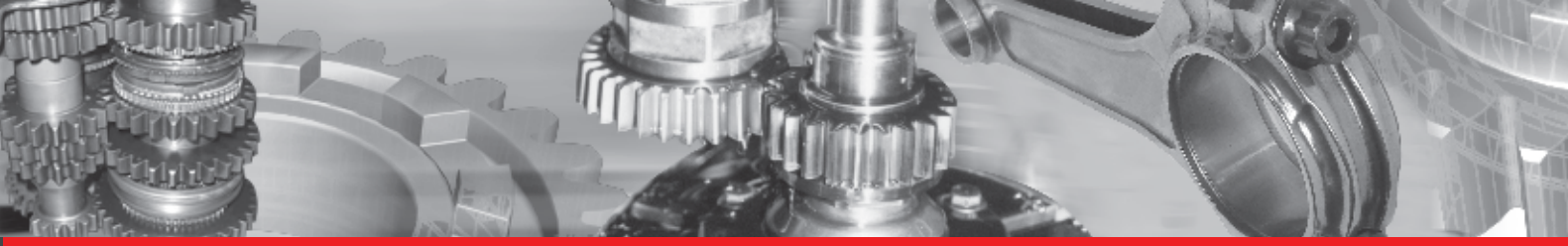


TT3
SERIES

RACING TRANMISSIONS

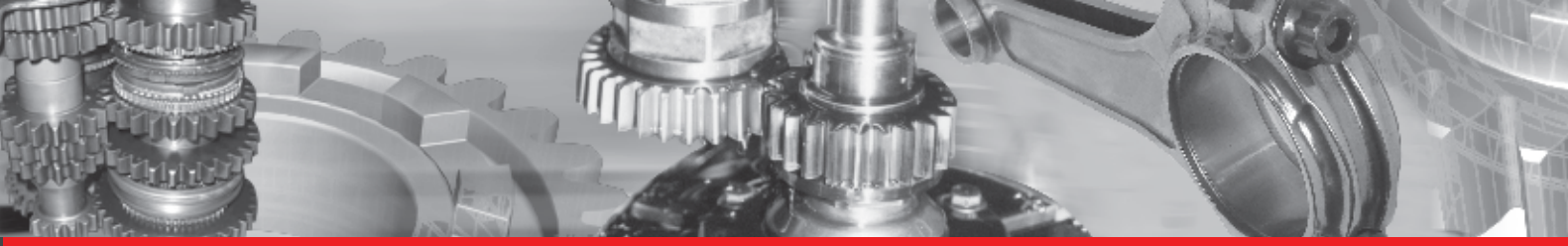
The TT series has been the result of years of racing experience. This model has been winning races and championships, worldwide, since 2002.

Due to its design, the TT3 has been successfully used in a wide variety of racing; this presentation only shows general information.

Given that evolution is permanent in racing, your feedback is always crucial, so do not hesitate in contacting the Saenz Technical Department at:

