DALLARA F302/3/4

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DALLARA F304

DALLARA AUTOMOBILI IS HAPPY WITH THE CHOICE YOU MADE BUYING THE DALLARA F303, AND WISHES YOU THE VERY BEST IN RACING IT.

For any question, advice or idea you might have, please don't hesitate to contact us.

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On the Dallara web site www.dallara.it you can find useful information about the company, our people and the factory. It also includes a 'second hand' cars service.

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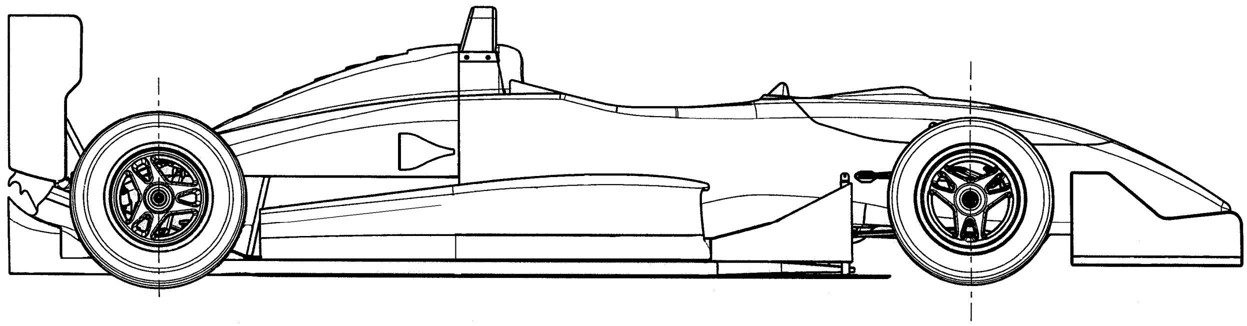
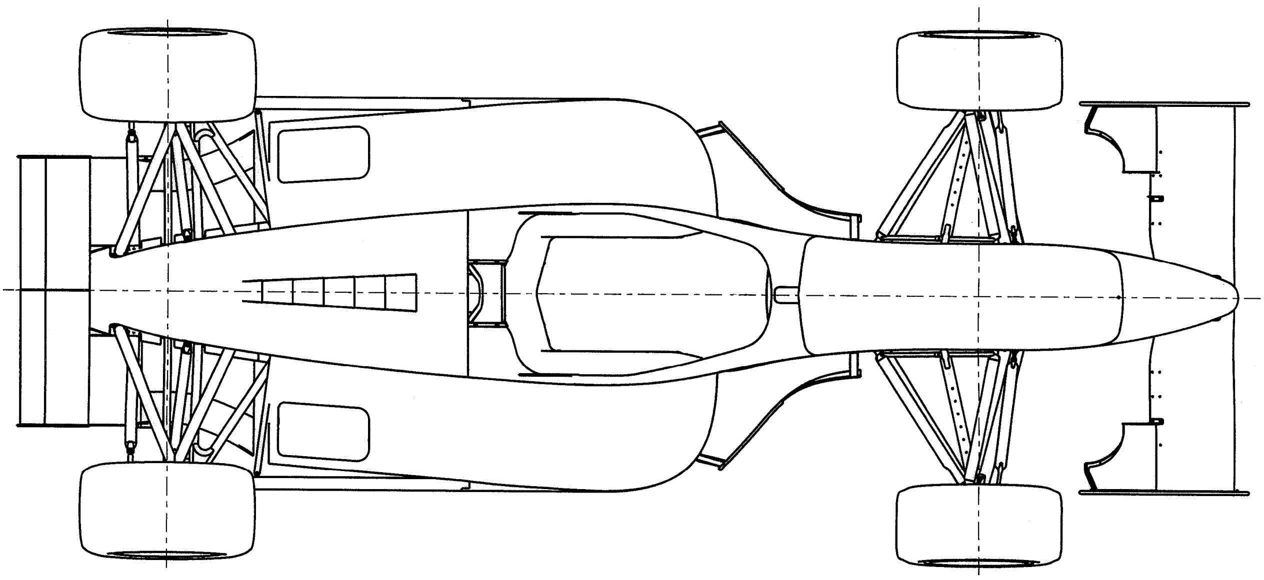




Wheelbase	2675mm (Optional LWB version 2730mm)
Front Track	1520mm
Rear Track	1470mm (Optional Narrow track 1420mm)
Overall height	915 mm (from ground to top of roll hop)
Overall width	1770 mm (width front suspension)
Overall length	4062 mm (from front end-plates to rearmost edge of rear wing)
Weight	550 Kg (including driver and ballast)
Front suspension	push-rod mono-damper
Rear suspension	push-rod twin damper
Chassis	Carbon and KEVLAR™ sandwich with AL / NOMEX™ honeycomb
Bodywork	Glass fibre composite with NOMEX honeycomb
Composites	HEXCEL-HERCULES
Castings	AGUSTA/FLABO/ALLMAG
Gearbox	HEWLAND, six forward gears plus reverse
Gears and differential	HEWLAND
Springs	EIBACH 36 mm ID
Dampers	KONI 2812-140 (bump and rebound adjustable)
Fuel cell	PREMIER – FT3
Extinguisher system	Lifeline (electrical operated)
Steering wheel	Sparco – 270 mm OD
Steering release system	SPA design
Coolers	BEHR/DALLARA
Filters	FIAAM
Rims	SPEEDLINE 9” front – 10.5” rear
Brake system	BREMBO
Battery	GATES/DEKA
Seat belt	TRW-SABELT
Installed engines	Fiat Novamotor Ford Swindon Honda Mugen Nissan Tomei Mercedes HWA Opel Spiess Renault Sodemo Toyota Tom’s

Tire dimensions depend on inflating pressure, rim width and camber angle.
These stiffness values are based on the recommended inflating pressure (hot tyres).

FRONT TIRE	Avon	Bridgestone	Kumho	Hankook	Yokohama
Specification	180/55-13	180/55-13	180/55-13	180/550-13	190/50-13
Free radius (mm)	277.5	277.2	275.0	275.5	278.0
Vertical stiffness (Kg/mm)	17.0	14.4	18.3 (1.2bar)	17.5	17.0
Hot tire pressure (bar)	1.50	1.50	1.50	1.60	1.60
REAR TIRE					
Specification	250/57-13	240/57-13	240/57-13	240/570-13	240/45-13
Free radius (mm)	287.0	286.5	288.0	286.0	288.0
Vertical stiffness (Kg/mm)	17.5	16.7	19.6 (1.2bar)	19.0	17.8
Hot tire pressure (bar)	1.65	1.50	1.45	1.60	1.60

loaded radius depends on tyre make, tyre pressure and camber

SUGGESTED SETUP

These set-ups consider the complete car with the driver seated in it, ready to race.

FRONT	Avon	Bridgestone	Kumho	Yokohama
Ride height (mm)	15	16	16	15
Camber (deg)	2°45’	3°30’	3°45’	3°45’
Toe (deg) (total two wheels)	20’ OUT	10’ OUT	20’ OUT	20’ OUT
Springs (lb/in)	800	700	700	800
Vertical Pre-load (mm)	8	6	6	8
Damper static length (mm)	335	335	335	335
Solid spacer (mm)	6	6	6	6
Push rod length (mm)				
Roll centre setting	STD	LOWER	STD	STD
Roll bar setting	<<<>>><<<	<<>><<>>	<<>><<>>	<<>><<>>
Roll pre-load (notches)	none	none	none	none
REAR				
Ride height (mm)	27	28	26	28
Camber (deg)	1°45’	2°30’	3°00	3°15’
Toe (deg) (total two wheels)	10’ IN	20’ IN	20’ IN	20’IN
Springs (lb/in)	900	800	800	800
Pre-load (mm)	none	none	none	none
Damper static length (mm)	335	335	335	335
Push rod length (mm)				
Roll centre setting	STD	STD	STD	STD
Roll bar	21 OD	26 OD	21OD	21OD
Differential setting	60/80#4	60/60#6	60/70#4	70/80#4

A well balanced car will make the driver come closer to the car’s limit.

- In fast corners aerodynamics (ride heights and wing settings) have more influence on the balance than in slower corners.
- In mid-and slow speed corners the weight distribution and the differential settings are most important.
- Tune the dampers to the chosen springs, not the springs to the dampers.
- Always pay attention to reach the correct tyre temperatures. No car can reach its limit on too cold tyres. No car can be reasonably balanced with a significant difference between front and rear tyre temperatures.
- Run the car always as low as possible, although without going stiffer on springs for running lower.

Effects of the adjustments on the cars' set-up.

Positive change in:	means:
Height	car rises
Toe	toe-out
Camber	upper part of rim outward
Castor	lower part of rim points ahead

	FRONT	REAR
PUSHROD ADJUSTER **1TURN** **Height change** Camber change (deg) Thread step	**4.275mm** 2' 20/"R+24/"L=2.32mm	**6.97mm** 14' 20/"R+24/"L=2.32mm
TOE ADJUSTER (PER WHEEL) **1TURN** **toe change (deg)** thread step	**36'** 24/"=1.06mm	**Height change -0.7mm** **Camber change -13'** **-45'** 20/"R+24/"L=2.32mm
CAMBER SPACER **+1mm** toe variation	**16'**	**16'** **11'=1/4Turn**
CASTOR ADJUSTER Castor change (deg) thread step **1TURN** height change (mm) camber change (deg) toe change (deg) SPRING PLATFORM **+1TURN** thread step (mm) height change (mm)	**25'** 24/"=1.06mm -0.14mm -6' -2' 2 1.79	20° brake calliper=14.5° **-35'** 24/"=1.06mm -0.8mm 1' 3' 2 2.47
WHEEL/SPRING RATIO (vertical)	Mono: 0.896/Twin: 1.174	Std: 1.237/Narrow: 1.193
ARB WHEEL/BELLEVILLE RATIO (MONO)	1.548	--
ARB WHEEL/DROP LINK RATIO (TWIN)	T-bar:1.14 Mono blade: 0.21	Std: 1.808 Narrow: 1.727
ROLL CENTRE HEIGHT	Tyre dependent	Tyre dependent

- Spacers to adjust camber are available in the following thickness: FRONT: 1.0, 1.5 and 2.0 mm. REAR: 0.8, 1.0, 1.2, 1.5 and 2.0mm. Combine these to make fine adjustments.
- Front and rear wheel to spring, front wheel to Belleville and rear wheel to drop link motion ratios may be considered as constant for all the wheel motion.
- Page 38 gives further information regarding the twin-damper system.

VERTICAL PRELOAD ADJUSTMENT

Remind there is always some 'pre-load' in the damper: typically this is around 10kg for the standard Koni damper. This 'pre-load' depends on damper make, type and the internal gas pressure.

In a non pre-load condition, as long as the damper is not fully extended, turning the platform C only raises the ride height (and lowers the pressure inside the damper). When the damper gets fully extended, turning on the platform C increases vertical spring pre-load on the car. We advise though, not to proceed this way, because some dampers (including Koni) should not be used fully extended. Therefore we advise to use the droop-stop A.

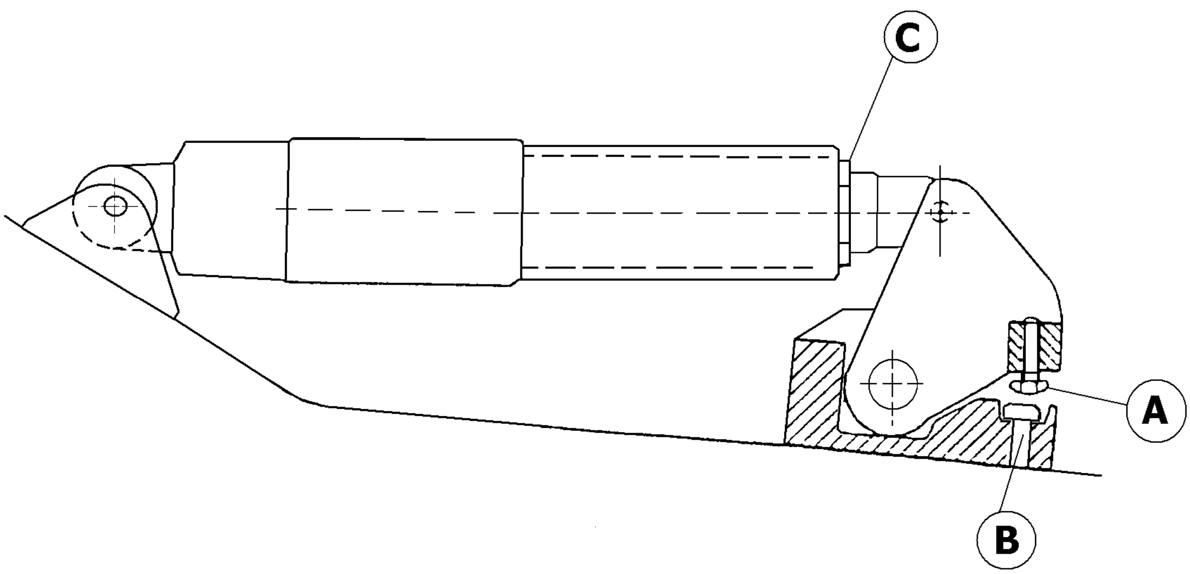
Pre-load is the necessary force that has to be applied to the spring to modify its length with respect to the static length value.

