	*11/4 turn*		
	Needle valve			2.0 *Vi.*	*2.0 Vi.*		
	Idle speed		RPM	2000	2000		
	Gaz grade			Super unleaded		Super unleaded	
DRIVE RATIO	**Drive ratio**			**24-44** *or 21-38*			
	Chain			74 or 68 links (412 00)		74 or 68 links (412 00)	
	Drive pulley	Type of drive pulley		TRA		TRA	
		Ramp identification		*CF1*			
		Calibration screw position		**5**			
		Spring color		*Black 185-410*			
		Clutch engagement	RPM	4500			
		Pin		*Solid (Steel)*			
		Lever		*Std aluminum*			
	Driven pulley	Spring	Color	*Beige*			
			Preload k (lb)	*8 lbs*			
		Cam	Angle	Angle 54-48 **degrees**			
	Drive belt		**Part number**	**9182**			
	Calibration done at temperature of			**30 degrees**			

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TECHNICAL DATA

SUPPLEMENT FOR MODEL FORMULA Z 1995

MODEL: FORMULA Z 1995							
RACING TYPE	*- GRASS DRAGS -*						
	Maximum horsepower *	RPM		*8000*			
ROTARY VALVE	Rotary valve "	Part number					
		Timing	opening				
			closing				
CARBURETTOR	Carburettor type			2 x *VM-40*		2 x *VM-*	
				PTO	MAG	PTO	MAG
	Main jet			260	260		
	Needle			*7DL7*	*7DL7*		
	Needle clip position			2	2		
	Slide cut-away			2.5	2.5		
	Pilot Jet			50	50		
	Needle jet			*AA-O*	*AA-O*		
	Air screw adjustment		ñ 1/8 turn	.75	.75		
	Needle valve			1.5 *Vi.*	*1.5 Vi.*		
	Idle speed		RPM				
	Gaz grade			Super unleaded		Super unleaded	
D R V E R A T O	Drive ratio			*22-44*			
	Chain			links (412 00)		links (412 00)	
	Drive pulley	Type of drive pulley		TRA		TRA	
		Ramp identification		*486 0657 00 CF1*			
		Calibration screw position		4			
		Spring color		*Black 785-410*			
		Clutch engagement	RPM	4600			
		Pin		*Hollow*			
		Lever		*Std aluminum*			
	Driven pulley	Spring	Color	*Beige*			
			Preload kg (lb)	*19 lbs*			
		Cam	Angle 54-46 deg.				
	Drive belt		Part number	414860700			
	Calibration done at temperature of						

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TECHNICAL DATA

SUPPLEMENT FOR MODEL FORMULA STX/Z 1994

	MODEL: FORMULA STX/Z 1994						
	RACING TYPE	- GRASS DRAGS-					
	Maximum horsepower ★	RPM		7800		7800	
ROTARY VALVE	Rotary valve	Part number					
		Timing	opening				
			closing	STX		Z	
CARBURETOR	Carburetor type			2 x VM-38		2 x VM-40	
				PTO	MAG	PTO	MAG
	Main jet			270	280	280	280
	Needle			6DH43	6DH43	7DL07	7DL07
	Needle clip position			2	2	2	2
	Slide cut-awav			2.5	2.5	2.5	2.5
	Pilot Jet			40	40	50	50
	Needle jet			P-6 480	P-6 480	AA-O	AA-O
	Air screw adjustment		± 1/8 turn	1.0	1.0	.75	.75
	Needle valve			1.5 vi.	1.5 Vi.	7.5 Vi.	7.5 Vi.
	Idle speed		RPM				
	Gaz grade			Super unleaded		Super unleaded	
DRIVE RATIO	Drive ratio			22-44 2/1		22-44 2/1	
	Chain			72 links		72 links	
	Drive pulley	Type of drive pulley		TRA	-	TRA	
		Ramp identification		280		280	
		Calibration screw position		"3"		"3"	
		Spring color		YL/RD 230-320		YL/RD 230-320	
		Clutch engagement	RPM	4800		4800,	
		Pin		Hollow pin		Hollow pin	
		Lever		Std aluminum		Std aluminum	
	Driven pulley	Spring	Color	Beige		Beige	
			Preload (lb)	20 lbs		20 lbs	
		Cam	Angle	50°		50°	
	Drive belt		Part number	414860700		414860700	
	Calibration dona at temperature of			30°		30°	

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TECHDAT

TECHNICAL DATA

SUPPLEMENT FOR MODEL FORMULA MX Z x **1994**

MODEL: FORMULA MX Z x 1994					
RACING TYPE	- GRASS DRAGS -				
	Maximum horsepower ★	RPM		*7750*	
ROT&Y' VALVE	Rotary valve	Part number		*420 9245 02*	
		Timing	opening	*145°*	
			closing	65°	
CARBURETOR	Carburetor type -,			2x *VM-34*	
				PTO	**MAG**
	Main jet			*210*	*220*
	Needle			*6-DHN44*	*6-DHN44*
	Needle clip position			4	4
	Slide cut-away			**2.5**	**2.5**
	Pilot Jet			**35**	**35“**
	Needle jet			*159-P2*	*159-P2*
	Air screw adjustment		± 1/8 turn	1.5	1.5
	Needle valve			*1.5 Vi.*	*1.5 Vi.*
	Idle speed		RPM		
	Gaz grade			**Super unleaded**	
DRIVE RATIO	**Drive ratio**			*2 to 1 (22-44)*	
	Chain			, links	
	Drive pulley	Type of drive pulley		**TRA**	
		Ramp identification		*486 0657 00* *CF1*	
		Calibration screw position		“3”	
		Spring color		*GR/YL*	
		Clutch engagement	RPM	4950	
		Pin		*Hollow pin + 2 sets screw*	
		Lever		***Std aluminum***	
	Driven pulley	Spring	Color	*Beige*	
			Preload kg (lb)	18 *lbs*	
		Cam	Angle 48° - 40°	486058100 “	
	Drive belt		Part number	414828700	
	Calibration done at temperature of .			30°	

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TECHNICAL DATA

SUPPLEMENT FOR MODEL FORMULA MACH Z 1994

	MODEL: FORMULA MACH Z 1994					
	RACING TYPE			*- GRASS DRAGS -*		
	Maximum horsepower ★	**RPM**		*8200*		
CARBURETOR	Carburetor type			3 x TM-38		
				PTO	CENTRE	MAG
	Main jet			260	260	260
	Needle			8DH2	8DH2	8DH2
	Needle clip position			1 3	1 3	1 3
	Slide cut-away			**3.0**	**3.0**	*3.0*
	Pilot Jet			50	50	50
	Needle jet			**Y 3 (327)**	**Y 3 (327)**	**Y 3 (327)**
	Air screw adjustment	**+/- 1/8 turn**		**3/16 to 1/4**	**3/16 to 1/4**	**3/16 to 1/4**
	Needle valve			**1.5 v.**	**1.5 v.**	**1.5 v.**
	Idle speed	**RPM**				
	Power jets			**Closed**		
	Gaz grade			**Super unleaded**		
DRIVE RATIO	**Drive ratio**			1.83 (24-44)		
	Chain			**links**		
	Drive **pulley**	Type of drive pulley		**TRA**		
		Ramp identification		280		
		Calibration screw position		**4**		
		Spring color		250-460 Pink		
		Clutch engagement	RPM	*4900*		
		Pin		Solid		
		Lever		Std. aluminum		
	Driven pulley	Spring	Color	Beige		
			Preload kg (lb)	2 0 lbs		
		Cam	Angle	52°		
	Drive belt		Part number	414794800		
	Calibration done at temperature of			*30°*		

★ **The maximum horsepower RPM is applicable on the vehicle. It may be different under certain circumstance and BOMBARDIER** INC. reserves the right to modify it without obligation.

Quality Service

Snowmobiles
Competition Bulletin
no. 94-5

Year month day
Date: 1994 05 26

MODELS : ALL 1994 MX Z, MX 2X

Serial nos. : All 3870, 3870X, 3886 and 3886X

Subject : Disc Brake

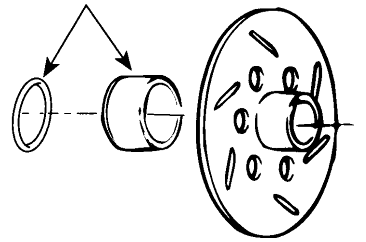
WARNING : **This information relates to the preparation and use of snowmobiles in** competitive events. Bombardier Inc. disclaims liability for all damages and/or injuries **resulting from the improper use of the contents. We strongly recommend that these modifications be carried out and/ or verified 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.**

GENERAL

It is possible to mount the disc brake as a floating unit.

PROCEDURE

Remove spacer and O-ring located between disc brake and chaincase.

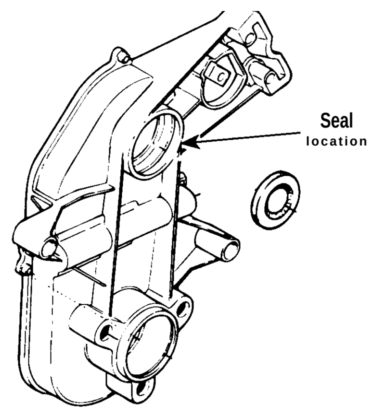


A006 003 026

Refer to **7994** *Shop Manual* (P/N **4840609 00)** for chaincase removal procedure.

However, pay particular attention to the following :

Original upper oil seal in chaincase must be replaced by a different model (P/N 4145312 00).



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Apply anti-seize lubricant (P/ N413 7010 00) onto countershaft and disc brake hub.

PART REQUIRED

P / N 414531200 Oil seal

NOTE : This is a service tip, no warranty applies.

Quality Service

Snowmobiles Competition Bulletin no. 944

Year month day
Date: 1993 09 22

MODELS : ALL FORMULA Z AND STX

Serial Nos. :All 3873,3874,3875,3893, 3894, 3897

Subject: Grass Drag Set-Up

◆ WARNING : This information relates to the preparation and use of snowmobiles **in** competitive events. Bombardier Inc. disclaims **liabi iity 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.**

CHASSIS PREPARATION

REAR SUSPENSION

Reduce slide thickness to 3 mm (1/8 in).

Replace all four original 135 mm idler wheels at front with 141 mm idler wheels (P/N 5030996 *00).*

Install two additional idler wheel sets, one at front and one at rear as illustrated.

Idler **wheel set includes :**

P / N **486056100** Aluminum Block (2)

P / N 486056000 Axle

P / N 486057000 Sleeve (2)

P / N **224781140 M8** Lock Washer (2)

P / N 222982565 M8 Screw (2)

P / N 224001211 Flat Washer (2)

P / N 224701170 Lock Washer (2)

P / N 222903565 MIO x 35 Screw (2)

P / N 570029100102 mm Idler Wheel (2)

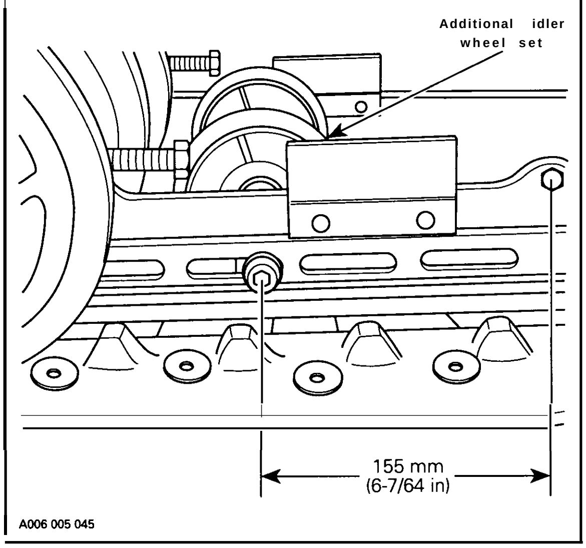
P / N 405404600 Bearing (2)

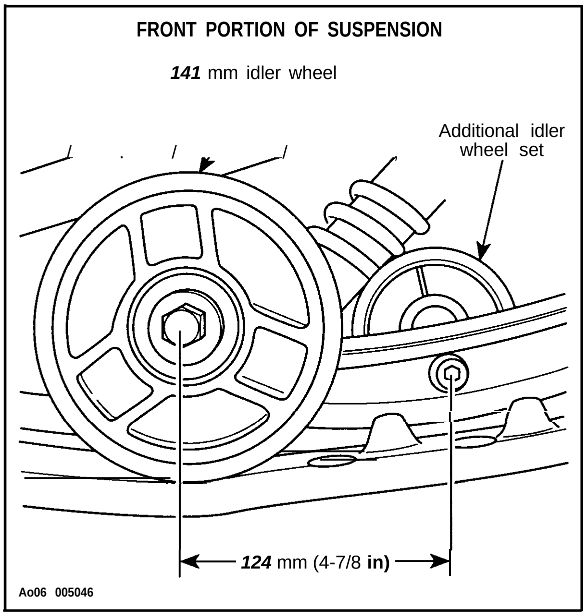
P / N 371907600 Snap Ring (2)

If these idler wheels are not available, order :

P / N 572043500 Idler Wheel Ass'y (2)

REAR PORTION OF SUSPENSION





Adjust preload of original center spring to the stiffer position.

Replace original stopper strap with a 50 mm (2 in) shorter one **(P/ N 4860562 00).**

Shock pivot can be bolted to front holes.

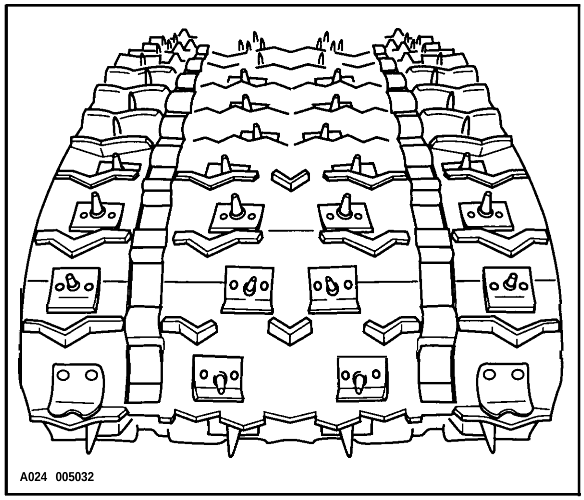
TRACK

Install studs on the track as per following illustration.

NOTE : When installing track studs, replace both radiator protectors with higher ones (P/ N 4148382 00) to ensure proper clearance.

CAUTION : Track studs should not interfere with protectors.

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 in track strength to name a few.



FRONT SUSPENSION

Collapse front suspension until lower and upper arms are horizontal. Tie suspension to limit travel (reduced to 75 mm **(3** in) in that position using straps on shock bolts.

Replace carbide runner with standard runner (p/ N 5050638 00).

DRIVE SYSTEM

DRIVE PULLEY

Replace original spring with a Green/Yellow (P / N 4147628 00).

Replace ramp with 145 (P/ N 4204801 45).

Install three hollow pins (P/ N 5042606 00).

Adjust calibration screws to second position.

Engagement speed should beat 4700 RPM.

Maximum engine RPM is 7500.

DRIVEN PULLEY

Install a 50° cam P / N 504140100

Adjust spring preload to 8.2 kg (18 lb).

CHAIN CASE

Replace original top sprocket (25 th) and chain with the following :

23-tooth narrow sprocket (P/ N 5040784 00)

72-link chain (P/ N 4121055 00)

DRIVE BELT

Use drive belt P / N414 828700.

▼ CAUTION : Following ignition timing and carburetor calibration are for grass racing at 20°C (68°F).

ENGINE

IGNITION TIMING

2.16 mm (.085 in) before to dead center.

AIR SILENCER

Remove foam from air silencer inlet.