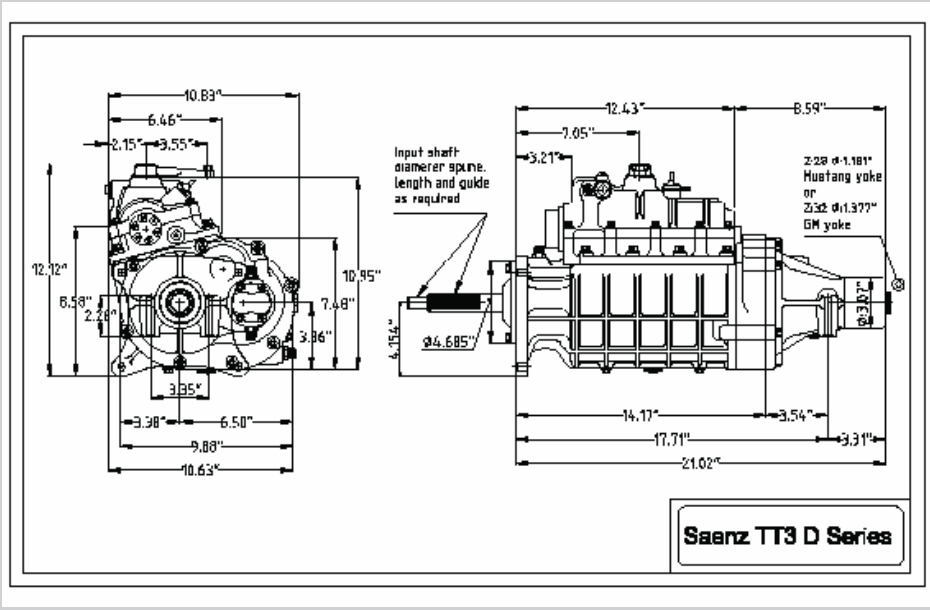
gabriel@saenzgroup.net

SAENZ

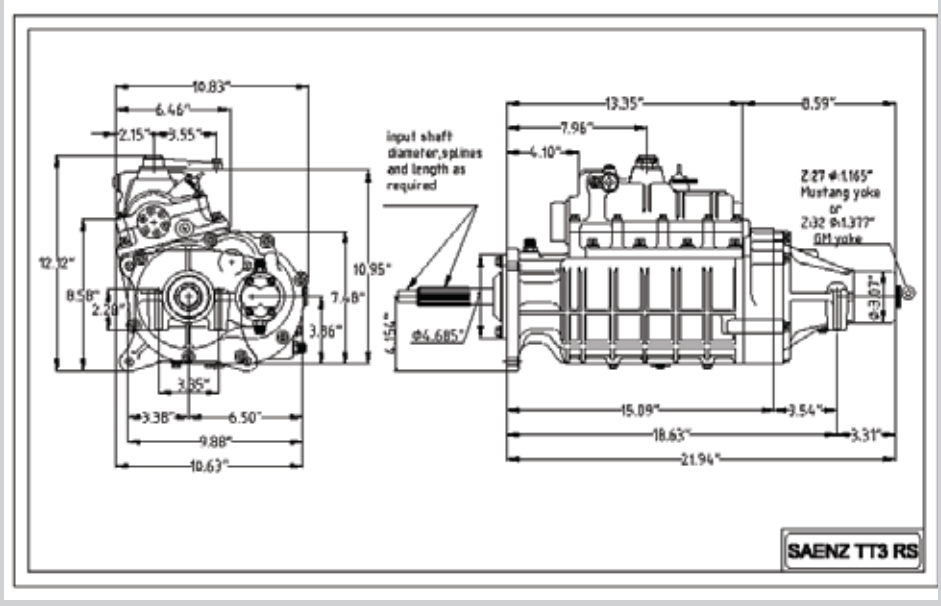


MAIN DIMENSIONS

D SERIES



R SERIES



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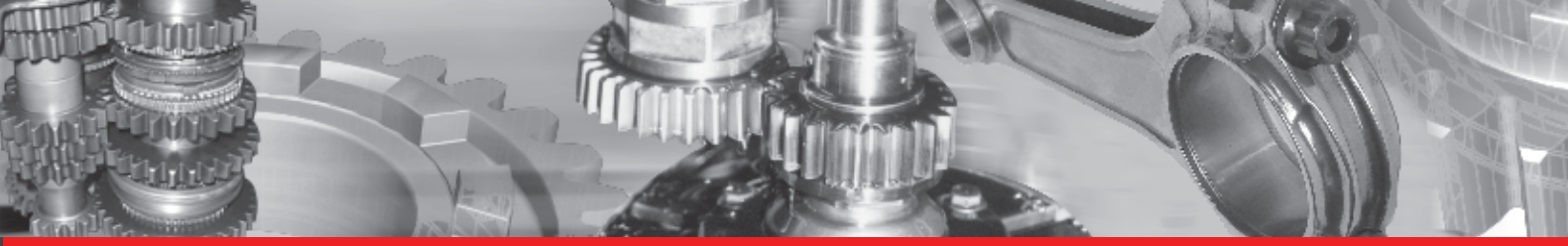
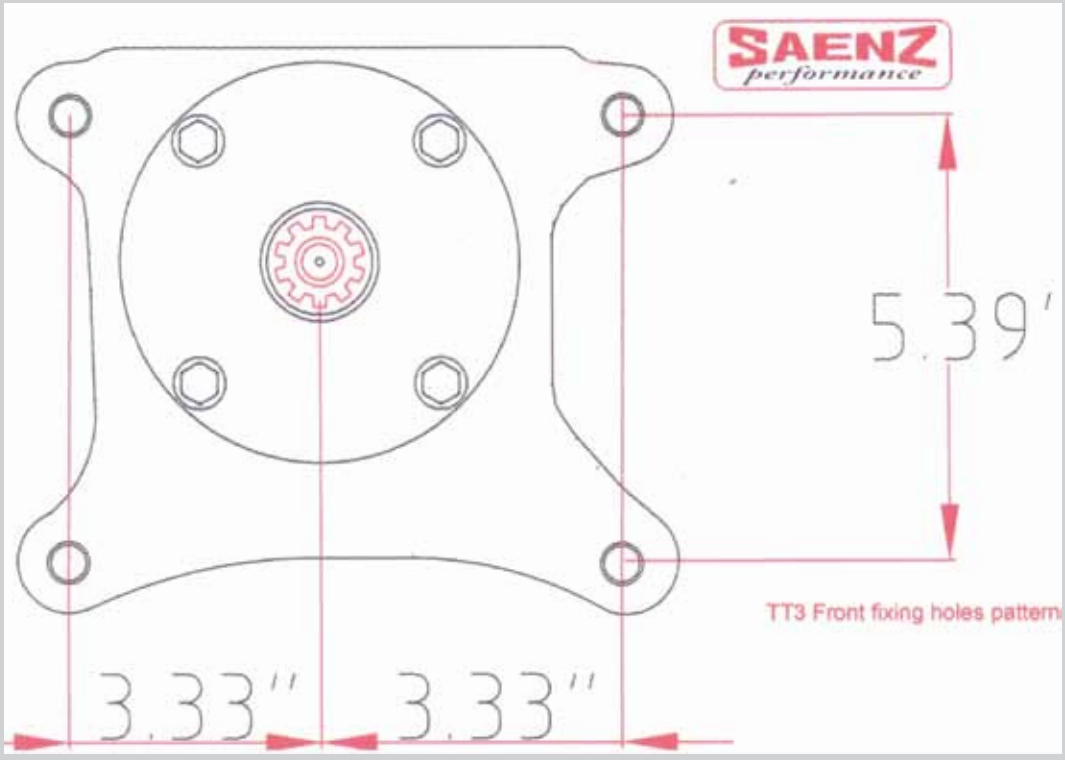


TT3
SERIES

SPLINES, YOKES AND ADAPTORS



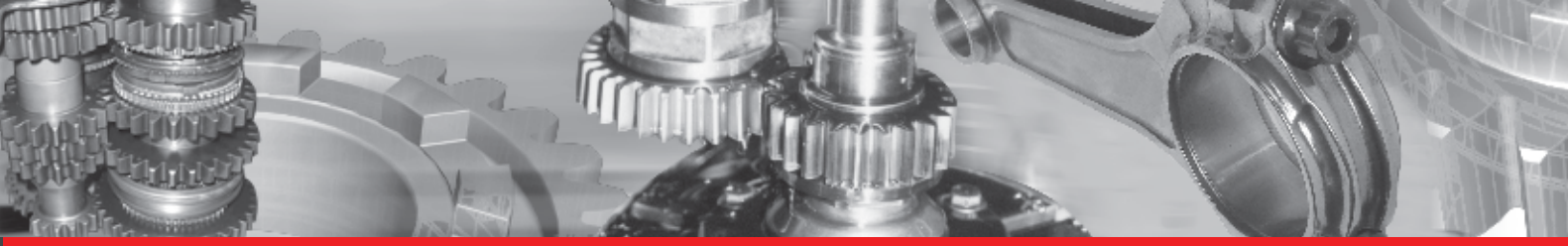
TT3 front bolt pattern is shown.
There is a wide variety of adaptors and it is possible to custom-make any adaptor to suit your specific application.

GM 26 spline x 1,125" or 10 x 1.102" are standard options for the input shaft, although any other could be supplied upon request.

GM 32 splines or Ford 28 splines are the options for the rear yoke.

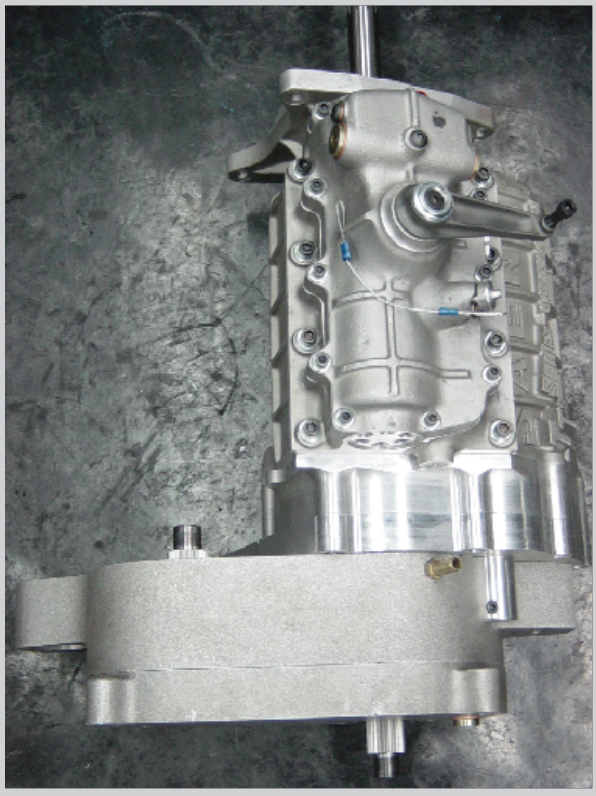
In 4WD applications, the tail is replaced with an adaptor that fits in transfer case. Normally a custom main shaft is necessary.