P = Ks x t x 2

P = pre-load in kg
Ks = spring stiffness in kg/m [(Ks in Lb/in) / 56 = Ks in kg/mm]
T = number of platform (C) turns
2 = mm / turn (for standard Dallara damper top)

SETTING THE PRE-LOAD

- Mount the damper-spring combination with the platform C just in contact with the spring
- Put the car including the driver on the set-up floor
- Screw the droop-stop A away from touching bolt B
- Adjust ride height with the pushrod adjusters to the desired setting
- Bring droop-stop A in contact with bolt B
- Turn platform C until desired pre-load force is achieved. (P = Ks x t x 2)

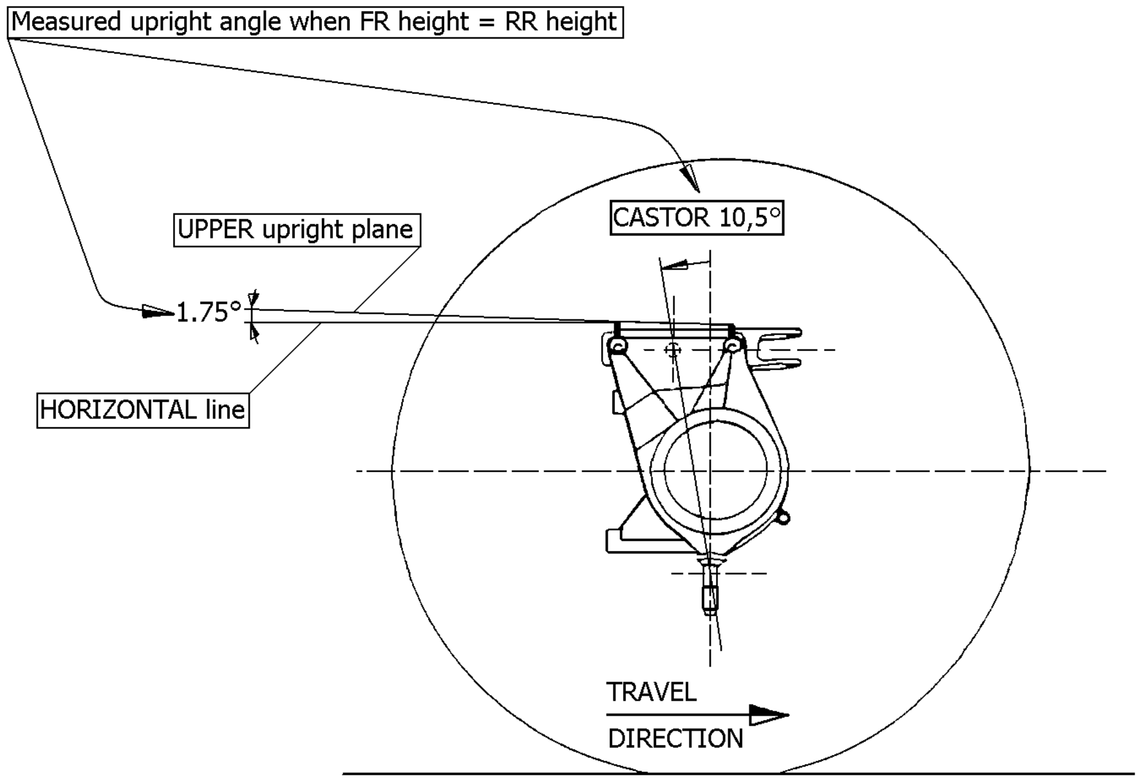


When the car is flat (same ride height front and rear), the upright inclination angle (apparent castor) is **1.75°** and the castor angle (build in castor) is **10.5°**.
With different front and rear ride heights: For instance, with 15 mm front and 28mm rear ride height, measured at wheel axis, (wheelbase is 2675 mm) you would measure a ‘apparent’ castor angle of 2.03°:

Pitch angle [(28-15)/2675] x 57.29 = 0.28°

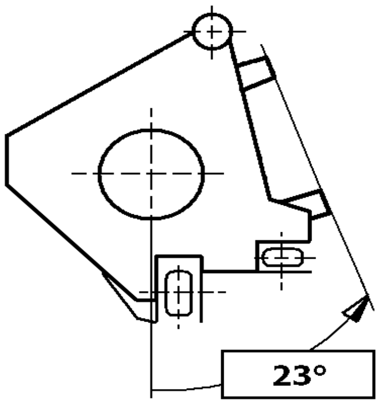
‘Build in’ castor angle becomes: 10.5° - 0.28° = 10.22° (corresponding to a 2.03° measured ‘apparent’ castor angle)

each change in front and/or rear ride height alters the castor angle



REAR

The rear wheel ‘castor’ angle can be measured to check bump steer to be zero. You can measure the angle on the brake caliper mounting platforms.
When the car is flat (front ride height equal to rear ride height) and you measure ‘apparent’ castor of 23°, the ‘castor’ angle is 16° and bump steer is zero.
Castor on the rear axle is not relevant as the wheels are not steered.



You can use each of the Belleville stacks with or without pre-load. There are two types of pre-load, described in detail here below. The limit of the system is the rocker touching the magnesium support when moving laterally.

Double stiffness pre-load

- **Within** the pre-load range, the stiffness is **double** the stiffness of one stack, both stacks are working
- **Passed** the pre-load, the stiffness gets back to the **nominal** stiffness of one stack

Infinite stiffness pre-load is accomplished with an additional nut and a counter nut

- **Within** the pre-load range, the **rocker doesn't move at all**
- **Passed** the pre-load, the stiffness gets back to the **nominal** stiffness of one stack

  - The choice of a pre-load setting, or the non pre-loaded setting might be based on the car's balance exigencies, tyre wear, drivers' preference etc.... Pre-load settings generally help for sharper turn-in characteristic.
  - Clearance between the platform and the rocker (B) shall not be more than 6.5mm when platform just touches the Belleville stack, with no pre-load.
  - The amount of pre-load is the difference between the current and the free length of the Belleville stack.
  - For any Belleville stack, in running condition, rocker lateral motion and the chosen pre-load must never reach the "Maximum Deflection" (see Table 6), to avoid a sudden lateral locking of the rocker.
  - Once the rocker overcomes the pre-load, the total stiffness reduces to the nominal stiffness of one Belleville stack. You may like to work within the roll pre-load range under certain conditions (turn-in...) and wish to pass over the pre-load range in some others (mid-corner, curbs...). Set accurately the transition point (pre-load level) between the two conditions, since the stiffness change is sudden and affects transient car behaviour.

You can achieve a progressive load / displacement characteristic by combining in series two different stacks or a regressive load / displacement ratio by fitting an appropriate pre-load. Total length of any stack should be maximum 34 mm.

BELLEVILLE STACK CONFIGURATIONS (Belleville thickness 2.0mm)

Stack configuration	Max deflection mm	Stack width mm	Nominal stack stiffness Kg/mm (no pre-load)	Maximum notches
<<<<>>>>	1.12	17.50	2504	8
<<<>>>	1.12	13.50	1796	8
<<<>>><<<	1.69	20.25	1197	12
<<>><<	1.69	14.25	761	12
<<>><<>>	2.25	19.00	571	17
<<>><<>><<	2.81	23.75	457	22
<><	1.69	8.25	362	14
<><>	2.25	11.00	272	17
<><><	2.81	13.75	218	22
<><><>	3.37	16.50	181	26
<><><><	3.93	19.25	155	28
<><><><>	4.50	22.00	136	34
<><><><><>	5.62	27.50	109	44

Note: the front rocker lateral movement has been increased from the previous (F399-301) maximum 6mm to about 10mm on the F302/3/4 car.

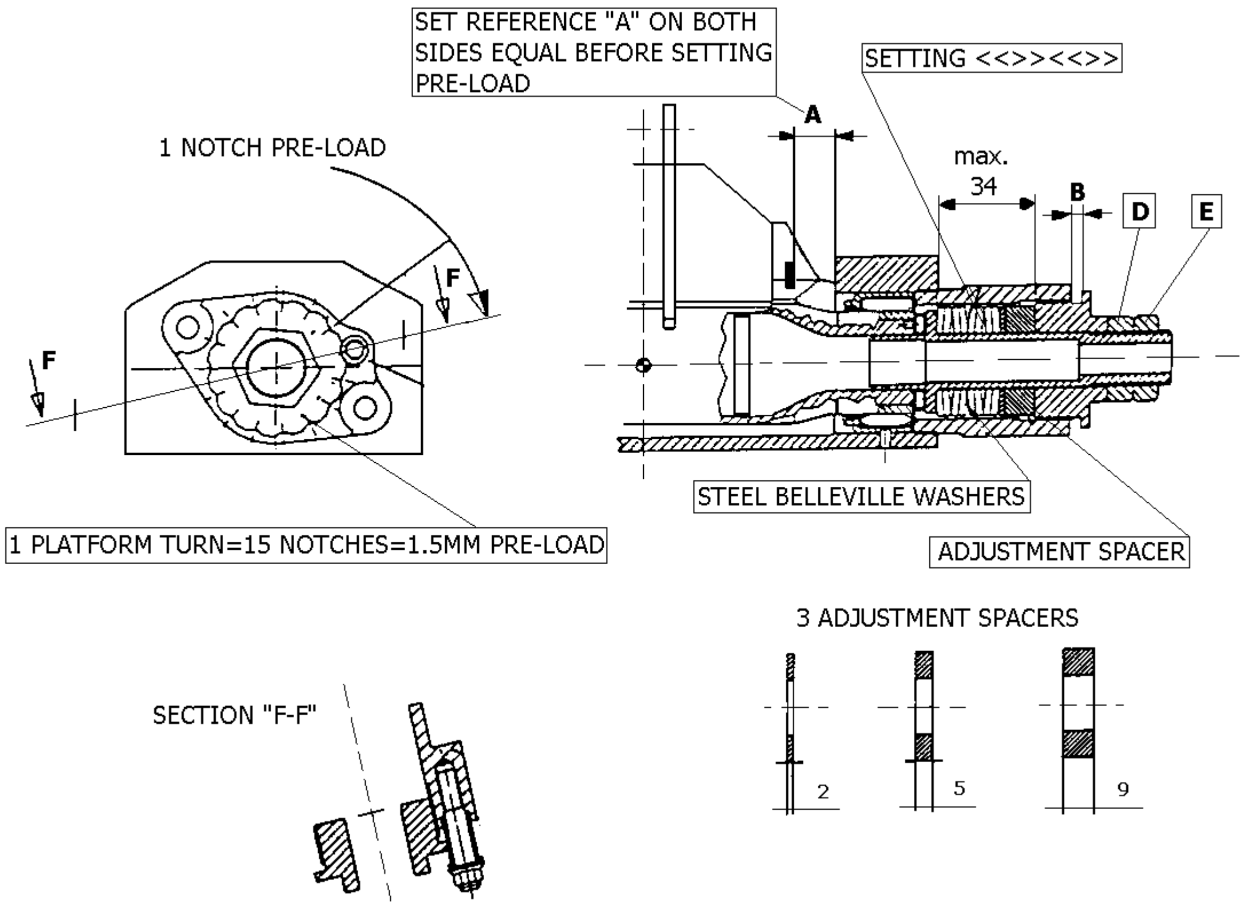
DOUBLE STIFFNESS PRE-LOAD

- Mount the stack you want to use and turn the platform until in contact with the Belleville stack
- Turn the platforms until distance A is the same on both sides
- Check distance B to be less than 6.5mm, if more, replace adjustment spacer
- Mark this platform position as the "zero pre-load" notch
- Turn both left and right platforms the amount of notches to set the desired pre-load. One turn of platform is 15 notches corresponding to 1.5mm displacement (1 notch = 0.1mm)

INFINITE STIFFNESS PRE-LOAD

- Set the pre-load as described for the double stiffness procedure here above
- Mount nut D in contact with the platform

Tighten counter nut E against nut D (check nut D stays against the platform)



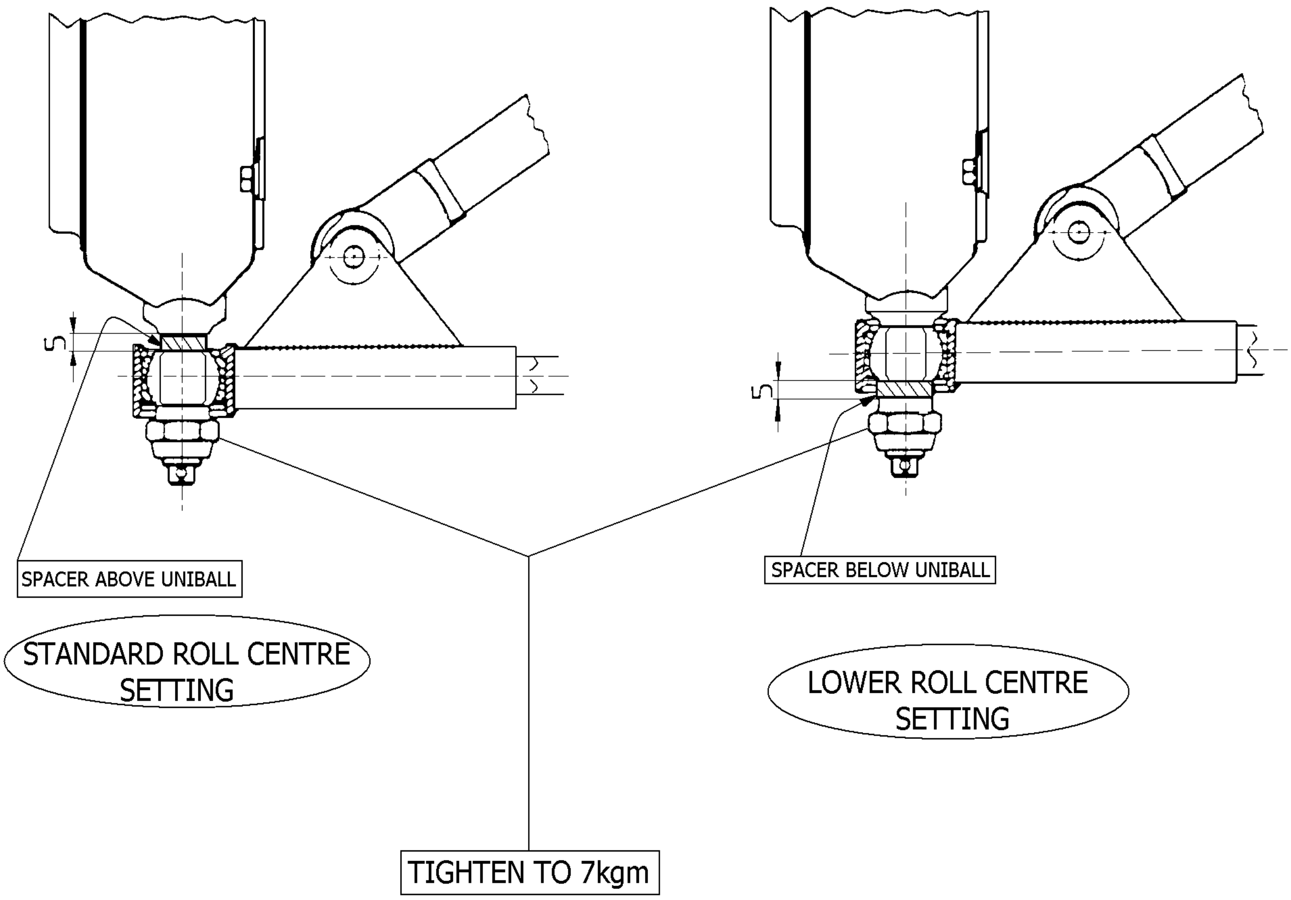
Twin-damper system information is on page 38

FRONT SUSPENSION ROLL CENTRE SETTING

Front roll centre height can be changed by moving the spacer to its upper or lower position on the wishbone spherical joint. When choosing "low roll centre" configuration, push-rod length has to be shortened by 1.2 register turns (7 faces of the adjuster) to keep the car at the same ride height..

When adjusting the roll centre height camber gain versus wheel travel varies a little.