CARBURETION

Formula STX (38 mm Carburetors)

	PTO	MAG
MAIN JET	280	290
JET NEEDLE	6DHN43-2 (STD)	6DHN43-2 (STD)
NEEDLE JET	480 P-6 (STD)	480 P-6 (STD)
PILOT JET	40	40
AIR SCREW	1.0	1.0
THROTTLE SLIDE	2.5 CUT-AWAY (STD)	2.5 CUT-AWAY (STD)
VALVE SEAT	1.5 VITON	1.5 VITON

Formula Z (40 mm Carburetors)

	PTO	MAG
MAIN JET	300	300
JET NEEDLE	7DL7-2 (STD)	7DL7-2 (STD)
NEEDLE JET	M - o (p / N 4041335 00)	AA-o (p/ N 4041335 00)
PILOT JET	50	50
AIR SCREW	3/4	3/4
THROTTLE SLIDE	2.5 CUT-AWAY (STD)	2.5 CUT-AWAY (STD)
VALVE SEAT	1.5 VITON	1.5 VITON

0 NOTE : This is a service tip, no warranty applies.

Quality
Service

Snowmobiles
Competition Bulletin
no. **94-3**

Year	month	day
1993	09	13

Date: 1993 09 13

MODELS : All 1993 FORMULA MACH 1
ALL 1994 MACH 1

Serial nos. : All 3797/ 3863 Models

Subject: Grass Drag Set-Up

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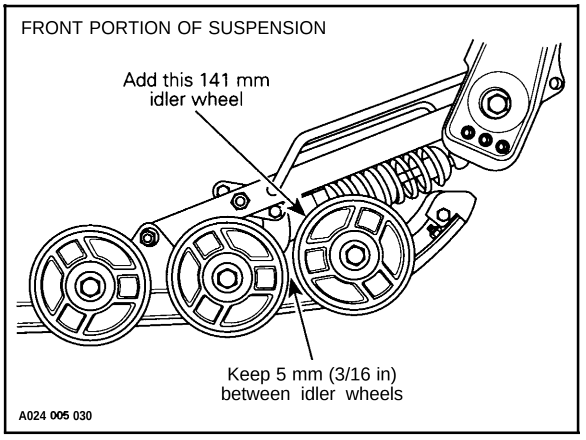
CHASSIS PREPARATION

REAR SUSPENSION

Reduce slide thickness to 3 mm (1/8 in).

Add additional idler wheels at front:

P/N 503099600	141 mm idler wheel (2)
P/N 503129700	Aluminum block (2)
P/N 222982565	M8 Allen screw (2)
P/N 228781045	M8 flanged nut 2)
P/N 222007565	Ml O x 75 screw (2)
P/N 222501045	MIO flanged nut (2)
P/N 503032900	Ml O washer (2)



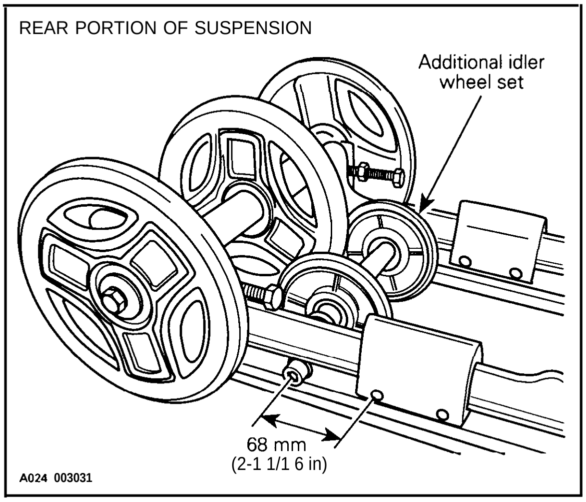
Install an additional idler wheel set at rear as illustrated.

Idler wheel set includes:

P/N 486056100	Aluminum block (2)
P/N 486056000	Axle
P/N 486057000	Sleeve (2)
P/N 224781140	M8 lock washer (2)
P / N 222982565	Screw M8 (2)
P/N 224001211	Flat washer(2)
P/N 224701140	Lock washer (2)
P/N 222903565	Screw Ml O x 35 (2)
P/N 570029100	Idler wheel 102 mm (2)
P/N 405404600	Bearing (2)
P/N 371907600	Snap ring (2)

If these idler wheels are not available, order:

P/N 572043500	Idler wheel ass'y (2)



Bolt rear arm pivot to rearmost hole of runner.

Replace center spring with a Blue/ Blue (P/N 4145591 00). Install a 20 mm (3/4 in) spacer between spring seat and spring.

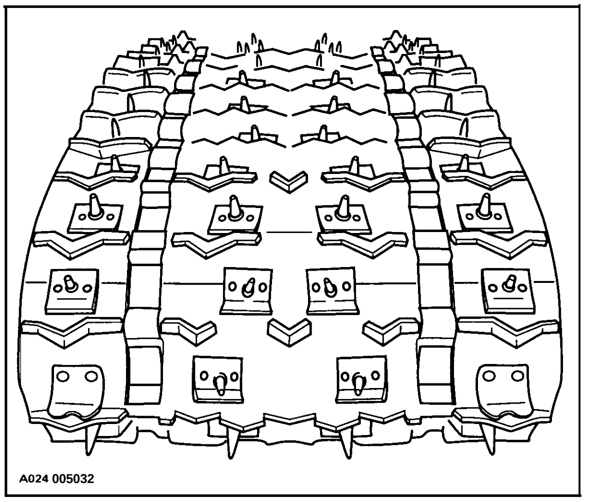
TRACK

Install studs on the track as per following illustration.

NOTE : When installing track studs, replace both radiator protectors with higher ones (P/ N 5617223 00) to ensure proper clearance.

CAUTION : Track studs should not interfere with protectors.

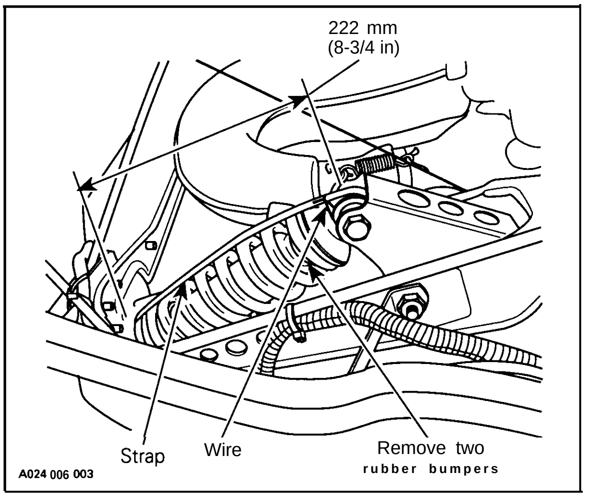
WARNING : Installation of track studs is not a safe practice recommended by Bombardier, and we strongly suggest not to alter the track configuration or design. The actual installation of studs involves many factors, including rider weight, suspension set-up, terrain type and conditions as well as driver's 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 in track strength to name a few.



FRONT SUSPENSION

Collapse front suspension until shock is 222 mm (8-3/4 in) long. Tie shocks in that position using straps and wires as illustrated.

Remove two of the three rubber bumpers on shock rod.



Replace carbide runners with standard runners.

DRIVE SYSTEM

DRIVE PULLEY

Replace original spring with a Blue/ Purple one (P/ N 4204381 37).

Replace ramp with DX(P/N4147960 00).

Install three hollow pins (P/ N 5042606 00) with two set screws (P/ N 3652020 00) per pin.

Adjust calibration screws to third position.

Engagement speed should beat 3800 RPM.

Maximum engine RPM is 7300.

DRIVEN PULLEY

Install a 50° cam (P/N 5041363 00).

Adjust spring preload to 7.3 kg (16 lb).

DRIVE BELT

Replace original drive belt with a softer one (P/N 4146338 00).

CHAIN CASE

Replace original top sprocket (26 th) with a 25-tooth sprocket (P/ N 5040843 00).

Keep original bottom sprocket (44 th) and drive chain (74 links).

Engine

AIR SILENCER

Remove foam from air silencer inlet.

CARBURETION

▼ CAUTION : Following carburetor calibration is for grass racing at 20°C **(68°F).**

	PTO	MAG
MAIN JET	**320**	**330**
NEEDLE JET	**AA-4**	**AA-4**
JET NEEDLE	7EG06-1 (P/N **4041472 00)**	7EG06-1 **(P/ N 4041472 oo)**
PILOT JET	**50**	**50**
AIR SCREW	**1.0**	**1.0**
THROTTLE SLIDE	2.5 CUT-AWAY	2.5 CUT-AWAY
VALVE SEAT	**1.5** VITON	1.5 VITON

IGNITION TIMING

Adjust timing at 2.29 mm (.090 in).

▼ CAUTION : **The above ignition timing is only for** 1/8 mile drag. Running engine **with this timing for a longer period can result** in engine damage.

O NOTE : This is a service tip, no warranty applies.

Quality Service

Snowmobiles

Competition Bulletin
no. **94-2**

	Year	month	day
Date:	**1993**	**09**	**14**

MODELS : All 1993 FORMULA MX Z
All 1994 FOMULA MX

Serial nos. : All 3844,3847, 3868, 3883

Subject: Grass Drag Set-Up

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CHASSIS PREPARATION

REAR SUSPENSION

Reduce slide thickness to 3 mm (1/8 in).

Replace all four original 135 mm idler wheels at front with 141 mm idler wheels (P/N 5030996 00).

Install two additional idler wheel sets, one at front and one at rear as illustrated.

Idler wheel set includes :

P/N 486056100 Aluminum Block (2)

P/N 486056000 Axle

P/N 486057000 Sleeve (2)

P/N 224781140 M8 Lock Washer (2)

P/N 222982565 M8 Screw (2)

P/N 224001211 Flat Washer (2)

P/N ,224701170 Lock Washer (2)

P / N 222903565 Ml O x 35 Screw (2)

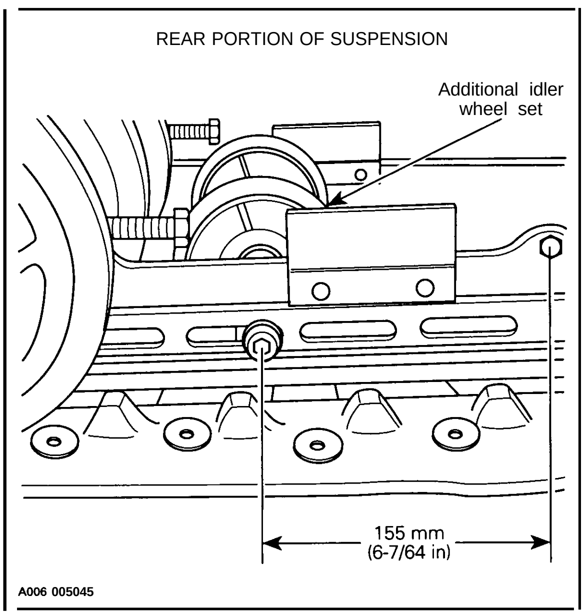
P / N 570029100102 mm Idler Wheel (2)

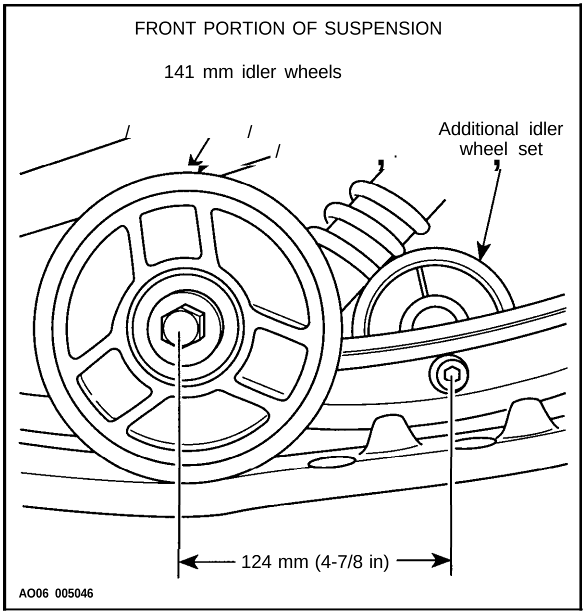
P / N 405404600 Bearing (2)

P / N 371907600 Snap Ring (2)

If these idler wheels are not available, order :

P / N 572043500 Idler Wheel Assy (2)





Adjust preload of original center spring to the stiffer position.

Replace original stopper strap with a 50 mm (2 in) shorter one (P/ N 4860562 00).

Shock pivot can be bolted to front holes.

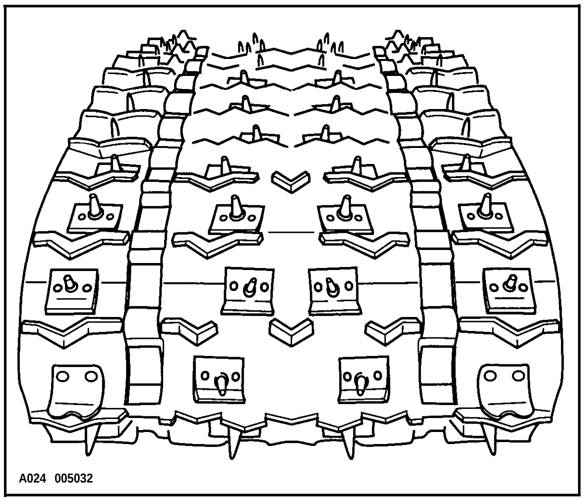
TRACK

Install studs on the track as per following illustration.

NOTE : When installing track studs, replace both radiator protectors with higher ones (P/ N 4148382 00) to ensure proper clearance.

CAUTION : Track studs should not interfere with protectors.

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 in track strength to name a few.**



FRONT SUSPENSION

Collapse front suspension until lower and upper arms are horizontal. Tie suspension to limit travel (reduced to 75 mm (3 in) in that position using straps on shock bolts.

Replace carbide runner with standard runner (P/ N 5050638 00).

DRIVE SYSTEM

DRIVE PULLEY

Replace original spring with a Green/ Pink (P/N 4147682 00).

Replace ramp with 145 (P/ N 4204801 45).

Install three hollow pins (P/ N 5042606 00) with two set screws (P/ N 3652020 00) **per** pin.

Adjust calibration screws to third position.

Engagement speed should beat 4500 RPM.

Maximum engine RPM is 7100.

DRIVEN PULLEY

Install a 50° cam :

P / N **504136300** (MX Z **1993)**

P / N **504140100** (MX **1994)**

Adjust spring preload to 8.2 kg (18 lb).

CHAIN CASE

For MX Z 1993 only, replace original top sprocket (24 th) and chain with the following :

23-tooth narrow sprocket (P/ N 5040784 00)

72-link chain (P/ N 4121055 00)

DRIVE BELT

Use drive belt P / N 414828700.

▼ **CAUTION : Following ignition timing and carburetor calibration are for grass racing at 20°C (68°F).**

ENGINE

IGNITION TIMING

Set to 2.54 mm (.100 in) before to dead center.

AIR SILENCER

Remove foam from air silencer inlet.

CARBURETION

	PTO	MAG
MAIN JET	250	250
JET NEEDLE	6DH4-2 P / N 404101900	6DH4-2 P / N 404101900
NEEDLE JET	159 P-2 P/N 404100700	159 P-2 P / N 404100700
PILOT JET	35	35
AIR SCREW	1.0	1.0
THROTTLE SLIDE	2.0 CUT-AWAY P / N 404128600	2.0 CUT-AWAY P / N 404128600
VALVE SEAT	1.2 VITON	1.2 VITON

NOTE : This is a service tip, no warranty applies.

Quality Service

Snowmobiles
Competition Bulletin
no. 94-1

Year month day
Date: 1993 07 22

MODELS : ALL 1993 FORMULA MACH Z
ALL 1994 MACH Z

Serial Nos. :All 3845, 3848, 3877, 3899 Models

Subject: Grass Drag Set-Up

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CHASSIS PREPARATION

REAR SUSPENSION

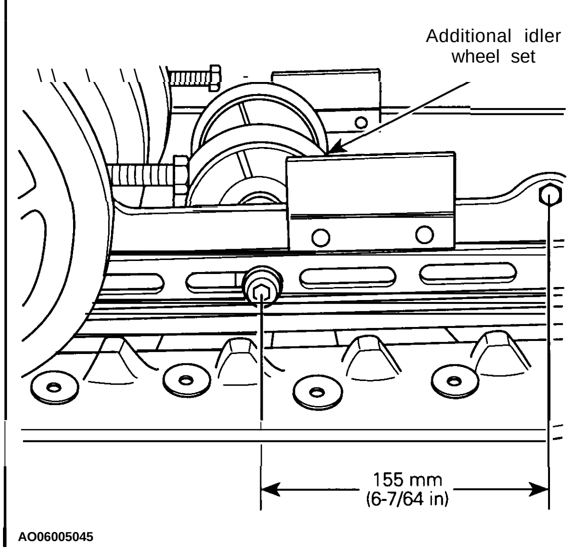
Reduce slide thickness to 3 mm (1/8 in).