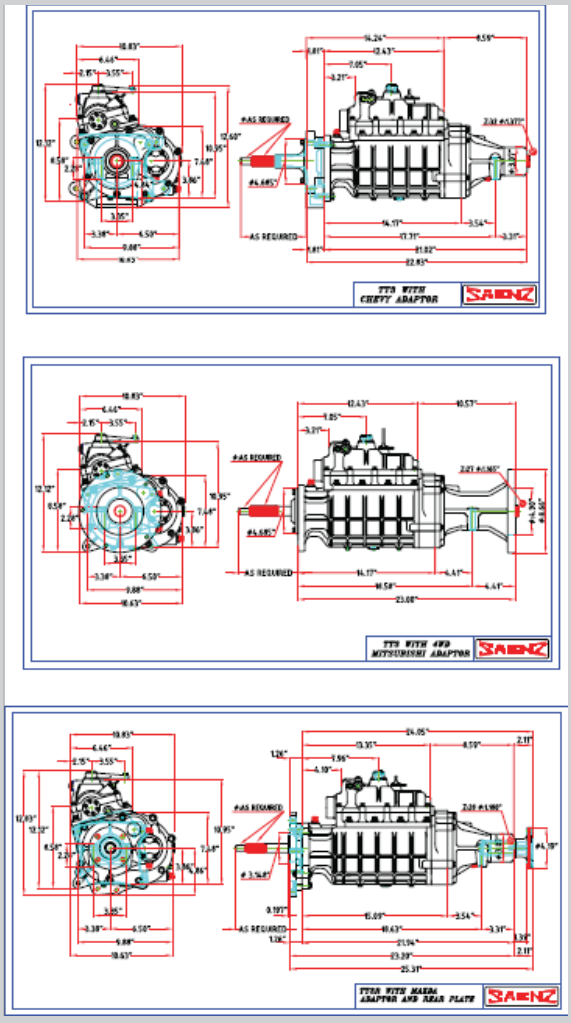
SAENZ



TT3
SERIES

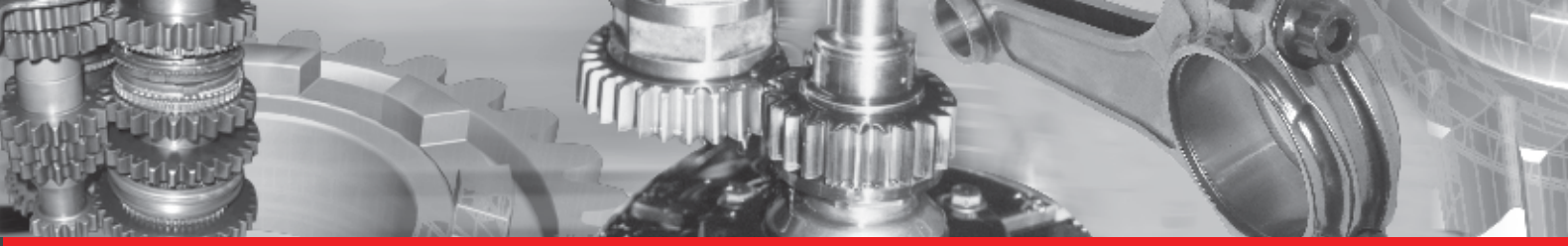
TAILORED APPLICATIONS





Saenz can adapt any TT3 to your specific application

SAENZ



D & R SERIES AVAILABLE RATIOS

Both series receive power at the input shaft (3ISXX) through the clutch.

The input shaft makes input gear turn at same RPM as the engine.

The input gear makes the layshaft turn through the input crown.

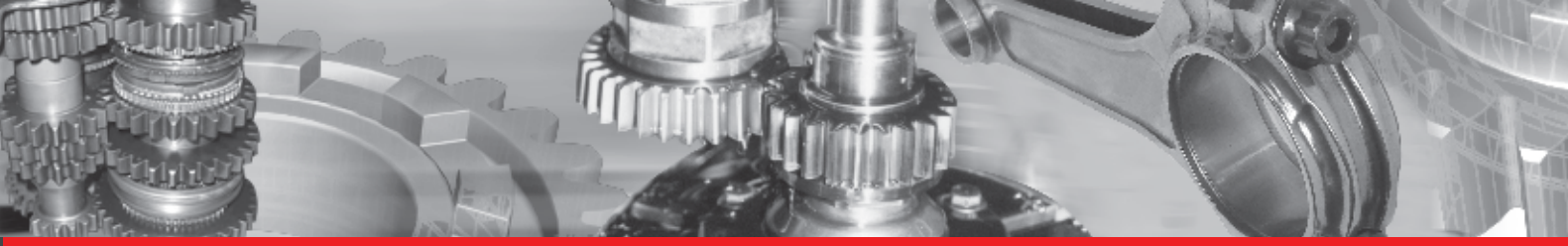
All the crown gears in the layshaft turns at its same angular speed.

The gear engaged to crowns turn at different speed depending on each ratio.

Once each gear is shifted, main shaft starts turning at its same gear speed.

The only difference between the D and R series is that in the D series, when top gear is shifted (whether 5th or 6th gear) input shaft engages main shaft and there is no gear working. So in a D series, top gear is always in a 1 to 1 ratio.

The R series allow for a change in the 6th gear ratio and there are also different input pair ratios available.



SAENZ performance

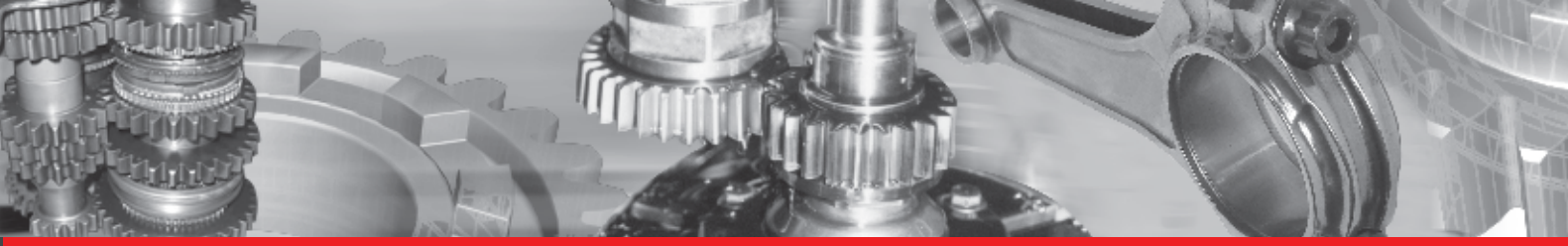
TT3D Series GEAR RATIO CHART

Nº	DRIVEN (on mainshaft)	DRIVER (on layshaft)	RATIO (input pair 22-22)
1	39	17	2.294
2	38	17	2.235
3	34	16	2.125
4	33	16	2.063
5	34	17	2.000
6	33	17	1.941
7	32	17	1.882
8	31	17	1.824
9	32	18	1.778
10	31	18	1.722
11	30	18	1.667
12	31	19	1.632
13	27	17	1.588
14	31	20	1.550
15	29	19	1.526
16	30	20	1.500
17	25	17	1.471
18	26	18	1.444
19	25	18	1.389
20	27	20	1.350
21	28	21	1.333
22	25	19	1.316
23	27	21	1.286
24	28	22	1.273
25	25	20	1.250
26	26	21	1.238
27	28	23	1.217
28	24	20	1.200
29	25	21	1.190
30	26	22	1.182
31	27	23	1.174
32	23	20	1.150
33	24	21	1.143
34	26	23	1.130
35	27	24	1.125
36	21	19	1.105
37	23	21	1.095
38	24	22	1.091
39	25	23	1.087
40	21	20	1.050
41	25	24	1.042
42	25	25	1.000
43	25	26	0.962

Indicated ratios are all changeable. Fixed first gears could be made upon request

TT3-D5S 1st,2nd,3rd,4th: driver on layshaft, driven on splined shaft 5th: direct, always 1 to 1 ratio.

TT3-D6S 1st,2nd,3rd,4th: driver on layshaft, driven on splined shaft 6th: direct, always 1 to 1 ratio.