OPTION	Roll centre height @ static ride height	Camber change with 10mm wheel travel
Std	X	5'
Low	-10 mm	3'



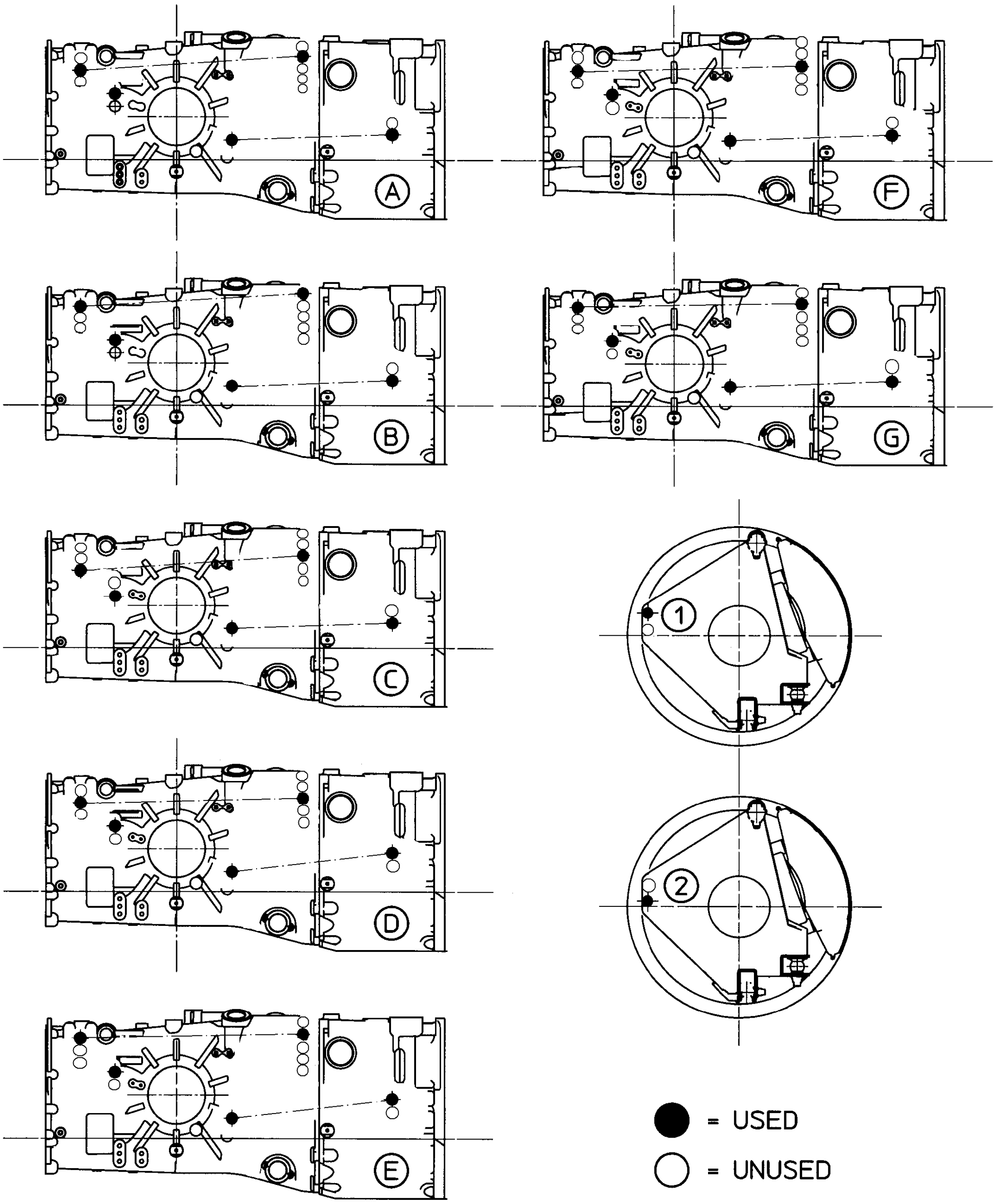
STEERING ASSEMBLY

Pinion primitive diameter	15.60 mm
Static steering ratio	13.1 steering wheel/wheel
Ackermann [%]	29

REAR SUSPENSION ROLL CENTER AND ANTISQUAT SETTING

OPTION	Roll centre height	Camber change	Antisquat
	@ static ride height	with 10mm wheel travel	%
A-1	Std	20'	48
B-2	-18	16'	48
C-1	+18	24'	48
***D-1**	std	23'	66
***E-2**	-15	18'	66
F-1	+8	22'	35
G-2	-10	18'	35

Option D-1 and E-2 alter caster angle. To obtain std value shorten by 2 turns the 'caster' uniball.Option B-2 needs special bracket for front top mounting (available at Dallara).



REAR ANTIROLL BAR STIFFNESS

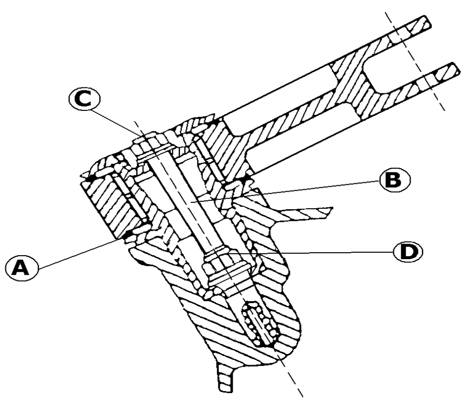
F302/3 features a rear anti-roll bar with two adjustable blades, long 80mm.
Ø 40mm is the biggest possible RARB, Ø13mm is the softest RARB available.
The two digits in this table represent the blade positions: 1=full soft, 5=full stiff.
Stiffness in kg/mm.   Note: P1-P5 = P3-P3 = P2-P4

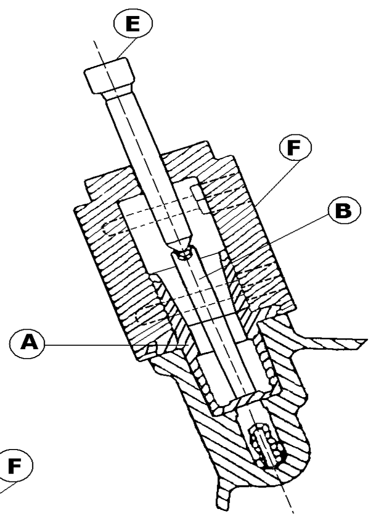
	Ø 13	Ø 14	Ø 16	Ø 19	Ø 21	Ø 22	Ø 24	Ø 26	Ø 28	Ø 30	Ø 35	Ø 40
P1-P1	15.7	19.9	29.4	44.6	53.8	57.8	65.0	70.6	75.1	78.7	84.5	87.7
1-2	15.8	20.2	30.0	45.9	55.7	60.1	67.9	74.1	79.0	83.0	89.5	93.0
2-2	16.0	20.4	30.6	47.4	57.8	62.5	71.0	77.8	83.3	87.7	95.0	99.0
1-3	16.3	20.8	31.5	49.5	61.1	66.3	76.0	83.8	90.2	95.5	104.1	108.9
2-3	16.4	21.1	32.1	51.2	63.6	69.3	80.0	88.7	95.8	101.8	111.7	117.3
1-4	16.7	21.5	33.1	53.7	67.6	74.1	86.3	96.6	105.1	112.3	124.5	131.4
1-5	16.9	21.8	33.8	55.7	70.7	77.8	91.5	103.1	112.8	121.2	135.5	143.8
2-5	17.0	22.1	34.6	57.8	74.1	82.0	97.3	110.5	121.8	131.6	148.7	158.7
3-4	17.3	22.6	35.7	61.0	79.6	88.7	106.9	123.0	137.2	149.8	172.3	185.9
3-5	17.5	22.9	36.6	63.5	83.9	94.2	114.9	133.8	150.7	166.0	194.2	211.5
4-4	17.8	23.4	37.9	67.5	91.0	103.1	128.4	152.5	174.9	195.8	236.3	262.5
4-5	18.0	23.8	38.8	70.6	96.7	110.5	140.2	169.3	197.5	224.5	279.4	316.8
5-5	18.2	24.2	39.8	74.0	103.2	119.1	154.3	190.4	226.7	263.1	341.7	399.4

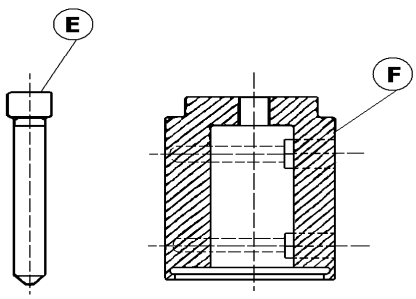
REAR SUSPENSION ROCKER REPLACEMENT

Rear rocker spins around the steel pivot A fitted onto the gearbox case by the stud B, fixed with LOCTITE 242™. The following procedure shows the disassembly of the rocker and the pivot A. Contact DALLARA customer's service regarding the special tools E and F.

- Unscrew the nut C. The tightening torque to fit it back is 3.5 Kgm;
- Take off the top cap and the rocker;
- Unscrew nut D with a long 14mm tubular spanner. The tightening torque to fit it back is 5.5 Kgm;
- Fit extractor F around pivot's outer flange and by screwing in bolt E you will extract the pivot;
- Remove stud B with the proper tool. The stud is fitted with Loctite in its insert. When removing the stud, heat up the stud's thread to break the Loctite with a heatgun up to 140°C.







This differential is designed with versatility as its major asset. Many parameters will lead you to the required setting. A car with good grip and low power may require a completely different arrangement than that required for a high power/low grip car.

Working principles: Ten friction plates within the diff, six connected to the side gears, four to the diff casing, control the amount of 'differential' action available. The amount of limited slip depends only on the frictional resistance between these ten plates.

Four factors contribute in defining this frictional resistance:

1. The bevel gears thrust apart as soon as the car moves. This is a feature of bevel gears and is not adjustable. The contribution of this on friction is minimal.
2. The ramp angle on the side gear ring influences the amount of the driving force on the diff that gets directed sideways and onto the plates. E.g., on the power/drive side ramp, 60 degrees transmits less force sideways than a 30 degree ramp. Likewise, on the off-power side ramp, an 80 degrees angle will transmit little force while 45 degrees locks more. 60°/80° is fitted as standard;
3. The pre-load with which they are assembled to start. In each diff there is a pre-load spacer that looks like one of the B plates, but thicker. Depending on diff model, it is either the first or the last component assembled into the diff casing. Its thickness dictates to what degree the plates are pre-loaded / forced against each other. The pre-load is set and checked on each diff by holding one side gear locked, via a dummy output shaft held in a vice, and by turning the other with a torque wrench. If the measured resistance is deemed too high, the spacer is ground down until the desired figure is achieved. The figure should be checked periodically as it tends to reduce as the diff runs, meanwhile a new A, slightly thicker spacer will allow re-setting;
4. The final and easiest adjustment is the re-arrangement of the contact order of the friction discs. The arrangement 1, with a disc succession A, B, A, B, A, has the maximum number of working friction faces. It gives the maximum resisting torque. The arrangement 3 has the minimum of working friction faces and gives the minimum resisting torque.

Standard Hewland available ramp angles are: 30/60; 45/45; 45/80; 60/80; 80/80

Differential settings have an important influence on the cars' balance, especially on corner turn-in and exit.

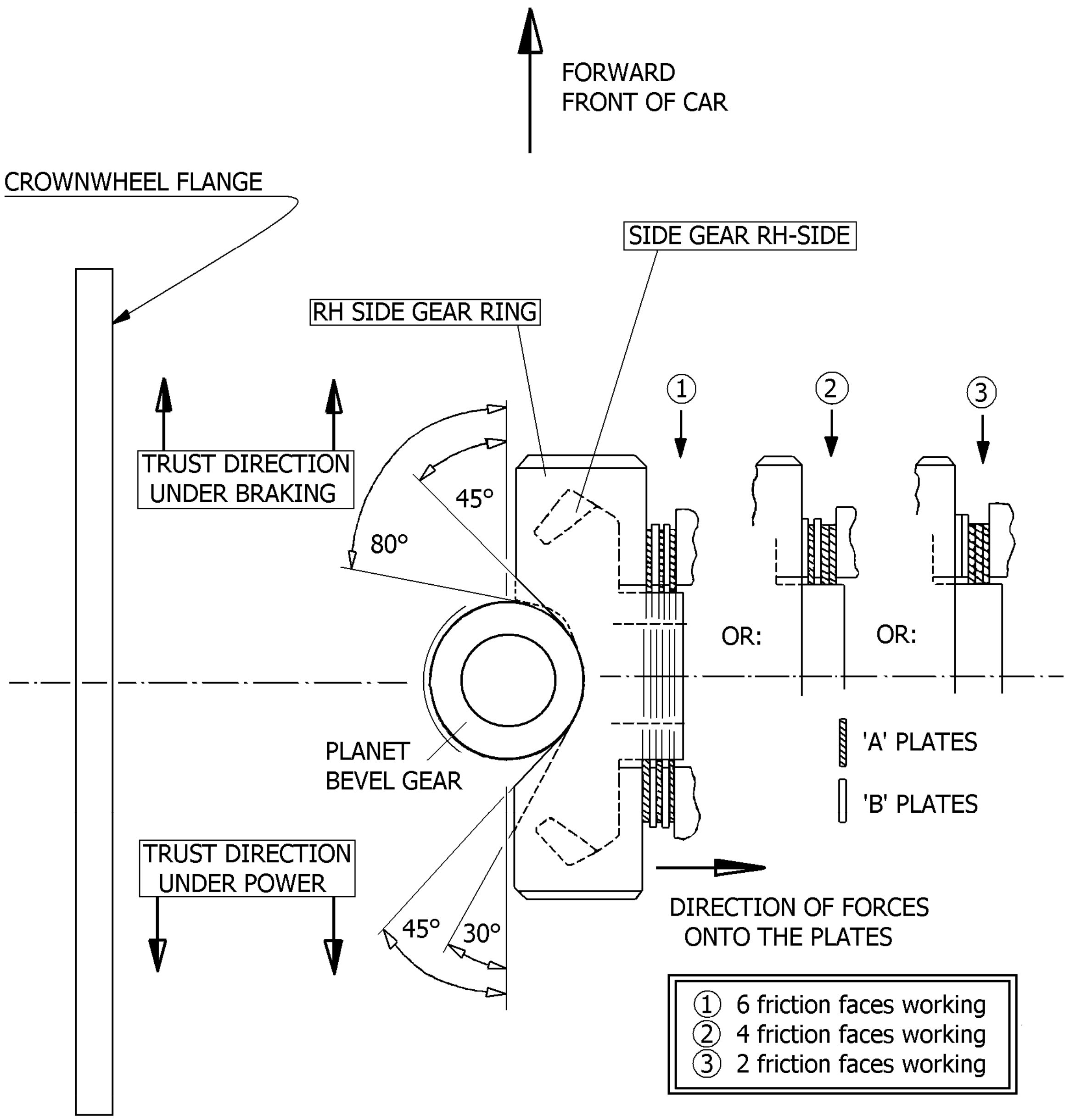
- The torque on the differential in drive (acceleration) is much bigger than the torque on the differential given by the engine brake (deceleration). Typical in line acceleration gets to about 1g, off-power/braking by the engine only gets typically up to 0.3g.
- The disc configuration (2, 4 or 6 faces) has the same effect on drive and off-power, the ramps are the only tool to differentiate the friction force or 'lock' between drive and brake.
- The discs wear off, just as a clutch, and should get checked regularly. This also means that the pre-load is 'wearing' down, especially when using the 2 friction discs configuration.
- Pre-load is kind of a 'constant lock' and the effect is felt in slow and fast corners in entry, mid-corner and exit. The ramps and disc configurations have more effect in slow and less in fast corners, and affect corner entry and exit, less so mid-corner.
- Pre-load blocks the differential (both wheels turn at the same speed) until the difference in torque is bigger than the pre-load. Once passed the pre-load, the remaining lock is achieved by the ramps and disc configuration only.
- Most circuits require little lock to prevent the inner wheel from spinning coming out of the corners, depending though on tyres, track, driving style and weather conditions. Excessive lock might result in power understeer.
- Some amount of lock in off-power helps to stabilize the rear end, excessive lock might cause turn-in understeer.