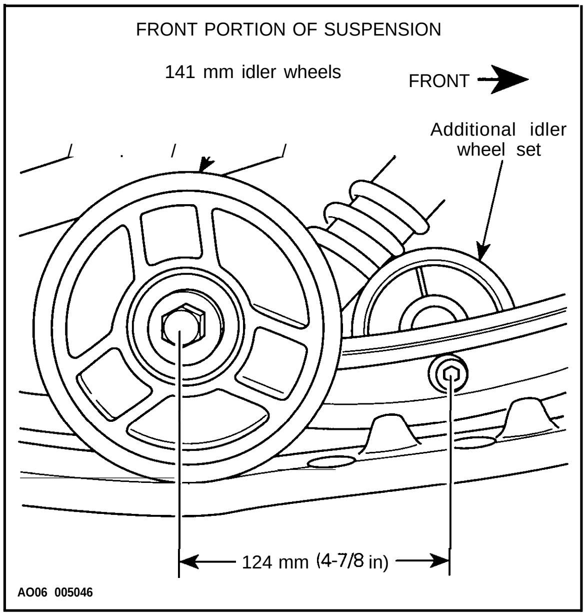
Replace all four original 135 mm idler wheels at front with 141 mm idler wheels (P/N 5030996 00).

Install two additional idler wheel sets, one at front and at rear as illustrated.

Idler wheel set includes two idler wheels 102 mm (P/ N 5700291 00) if these idler wheels are not available, order idler wheels (P/ N 5720435 00), two aluminum blocks (P/ N 4860561 00), an axle (p/ N 4860560 00), two sleeves (P/N 4860560 00) two lock washers M8 (P / N 2247811 40), two screws M8 (P/ N 2229825 65), two flat washers (p/ N 2240012 11), two lock washers (P/N 224 7011 00) and two screws MIO (P/N 2229035 00).

REAR PORTION OF SUSPENSION





Replace original center spring with a Blue/ Blue (P/ N 4145591 00).

Replace original stopper strap with a 50 mm (2 in) shorter one (P/ N 4860562 00).

Shock pivot can be bolted to front holes.

When installing track studs, replace both radiator protectors with higher ones (P/ N 4148382 00).

FRONT SUSPENSION

Collapse front suspension until lower and upper arms are horizontal. Tie suspension to limit travel (reduced to 75 mm (3 in) in that position using straps on shock bolts.

Replace carbide runners with standard runners (p/ N 5050638 00).

DRIVE SYSTEM

DRIVE PULLEY

Replace original spring with a Violet (P/N 417 2057 20) 254 lb (Comet P / N 207758A).

Install four large washers (P/ N 417 2057 08) between spider and sliding half.

Remove washer (P/ N 417 2057 07) between sliding half and fixed half. Drive belt side play will be reduced to a minimum.

DRIVEN PULLEY

Install a 54° cam (P/N 4860563 00).

Adjust spring preload 6.4 kg (14 lb).

Engagement speed should beat 3600 RPM.

Maximum engine RPM is 8400.

CHAINCAISE

Replace original top sprocket (25 th) with a 23-tooth sprocket (P/ N 5040854 00).

Replace original bottom sprocket (40 th) with a 44-tooth sprocket (P/ N 5040855 00). Keep original drive chain (72 links).

AIR SILENCER

Remove foams from both air silencer inlets.

0 NOTE : This is a service tip, no warranty applies.

Quality Service

Snowmobiles
Competition Bulletin
no. 94-1
REVISION 3

	Year	month	day
Date:	**1993**	**11**	**05**

MODELS : All 1993 FORMULA MACH Z

Serial nos.: All 3845

Subject: Grass Drag Set-Up

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CHASSIS PREPARATION

REAR SUSPENSION

Reduce slide thickness to 3 mm (1/8 in).

Replace all four original 135 mm idler wheels at front with 141 mm idler wheels (P/N 5030996 00).

Install two additional idler wheel sets, one at front and one at rear as illustrated.

Idler wheel set includes :

P / N **486056100** Aluminum Block (2)

P / N **486056000** Axle

P / N **486057000** Sleeve (2)

P / N 224781140 M8 Lock Washer (2)

P / N 222982565 M8 Screw (2)

P / N 224001211 Flat Washer (2)

P / N 224701170 Lock Washer (2)

P / N 222903565 Ml O x 35 Screw (2)

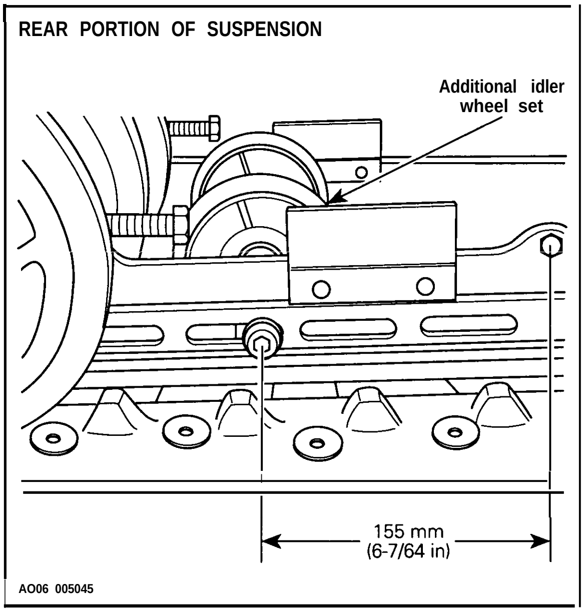
P / N 570029100 Idler Wheel (2)

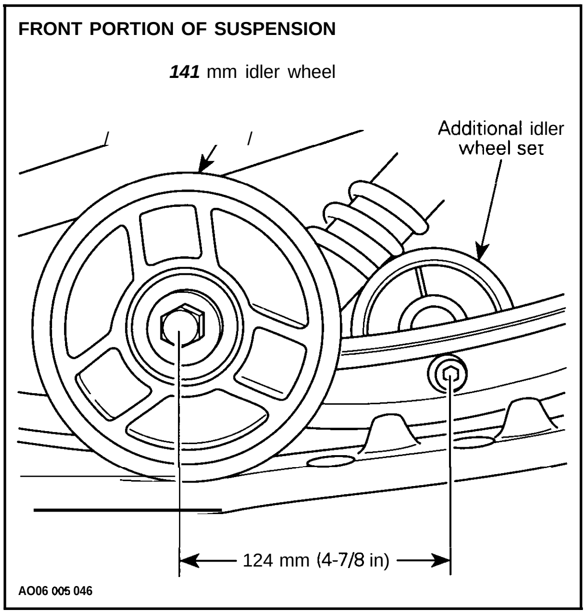
P / N 405404600 Bearing (2)

P / N 371907600 Snap Ring (2)

If these idler wheels **ass'y** are not available, order:

P / N 570043500102 mm Idler Wheel Ass'y **(2)**





Adjust original center spring to stiffer position.

Replace original stopper strap with a 50 mm (2 in) shorter one (P/ N 4860562 00).

Shock pivot can be bolted to front holes.

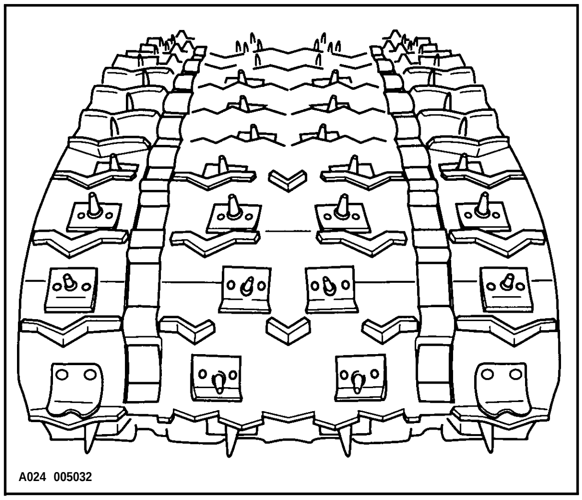
TRACK

Install studs on the track as per following illustration.

NOTE : When installing track studs, replace both radiator protectors with higher ones (p/ N 4148382 00).

CAUTION : Track studs should not interfere with protectors.

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 in track strength to name a few.**



FRONT SUSPENSION

Collapse front suspension until lower and upper arms are horizontal. Tie suspension to limit travel (reduced to 75 mm (3 in) in that position using straps on shock bolts).

Replace carbide runner with standard runner (P/ N 5050638 00).

DRIVE SYSTEM

DRIVE PULLEY

Replace original spring with a Violet (P/N 417 2057 20) 254 lb (Comet P / N 207758A).

Engagement speed should beat 4500 RPM.

Maximum engine RPM is 8400.

DRIVEN PULLEY

Install a 54° cam (P/N 4860563 00).

Adjust spring preload to 6.4 kg (14 lb).

CHAIN CASE

Replace original top and bottom sprockets along with drive chain with the following :

24-tooth sprocket (P/ N 5041397 00).

44-tooth sprocket (P/ N 5040855 00).

Drive chain (74 links) (P/ N 4121069 00).

DRIVE BELT

Use drive belt (P/ N 4147948 00).

ENGINE

AIR SILENCER

Remove foams from both air silencer inlets.

CARBURETION

▼ CAUTION : **Following carburetor calibration is for grass racing at 20°C (68°F).**

	PTO	CTR	MAG
MAIN JET (p/ N 4041004 00)	**270**	**270**	**270**
NEEDLE JET (P/ N 404149UOO)	**Y-3 (327)**	**Y-3 (327)**	**Y-3 (327)**
JET NEEDLE	8DH2-3	8DH2-3	8DH2-3
PILOT JET (p/ N 4041448 00)	**50**	**50**	**50**
AIR SCREW	**1/8**	**1/8**	**1/8**
POWER JET	**CLOSE** ①	CLOSE	CLOSE
THROTTLE SLIDE (p/ N 4041494 00)	3.5 CUT-AWAY	3.5 CUT-AWAY	3.5 CUT-AWAY
VALVE SEAT (p/ N 4041495 00)	1.5 VITON	1.5 VITON	1.5 VITON

① Obstruct power jet circuit by inserting a ball bearing in hose or by soldering power jet orifice with tin.

NOTE : This is a service tip, no warranty applies.

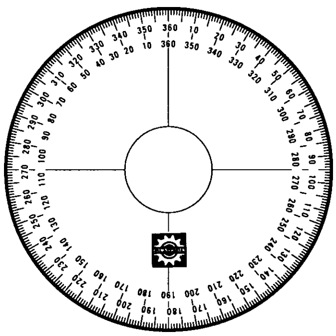
SERVICE TOOLS

ENGINE (Mandatory service tools)

NOTE : The numbers outlined in black (example : ❑) are reference numbers to tools from other divisions (Sea-Doo and /or Sea-Doo Jet Boats). Matching numbers are the same tool even if the part numbers are different.

Degree wheel **1**

(p/ N 4143529 00)



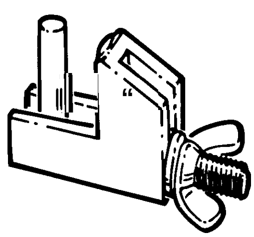
AOOB334

APPLICATION

All rotary valve engines.

Hose pincher (2) **2**

(P/ N 5290099 00)



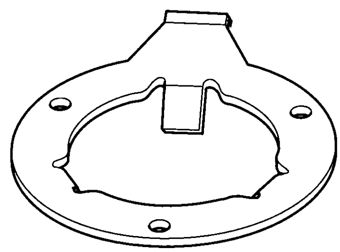
A01B214

APPLICATION

All vehicles.

Fan holder **3**

(p/ N 4208763 57)



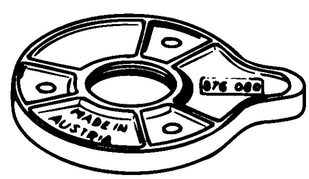
AOOCOQ4

APPLICATION

377, 443 and 503 engines.

Magneto puller ring

(p/ N 4208760 80)



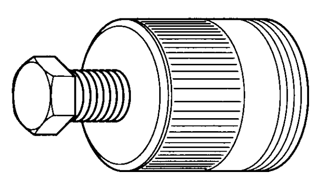
A00C1R4

APPLICATION

All engines except 247.

Magneto puller **5**

(p/ N 5290225 00)



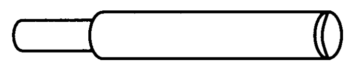
AOOC1A4

APPLICATION

All engines except 247.

Aligning pin (4)

(P / N 5290189 00)



AOOA1D4

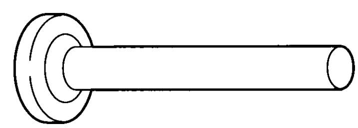
APPLICATION

467 and 582 engines.

Pusher **7**

(washer behind the impeller)

(p/ N 5290207 00)



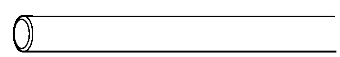
AOOC3H4

APPLICATION

Rotary valve engines.

Rotary valve shaft pusher

(P/ N 4208766 12)



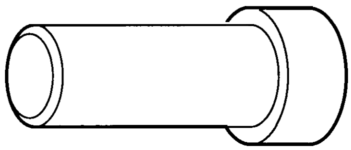
AOOCOF4

APPLICATION

Rotary valve engines.

ENGINE (Mandatory service tools)

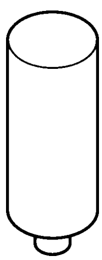
Rotary valve seal pusher
(p/ N 4208766 07)



A00C0Y4

APPLICATION
Rotary valve engines.

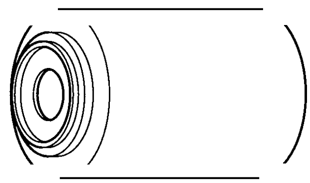
Seal pusher (water pump) 10
(p/ N 4208765 12)



A00C374

APPLICATION
Rotary valve engines.

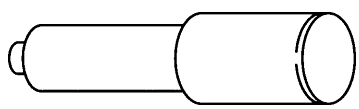
Rotary valve shaft seal pusher (coolant pump side)
(p/ N 4208770 50)



A00C0X4

APPLICATION
Rotary valve engines.

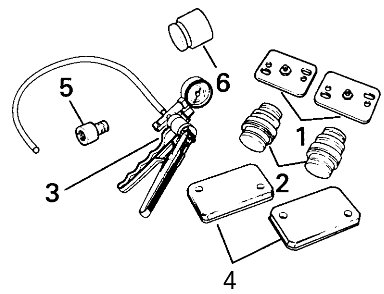
Bearing pusher (rotary valve) 12
(P/ N 4208765 00)



A00B2J4

APPLICATION
Rotary valve engines.

Engine leak tester kit
(P/ N 8617491 00)



A01B2D4

APPLICATION
All engines.

Parts included in the kit :

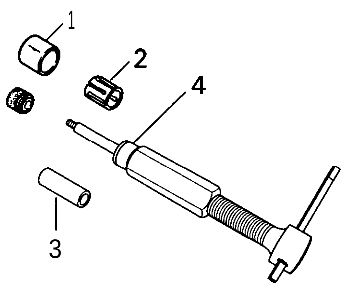
1) Exhaust oulet plug (2)
(p/ N 5290246 00)
2) Intake manifold plug (2)
(p/ N 5290110 00)
3) Air pump (1)
(p/ N 5290218 00)
4) RAVE system plug (2)
(p/ N 5290112 00)
5) Adapter (2)
(p/ N 5172349 00)
6) Intake manifold plug -779
(p/ N 5290305 00)

2-1/4 in plug (1)
(p/ N 5290211 00)
2-3/4 in plug (1)
(P/ N 5290212 00)
Plates (2)
(P/ N 5290213 00)
Radiator plug (1)
(P/ N 5290214 00)
Clamp (1)
(p/ N 4088035 00)
Adapter 3/1 6 ID x 1/8 NPT
(p/ N 4082011 00)

NOTE : Must maintain a pressure of 5 lb during 3 minutes. Never pressurize over 5 lb.