TT3 SERIES

TT3 R Series Ratio Chart

SAENZ performance

AVAILABLE INPUT PAIRS - DROP GEARS

Nº	DRIVEN (on mainshaft)	DRIVER (on layshaft)	Driver 23 Driven 21	Driver 22 Driven 21	Driver 22 Driven 22	Driver 21 Driven 22	Driver 21 Driven 23
1	39	17	2.095	2.190	2.294	2.403	2.513
2	38	17	2.041	2.134	2.235	2.342	2.448
3	34	16	1.940	2.028	2.125	2.226	2.327
4	33	16	1.883	1.969	2.063	2.161	2.259
5	34	17	1.826	1.909	2.000	2.095	2.190
6	33	17	1.772	1.853	1.941	2.034	2.126
7	32	17	1.719	1.797	1.882	1.972	2.062
8	31	17	1.665	1.741	1.824	1.910	1.997
9	32	18	1.623	1.697	1.778	1.862	1.947
10	31	18	1.572	1.644	1.722	1.804	1.886
11	30	18	1.522	1.591	1.667	1.746	1.825
12	31	19	1.490	1.557	1.632	1.709	1.787
13	27	17	1.450	1.516	1.588	1.664	1.739
14	31	20	1.415	1.480	1.550	1.624	1.698
15	29	19	1.394	1.457	1.526	1.599	1.672
16	30	20	1.370	1.432	1.500	1.571	1.643
17	25	17	1.343	1.404	1.471	1.541	1.611
18	26	18	1.319	1.379	1.444	1.513	1.582
19	25	18	1.268	1.326	1.389	1.455	1.521
20	27	20	1.233	1.289	1.350	1.414	1.479
21	28	21	1.217	1.273	1.333	1.397	1.460
22	25	19	1.201	1.256	1.316	1.378	1.441
23	27	21	1.174	1.227	1.286	1.347	1.408
24	28	22	1.162	1.215	1.273	1.333	1.394
25	25	20	1.141	1.193	1.250	1.310	1.369
26	26	21	1.130	1.182	1.238	1.297	1.356
27	28	23	1.112	1.162	1.217	1.275	1.333
28	24	20	1.096	1.145	1.200	1.257	1.314
29	25	21	1.087	1.136	1.190	1.247	1.304
30	26	22	1.079	1.128	1.182	1.238	1.294
31	27	23	1.072	1.121	1.174	1.230	1.286
32	23	20	1.050	1.098	1.150	1.205	1.260
33	24	21	1.043	1.091	1.143	1.197	1.252
34	26	23	1.032	1.079	1.130	1.184	1.238
35	27	24	1.027	1.074	1.125	1.179	1.232
36	21	19	1.009	1.055	1.105	1.158	1.211
37	23	21	1.000	1.045	1.095	1.147	1.200
38	24	22	0.996	1.041	1.091	1.143	1.195
39	25	23	0.992	1.038	1.087	1.139	1.190
40	21	20	0.959	1.002	1.050	1.100	1.150
41	25	24	0.951	0.994	1.042	1.091	1.141
42	25	25	0.913	0.955	1.000	1.048	1.095
43	25	26	0.878	0.918	0.962	1.007	1.053

Indicated ratios are all changeable. Fixed first gears could be made upon request

TT3-R5S 1st,2nd,3rd,4th,5th: driver on layshaft, driven on splined shaft, all changeable.Changeable input pair

TT3-R6S 1st,2nd,3rd,4th,5th, 6th: driver on layshaft, driven on splined shaft all changeable,.Changeable input pair.

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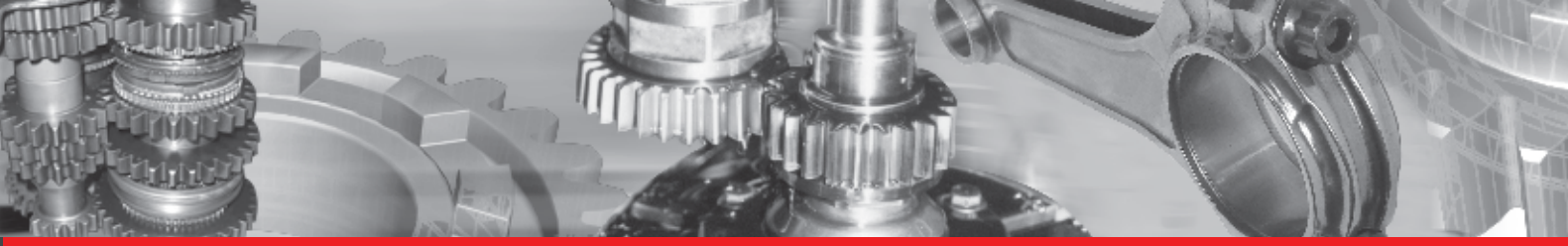
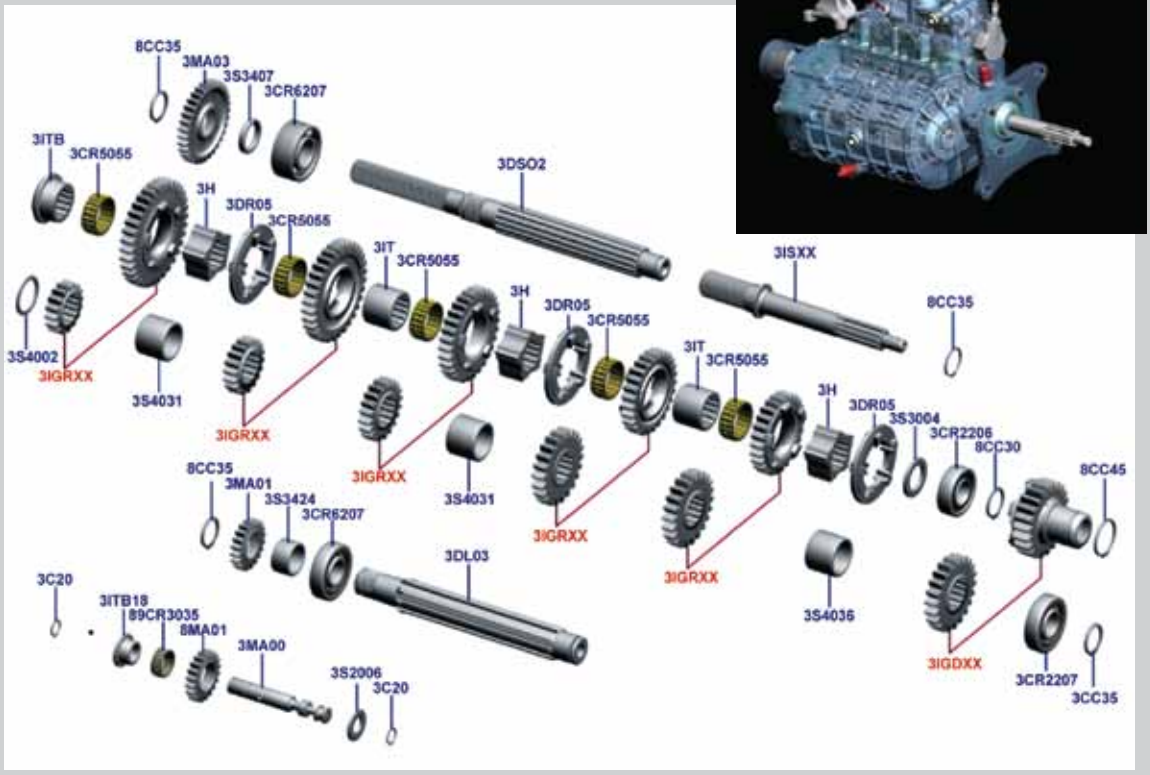
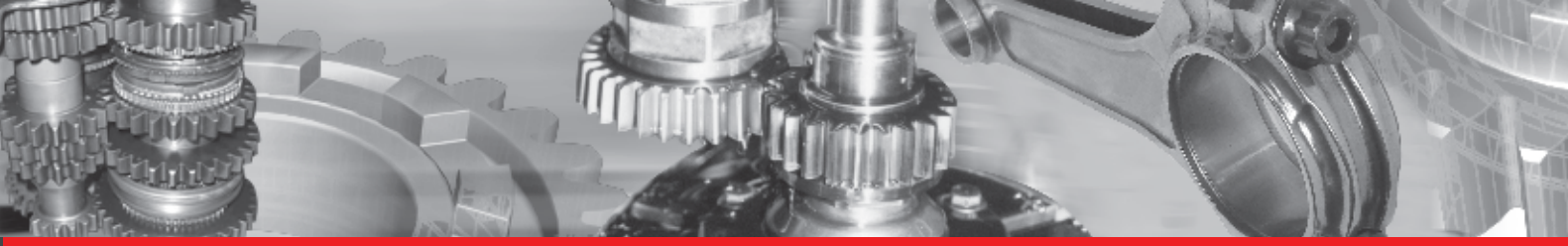