This table shows the % of lock from minimum to maximum lock.
Lock%= (slower wheel torque – faster wheel torque)/ total torque

LOCK%	2.5	5.0	7.0	9.5	11	12.0	15.5	18.0	24.0	25.0	33.5	42.0	44.0	55.0	68.5
RAMP	80	80	70	80	70	60	70	60	45	60	45	30	45	30	30
DISCS	2	4	2	6	4	2	6	4	2	6	4	2	6	4	6

60/70 and 70/80 ramps are available at Dallara Automobili S.r.l.

- Check the plate arrangement is equal on both sides.
- Side gear ring, diff end plate, diff wall and pre-load spacer all act as “B” plates
- A bigger ramp angle transmits less thrust onto the plates than a smaller ramp angle.



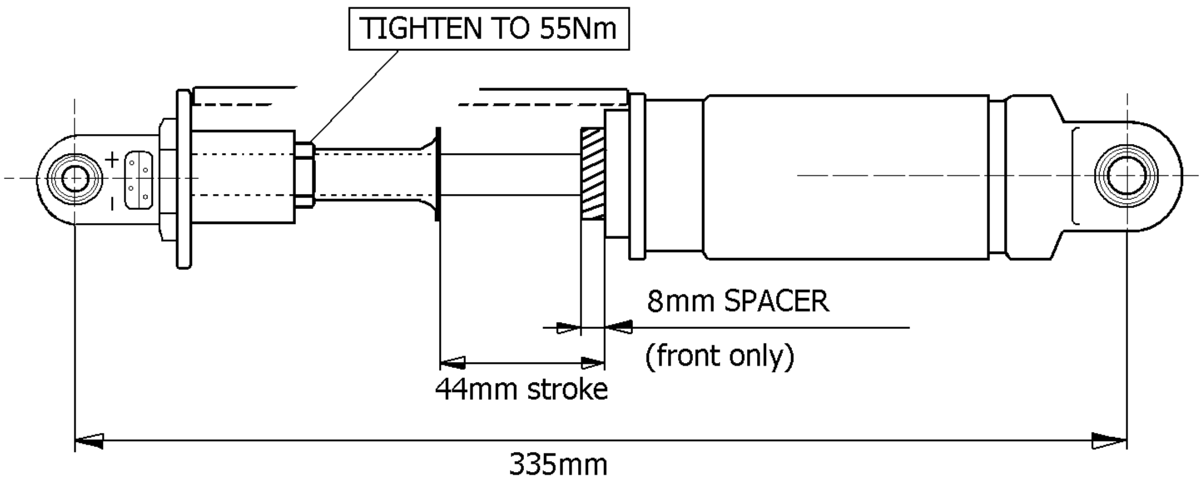
DAMPER DIMENSIONS

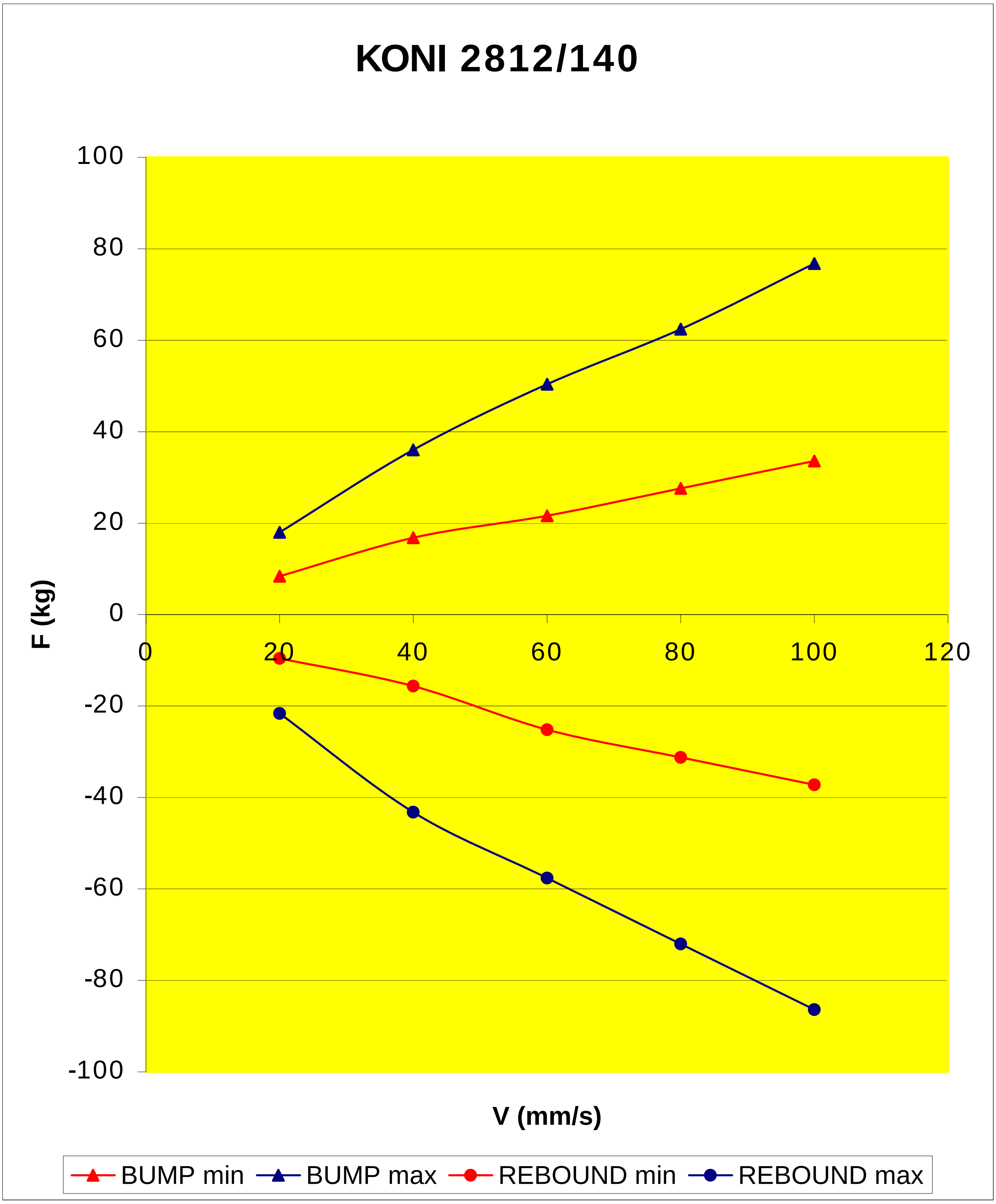
Standard dampers are KONI 2812-140. Front and rear have the same open length and identical installation parts. Damper assembly dimensions are:

		mm
full open length		335
full closed length	FRONT	299
	REAR	291
Stroke	FRONT	36
	REAR	44

On Koni dampers you should always use the 8mm Teflon spacer on **front assembly** to prevent the rocker to lock. If you plan to use alternative products check that maximum stroke to be less than 36 mm.

Dallara, on request, delivers installation kits for PENSKE and QUANTUM dampers. If you want to install other dampers, remind that full open and closed length must be equal to those listed above.




KONI 2812/140
F (kg)
100
80
60
40
20
0
-20
-40
-60
-80
-100
0
20
40
60
80
100
120
V (mm/s)
BUMP min
BUMP max
REBOUND min
REBOUND max

- Ride height is fundamental for setting and changing the aerodynamic balance of the car.
- A lower car generally generates more down-force than a higher car.
- A lower car improves performance as it features a lower centre of gravity.
- The easiest way to measure ride heights is checking the FR and RR distances between the floor wood and the set-up floor, preferably with the driver on board and tyres at hot tyre pressure. This is the only method which takes into account the ride height changes caused by wear on the floor wood.

It might sometimes be difficult to measure ride heights directly, so we also provide alternative references.
The **example** shows **front ride height 15mm** and **rear 30mm** (at wheel axis).
With 2675mm wheelbase, this gives 0.32 ° pitch angle. [(30 – 15) / 2675] x 57.29 = 0.32°

At the **front end** of the car you have two alternative references:

- Two round platforms 513.5mm from car bottom, on top of the tub at the wheel axle line. You can measure their distance from the ground as 528.5-513.5 = **15**mm ride height

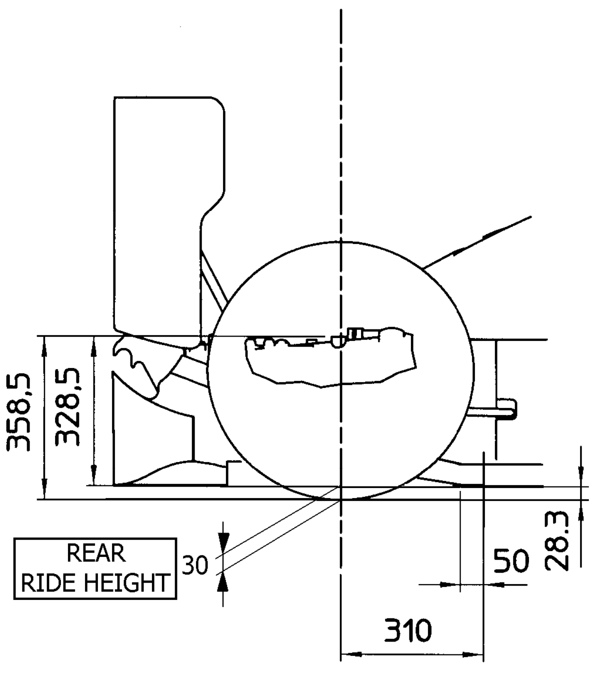
- A flat surface (skid) about 310 mm behind the wheel axis and 40 mm behind the skid leading edge. Measure its distance from ground as 16.7 - (tan0.32°*310)=**15**mm

At the **rear end** of the car you have two alternative references:

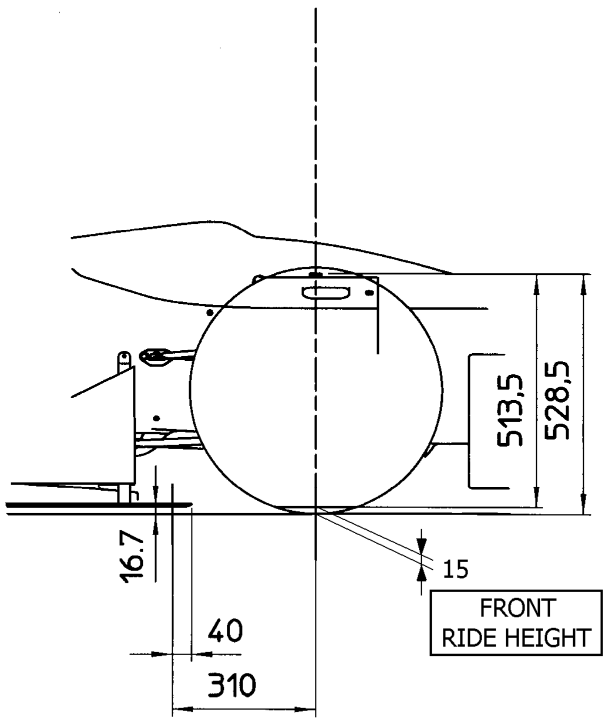
- Two machined areas, at 328.5 mm from car bottom, on the gearbox at wheel axle line. You can measure their distance from the ground as 358.5 – 328.5 = **30**mm height

- Under the flat bottom, about 310 mm ahead of rear wheel axis and 50mm ahead of the start of the diffuser. Measure and calculate its distance from ground as (tan0.32° *310) + 28 (measured)= **30**mm height