ENGINE (Mandatory service tools)

Piston pin puller **16**
P / N 5290290 00)



A01B4H4

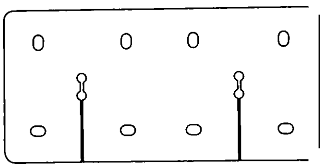
APPLICATION

All engines.

Parts included :

1) **Locating sleeve (3)**
   (p/ N 5290238 00)
2) **Expansion sleeve (3)**
   (p/ N 5290237 00)
3) **Adaptor**
   (P/ N 5290236 00)
4) **Bushing**
   (p/ N 5290277 03)

Rubber pad **17**
(P/ N 5290234 00)

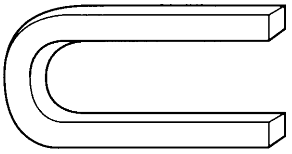


A01B4C4

APPLICATION

All cageless **bearing engines (277 and 503).**

Rotary valve circlip **tool**
A) **(p/N 5290291** 00) **18**
B) (P / N 5290208 00) **15**



A00C3I4

APPLICATION

A) 454 and 670 engines.

B) All rotary valve engines except the 454 and 670.

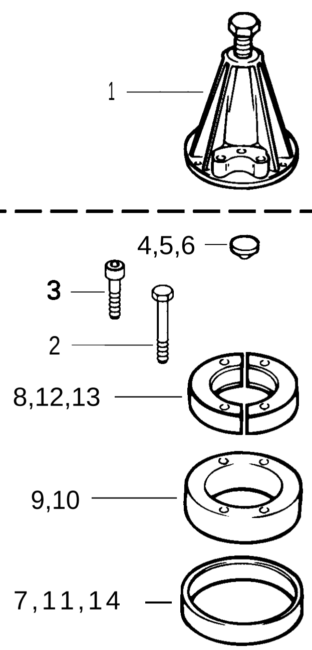
ENGINE (Optional service tools)

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

1- Crankshaft puller assembly (p/ N 4208762 98) **200**

For 779 : (p/ N 4208776 35) **250**

With 145 mm scre (P/ N 4209407 55) **258**



AOOC3L4

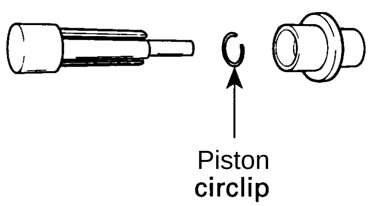
APPLICATION

All engines.

2- Screw M8 x 70 (4)	P / N 420841201	**500**
All engines except 247.		
3- Screw M8 x 40 (4)	P / N 420840681	**559**
247, 277, 467 and 670 engines.		
4- Crankshaft protector PTO	P / N 420876552	**259**
All engines except 247.		
5- Crankshaft protector MAG	P / N 420976890	**200**
247 engine.		
6- Crankshaft protector MAG	P / N 420876557	**554**
All engines except 247.		
7- Puller ring	P / N 420977480	**257**
All engines.		
8- Half ring ass'y	P / N 420276025	**558**
All engines except 377, 503 and 779.		
9- Distance ring	P / N 420876565	**261**
All engines except 247 and 277.		
10- Distance ring	P / N 420876569	**557**
377, 443, 503, 582, 583 and 670 engines.		
11- Puller ring	P / N 420977490	**555**
All engines.		
12- Half ring	P / N 420977475	**556**
All engines except 247 and 779.		
13- Half ring ass'y	P / N 420977479	**252**
779 engine.		
14- Puller ring	P / N 420977494	**251**
779 engine.		

ENGINE (Optional service tools)

Piston circlip installer
A) (p/N 5290169 00) **202**
B) (P/N 290 877 076) **548**



A01B1P4

APPLICATION

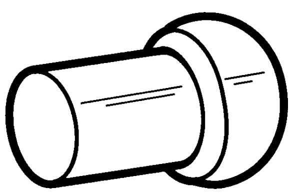
A) All engines except 670.

B) 670 engines.

Piston pin / connecting rod bearing centering tool **203**

(p/ N 5290091 00)

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



A01B1RA

APPLICATION

All engines.

Ring compressor

A)(P/N4208760 90) **204**
(62 mm)

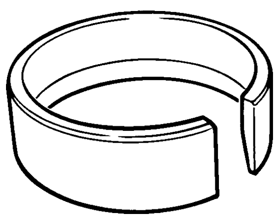
B) (P/N 4208769 74) **205**
(69.5 mm)

C) (P/N 4208769 70) **206**
(72 mm)

D) (P / N 4208769 72) **207**
(76 mm)

E) (p/N 4208769 75) **208**
(67.5 mm)

F) (P/N 5290308 00) **262**
(78 mm)



A01B1T4

APPLICATION

A) 377 engines.

B) 467 engines.

C) 503, 253 and 536 engines.

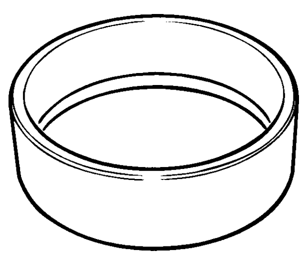
D) 582, 583 and 643 engines.

E) 447 engines.

F) 670 engines.

Magneto coil centering ring **209**

(p/ N 4208769 22)



A01B1V4

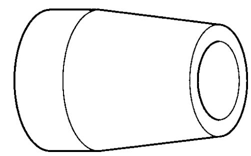
APPLICATION

All engines with Nippondenso CDI (160 W).

Seal protector sleeve

(p/ N 4209779 10) **210**
(PTO)

(p/ N 4202769 00) **211**
(MAG)



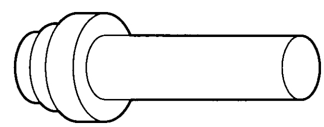
A0OCOD4

APPLICATION

247 engine.

Engine seal pusher **212**

(p/ N 4209779 20)



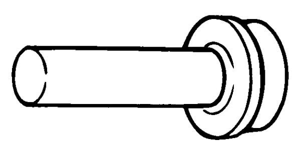
A0OCOV4

APPLICATION

247 engine.

Polyamid ring pusher **213**

(p/ N 420 2769 30)



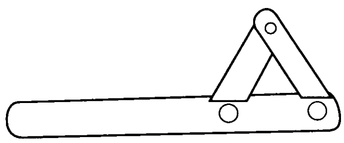
A0OCOZ4

APPLICATION

247 engine.

ENGINE (Optional service tools)

Magneto holder **215**
(P/ N 4209765 50)

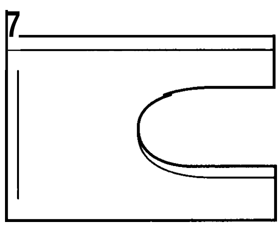


AOOC1V4

APPLICATION

247 engine.

Crankshaft feeler gaug 216
P / N 4208766 20)

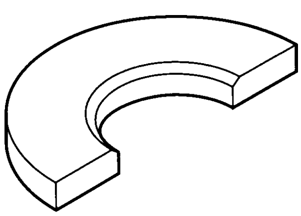


AOOC114

APPLICATION

377, 443, 447 and 503 engines.

Crankshaft distance gauge **217**
(p/ N 4208768 22)

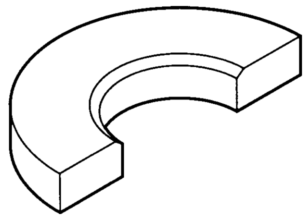


AOOC294

APPLICATION

377, 443 and 447 engines.

Crankshaft distance gauge **218**
(P/ N 4208768 24)

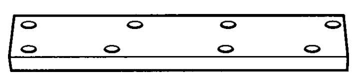


AOOC3A4

APPLICATION

503 engine.

Cylinder aligning tool
A) (P / N 4208769 02) **220**
(on exhaust side)
B) (P / N 4208761 71) **221**
(on intake side)



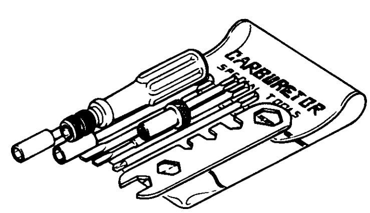
AOOBOB4

APPLICATION

A) 467, 536, 537, 582, 583, 643 and 670 engines.

B) 377, 443, 447 and 503 engines.

Mikuni carburetor tool kit **222**
(p/ N 4041120 00)

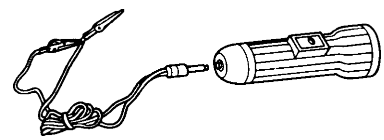


AOOB2F4

APPLICATION

All models.

Circuit tester **223**
(continuity light)
(p/ N 4140122 00)

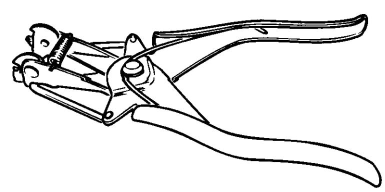


A00C214

APPLICATION

All vehicles.

Piston ring expander **224**
(p/ N 5290097 00)

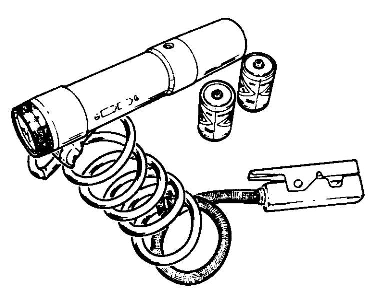


A01B2G4

APPLICATION

All engines.

Stroboscopic timing light **225**
(p/ N 5290092 00)



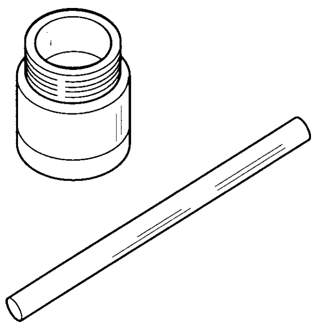
A01B2K4

APPLICATION

All engines.

ENGINE (Optional service tools)

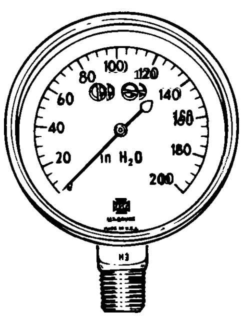
RAVE movement indicator **226**
(P/ N 8617258 00)



A18B014

APPLICATION
All RAVE equipped engines.

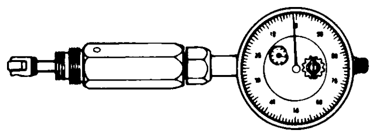
Air pressure gauge, 0-200 inch of water **227**
(p/ N 5290104 00)



A18B034

APPLICATION
For pressure testing gauge.

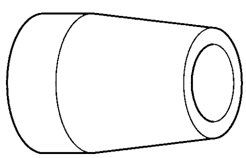
Dial indicator (TDC gauge) **230**
(p/ N 2950001 43)



AOOB2E4

APPLICATION
All engines.

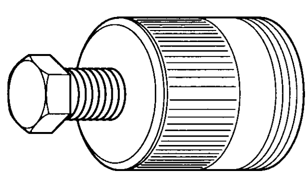
Seal protector sleeve
A) (p/N 4208769 80) (for 10 mm shaft) **231**
B) (P/N 4208764 90) (for 12 mm shaft) **232**



AOOCOD4

APPLICATION
467, 582, 583 and 670 engines.

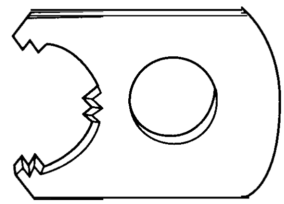
Magneto puller **233**
(p/ N 4209762 35)



AOOC1A4

APPLICATION
247 engine.

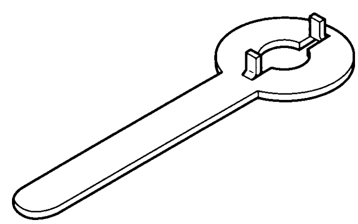
Injection pump gear holder **234**
(p/ N 4208766 95)



AOOB314

APPLICATION
253, 377, 447 and 503 engines.

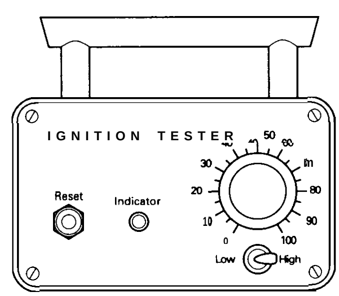
Injection pump gear holder **235**
(P/ N 4202779 05)



A00C164

APPLICATION
467, 494, 536, 537, 582, 583, 643, 670 and 779 engines.

Bombardier magneto tester **236**
(P/ N 4190033 00)



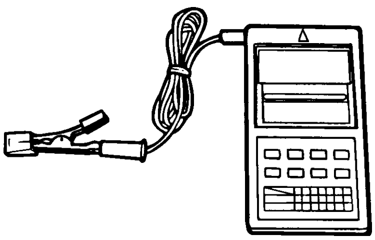
AOOC1K4

APPLICATION
All engines.

ENGINE (Optional service tools)

Digital / induction type tachometer **237**

(p/ N 5290145 00)



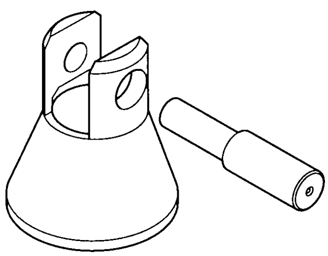
F01B1G4

APPLICATION

All engines.

Connecting rod holder **238**

(p/ N 4209779 00)



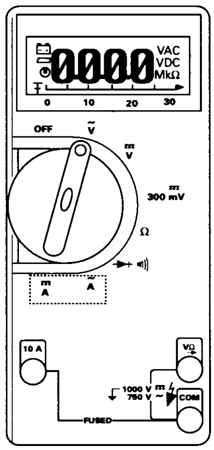
A00C0N4

APPLICATION

247 engine.

Fluke multimeter **242**

(p/ N 5290220 00)



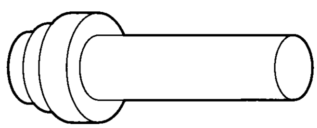
F01B1O4

APPLICATION

All models.

MAG seal pusher **243**

(p/ N 4202778 75)



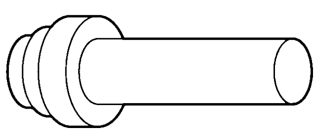
A00C0V4

APPLICATION

277 engine.

PTO seal pusher **244**

(P/ N 420 8766 60)



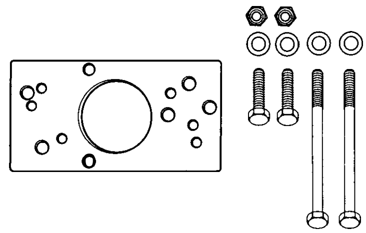
A00C0V4

APPLICATION

277 engine.

Base puller plate kit **245**

(p/ N 5290249 00)



A05C0M4

APPLICATION

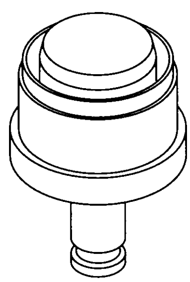
277 engine.

Insertion jig **247**

(Magneto **side seal)**

(P/ N 4208765 16)

NEW



A00C3TA

APPLICATION

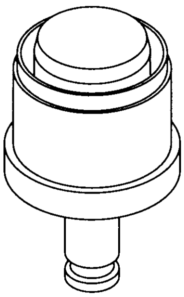
779 engine.