INTERNAL PARTS

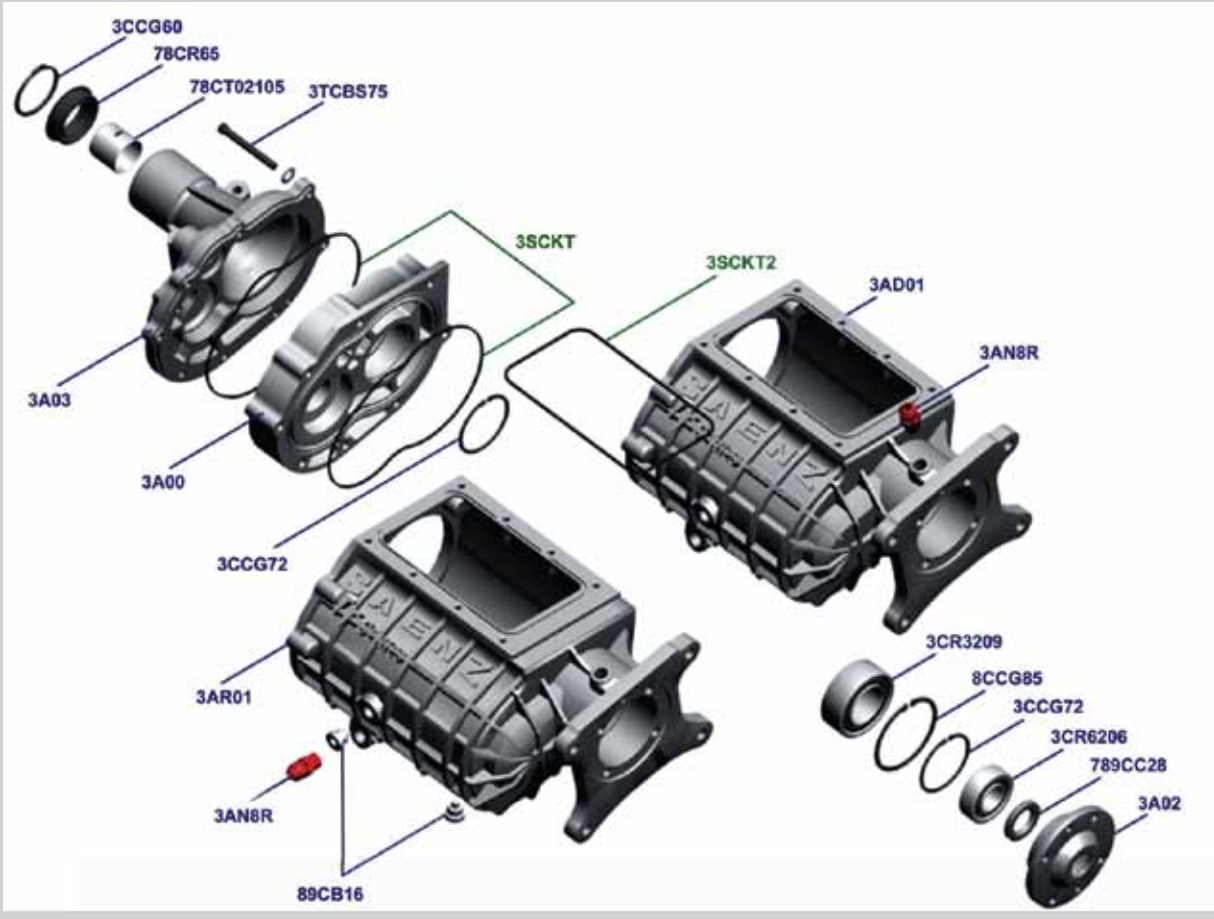


This schema is for a 6 speed D series. In 5 speed version, the first gear pair is replaced by a spacer in each shaft.

SAENZ

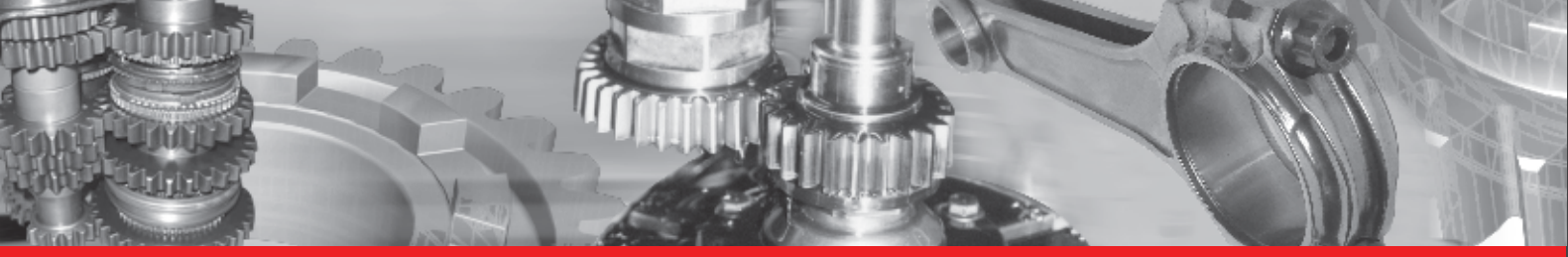


EXTERNAL PARTS



The main body on the left is for R series and D series main body is the one on the right

SAENZ



TT3
SERIES

MOUNTING TIPS
REMINDERS

- It is very important that the main shaft be aligned with crankshaft. Any misalignment would cause input shaft to bend each engine revolution.
So exercise care about gearbox guidance in the bellhousing.

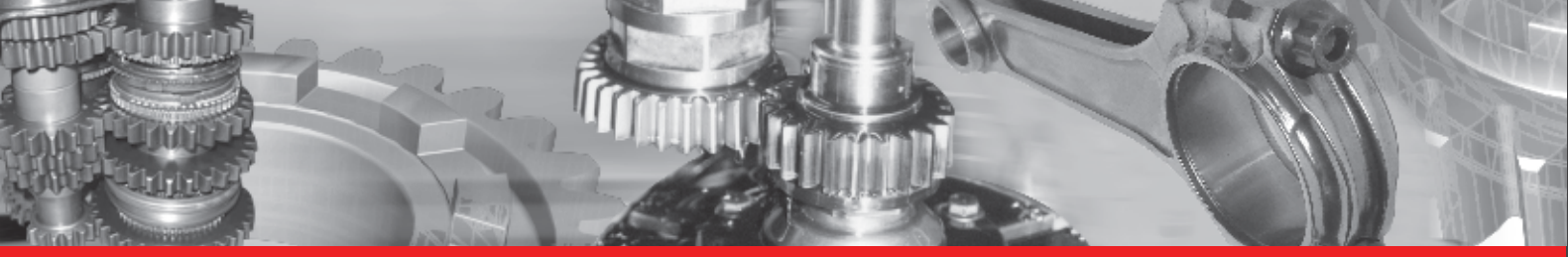
- Check input shaft length splines and guide before mounting

- Gearbox has to meet freely the bellhousing

- Tail bolts must easy enter once front bolts are installed

- Check the rear yoke clearance taking care to avoid rear seal be damaged with suspension movement

SAENZ



LUBRICATION

There are many good quality racing gear oils in the market and Saenz TT3 performs properly with any of them.

The Saenz TT3 combines aluminum and steel parts so it is very important to keep gearbox temperature under 212ºF (100ºC).

There are 3 basic lubrication system that could be used in the Saenz TT3.