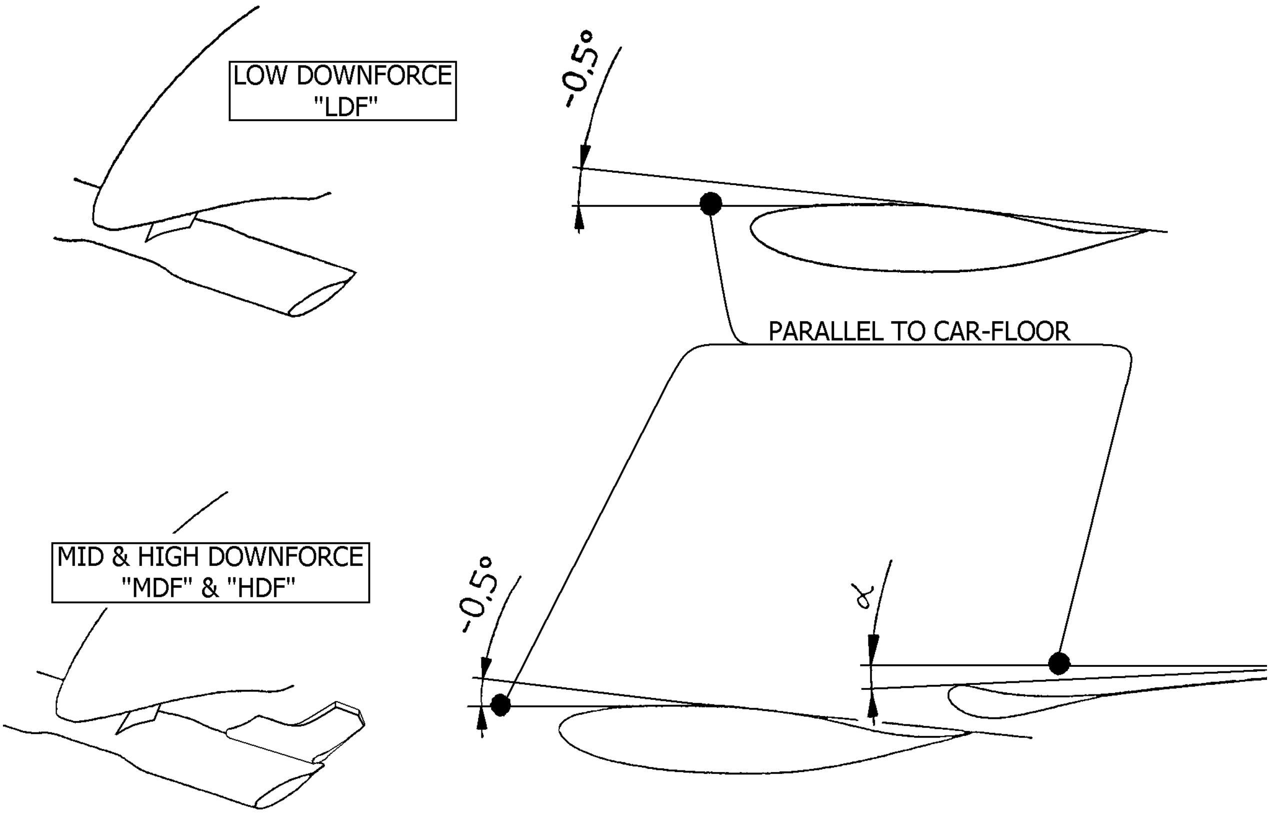
REAR RIDE HEIGHT
30mm



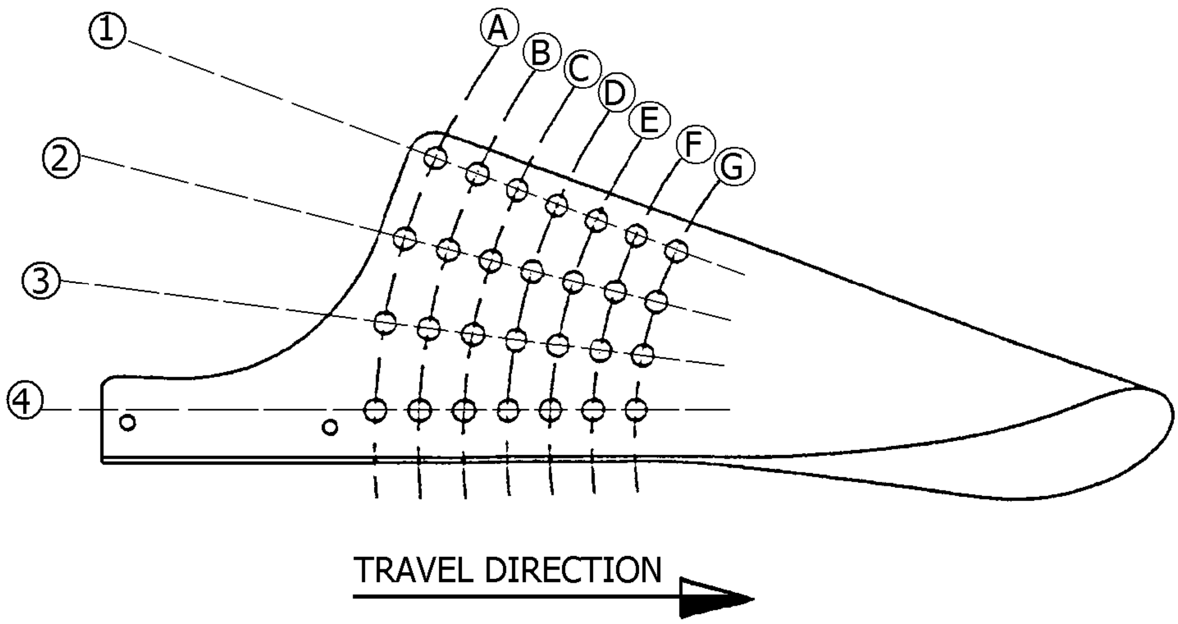
FRONT RIDE HEIGHT
15mm



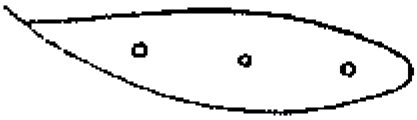
FRONT WING CONFIGURATIONS

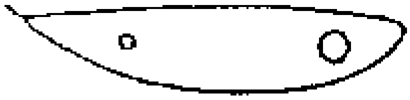


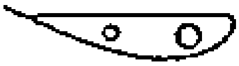
FRONT WING SIDEPLATE HOLES



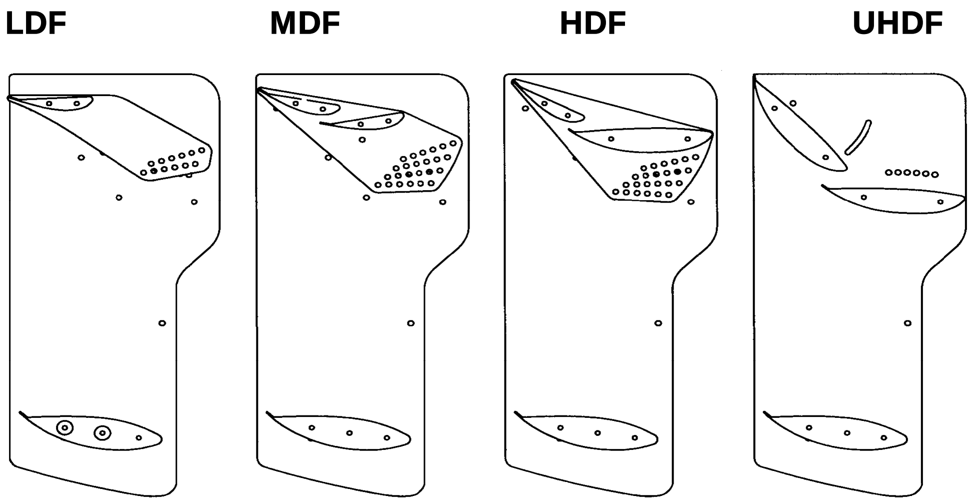
REARWING PROFILES



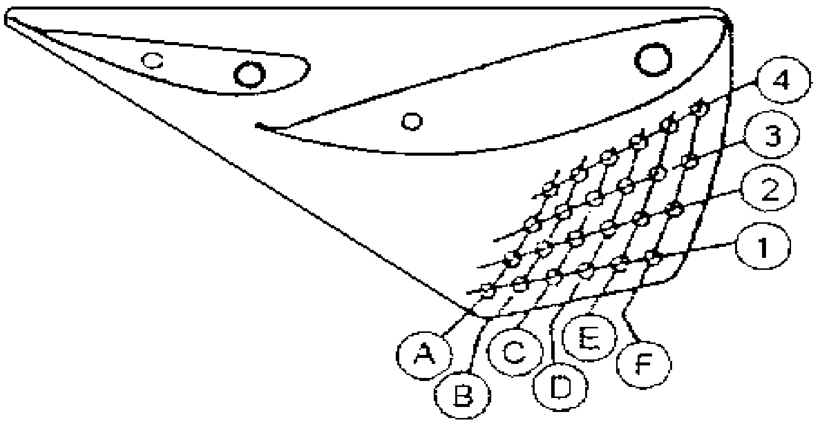




REAR WING CONFIGURATION



REAR WING SIDEPLATE HOLES



- Front flap angle is measured on top of the flap front-end and inside the Gurney 'corner'.
- Correspondence between holes and incidence angle is just indicative, because wing angle is also a function of the front and rear ride heights.
- Machined side-plates allow 1 degree step adjustment.

FRONT

FRONT FLAP (MF & SF)							
	A	**B**	**C**	**D**	**E**	**F**	**G**
1	10°	11°	12°	13°	14°	15°	16°
2	17°	18°	19°	20°	21°	22°	23°
3	24°	25°	26°	27°	28°	29°	30°
4	31°	32°	33°	34°	35°	36°	37°

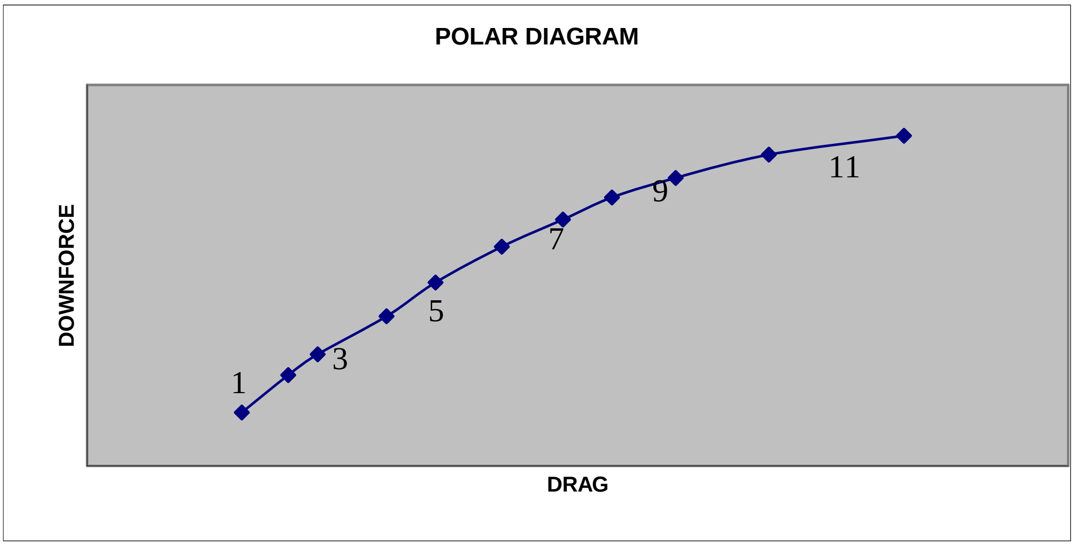
REAR

REAR TOP LDF						
	A	**B**	**C**	**D**	**E**	**F**
1	0°	1°	2°	3°	4°	5°
2	6°	7°	8°	9°	10°	11°

MDF & HDF						
	A	**B**	**C**	**D**	**E**	**F**
1	2°	3°	4°	5°	6°	7°
2	8°	9°	10°	11°	12°	13°
3	14°	15°	16°	17°	18°	19°
4	20°	21°	22°	23°	24°	25°

The following gives the **F304 HDF** rear wing incidence to achieve the same level of down-force as **the F303 HDF/UHDF** rear wing configuration.

F304		F303	
LOWER	7°	7°	LOWER
HDF	12°	17°	HDF
HDF	16°	21°	HDF
LOWER	15°	15°	LOWER
HDF	23°	-	UHDF



REAR	FRONT
LDF = Low Down Force (single small top)	Without Flap
MDF = Medium Down Force (twin small top)	MF = Medium Flap
HDF = High Down Force (std, small and mid combined top)	SF = Standard Flap
UHDF = Ultra High Down Force (twin mid top)	SF = Standard Flap

- All configurations give 38% of total downforce to the front.
- Front ride height is 10mm and rear ride height is 22mm, which corresponds with typical dynamic ride heights.

CFG	REAR				FRONT			CFG
	TOP TYPE	TOP SETTING	LOWER		FLAP TYPE	FLAP SETTING	MAIN PLANE	
1	LDF	2	3		NONE	-	-0.5	1
2	MDF	8	3		MF	10	-0.5	2
3	MDF	13	3		MF	14	-0.5	3
4	MDF	21	3		MF	20	-0.5	4
5	MDF	23	5		MF	26	-0.5	5
6	HDF	7	7		SF	11	-0.5	6
7	HDF	13	7		SF	16	-0.5	7
8	HDF	17	7		SF	20	-0.5	8
9	HDF	21	7		SF	24	-0.5	9
10	HDF	23	15		SF	28	-0.5	11
11	UHDF	-	15		SF	32	-0.5	12

CFG	REAR TOP WING	CENTRAL DIFUSER	REAR FLOOR	FRONT WING TURNING VANES
	LDF/MDF	LOW & MEDIUM	2003-short	OFF
	HDF	HIGH (std)	2004	OFF
	HDF/UHDF	HIGH (std)	2004	ON

<HIGH> central difuser is the standard F302/3/4 difuser part under the gearbox, <LOW & Medium> is available at Dallara or your parts dealer.

- Front wing main-plane and rear lower wing are set relative to the chassis reference plane.
- The optimum setting for the front main-plane is -0.5° (minus 0.5°). Any chassis rake angle will alter this setting.
- Front flap inclination is intended to be the angle, relative to the chassis reference plane, measured on top of the flap front and inside the Gurney ‘corner’.
- Rear top wing assembly inclination is intended to be the angle, relative to the chassis reference plane, measured between the front of the flap, on top and the rearmost trailing edge. Any chassis rake will alter this setting.
- Front and rear ride height settings are fundamental to the aerodynamic balance and ultimate performance of the car. Pay attention to the changes between static setting and the dynamic values on the track.

DOWNFORCE CFG	MINIMUM SUGGESTED		MAXIMUM SUGGESTED	
	HOLE	INCIDENCE	HOLE	INCIDENCE
FRONT MF FLAP	A1	10°	G4	37°
FRONT SF FLAP	A1	10°	D4	34°
REAR TOP MDF WING	A1	2°	D4	23°
REAR TOP HDF WING	A1	2°	D4	23°
REAR LOWER cfg. 1-4		0°		7°
REAR LOWER cfg. 5-11		7°		16°

BALANCE

HOW TO BALANCE 1° FRONT FLAP VARIATION BY CHANGING THE REAR WING, REAR RIDE HEIGHT OR FRONT RIDE HEIGHT?