ENGINE (Optional service tools)

Insertion jig (Magneto seal) **248**

(p/ N 4208765 14)

N E W



AOOC3UA

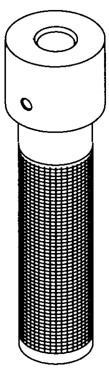
APPLICATION

454 and 670 engines.

Handle for insertion jig **249**

(p/ N 4208776 50)

N E W



AOOC3V4

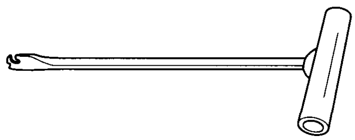
APPLICATION

454, 670 and 779 engines.

Exhaust spring installer/ remover **253**

(P/ N 5290281 00)

N E W



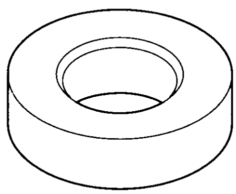
AOOC3S4

APPLICATION

All models.

Bearing simulator **219**

(p/ N 4208761 55)



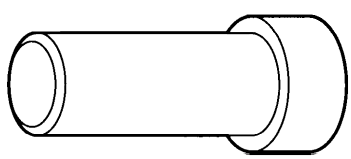
A00C1H4

APPLICATION

253, 305, 343, 402 and 440 engines.

Rotary valve seal and shaft pusher **229**

(P/ N 4208766 05)



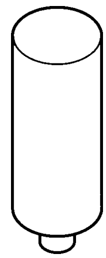
AOOCOY4

APPLICATION

Rotary valve engines 1990 models and older.

Seal pusher (rotary valve) **240**

(p/ N 4208765 10)



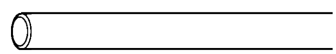
AOOC374

APPLICATION

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

Rotary valve shaft pusher **239**

(p/ N 4208766 10)



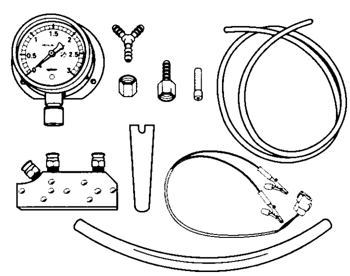
AOOCOF4

APPLICATION

All rotary valve engines with 12 mm shaft.

Self fuel control injection (S. F. C. I.) system test kit **241**

(p/ N 8617391 00)



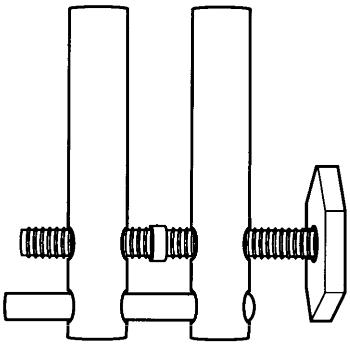
A28E034

APPLICATION

1993 Formula Plus EFI.

ENGINE (Optional service tools)

Large hose pincher **773**
(P/ N 5290304 00)

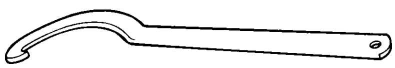


F01B234

APPLICATION
All vehicles.

TRANSMISSION (Mandatory service tools)

Clutch holder **51**
(p/ N 5290064 00)

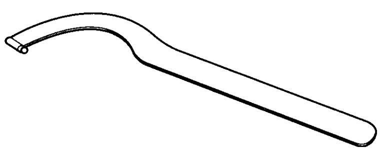


A01B154

APPLICATION

All TRA **drive pulleys.**

Clutch holder **79**
(p/ N 5290276 00)

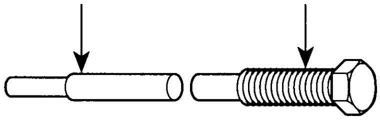


A02B034

APPLICATION

Bombardier Lite **drive pulley.**

Drive pulley puller **53**
(p/ N 5290275 00)
Consists of :

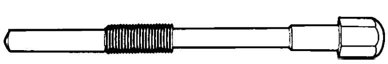


A00C094

APPLICATION

Bombardier Lite drive pulley, except Elan.

TRA drive pulley puller **75**
(P/ N 5290224 00)

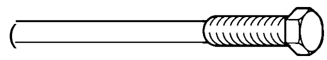


A06B014

APPLICATION

TRA **drive pulley** for the 454,494, 599, 670 and 779 engines.

TRA drive pulley puller **55**
(p/ N 5290079 00) (25 mm)

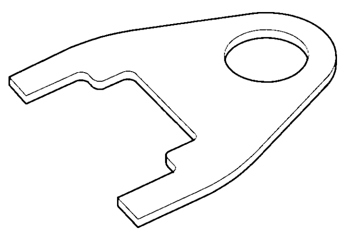


A18B044

APPLICATION

TRA **drive pulley (except 599,670 and 779 engines).**

Forks (3) **57**
(p/ N 5290055 00)

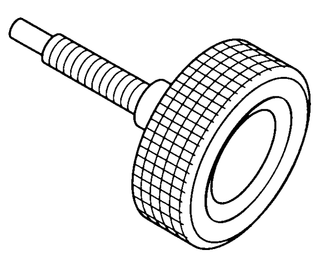


A16B014

APPLICATION

All vehicles equipped with a TRA **drive pulley.**

Drive belt installer **58**
(p/ N 5290172 00)

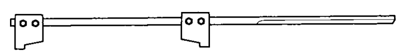


AOOA1A4

APPLICATION

All vehicles except Elan and Tundra II.

Alignment bar
A) (P/N 5290267 00) **78**
B) (p/N 5290269 00) **C0**
C) (p/N 5290300 00) **80**
D) (P / N 5290268 00) **73**

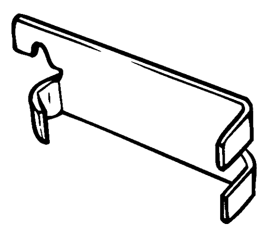


A01B4D4

APPLICATION

A) F-Series and S-Series with 503.
B) Tundra II.
C) S-Series with Bombardier Lite **drive pulley.**
D) Safari L and Skandic.

Spring scale hook **62**
(p/ N 5290152 00)



A01B514

APPLICATION

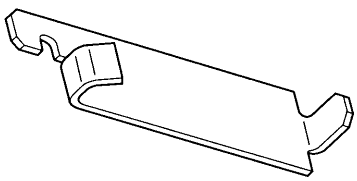
1994 models and older except Alpine II.

TRANSMISSION (Mandatory service tools)

Spring scale hook **84**

(p/ N 5290309 00)

NEW



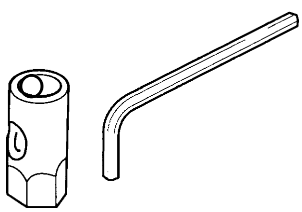
A00B4A4

APPLICATION

F-Series and S-Series (1 995 and newer).

Drive belt tension adjuster tool **63**

(P/ N 5290087 00)



A15B044

APPLICATION

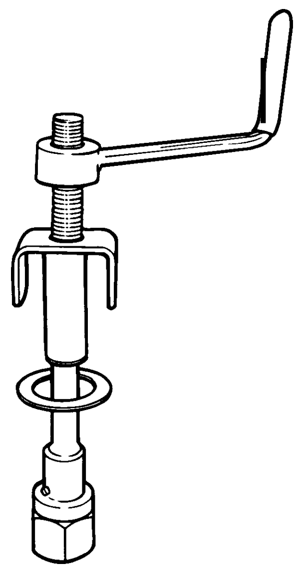
All vehicles except Elan, Tundra II and Skandic WT.

Spring compressor / TRA clutch flare tool **64**

(f' /N **5290186** 00)

Parts included in the kit:

1) Spring compressor
(P/ N 5290151 00)



A01B334

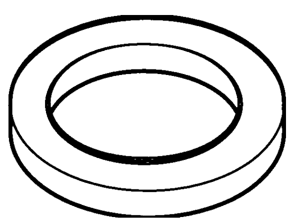
APPLICATION (1)

S and F-Series and Alpine II driven pulley type.

All TRA pulley.

3) **Washer (2)**

(p/ N 7329000 *15)*



A01B3T4

APPLICATION (3)

All applications.

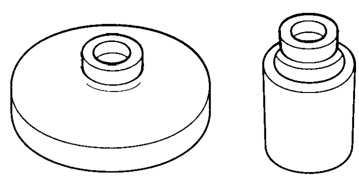
2) **TRA clutch spring cover bushing flare tool**

A) INTERIOR flare tool
(p/ N **5290180** 00)
EXTERIOR flare tool
(P/ N 5290181 00)

NOTE : Letter A stamper on tools.

B) INTERIOR flare tool
(p/ N 5290182 00)
EXTERIOR flare tool
(P/ N 5290183 00)

NOTE : Letter B stamper on tools.



A01B3F4

APPLICATION (2)

A) TRA **pulley (25** mm shaft).

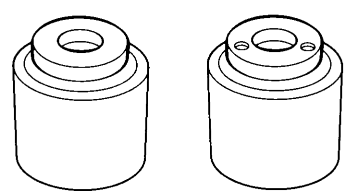
B) TRA **pulley (27** mm shaft).

4) TRA clutch outer half bushing flare tool

INTERIOR flare tool
(P/ N 5290184 00)

EXTERIOR flare tool
(P/N *5290185* 00)

NOTE : Letter C stamper on tools.



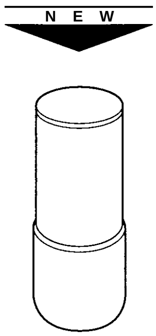
A01B314

APPLICATION (4)

All TRA drive pulleys.

T'TRANSMISSION (Mandatory service tools)

Burnishing bar **77**
(P/ N 5290264 02)

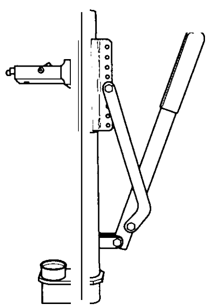


A00B464

APPLICATION

Safari L and Skandic.

Shock spring remover kit **65**
(p/ N 5290271 00)
Parts included in the kit :
Pin
(p/ N 4145284 00)

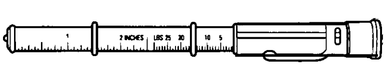


A01B404

APPLICATION

All suspensions with coil spring.

Tension tester **74**
(p/ N 4143482 00)

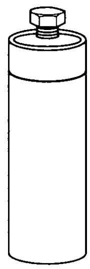


AOOC074

APPLICATION

All models.

Countershaft bearing installer **83**
(p/ N 5290302 00)

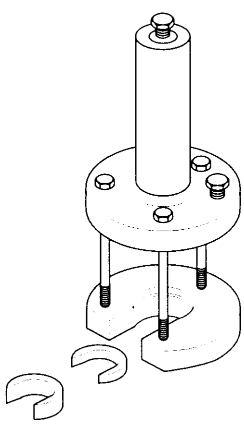


AOOA194

APPLICATION

S-Series and F-Series.

Countershaft **bearing remover** **82**
(p/ N 5290301 00)



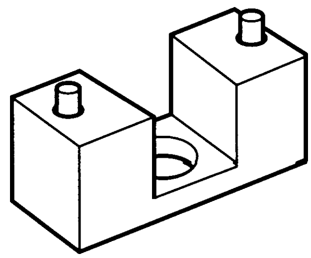
Q

A00A274

APPLICATION

S-Series and F-Series.

Spring cover tool **81**
(p/ N 5290273 00)

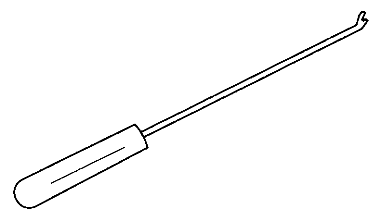


A01B4M4

APPLICATION

Bombardier Lite drive pulley.

Transmission adjuster **76**
(p/ N 5290285 00)



AOODOX4

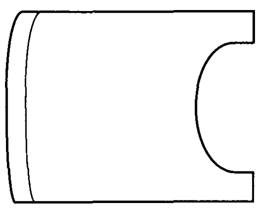
APPLICATION

F-Series equipped with reverse gear.

TRANSMISSION (Optional service tools)

Alignment tool **306**

(p/ N 4204760 10)



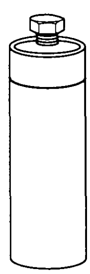
A00C1D4

APPLICATION

Skandic WT **and Alpine II gear-box.**

Contershaft **bearing installer** **501**

(p/ N 5290188 00)



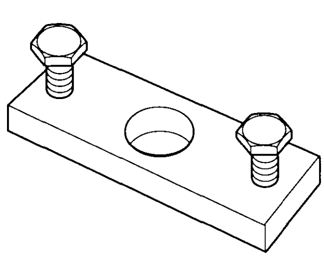
A00A194

APPLICATION

PRS **chassis.**

Cam pusher **309**

(p/ N 5290129 00)



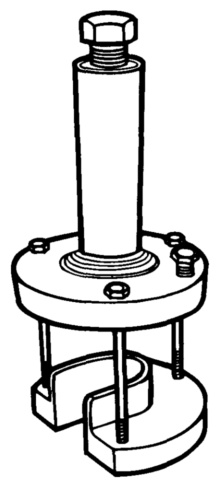
A18B064

APPLICATION

Tundra II **LT.**

Contershaft bearing remover **502**

(P/ N 5290187 00)



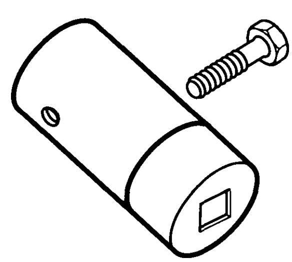
A00A164

APPLICATION

PRS **chassis.**

Drive pulley puller **318**

(P/ N 5290231 00)



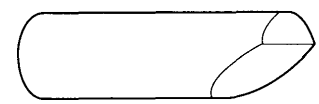
A00C3J4

APPLICATION

Elan.

Transmission ball mounting pin **305**

(p/ N 4204760 20)



A00C1C4

APPLICATION

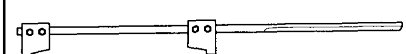
Alpine II 3-speed transmission.

Alignment bar

A) (P/N 5290256 00) **324**

B) (P/N 5290282 00) **320**

C) (P/N 5290283 00) **321**



A01B4D4

APPLICATION

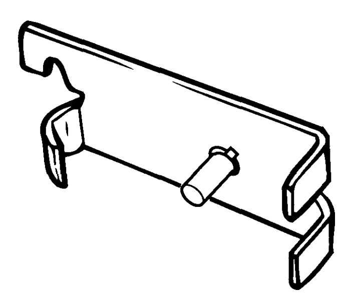
A) PRS **chassis.**

B) Alpine II.

C) Elan.

Spring scale hook **323**

(p/ N 5290065 00)



A01B174

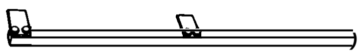
APPLICATION

Alpine II 1994 and older.

TRANSMISSION (Optional service tools)

Alignment template **300**

(p/ N 5290083 00)



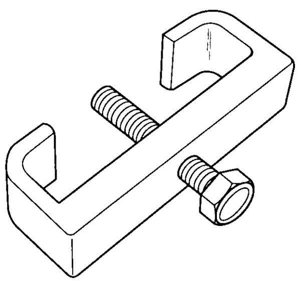
A03B034

APPLICATION

scout.

Driven pulley support extractor **310**

(p/ N **5290135** 00)



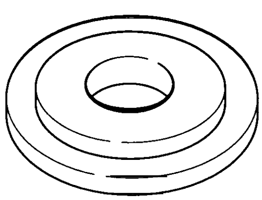
A25B0F4

APPLICATION

Safari (except Cheyenne), Stratos / E, Citation E / LS / LSE, Escapade, Skandic 503, SS-25 and Formula SP / SS (no vehicles equipped with reverse).