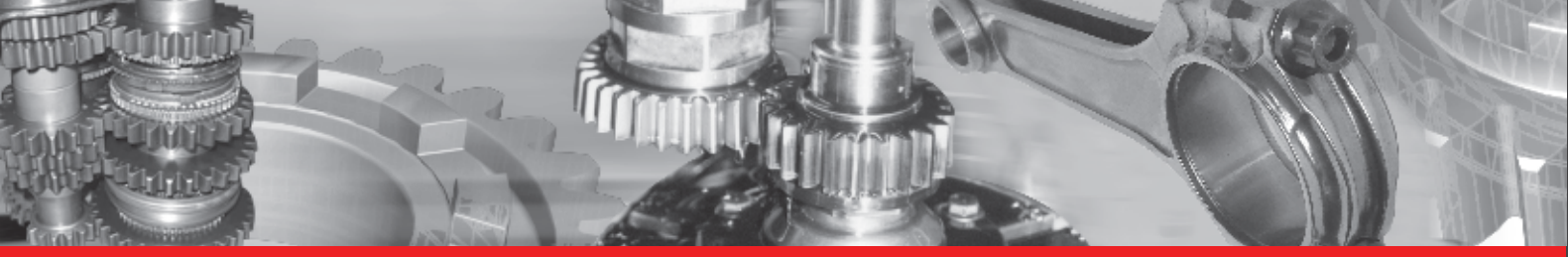
Splash lubrication is the simplest. Just fill main case with oil until one gear of each pair contacts the oil. This is about 1.5-1.7 quarts.

Another system is recirculation, where a pump takes oil from the gear box and returns it at a lower temperature.

Oil is taken from the lower side plug and it returns through the upper side plug. To use this system it is necessary to modify upper side plug thread (16 x1.5 mm). Just tap it to 3/8" NPTF for the fitting.

Check that at least one gear of each pair to be in contact with the oil once all recirculation system is filled,.

SAENZ



LUBRICATION

Saenz has developed an oil injection system where a calibrated rail sends oil directly to the gear contact point.

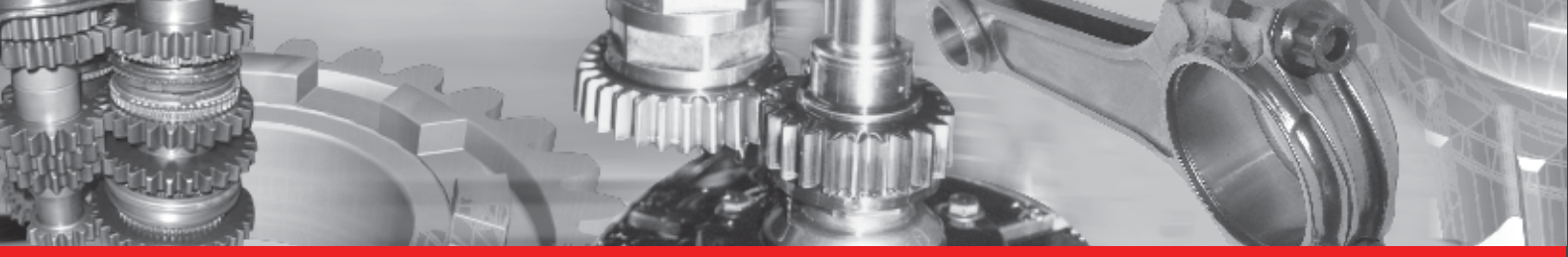
A pump located in the tail and powered by the layshaft, takes the oil from the bottom side plug through a filter to the riel, the input bearing and the tail bush.

A breather in the top of the shifter equalizes gearbox internal pressure with atmospheric air pressure.

Without cooler system, just a quart of oil is needed to properly lubricate the TT3. Less weight and power consumption is achieved.

Too much oil will cover injectors causing system to fail

SAENZ



SUGGESTED MAINTENANCE

- Check for oil leakage each time car is in the pits and pay attention to oil level.

- Dog ring wear is the beginning of most shifter problems. Dog teeth waste for many causes and its life varies accordingly. Once ends are rounded 0,05" dispose them. The one in the picture caused shifter fork bent.

- Dog rings could be mixed or rotated to extend their life.

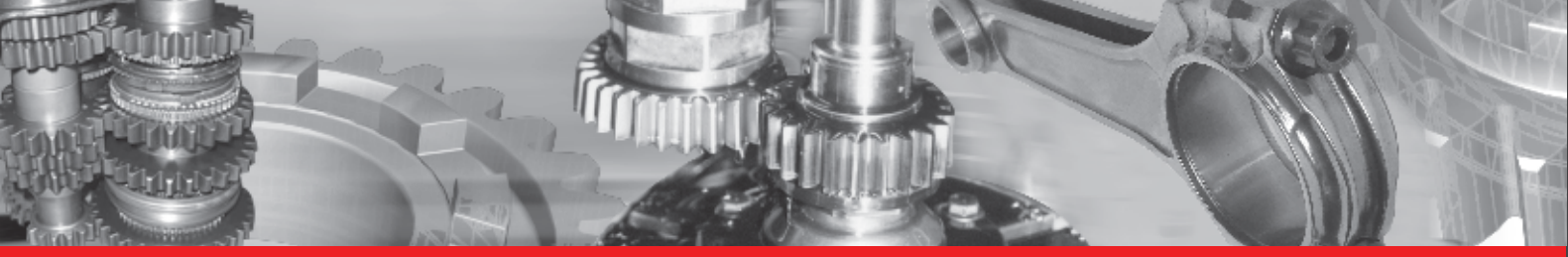
- Control splines, mainly the input shaft one to verify correct clutch disc sliding.

- Check gear surface for crack, pitting and marks.

- Inspect bearings, seals and tail bush.

- As far as dog teeth are not damaged, there is no further maintenance required by the shifter. Just visual inspection and no disassemble is recommended. If shifting problems appear due to wear dog teeth, replace bend / wasted forks and marked fork shaft if needed.

SAENZ



TT3
SERIES

TOOLS NEEDED

Hex Allen wrenches 1/4" , 3/16", 1/8".

Internal and external Seeger type pliers.

1/2" and 3/8" wrench.

8mm square male wrench.

Plastic hammer.

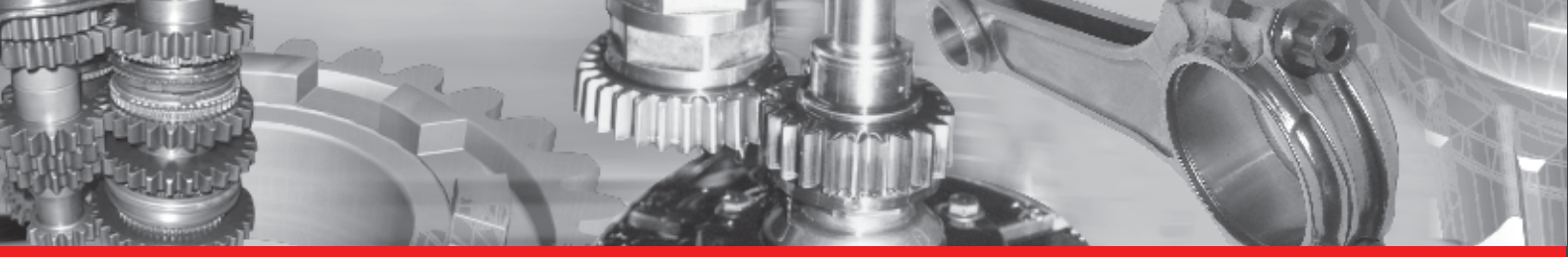
7/8", 1/2" open end wrench (only for injection plumbing only).

If transmission is hot, take care with bolts in aluminum threads.

If transmission is cold warm aluminum parts to remove bearings.

Dispose used oil friendly.