<table>
<tr><th>Front flap type</th><th>Rear top: MDF</th><th>Front flap type</th><th>Rear top: HDF</th></tr>
<tr><td rowspan="6">MF</td><td>0.7 holes
RR top</td><td rowspan="3">MF</td><td>0.5 holes
RR top</td></tr>
<tr><td>1.3mm lower
RR height</td><td>1.4mm lower
RR height</td></tr>
<tr><td>0.6mm higher
FR height</td><td>0.7mm higher
FR height</td></tr>
<tr><td rowspan="3"></td><td rowspan="3">SF</td><td>0.75 holes
RR top</td></tr>
<tr><td>2.5mm lower
RR height</td></tr>
<tr><td>1.3mm higher
FR height</td></tr>
</table>

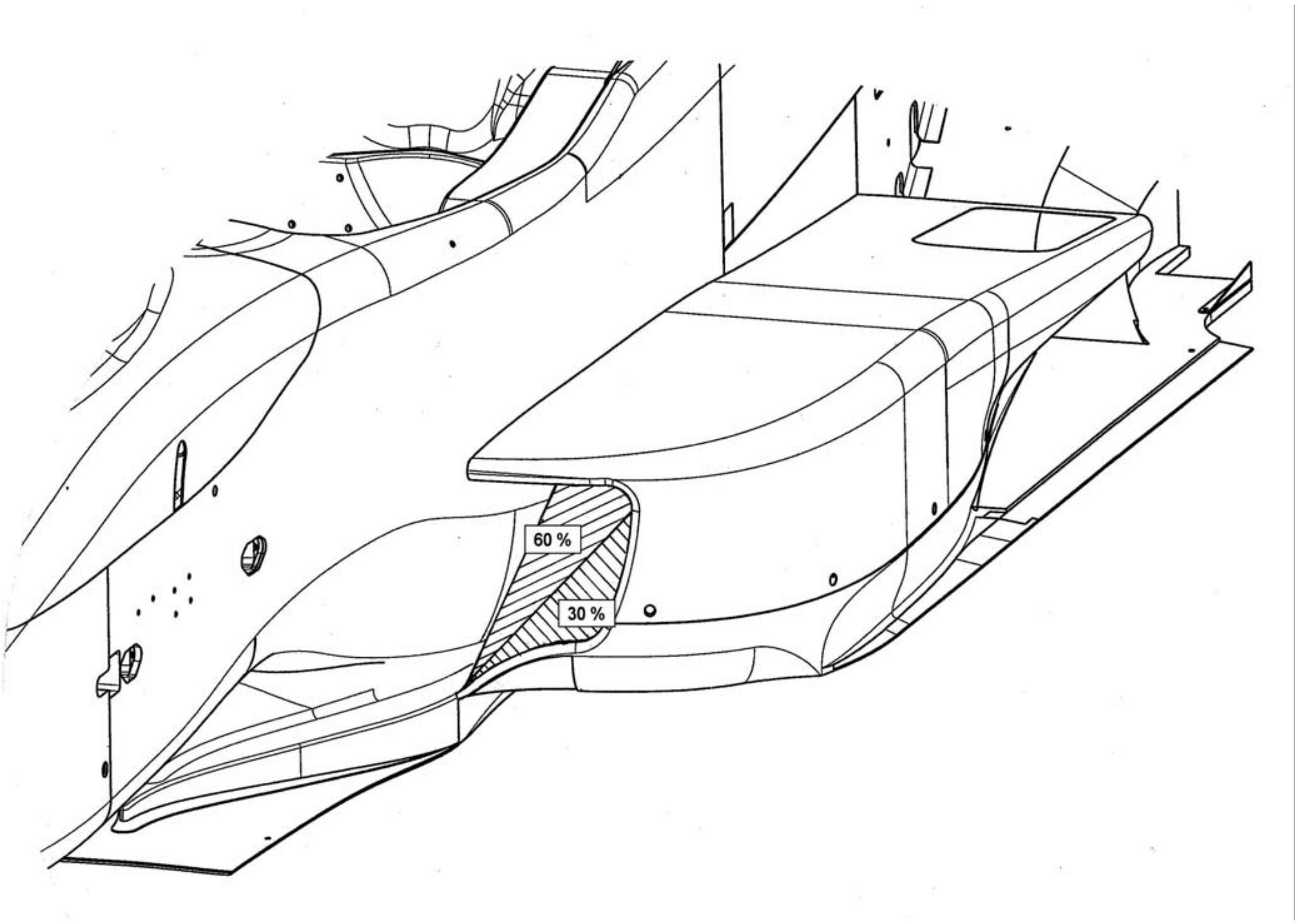
MF: MEDIUM FLAP; **SF**: STANDARD FLAP

- Depending on the ambient temperature and the ‘engine tuner’ requested water temperature you might need to adjust the cooling capacity of the radiators.
- Cooling efficiency increases by sealing any eventual leakage in the inlet ducts to the radiators.
- Blanking increases rear down-force. To keep the same balance you might need to reduce the rear top wing incidence, or increase the front flap incidence.

The most efficient way of adjusting the cooling is the following:

	CONFIGURATION	EQUIVALENT INCREASE IN REAR HDF WING INCIDENCE
	Without Blanking	Reference
1	+30% FRONT	+0.5°
2	+60% FRONT	+0.5°

Figure shows the 30% and 60% blanking of the radiator inlet regarding configuration 1 and 2.



HUB ASSEMBLY

The following procedure explains how to change front and rear hub bearings

- **Removal of bearing**
  a) Remove spigot by removing the 6 screws A;
  b) push off drive flange by using two 6x1 screws set on thread B;
  c) remove circlip C;
  d) press off bearing from the upright;
  e) push off retainer by means of two 6x1 screws set on thread B.

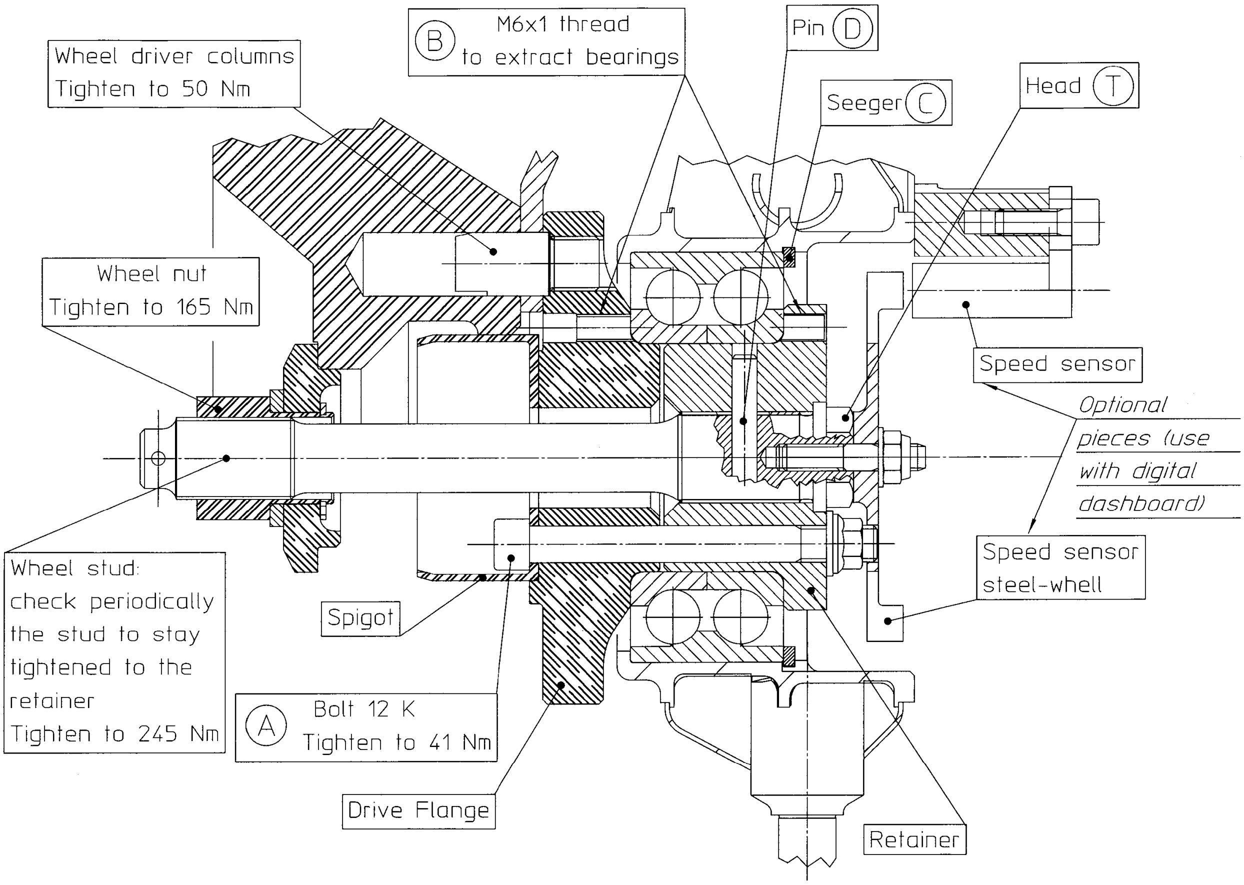
- **Replacement of bearing**
  a) Press wheel bearing into the upright;
  b) Fit circlip C;
  c) Press the retainer into the wheel bearing;
  d) Place spigot in position on the drive flange, fit A screws, washers and nuts and tighten to 41 Nm (**Caution**: this value is for 12K screws only).

- **Wheel stud removal**
  a) To reduce resistance to Loctite, heat wheel stud and retainer to 180°C;
  b) Remove pin D, remove wheel stud.

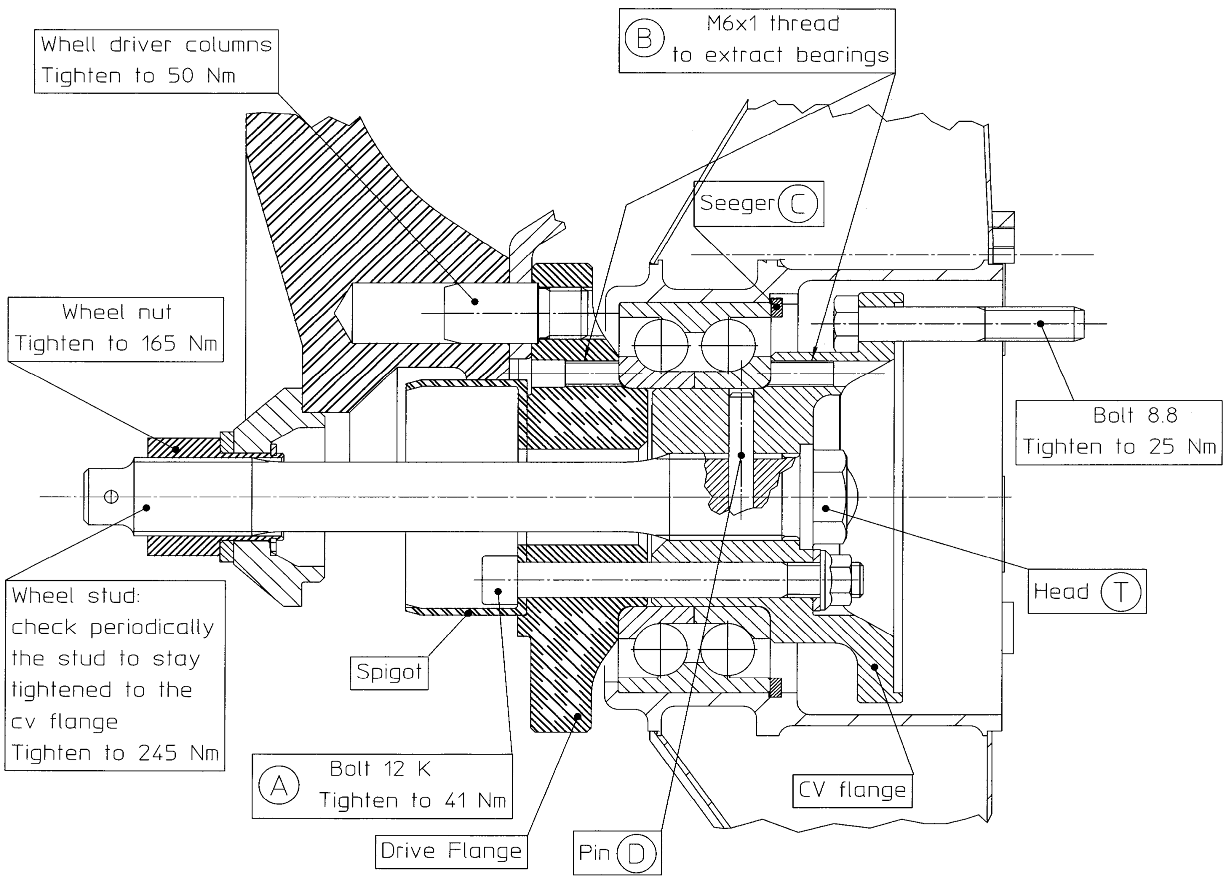
- **Wheel stud replacement**
  a) Remove pin D;
  b) Clean and degrease retainer thread and wheel stud;
  c) Spray degreaser to threaded area of retainer and wheel stud. **Caution**: Don't use petrol;
  d) Apply LOCTITE 638™ to wheel stud thread;
  e) Screw wheel stud into retainer and tighten to 245 Nm by forcing on head T;
  f) Drill wheel stud and insert pin D.

- **Bearing assembly into hub replacement**
  a) Warm the hub to 100°C;
  b) Fit the bearing assembly

FRONT HUB



REAR HUB



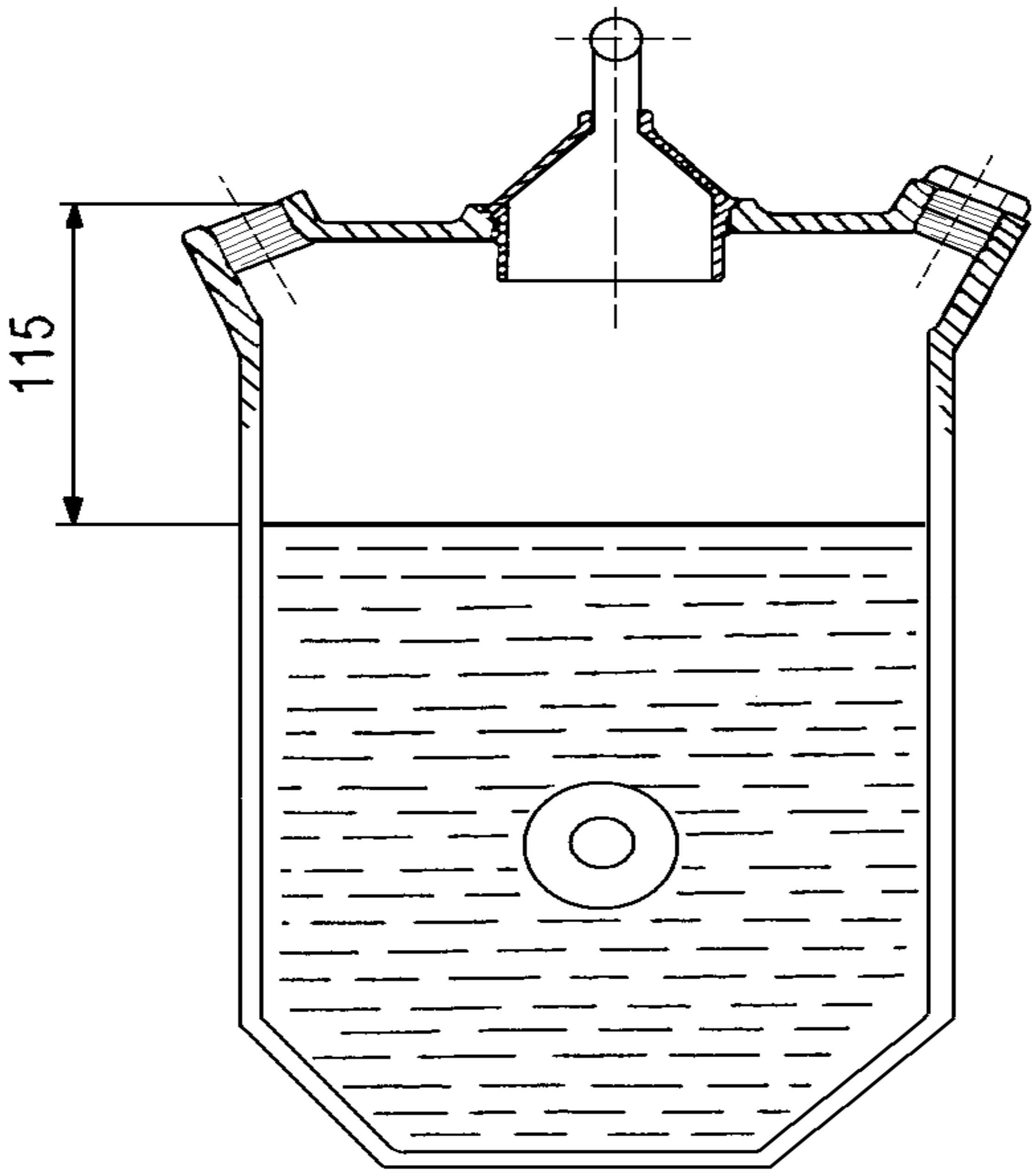
ENGINE OIL SYSTEM

The distance between the oil cap and the oil surface should be about 115 mm.