TRA **clutch spring cover remover cap** **312**

(p/ N **5290103** 00)



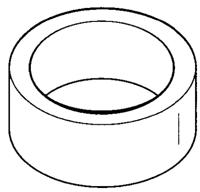
A16B054

APPLICATION

TRA **clutch (drive pulley).**

Spacer **311**

(p/ N 5290054 00)



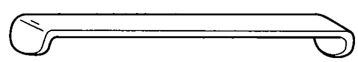
A16B044

APPLICATION

TRA **clutch (drive pulley).**

Drive pulley retainer **313**

(P/ N 5290017 00)



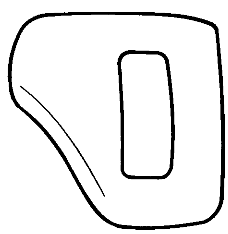
AOOC224

APPLICATION

Round shaft drive pulley.

Transmission shifter template **314**

(p/ N 5290198 00)



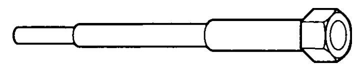
A15H3J4

APPLICATION

1991 to 1994 PRS chassis.

Drive pulley puller **319**

(p/ N 5290021 00)
(Standard threads)



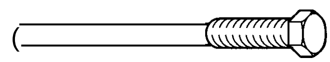
A00C084

APPLICATION

Square shaft, standard (SAE) threads.

TRA drive pulley puller (27 mm) **322**

(p/ N 5290101 00)



A18B044

APPLICATION

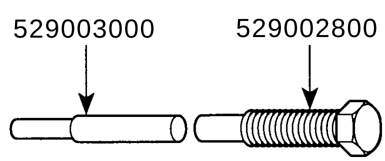
TRA **drive pulley (27 mm) shaft except 454, 670 and 779 engines.**

Drive pulley puller **400**

(P/ N 8604142 00)

(square shaft metric)

Consist of :



A00C095

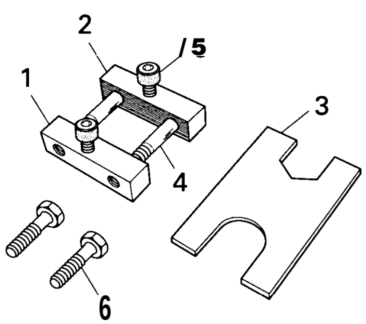
APPLICATION

Square shaft, metric threads drive pulley.

T'TRANSMISSION (Optional service tools)

Drive axle sprocket adjuster **340**

(p/ N **8617257** 00)



A01B204

APPLICATION

All vehicles except Elan.

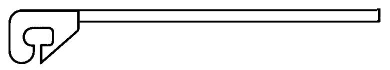
Parts included in the kit :

1) Block with threads (P/ N 5290107 00)
2) Block without threads (p/ N 5290108 00)
3) Plate (P/ N 5290106 00)
4) Bolt Ml O (2) (p/ N 2220075 00)
5) Allen screw M8 (2) (p/ N 420 840991)
6) Screw M8 (2) (p/ N 2220825 65)

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

Transmission adjuster **504**

(P/ N 5290303 00)



A03D1T4

APPLICATION

vehicles equipped with "push-**pull"** reverse transmission.

SUSPENSION (Optional service tools)

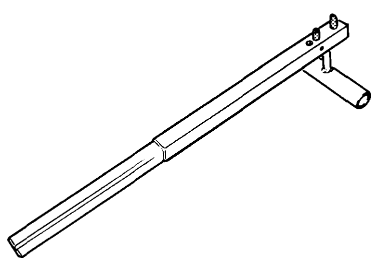
A) Track cleat remover **345**

(p/ N 5290082 00)

Pins **346**

(p/ N 5290082 04)

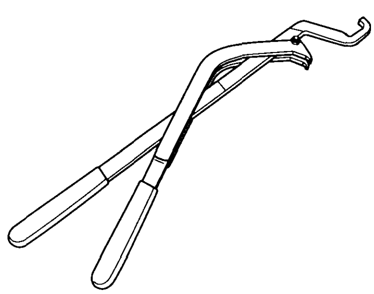
NOTE : Pins can be rotated 180° depending on whether the tool is used by a left-hander or right-hander.



A01B1J4

B) TRA track cleat remover **254**

(p/ N 5290287 00)



A01F224

APPLICATION

A) 1993 and older.

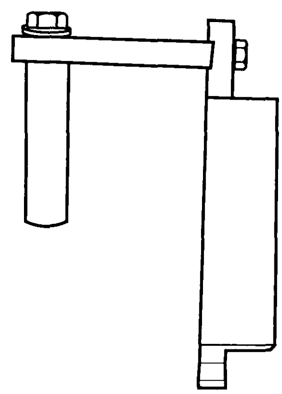
B) 1994 and newer except Elan and Tundra II.

Camber angle tool **343**

(p/ N 5290216 00)

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

Suggestion : K-D tool no. 2968



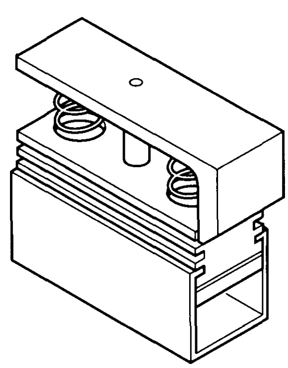
A06B024

APPLICATION

All DSA front suspensions.

Track tension gauge **342**

(P /N 5290215 00)



AOOB3X4

APPLICATION

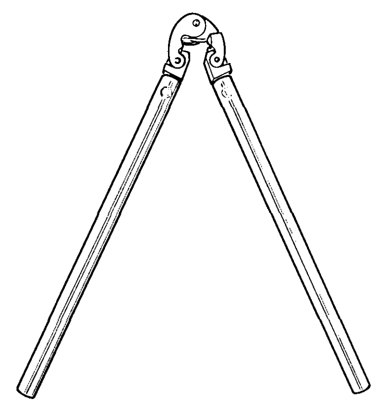
All models except Elan.

Track cleat installer

A) (p / N 5290085 00) **347**
Narrow

B) (p/N 5290288 00) **255**
Narrow

C) (P/N 5290077 00) **344**
Wide



A01B1M4

APPLICATION

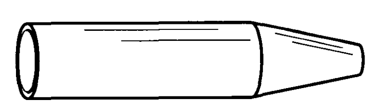
A) 1993 and older.

B) 1994 and newer.

C) 1992 and older with wide cleat opening.

Dome guide **349**

(P / N 529 0265 00



A06F1B4

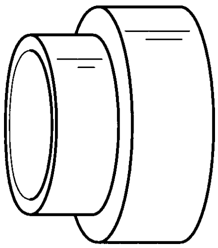
APPLICATION

MX Z T / A shocks.

SUSPENSION (Optional service tools)

Piston guide **500**

(p/ N 5290266 00)



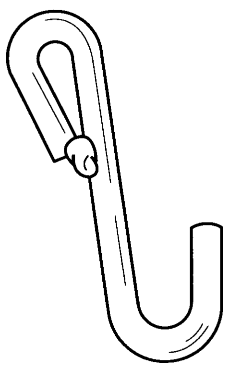
A06F1C4

APPLICATION

MX Z T / A shocks.

Suspension spring installer (hook) **325**

(p/ N 5290066 00)



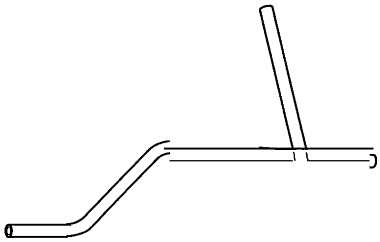
A19B034

APPLICATION

Cheyenne.

Spring installer (bar) **326**

(p/ N 5290050 00)



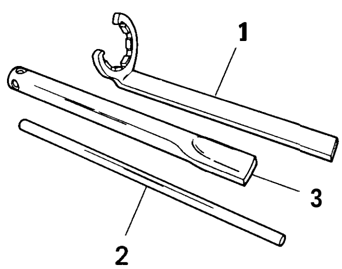
A00C114

APPLICATION

Tundra II / LT and Scout.

Spring cam adjuster key 330

(p/ N 8617317 00)



A25B0D4

APPLICATION

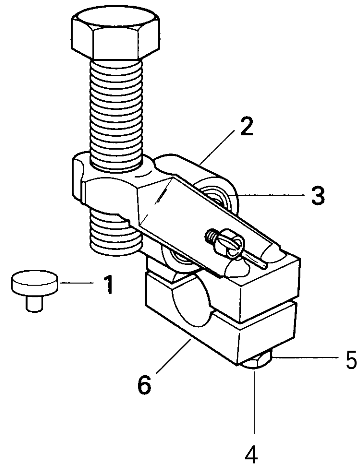
Safari A-arm suspension spring.

Replacement parts :

1) **Adjustment key**
   (p/ N 5290138 00)
2) **Handle**
   (p/ N 5290140 00)
3) **Key extension**
   (p/ N 5290139 00)

Bushing installer / remover **331**

(p/ N 5290119 00)



A25B054

APPLICATION

A-arm suspension.

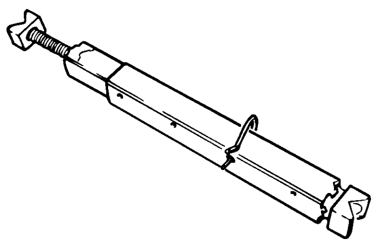
Parts included in the kit:

1) **Buffer**
   (p/ N 5290118 00)
2) **Outer sleeve**
   (p/ N 5290125 00)
3) **Inner sleeve**
   (p/ N 5290126 00)
4) **Hexagonal screw (2)**
   (p/ N 2220830 65)
5) **Flat washer (2)**
   (p/ N 224 081201)
6) **Lower retainer**
   (P/ N 5290121 00)

SUSPENSION (Optional service tools)

Drive axle holder **333**

(p/ N 5290072 00)



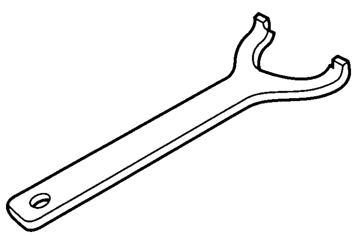
A01B1E4

APPLICATION

All models.

Kayaba shock adjustment tool **334**

(p/ N 5290190 00)



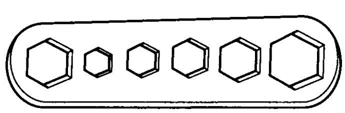
AOOA1K4

APPLICATION

C-7 suspension.

Hexagonal wrench **335**

(p/ N 5290147 00)



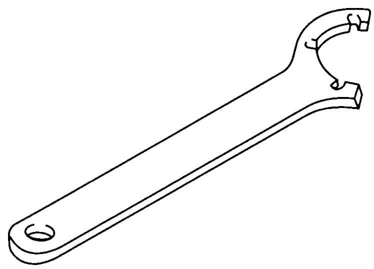
A19B024

APPLICATION

Safari and Skandic prior to 1995.

Suspension adjustment wrench **336**

(p/ N 5290122 00)



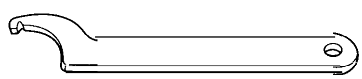
A25A014

APPLICATION

Rear suspension.

Suspension adjustment wrench **337**

(p/ N 5290098 00)



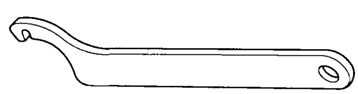
A24A014

APPLICATION

Models equipped with a mono-**shock suspension.**

Suspension adjustment wrench **338**

(p/ N 5290171 00)



A15B094

APPLICATION

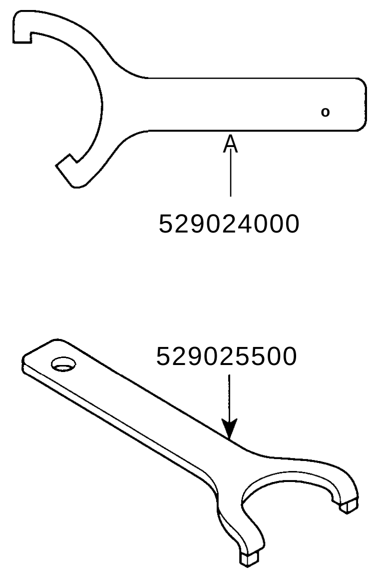
1992 and old Formula C-7.

Adjustment wrench **506**

(p/ N 8617439 00)

Consists of :

NEW



A00B4B4

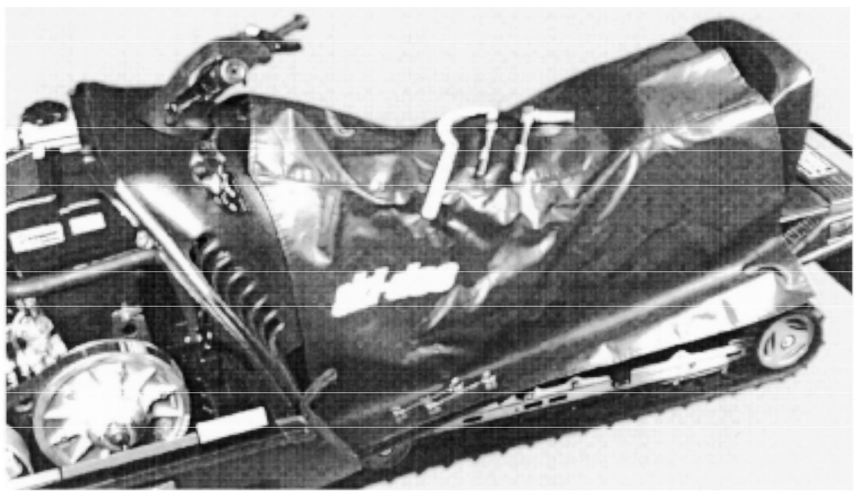
APPLICATION

T / A shock.

VEHICLES (Optional service tools)

Protective mat **503**

(P/N 5290306 00)



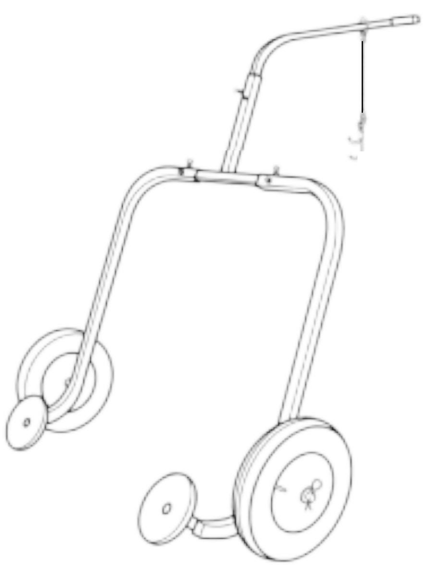
A01B45W

APPLICATION

All vehicles.

Dolly **348**

(P/N 52?3 0299 00)



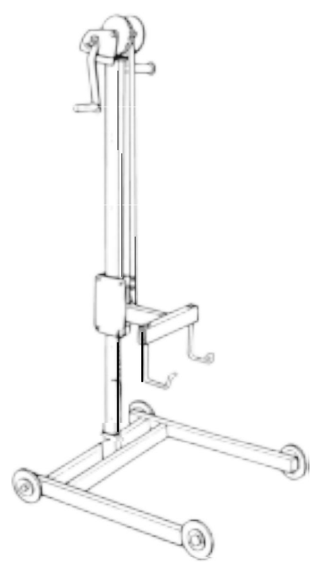
A60B4CJ

APPLICATION

All models.

Snowmobile jack **341**

(P/N 5290200 00)



A01A1JJ

APPLICATION

All models.

SERVICE PRODUCTS

MANDATORY SERVICE PRODUCTS

O NOTE : The numbers outlined in black (example : ❑)are reference to tool numbers from other divisions (Sea-Doo and / or Sea-Doo Jet Boats). Matching numbers are the same tool even if the part numbers are different.

Loctite® is a trademarks of Loctite Corporation.

Dow Corning” is a trademarks of Dow Corning Corporation.

Retaining compound **151**

(p/ N 4137031 00)

Loctite® RC / 609 :
Retaining compound (1 O mL)
(green)

AOOB2S4

APPLICATION

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

Paste gasket **152**

(p/ N 4137027 00)

Loctite°515 :
Gasket eliminator (50 mL)

AOOB2T4

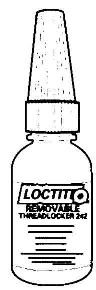
APPLICATION

Crankcase halves transmission and gearbox mating surfaces.