SAENZ



ASSEMBLY

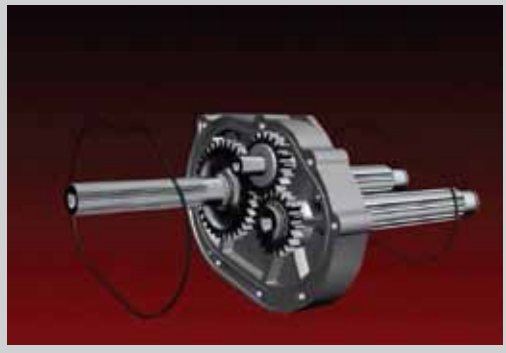

The Saenz TT3 has been designed to use commercial bearings although, due to the stress they support, it is recommended these should be of high quality.
In order to achieve proper adjustment at working temperatures, bores in the plate are slightly smaller than the bearings' O.D.
Therefore, it is necessary to heat the 3A00 plate to 180ºF to more easily fit the bearings into their seats.
3CR6207 in the main shaft side and 3CR6207 in the layshaft side.

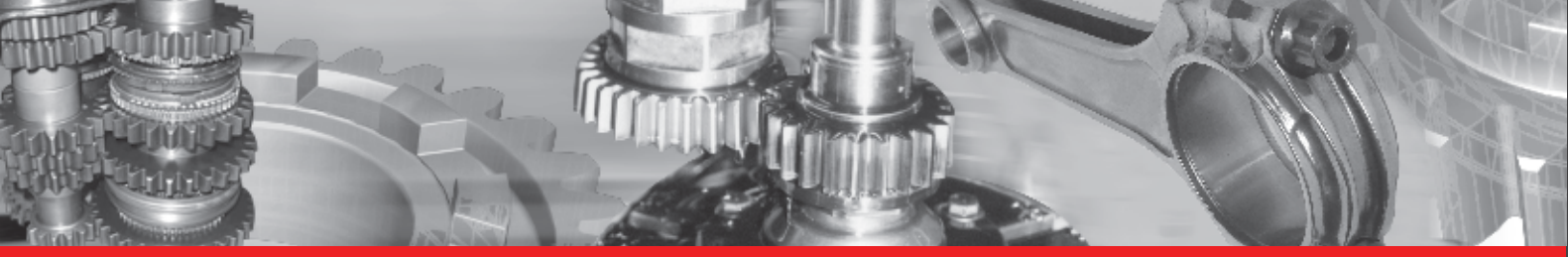

Check 3CCG72 circlip enters firmly into the slot.


Inspect shafts, looking for marks, cracks and spline wear. If they are bent, they could be repaired with a hydraulic press.
Misalignments in excess of 0.002" cause vibration and consume extra power.
Always check for cracks after shaft bending repairs.

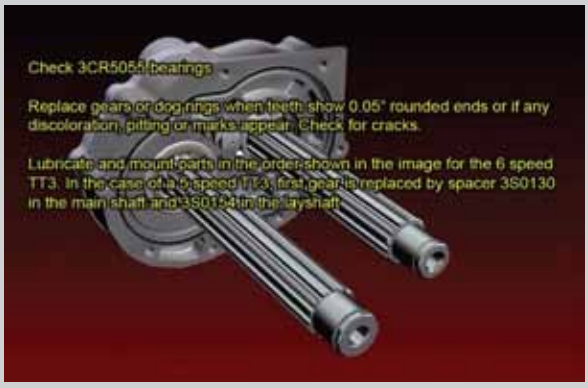

Once circlips are installed, mount both shafts, which should slide easily into the bearings due to the temperature differential from the aluminum plate to the bearings.
If bearings and shaft are at same temperature, they must be press fitted.
Once installed, test to make sure the shaft turns freely.


Place 3MA03 on main shaft and 3MA01 on layshaft, then fit the 6CC30 circlips.





ASSEMBLY



SAENZ

ASSEMBLY


The TT3D series standard input gear is 3IGD2222. TT3R series input pair ratios are indicated by the last four numbers.


Bolt size is 5/16"-18h x 3" UHL


Bolt size is 5/16"-18h x 1" UHL.

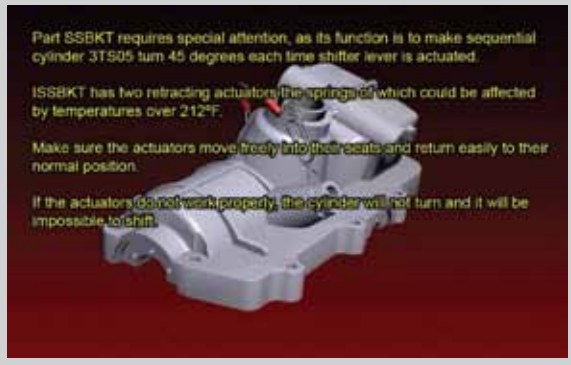

3TF and 3TP are machined to locate 3TS05 sequential cylinder.
Install them with the cylinder in shifter base and fix them with 3 lower 3/16-24 5/8 UHL bolts on each side of the cylinder.
Check sequential cylinder has no backlash.


Although 3CFS forks are the same, it is advisable not to mix them.
Before installing them, make a visual inspection and check they move smoothly on the shaft.


Check 3FS20 shaft surface and replace it, if any mark is discovered.

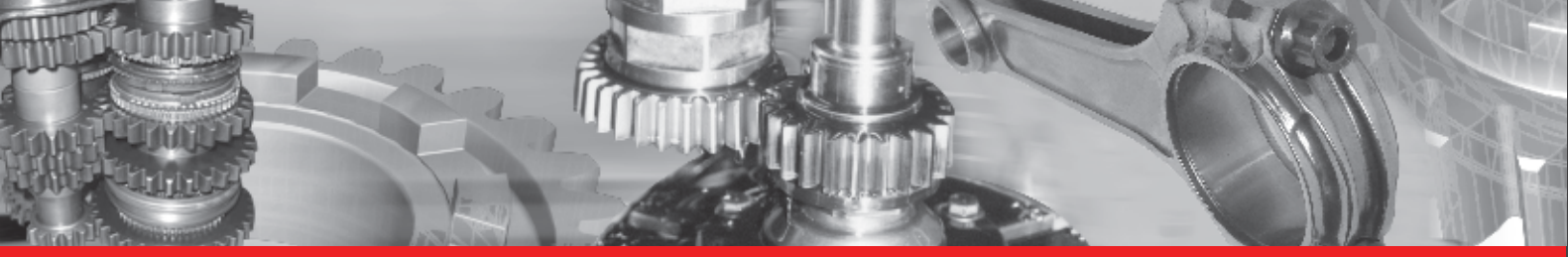
TT3
SERIES

ASSEMBLY



See animation atached in these CD.

SAENZ



TROUBLE SHOOTING

Oil leakage

- Excessive oil level raises internal pressure and temperature.
- Obstructed breather.
- defective seals.

Gear lever moves but shifting is not possible:

- Actuators in SSSKT blocked; sometimes due to excessive temperature, wear or spring failure
- 3SCRO2bush is gripped
- Shifter lever does not return to initial position, may be because a mechanical problem or sometimes driver does not allow it to return, mainly in short shifting.