Less oil may cause cavitation and lead air into the oil circuit.

More oil may cause excessive power consumption due to the oil squash.

Typically you would need a total of 4.5 litres to fit in the oil tank (including the oil in the engine and hoses). Check with the engine tuner for the specific amount for your engine.

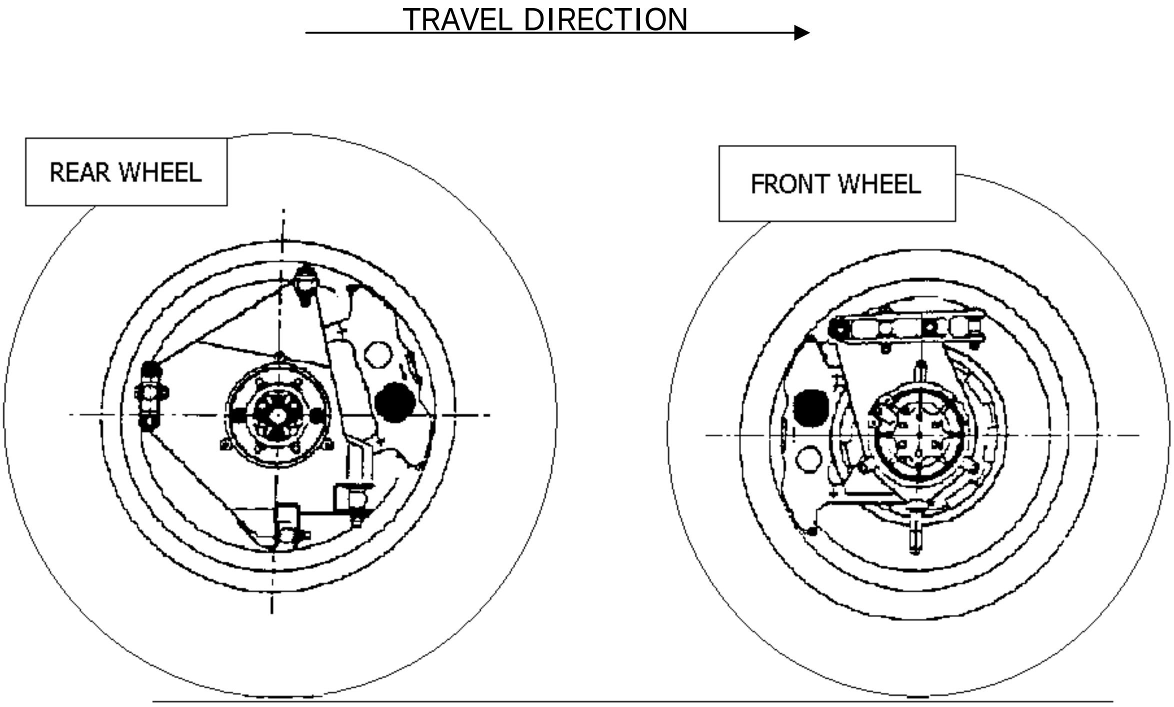


GEARBOX OIL

In order to properly run the gearbox and the differential you need 2.5 litres of oil, SAE 80 or 90.

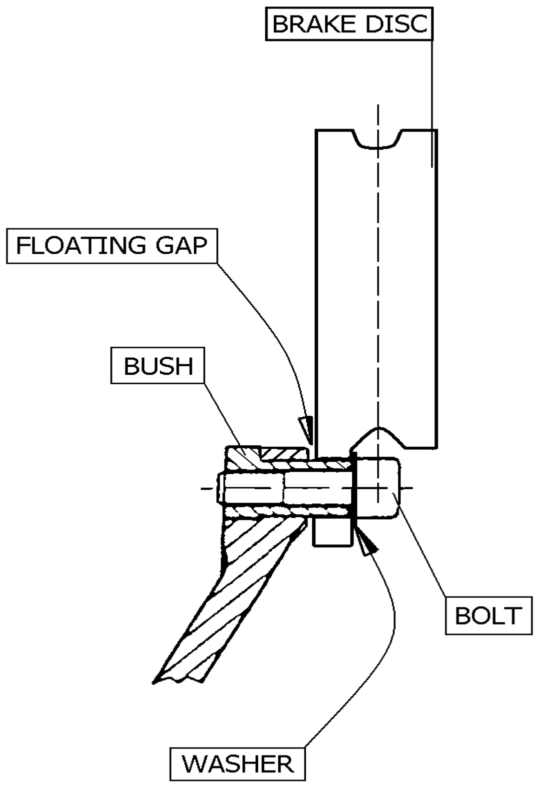
BREMBO BRAKE CALIPER ASSEMBLY

Note: the dark piston is the bigger in diameter from both. The car features four different callipers.

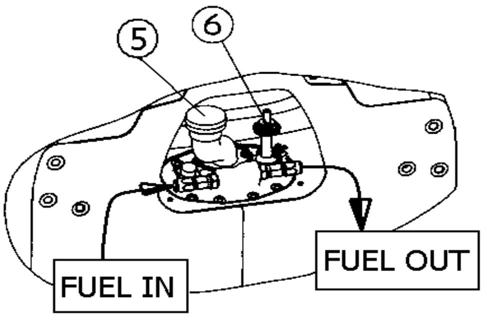


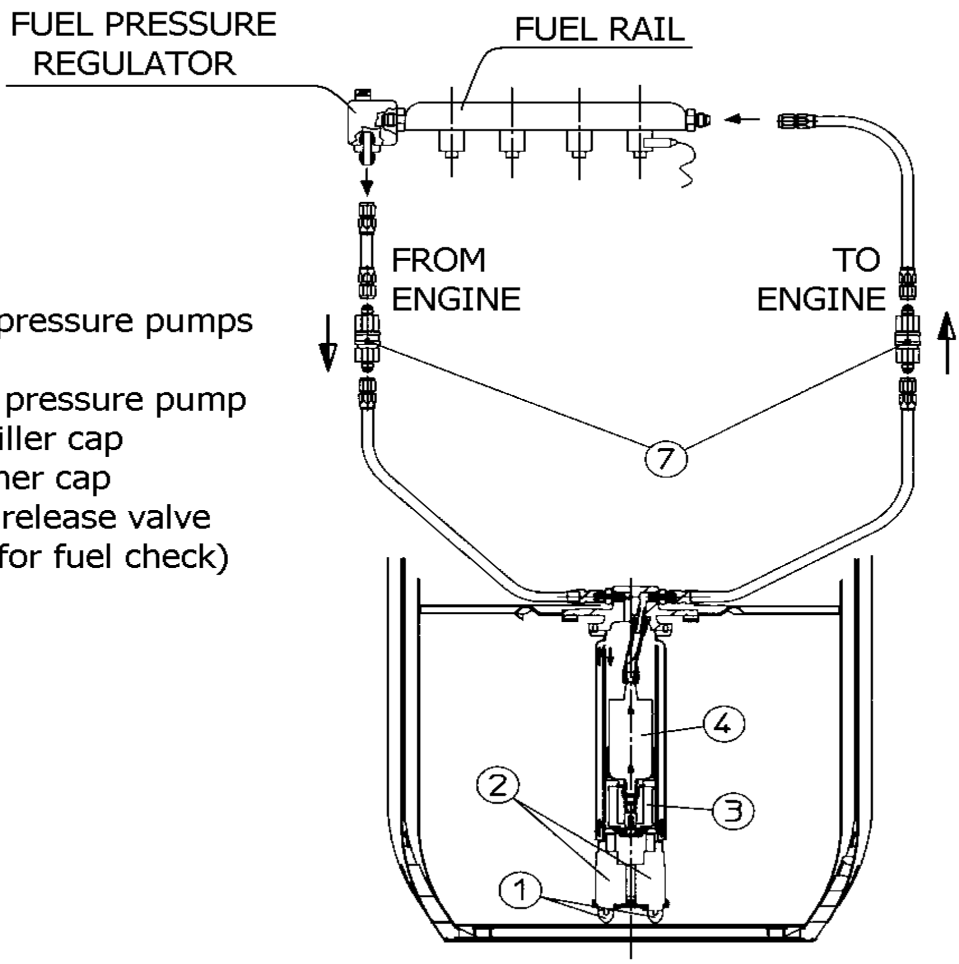
BRAKE DISC ASSEMBLY

.



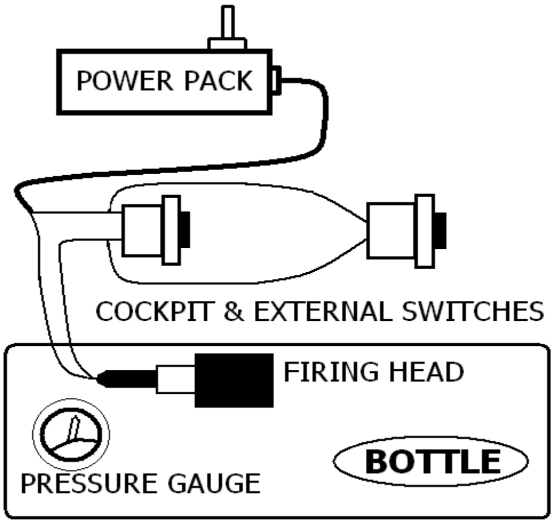
F302/3/4 features twin electrical-submerged low pressure fuel pumps as a redundant caution in case one pump fails. The driver can switch one or the other low pressure pump from the cockpit.
Available at Dallara is a ‘SAFETY’ filling system with dry-brake valves and a system to empty the tank using an external fuel pump. Contact us for detail information.





1) Filter
2) LOW pressure pumps
3) Filter
4) HIGH pressure pump
5) Fuel filler cap
6) Breather cap
7) quick release valve
(also for fuel check)

LAYOUT



DETAILS

The LIFELINE system is an electrically triggered Halon or foam spray fire extinguisher system. The system uses an actuator to operate the valve located on the pressurised container, containing the extinguishing liquid. These are triggered remotely using a battery powered power pack.
In order to guarantee reliable operation the actuator follow military specifications. The system/battery test electronics are integrated into the remote power pack. The connector on the firing head is also of military grade.

TESTING

The power pack electronics can test the continuity of the electrical wiring, and provides a high current pulse test on the battery, to ensure system integrity before use. The battery test electronics do not excessively drain the battery during this test.
The tests are carried out using a three way switch on the power pack. Since the system is only as good as the battery that powers it and the integrity of the wiring and its connections, the tests should be performed before each race.
To check the battery, press and hold up the power pack switch. Every 2 seconds you'll see a YELLOW light flash. If the light flashes very dimly the battery should be replaced. If in doubt change the battery.
To check the wiring continuity, ensure that the power pack switch is on “SYSTEM INACTIVE” to ensure that the extinguisher is not fired. Press the internal firing button and check that the RED light comes on. Press the external firing button and check that this also makes the RED light comes on.

CARES

- Ensure that the wiring cables do not run next or in the same loom as the power ones, especially those for ignition and battery power. Ideally, run all cables next to the chassis (earth);
- ensure that all plugs exposed to water spray are protected with rubber boots;
- do not allow cables to run through sharp edged passages without protection;
- do not fix the cables next to or onto any surface likely to exceed 100 °C;
- do not attempt to turn firing heads as system may be activated.

GEARBOX information

The F302/3/4 car mounts a new Hewland 6 gear sequential gearbox, the FTR-200. All gears, crown-wheel and pinion, some differential parts, bearings and the casing are new. Consequently the maintenance is different in many ways and some specific tools are required for proper maintenance. Hewland has written a technical manual, including a spare parts list, for the FTR-200. The manual is available at Hewland. To receive a copy please, contact the commercial office at Hewland by e-mail: sales@hewland.com

To take the differential out you first need to take remove the LH-side outer tripod housing which is locked with a wire ring (circlip type fitting) inside the RH tripod housing. We build a specific tool, available at Dallara's stores.

To open the differential you have to remove the bearing in order to reach the bolts of the casing cover. Use proper tools in order to avoid damaging the bearing and the diff cover.

IMPORTANT BASIC INFO

- The mandatory standard Dallara crown-wheel & pinion ratio: 12/34
- Total oil quantity for diff and gearbox: 2.5L
- Oil type: SAE 80 or 90
- Pinion bearing nut tightening torque: 176Nm (130lbs.ft)
- Pinion shaft nut tightening torque: 135Nm (100lbs.ft)

PLEASE; CONTACT US IMMEDIATELY REGARDING ANY PROBLEM OR ANOMALY

STUD INSTALLATION AND REMOVAL

Please, take extreme care when removing and substituting any stud.
Typically use:
Loctite 270 (soft Loctite) for suspension brackets, brake callipers
Loctite 242 (hard Loctite) for chassis, gearbox, bell-housing, roll hoop

Most studs are mounted with loctite and do require a proper installation procedure

- Clean the hole from dust, debris, oil etc
- Drive a screw tap to remove machining residuals
- Clean the hole with brake cleaner and dry with compressed air
- Pre-assemble the stud without Loctite to check its position and remove again
- Clean the hole again with a degreaser and dry with compressed air
- Coat the hole with Loctite
- Install the stud
- Tight the stud with the recommended tightening torque. You can do so by using a pair of nuts locked against each other.

Stud tightening torques: M5: M6: M7: M8: M10:

TRANSMISSION

- to prevent the drive-shaft bolts from loosing, fit them with LOCTITE 242;

AERODYNAMICS

- do not remove from high- and mid-downforce rear top wing assembly the small profile for use as rear low downforce wing because these are not reinforced. Use the specific wing profile, available at Dallara;
- when running the car with a rear ride height of 40mm or more, check the height of the rear wing endplate. Total height cannot exceed 900mm.