Medium-strength threadlocker **154**

(p/ N 4137030 00)

Loctite® 242 :
Threadlocker (1 O mL)
(blue, medium strength)



AOOB324

APPLICATION

Flywheel nut, crankcase studs, etc.

High strength thread locker **155**

(p/ N 4137074 00)

Loctite® 271 :
Threadlocker (1 O mL)
(red, high strength)

(TYPICAL)

A00B2U4

APPLICATION

Fasteners and studs up to 1“ diameter.

MANDATORY SERVICE PRODUCTS

Gasket / paint remov **156**

(p/ N 4137085 00)
Loctite® 79040 Chisel
510 g (18 oz)

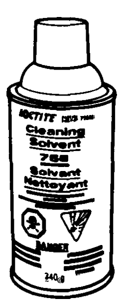
AOOB3L4

APPLICATION

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

Cleaning solvent **157**

(p/ N 4137082 00)
Loctite® 755-59
340 g (12 oz)



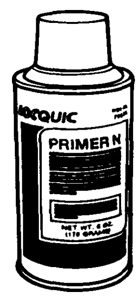
AOOB3M4

APPLICATION

Clean carburetor parts and degrease all oily surfaces.

Loctite® primer **158**

(p/ N 4137081 00)
Loctite® 764-56
Primer N
170 g (6 oz)



AOOB3N4

APPLICATION

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

Silicone compound **159**

(P/ N 420 897061)
Dow Corning® MS4

AOOB3R4

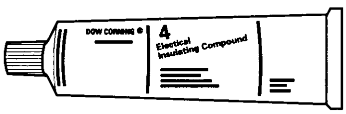
APPLICATION

Lubricate pawl and pawl lock of rewind starter.

OPTIONAL SERVICE PRODUCTS

Silicone dielectric grease (3 oz) **350**

(P/ N 4137017 00)



AOOB1X4

APPLICATION

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

Grease LMZ no. 1 (400 g) **351**

(p/ N 4137075 00)

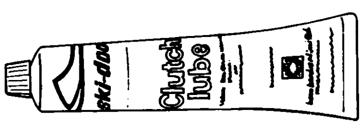
AOOB1Y4

APPLICATION

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

Clutch lube (4 oz) **352**

(P/ N 4138007 00)



AOOB1Z4

APPLICATION

Roller round shaft drive pulleys.

Chaincase oil **353**

(p/ N 4138019 00)

AOOB2R4

APPLICATION

Chaincase **lubricant on Elan and Tundra II.**

Synthetic chaincase **oil** **354**

(p/ N 4138033 00)

A01B4Q4

APPLICATION

Chaincase lubricant on all models except Élan and Tundra II.

Blizzard oil (12 x 500 mL) **355**

(p/ N 4138031 00)

A00B2Q4

APPLICATION

All models.

Injection oil

(p/ N 4138029 00) (12 x 1 liter) **356**

(p/ N 4138030 00) (3x 4 liter) **357**

F01B2H4

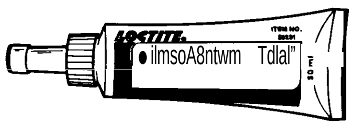
APPLICATION

All engines.

OPTIONAL SERVICE PRODUCTS

358

Pipe sealant
(p/ N 4137023 00)
Loctite 592 (50 mL)



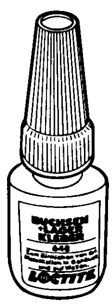
A00B2W4

APPLICATION

Engine plugs and senders.

359

High temperature threadlocker
(p/ N 4208997 88)
Loctite **648 (green)**
(5 g)



AOOB3D4

APPLICATION

For RAVE valve rod distance nut on 583, 670 and 779 engines.

362

Anti-seize lubricant
(p/ N 4137010 00)
Loctite anti-seize lubricant 454 g (16 oz)

F01B174

APPLICATION

Unpainted surfaces of drive pulley countershaft.

363

Bearing grease
(400 g)
(p/ N 4137061 00)

A00B2LJ

APPLICATION

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

364

Storage oil
(350 g spray can)
(p/ N 4960141 00)

AOOB384

APPLICATION

All models.

365

Degreaser
(P/ N413 7084 00)
Permatex® **48 TA**
433 g (15 oz)

AOOB3K4

APPLICATION

Engine, chaincase, pulleys and any greasy surfaces.

OPTIONAL SERVICE PRODUCTS

Gel instant adhesive **366**

(p/ N413 7083 00)

Loctite 454-40
20 g (.70 oz)

AOOB304

APPLICATION

Isolating foam and rubber strip.

Tough adhesive **367**

(P/ N413 4083 00)

Loctite **Black Max 38004**
3 mL **(.1 O** oz)

AOOB3P4

APPLICATION

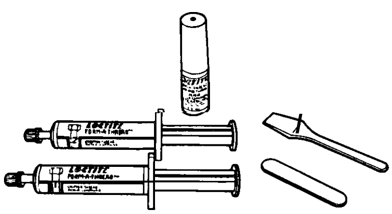
Shifter boot or grip.

Stripped threads repair kit **368**

(p/ N 4137086 00)

Loctite **81668**

Form-A-thread 81668



AOOA1J4

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.

HYLOMAR sealant **369**
(100 *g)*

(P/ N 4137071 00)

AOOB3F4

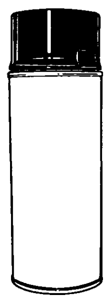
APPLICATION

To form an oil resistant seal (ex: transmission).

Paint for frame touch-up **370**

(p/ N413 4010 00)

Black semi-gloss
(spray can)



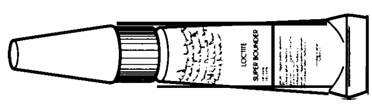
AOOB3H4

APPLICATION

All models with a black frame.

General purpose instant adhesive (495) **373**

(p/ N 4137032 00)



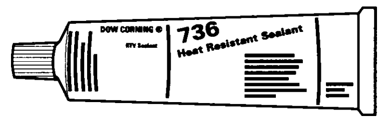
AOOB2V4

APPLICATION

Rubber to metal bonding and most hard plastic.

Sealant 736 Dow Corning **374**

(P/ N 4137092 00)



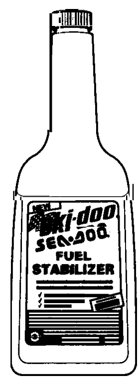
A00B3U4

APPLICATION

All models.

Fuel stabilizer **375**

(p/ N413 4086 00)



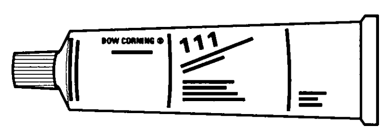
A00B3V4

APPLICATION

All models.

Molykote 111 **376**

(p/ N 4137070 00)



AOOB3W4

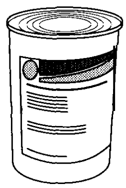
APPLICATION

Rotary valve shaft seals.

OPTIONAL SERVICE PRODUCTS

377

Shock oil
(1 liter)
(P/ N413 7094 00)

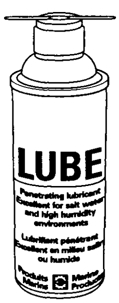


A06FOP4

APPLICATION
MX Z T / A shocks.

378

Bombardier Lube
(P/ N 2936000 16)



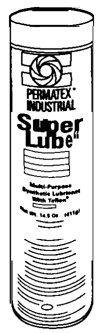
A01B4P4

APPLICATION
Steering ball joints on all models.

379

Super Lube (grease)
(P/ N 2935500 13)

NEW



AOOB474

APPLICATION
Tie rod bushings.

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 200psi.

Center

- Use medium spring pressure. You need some track pressure for traction but the front arm must be able to compress easily to absorb bumps.
- The limiter strap should be fairly short to keep front end lift to a minimum. Two to three inches of lift is plenty. A balance must be maintained between having enough traction and keeping the front end down for steering.

Rear suspension

- Spring pressure should be kept firm in order to reduce weight transfer and help keep the front end down on the ground.

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 1995 Summit.
- 861747500 Long track kit for DSA chassis with C-7 suspension
  (includes all parts and a 15x 136x 1.5 inch paddle track)
- 570207700 15x 136x 1.5 inch paddle track (1995 Summit)
- 861747800 Paddle track kit (includes a 15 x 121 x 1.5 inch paddle track
  and two taller tunnel protectors).
- 570208200 15 x 121 x 1.5 inch paddle track
- 414838200 Tall tunnel protectors for DSA short track chassis
- 570206800 15x 136x .912 inch deep lug track (1994 Summit)
- 570207000 15 x 121 x .912 inch deep lug track

Transmission

- **Use a** one tooth smaller than stock top sprocket.
- **Good** backshifting **is important. Use a few pounds more than normal preload on the driven pulley.**
- **Adjust the TRA to maintain optimum** RPM.

Driving style

- **Contrary to popular belief, constant full throttle is not always the fastest way to the top. Use your thumb to adjust for the conditions. Sometimes you need to back out of it to keep the track from spinning excessively. You need to keep your momentum up but you must keep the sled on the ground so your track is hooked up and the skis can steer you around any obstacles.**

For more Hillclimb **information contact Mark Thompson by fax at (801) 752-8249.**

DRAG RACING (ICE AND GRASS)

Special Rules

- Snow flap must be retained by chains or 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.
- 486066300 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 stock 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 (486 0562 00 nylon). On grass, more weight transfer can be used to keep the weight off the skis. On ice, run the limiter very short to keep ski lift to a maximum of six inches.

Rear suspension

- Lower the ride height to the two inch minimum.
- Grass : Soften preload to help weight transfer and keep the skis from dragging.
- Ice : Use a lot of preload to help keep the front end down for better top speed at the end of the chute.
- Add two pairs of additional idler wheels and replace the 135 mm diameter wheels with 141 mm diameter wheels.
- Shave the slider shoes down to a 3mm (1/8 inch) thickness.
- Add a slide lube system if rules allow.

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 x 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. Try some of the “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, 4to 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.

O 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 5000 RPM engagement. It is best to stay around 4800-4900 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, especially on the grass when pulley and belt temperatures are quite high (you may even want to ice the pulleys to enhance the cool down process. Just be sure all water is removed from the pulley surface and then clean them with acetone). Excessive pulley heat indicates belt slippage and you may need to recalibrate your clutch to "squeeze" the belt harder.
- Generally, you will find your quickest elapsed times by setting the clutches to run the engine 200 to 300 RPM below the normal power peak. TEST!!
- 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.
- 486066300 DSA front spring 125 lbs/in 8 inch free length
- 486066400 DSA front spring 150 lbs/in 8 inch free length
- Use the 3/4 inch diameter sway bar kit (580 6045 00).
- Camber : Left=O degrees Right= Negative 2 to 4 degrees
- Verify ski toe out at the carbide edge.
- Spot weld the upper deck to the lower portion of the steel skis. One inch every one inch is sufficient.
- MX-Z swing arms should be used or others should be reinforced by the radius rod mounts and a piece of angle welded lengthwise on the underside.
- 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 4860665 00(70 lbs/inch, 6 inch free length) and soft preload.
- Use a shorter nylon limiter strap (486 0562 00).
- Additional holes will need to be drilled in the MX-Z rubber straps.

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 maybe 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.
- Install a slide lubrication system with nozzles on the outside of the right hand slider shoes.

- Remove non guide clips and install Fill style taller track guides (486 0616 00) on the right side of the track.

Traction

- Most rules limit maximum stud height to 3/8 inch over the tallest part of the track. This equates to an .875 inch stud with a backer plate on the 94-95 stock tracks. Always verify your stud heights!
- 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 setup 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 setup 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!

A FEW WORDS OF WISDOM (learned the hard way)

"RIDING IS THE EASY PART, GETTING TO THE START LINE IS THE ULTIMATE CHALLENGE"

"TIME SPENT IN PREPARATION IS SELDOM WASTED"

"FIRST YOU MUST FINISH, BEFORE YOU CAN FINISH IN FIRST PLACE"

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 useage 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.**

RACE CIRCUIT RULES

Remember it is the driver and team's responsibility to have the sled race-ready in accordance with the rules of the circuit you race in. All races approved for Ski Doo's Winners Circle contingency awards are governed by the general rules laid out in the ISR annual handbook. It is common practise for the various race associations across North America to modify the ISR rules for local use. This does result in conflicting standards and therefore every driver must carefully check the rules.

Contact the following circuits for detailed race rules for Cross-Country and Sno-Cross competition;

ISR	— International Racing Association	— 414-335-2401
Isoc	— International Series Of Champions	—61 2-497-2222 Fax 428-8845
MRP	— Motorsports Racing Plus	— 612-786-7338
HRA	— Heartland Racing Association	— 218-547-1714
RMXC	— Rocky Mountain Cross Country	— 307-587-9835
RMR	— Rock Maple Racing	— 802-464-3284 Fax 464-1246
CCMQ	— Circuit de Courses de Motoneiges du Quebec Inc.	— 514-794-2298
CSRA	— Canadian Sno-X Racing Association	— 905-476-7182 Fax 476-7157
CAN-AM	— Cross-Country Racing Circuit	— 204-783-3385

PARTS SUPPORT — The factory may have an inventory of parts available to support various races but you should not count on it for total support. A well organized racer must be self-contained and should not count on anyone but himself for parts support!

CROSS BORDER INFORMATION

1. IF YOU ARE A CANADIAN OR US CITIZEN — You will need valid ID at both borders. This would include a birth certificate or a drivers license or a passport for all team members. The team manager should double check all members for ID before leaving the home town.
2. OTHER COUNTRIES — You will need a valid passport for all team members from countries other than the US or Canada.
3. BORDER CONFIRMATION — It is better to be safe than sorry, so if you have any doubt contact a border official directly and do it well before race time.
4. SNOWMOBILES AND SUPPORT VEHICLES — Ensure that all support vehicles and snowmobiles have valid ownerships, registrations and insurance for the state or province of origin. Do not forget about your trailer!
5. PARTS AND EQUIPMENT — As a general rule the border officials will let race teams pass with little difficulty but large inventories of parts that appear to have a retail use may be subject to a temporary bond.

6. HEALTH INSURANCE — Check your personal health insurance plan to see what coverage is in effect while in another country. You may want to supplement your existing policy with temporary Blue Cross or equivalent for the driver and all team members.

TEAM PRESS COVERAGE AND SPONSOR RECOGNITION

You should make sure that all current and future potential sponsors are looked after in a professional manner. Here are a few tips;

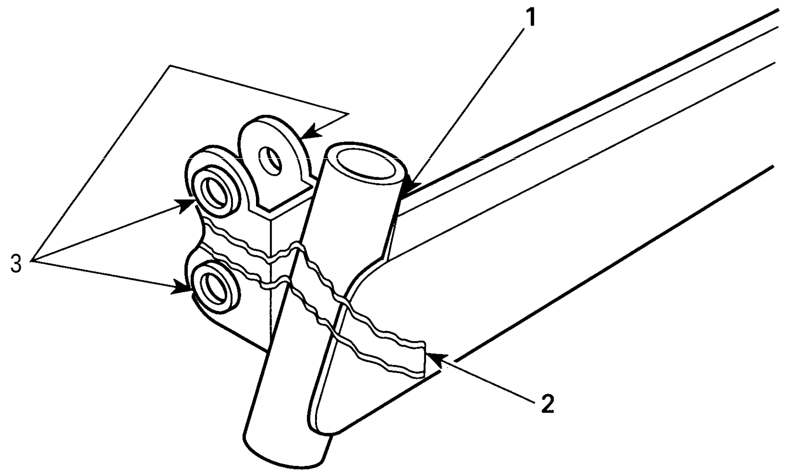
1. PRE RACE COVERAGE - press articles and newsletters
2. SLED AND TEAM IDENTIFICATION - jackets, hats, trailer graphics
3. RACE REPORT - phone back home daily to a central contact
4. POST RACE TEAM PHOTO AND REPORT - take a camera
5. THANK YOU LETTERS AND PRESENTATIONS - remember your crew

Front suspension

- Adjust the spring preload to get about 1.5 inches of sag from full extension to normal ride height with the driver on board.
- For more front end bite, use the 5/8 inch diameter sway bar.
- Steering ball joints should have as many jam nuts added as will fit between the tie rod and the ball joint. This helps prevent bending of the threaded portion of the ball joint.