STEERING

steering rack-end rod ends must absolutely get replaced after crashing;

CLUTCH

When using a thicker than F3 typical AP twin-plate metal clutch (i.e. carbon clutch…), check that the clutch piston can move backwards enough to release the clutch completely. You can shorten the clutch piston spacer by turning off the required amount.

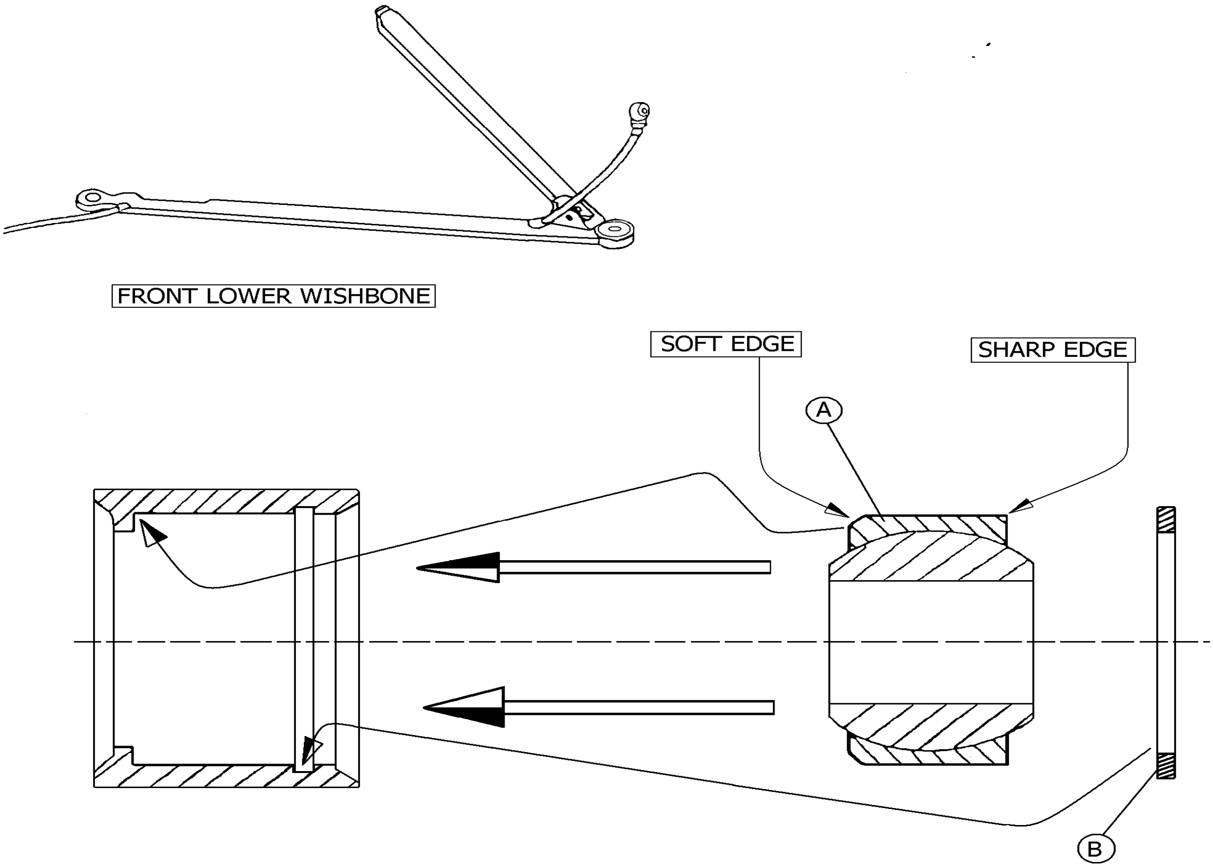
WISHBONES

Never lift up the car gripping the middle of the wishbones. Never sit or stand on any wishbone.

SUSPENSION

- check wheel stud to inner hub tightening in front and rear uprights. You can notice if the lock-nut did come loose by observing relative displacement of two red notches on the lock-nut and on the spigot
- check, every 1000 Km, lower pin lock-nut of front upright to prevent from coming loose
- after any accident, check alignment of front and rear push-rods and their respective adjusters
- wishbones are treated with PARCO-LUBRITE. Clean the surface with acetone before inspection
- check periodically the tightening of the K-nuts which fixes the drop links on the rear anti roll bar blades.

- ball joint A, used in the front lower and rear lower wishbones, must be fitted with sharp-edge side in contact with circlip B, as shown in following drawing



TIGHTENING TORQUES

This table lists suggested tightening torques. For additional security use LOCTITE 242 or 243.

Tightening torques	Nm	Kgm	lbs ft
Pinion bearing nut	176	17.9	130
pinion-shaft nut	135	13.8	100
Final drive bolts	73	7.5	55
Brake disc bolt	7	0.7	5
Brake caliper studs	50	5.1	37
Wheel nut	165	17.0	125
Wheel stud	245	25.0	180
Damper end-stroke spacer	65	6.6	49
Wheel driver columns	50	5.1	37
Nut 7 × 1 (see hub assembly)	17	1.7	13
Bolt 8.8 (see hub assembly)	25	2.5	19
Bolt 12K (see hub assembly)	39	4.0	29
Rocker cap nut	34	3.5	25
Rocker stud nut	54	5.5	40
10-32 UNF 'K' nut	3	0.3	2
$^{1}/_{4}$ UNF 'K' nut	12	1.2	9
$^{5}/_{16}$ UNF 'K' nut	24	2.4	18
$^{3}/_{8}$ UNF 'K' nut	50	5.1	37

Table shows conversion from SWG (Std Wire Gage) to metric units for sheet-metal thickness

SWG	8	10	12	14	16	18	20
Metric (mm)	4.064	3.251	2.642	2.032	1.626	1.219	0.914

CONVERSION TABLE

Length

1 inch=25.4 mm	1 millimeter=0.03937 in
1 foot=304.8 mm=12 in	1 centimeter=0.3937 in
1 yard=914.4 mm=3 ft	1 meter=39.37 in
1 mile=5280 ft=1.60934 km	1 kilometer=0.62137 miles

Volume

1 cubic inch (c.i.)=16.387 cubic centimetres	1 cubic centimeter=0.061 cubic inch
	1 liter=1000 cc=61.0255 cubic inch

Pressure

1 psi=0.0716 bar	1 kg/cm2=1.019 bar
	1 bar=10^5 Pa=0.1MPa
	1 bar=13.95 psi

Weight

1 ounce (oz)=28.35 grams	1 Kg=1000 grams = 2.205 lb
1 pound (lb.)=16 ounces=453.592 grams	

Speed

1 MPH=1.467 feet per second	
1 mph=0.62137 kilometres per hour	1 kilometre per hour=1.60934 mph
1 IPS (in/s)=25.4 mm/s	1 mm/s=0.039 IPS

Specific weight

Water=1 kg/l
Mineral Oil=0.903 Kg/l
Gasoline=0.74 Kg/l

Useful formulas

Engine displacement=0.7854 × bore × bore × stroke × no. of cylinders
British horsepower (BHP)= RPM × torque (lbs ft) / 5250
Km/h = [RPM × tire radius(mm) x gear ratio] / 7519
Lap speed (km/h) = track length (Km) × 3600/lap time (s)
Average speed (km/h) =track length (Km) ×3600 × no. of laps/total time (seconds)

Motor racing is not covered by warranty due to the intentional choice of drivers to race in a dangerous environment

DALLARA indicates that, under normal operating conditions, a new car would not show failure in structural components before it has completed around 25000 Km. It holds true if necessary maintenance and checks are provided and if the car had no incidents from the origin.

DALLARA is not responsible for incorrect chassis repairs, if made outside its factory or in centres not-recognised by FIA.

Chassis should be checked for structural failure not later than two years after delivery from DALLARA factory, and anyway after any major accident. After first check or after any major accident it is mandatory to check the chassis every year in a centre recognised by FIA authority.

DALLARA is not responsible for damage caused by non-genuine spare parts.

Under maintenance, following parts should be replaced after 25000 Km or two-years use:

- wiring loom
- starter motor
- steering column
- steering rack and tie-rods
- brake pedal
- brake disc bell
- wheel bearings
- suspension arms and spherical joints
- engine installation parts
- drive-shafts
- wings and rear wing supporting plate

We firmly remind you that **Main roll over hoop**, **Mono-coque** and **Front nose-box** and all other parts mentioned in Art 2.7 of the FIA F3 regulations are **FIA approved** and cannot be modified by unauthorised personnel for whatever reason.

Any change to these parts is sufficient reason for disqualification.

REAR SPRINGS

T-bar and Mono blade ARB	Bar only (kg/mm)	500 Bar @ Ground (kg/mm)	600 Bar @ Ground (kg/mm)	700 Bar @ Ground (kg/mm)	800 Bar @ Ground kg/mm)	900 Bar @ Ground kg/mm)	1000 Bar @ Ground kg/mm)	1100 Bar @ Ground kg/mm)	1200 Bar @ Ground (kg/mm)
ARB OFF	0,0	6,5	7,8	9,1	10,4	11,7	13,0	14,3	15,6
T 13 SOLID Blade L221 P1	8,8	13,2	14,5	15,8	17,1	18,4	19,7	21,0	22,3
T 13 SOLID Blade L221 P2	9,5	13,8	15,1	16,4	17,7	19,0	20,3	21,6	22,9
T 13 SOLID Blade L221 P3	9,9	14,1	15,4	16,7	18,0	19,3	20,6	21,9	23,2
T 13 SOLID Blade L221 P4	10,2	14,3	15,6	16,9	18,2	19,5	20,8	22,1	23,4
T 13 SOLID Blade L221 P5	10,4	14,5	15,8	17,1	18,4	19,7	21,0	22,3	23,5
T 13 SOLID Blade L170 P1	16,1	18,9	20,2	21,5	22,8	24,0	25,3	26,6	27,9
T 13 SOLID Blade L170 P2	17,7	20,1	21,4	22,7	24,0	25,3	26,6	27,9	29,2
T 13 SOLID Blade L170 P3	18,2	20,5	21,8	23,1	24,4	25,7	27,0	28,3	29,6
T 13 SOLID Blade L170 P4	18,4	20,6	21,9	23,2	24,5	25,8	27,1	28,4	29,7
T 13 SOLID Blade L170 P5	18,6	20,8	22,1	23,4	24,7	26,0	27,3	28,6	29,9
T 20x2 Blade L221 P1	19,9	21,8	23,1	24,4	25,6	26,9	28,2	29,5	30,8
T 20x2 Blade L221 P2	21,9	23,3	24,6	25,9	27,2	28,5	29,8	31,1	32,4
T 20x2 Blade L221 P3	27,0	27,2	28,5	29,8	31,1	32,4	33,7	35,0	36,3
T 20x2 Blade L221 P4	33,1	31,9	33,2	34,5	35,8	37,1	38,4	39,7	41,0
T 20x2 Blade L221 P5	33,3	32,1	33,4	34,7	36,0	37,3	38,6	39,9	41,2
T 30x5 Blade L221 P1	24,4	25,3	26,6	27,9	29,2	30,5	31,8	33,1	34,4
T 30x5 Blade L221 P2	29,8	29,4	30,7	32,0	33,3	34,6	35,9	37,2	38,5
T 30x5 Blade L221 P3	45,4	41,4	42,7	44,0	45,3	46,6	47,9	49,2	50,5
T 30x5 Blade L221 P4	61,0	53,4	54,7	56,0	57,3	58,6	59,9	61,2	62,5
T 30x5 Blade L221 P5	64,5	56,1	57,4	58,7	60,0	61,3	62,6	63,9	65,2
T 20x2 Blade L170 P1	49,7	44,8	46,0	47,3	48,6	49,9	51,2	52,5	53,8
T 20x2 Blade L170 P2	53,8	47,8	49,1	50,4	51,7	53,0	54,3	55,6	56,9
T 20x2 Blade L170 P3	63,5	55,4	56,7	58,0	59,2	60,5	61,8	63,1	64,4
T 20x2 Blade L170 P4	75,4	64,5	65,8	67,1	68,4	69,7	71,0	72,3	73,6
T 20x2 Blade L170 P5	75,9	64,9	66,2	67,5	68,8	70,1	71,4	72,7	74,0
T 30x5 Blade L170 P1	62,1	54,3	55,6	56,9	58,2	59,5	60,8	62,1	63,4
T 30x5 Blade L170 P2	69,4	59,9	61,2	62,5	63,8	65,1	66,4	67,7	69,0
T 30x5 Blade L170 P3	88,2	74,3	75,6	76,9	78,2	79,5	80,8	82,1	83,4
T 30x5 Blade L170 P4	109,9	91,1	92,4	93,7	95,0	96,2	97,5	98,8	.00,1
T 30x5 Blade L170 P5	117,5	96,9	98,2	99,5	100,8	102,1	103,3	104,6	.05,9
Mono Blade 140 Thin P1	2,9	72,5	73,8	75,1	76,4	77,7	79,0	80,3	81,6
M-Blade 140 Thin P2	3,0	75,5	76,8	78,1	79,4	80,7	82,0	83,3	84,6
M-Blade 140 Thin P3	3,8	93,1	94,4	95,7	97,0	98,3	99,6	100,9	.02,2
M-Blade 140 Thin P4	5,1	122,8	124,1	125,3	126,6	127,9	129,2	130,5	.31,8
M-Blade 140 Thin P5	5,8	139,0	140,3	141,6	142,9	144,2	145,5	146,8	.48,1
M-Blade 140 Optional P1	5,0	119,9	121,2	122,5	123,8	125,1	126,4	127,7	.29,0
M-Blade 140 Optional P2	5,3	127,6	128,9	130,2	131,5	132,8	134,1	135,4	.36,7
M-Blade 140 Optional P3	6,5	153,4	154,7	156,0	157,3	158,6	159,9	161,2	.62,5
M-Blade 140 Optional P4	8,3	195,7	197,0	198,3	199,6	200,9	202,2	203,5	'04,8
M-Blade 140 Optional P5	9,7	225,5	226,8	228,1	229,4	230,7	232,0	233,3	'34,6

The list below gives comparable stiffness at ground for various mono damper anti roll settings. Take into account that while the car rolls the mono damper does not contribute in the resistance to roll. With the twin damper system, especially when using soft spring and anti-roll bars, the contribution of the dampers to the roll resistance is not negligible.

MONO DAMPER SYSTEM ARB STACK STIFFNESS	Bar @ Ground (kg/mm)
109	22,7
136	28,4
155	32,3
181	37,8
218	45,5
272	56,8
362	75,5
457	95,4
571	119,1
761	158,8
1197	249,8
1796	374,7
2504	522,5