SWING ARM REINFORCEMENT - When high speed lake racing using full race carbides you may want to add additional strength to the production **swingarms.** Strap the **swingarms as per attached sketch. Note 4130 chrome moly is used in the 1994/96 MX Z swingarm.**

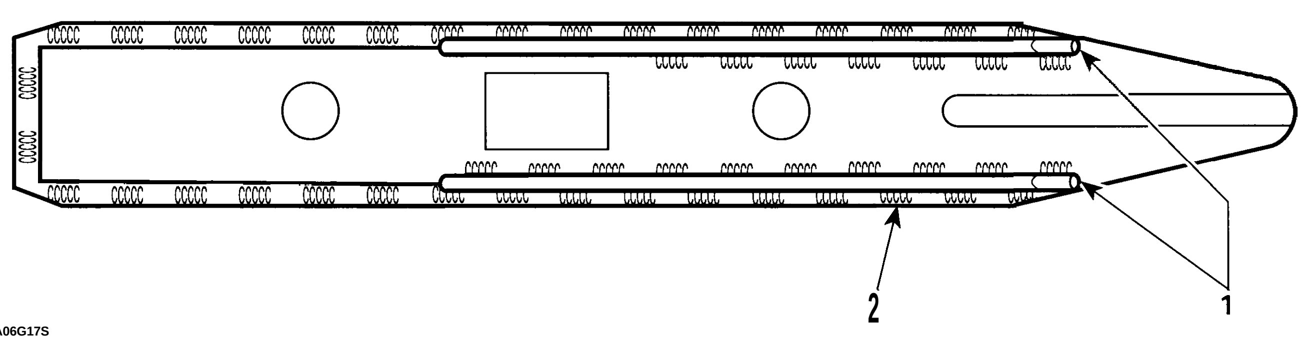
For extra strength you may want to weld a solid washer over each of the radius rod attachment holes located on the front swingarm and strap the swing arm to the ski spindle tube.



1. Reinforce weld on swingarmto spindle tube to radius rod bracket
2. Strap here
3. Add 1/8" thick washers over holes

FRONT END ALIGNMENT-STEEL SKI — The OEM steel skis are all tapered from front to back and will therefore give you an incorrect measurement when checking alignment using the outside edges as reference points. Measure your skis to determine the variance and compensate accordingly. Of course any carbide runner must be checked from the underside position across the sharpened edges for true alignment first.

STEEL SKI MODIFICATION — In some racing applications you may want to increase the strength of the OEM ski to withstand frontal impacts. Weld steel rod (1/4 inch) to the topside of both skis as per attached sketch. This should **be done to the left and right side of both skis and start 4 inches behind the ski spindle and go forward and into front upward curve. Top section of ski should be welded to bottom section. This is especially important for ice racing.**



1. Weld 1" every 1"
2. 1/4"@ reinforcing rod

CENTER

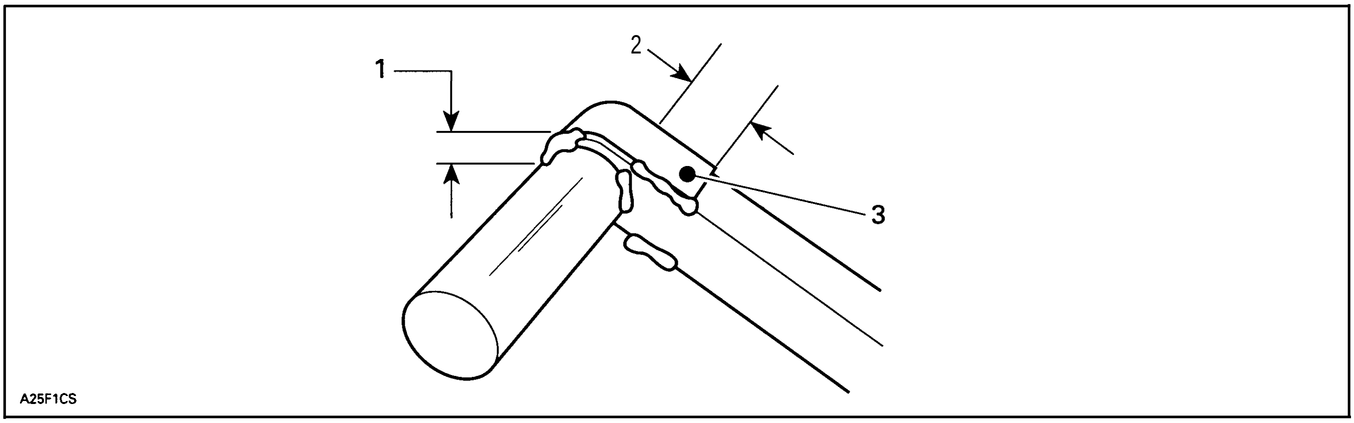
- **For more ski pressure and more front end bite, use spring** P/N **486066600 (180** lbs/inch, 7.5 inch **free length).**

REAR

- **Adjust the spring preload to get about 1.5 inches of sag from full extension to normal ride height with the driver on board.**

Some drivers report positive results when adding additional strength to the tunnel. Remove the 2 rear plastic covers covering the rear bumper. Drive the steel rods located inside the tunnel rolls forward until they contact the frame post. Tack-weld in place and lock these rods in place with at least 3 rivets per side.

It is possible to further strengthen the rear suspension swingarms. **Weld straps in key areas as per attached sketch.**



1. Weld 12 mm (1-1/2 in) long (2 locations)
2. Weld40 mm (1-1/2 in) long (4 locations)
3. Reinforcing strap

Traction

- **Most rules limit maximum stud height to 3/8 inch over the tallest part of the track. This equates to an .875 inch stud with a backer plate on the 94-95 stock tracks. Always verify your stud heights!**
- **Use a thick profile, carbide tipped stud for most conditions. 3 picks per bar with stock 8 inch carbide runners work well for terrain races while 4 picks per bar with square bar 10 inch carbide runners work well on ice races. Sharper, thinner studs can be used on lake events.**

Transmission

- Trail clutching with good backshifting will work for most terrain type races, while many lake events put a premium on top speed.
- Snow cross events will require an excellent holeshot and also good back shifting while top speed is not important. Use a spring and ramp combination in the drive clutch to get 5000 RPM engagement. Lower engagement may be used if traction is less than desirable.
- Maintain your clutches on a weekly basis. A clean, free moving driven pulley is important to good backshifting. Clean the pulley faces with acetone on a regular basis.

Miscellaneous

- HPG T/A shocks should only be serviced by an authorized dealer using approved tools. However some drivers have removed and retightened the acorn nut ,covering the schraeder valve itself, with too much torque. When the acorn nut is later removed it may break the seal of the valve to shock body and cause the accidental loss of the nitrogen charge. As a precaution recharge the shock if in doubt.

If the acorn nut is removed inspect the position of the internal O-ring-style seal to ensure correct seating. If it sits in there off-center it may prematurely release the nitrogen charge when the acorn nut is replaced.

<u>High pressure gas can be dangerous</u> - consult the HPG manual prior to attempting any service work!

- Ensure that your tether cord is a full 5 feet at extension (as per ISR rules) to avoid accidental shutdown in minor get offs. Use a second tether cord attached to the first and adjusted for proper length using tie raps or equivalent. This method also provides you with a handy spare.
- The factory spec calls for the use of Dot 4 brake fluid <u>not Dot 3</u> as indicated on the master cylinder. Dot 4 is used to reduce the chance of overheating brake fluid in race conditions. Dot 5 fluid is not recommended due to potential moisture problems associated with its formulation in winter conditions. Do not overfill the reservoir as expansion room is required.
- The rubber hood latchs can be pinched between the hood and belly pan and become sliced. To fix this problem simply drill out the lower attaching rivet and rerivet the latch on the outside surface of the belly pan at the same height.

This same rubber latchs and button (2 sets) can be used to provide additional hood tie down points in the area directly above the ski spindles. The fixed point could be on the bumper and the button located on the hood itself.

order (2) rubber latch	P / N 570027100
(2) button	P/ N 517245800
(2) hex. screw M5x14	P / N 222051465

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
- primer line
- 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
- DOT 4 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
- 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
- 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 pads
- brake lever
- radius rods and rod ends
- 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
- studs
- 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 en route 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**
- **deicer**
- **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
- long magnet
- pop riveter
- WD40
- shop rags
- contact gloves
- tie wraps
- brake fluid
- antifreeze
- big hammer and pry bar
- clip board, checklist and markers
- other:
- toboggan/cart for tools and parts
- 1 tool set per mechanic
- clutch tools including alignment bar
- hand drill and bits
- devcon
- contact cleaner or acetone
- silicone seal
- duct and electrical tape
- injection and chaincase oil
- deicer
- tape measures
- grease gun
- safety wire

Things to "DOO" during work period or between heats :

- carefully remove ice and snow from front and rear suspension
- inspect suspension components
- check/replace studs
- check camber
- check tightness of all suspension bolts
- check all idler wheels **for missing rubber and condition of bearings**
- **lube steering and front suspension ball joints**
- **check chain tension and oil level**
- **check clutch alignment and clean pulley faces**
- **check carb. and air box tightness**
- **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
- 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 coolant hose condition/routing**
- **check light bulbs**

Replace any tools or parts used from race vehicle supply.

Shut off fuel before impound.

FAX HOTLINE SERVICE

To keep you up to date with the latest XC & Sno Cross tips, a fax hotline service is available to all licensed Ski-Doo racers. To initiate service have your dealer contact on his letterhead. We encourage 2 way feedback and would like to hear about any problems and possible solutions you may have which will improve the performance of the MX Z.

Contact Bill Rader at fax (715) 847-6869, phone (715) 847-6884.

ENDURO RACING

Enduro racing is a race of distance found primarily in Michigan but occasional elsewhere in the U.S. Racers compete on ice ovals, three eighths to one mile in length, and travel 150 to 500 miles non stop. The races take approximately two to eight hours depending on the course and conditions. Driving is usually shared by two or more drivers but change is not mandatory and some racers prefer to run the distance unassisted, fuel and maintenance stops give the racers short breaks or time to switch drivers but many times the engines are never stopped during the entire event so the action never stops. Like auto racing, caution flags often come out to slow the pace while mishaps are tended to or for track grooming. As many as 35 sleds may be on the track at one time which keeps the action fast and furious.

The racing machines resemble F-III type sleds and Michigans M. I.R.A. uses many ISR F-III rules. However many cross country techniques and strategies are also used because of the length and rugged nature of the races. To prepare a machine for this type of racing one would combine a cross country sled with a Formula Ill sled.

The engines may be up to 600cc in size and are usually modified to various degrees. Some racers prefer highly modified engines for maximum HP, others prefer milder engines for reliability. Either way, the engines are many times lowered in the chassis for a low center of gravity. The suspensions are usually lowered or shock travel limited to further lower the machines much like oval racers. However during long rough races like the 500 in Sault Ste-Marie, full travel is sometimes best. As with cross country racing the high stress parts of the machines must be reinforced. The ice ovals exert tremendous forces on front end components, especialy when the maximum of 13 gallons of fuel is on board and the track gets rough.

To determine the starting grid for an endurance race; qualification, heat racing or timed qualifications usually run the day or days before the race. A racer should have his engine and sled in a qualification mode to ensure a spot on the starting grid. At Michigan's “500”, as many as 70 teams may try to qualify for the 35 positions available. Competition is fierce for these 35 spots and requires a much different strategy than race day.

The machine should be low, light, and sharp with high HP engine components. Many racers use “qualifying” cylinders, pipes, carburetors and clutching, then switch to a milder state of tune for the long race. This requires that mechanics and tuners be able to tune two completely different racers and can be very stressful. Many teams will qualify with chassis very low. For better cornering in smooth ice then switch to more travel to soak up the big bumps on race day. This requires knowledge of the sleds handling characteristics in both modes. Testing is the key here; many hours of testing.

During the race, drivers must pit to take on fuel, change carbides, switch drivers and perform any other maintenance required. This requires a very organized pit crew. A crew chief will constantly analyze the race progress and conditions and make necessary decisions on when to make repairs or adjustments. Constant communication with the driver by hand signals or radio keeps everyone informed as to the situation of the race. The pit crew must be very knowledgeable of the machine and must practice the adjustments or repairs which will be encountered during the race.

Personal training and conditioning is also a must for the serious enduro racer. A fatigued driver has no business on an ice oval with 30 fellow drivers in pursuit. Everyones safety is at stake and should be taken seriously.

Enduro racing is a team effort and very rewarding. Drivers get a lot of track time for their dollar and a well prepared team can be quite successful.

NUTRITION

It is recommended that you consult a physician before designing your **own** nutrition and fitness program.

No single **food can make you healthy, fit, nor race ready!**

Eating the right combination of these 25 foods will improve your health and athletic performance;

1. **Bananas** **the perfect "portable snack", rich source of potassium good source of fiber, helps prevent muscle cramps.**
2. **Lean** beef **great source of iron, zinc and high quality protein, choose only lean cuts.**
3. **Black beans** **excellent source of soluble fibers,** folic **acid, will help lower cholesterol levels.**
4. Broccoli **one of the best! Vitamins C & D,** folic **acid, calcium.**
5. Brown rice **complex carbohydrates, twice the fiber of white rice, zinc , magnesium, protein, vitamin** B6, selenium.
6. **Carrot juice** **the most concentrated source of beta-carotene, may boost your ability to fight bacterial and viral infections.**
7. White chicken **use low fat varieties, note that thigh with skin can contain as much fat as beef ! Provides** B6 Vit.
8. **Corn** **source of fiber and** carbos, **use fresh corn or frozen/can.**
9. Dried fruit **with water removed they become terrific source of concentrated energy, iron, apricots, figs, raisins.**
10. Fat-free **yogurt** **calcium, riboflavin, convenient (use non-sugar)**
11. **Fig** bars **strong** carbo **"punch". convenient, fiber, low in fat.**
12. **Grapes** **boron, good for bones.**
13. **Low or fat-free cheeses** **calcium, sodium.**
14. Kiwi **strange little fruit from New Zealand, vitamin C, fiber.**
15. Oatmeal **soluble fiber.**
16. Lentils **proteins, complex** carbos, **iron for low/non meat eaters.**
17. **Orange juice** **liquid "punch".** Vit **C, potassium,** folic **acid.**
18. **Papaya** **potassium, vitamin C, beta-carotene.**
19. **Potatoes** one **of the most underrated foods! Complex** carbos, **twice as much potassium as a banana,** Vit **C, iron ; baked are best. Avoid the drive thru species!**
20. **Pasta** **the runner's staple. Complex** carbos, **thiamin, riboflavin, niacin. atheletes need to get** 60-65% **of their daily calories from** carbos, **pasta is a convenient source.**
21. **Salmon** rich in omega-3 fatty acids (good **for** the heart) eat fish twice per week. Fish oils help combat arthritis.
22. **Skim milk** **low-fat source of calcium, vitamin D, good for bones.**
23. **Strawberries** **fiber, vitamin C,** ellagic acid.
24. **Whole grains cereals** **complex** carbos, **fiber.**
25. **Water** **the mineral content of water varies greatly whether it is bottled or from the tap drinks** lots, **8 plus glasses per day.**

PHYSICAL TRAINING

Start tomorrow and change the way you "DOO" business! Get into a daily routine that includes balanced nutrition, rest, exercise, riding and vehicle service.

You can not change a week before the race and undo bad habits that may have taken many years to perfect!

Personal discipline and sacrifice is required before achieving success on the track.

You owe it to yourself and your sponsors to deliver the best return on time and money invested in your effort.

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 cafeine** cofee **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 pushups - chest [not belly] touching the floor.

   C : 32 situps - knees bent, hands locked behind head.

As you start training, quality is more important than quantity therefore do 1 good chinup **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** chinup **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-Doors 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 suprises 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 trailside repairs to get across the finish line. The driver and team must train together regularity 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".

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