Some gears are not shifting while others do shift:

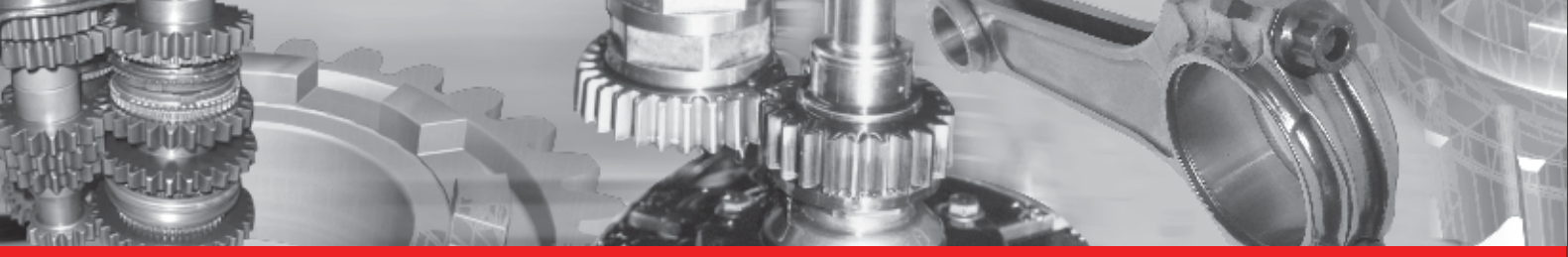
- Dog teeth wear
- Bent fork (s)
- Fork gripped on shaft

Vibrations:

- Bad mounting
- Bent input, lay or main shaft
- Broken gear
- Broken bearing
- Bent tail
- Bent rear yoke or bad joints

There is no device in the TT3 that equals gear speed (when shifting) that are spinning at different speeds according to ratio. So skill is needed to avoid premature dogs fail. Dog teeth life varies basically with the RPM drop between gears, car weight, engine power and the driver´s shifting ability

SAENZ



CALIBRATION

When in neutral, forks must locate dog rings midway between gear dog teeth. This calibration is made at the factory and it does not change with disassembly / assembly or when gears or dog rings are replaced.

To verify calibration:

1) While shifter is on the gearbox, remove 3SCD (captor) and SDC (magnetic emitter).
2) Take out 3 upper bolts from the 6 of each 3TC & 3TF cylinder caps.
3) Remove 10 bolts from shifter cap. Note the bolt with different head also has a different under head length and must be re-installed in same position.
4) Remove ST3MC cap gently, helped by a plastic hammer.
5) Cylinder shifter 3TS06 will appear as in the picture.
6) Make it turn until no dog is engaged.
7) At that point each dog ring has to be placed midway between two gears.
8) If this is, your shifter is calibrated. Make it turn to verify each dog ring engages properly into the dog teeth of the each gear.

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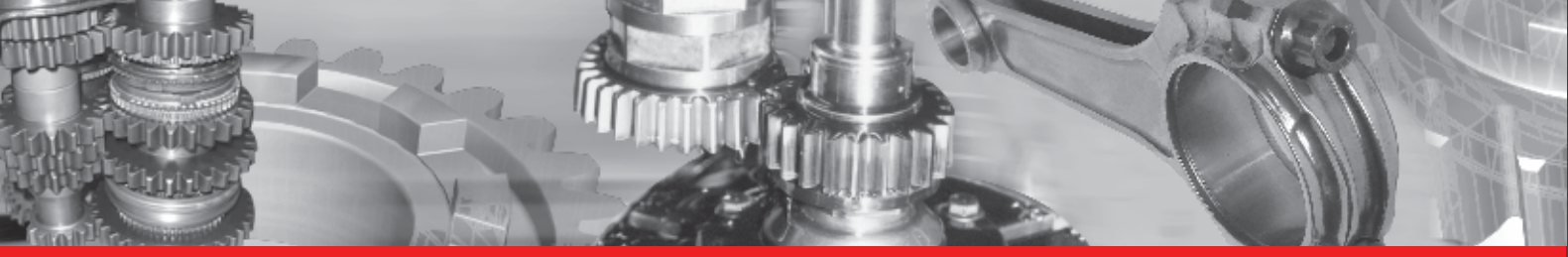


CALIBRATION

Before changing the calibration verify that parts are properly mounted inside transmission.

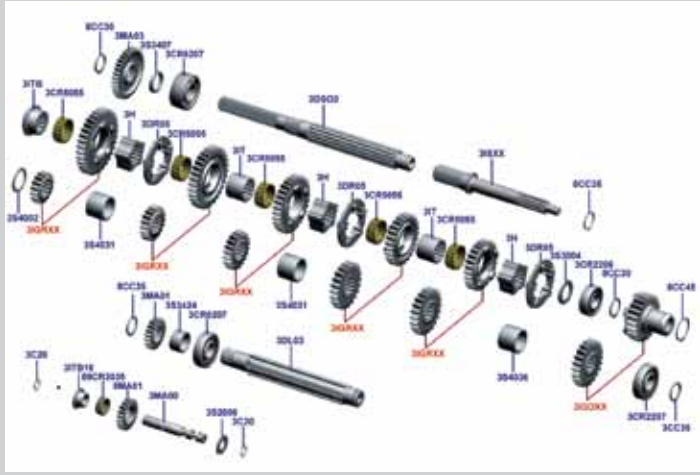
If shifter has changed, TT3 calibration has to be revised.

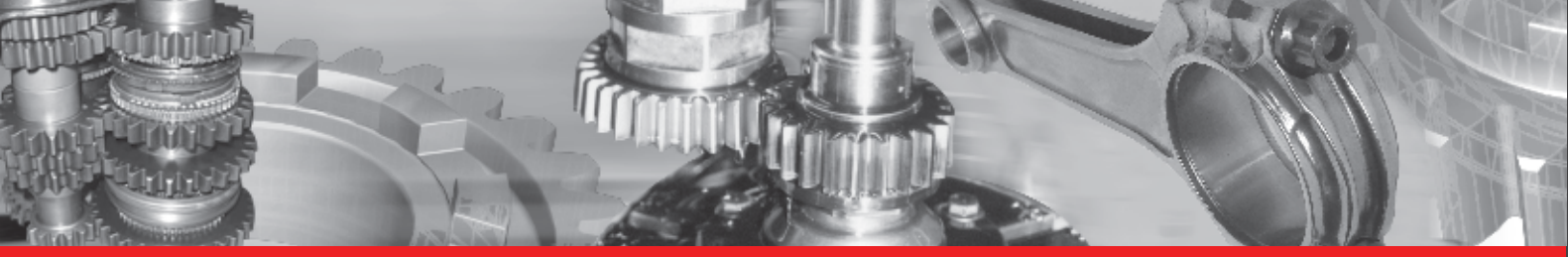
TT3 needs to be calibrated if:

- Any of the dog ring is not at the midpoint while in neutral or if it does not fully engage into the gear, while the others do.

- It means fork 3CFS is bent. Replace it.
- No ring is in the middle, they are all towards the front or the rear. If the dog rings closer to the 2nd, 4th, 6th than the 1st, 3rd, and 5th gears(cylinder has to be moved back). Or vice versa.

This means 3TS06 shifter has to be recalibrated, it is to move cylinder back in this case.





CALIBRATION

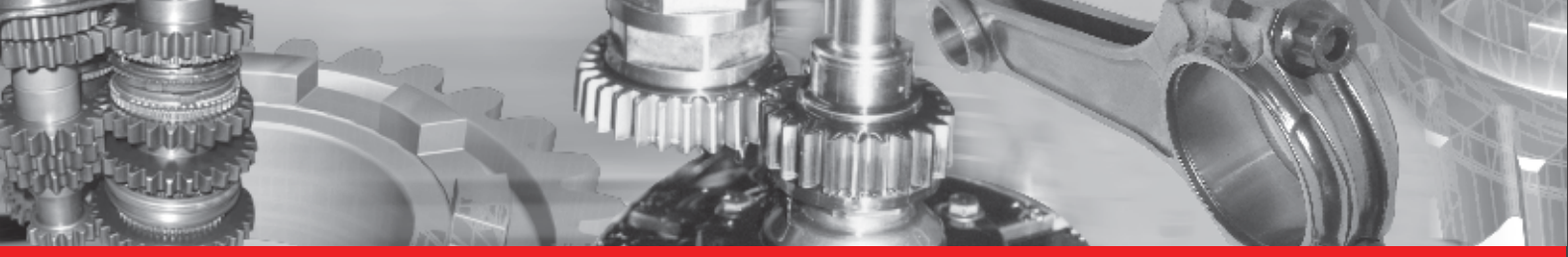
Lets consider the case when cylinder has to be moved back
1) Verify there is no backlash in the cylinder housing.
2) Measure the distance between dog ring to each gear dog teeth. Take the difference between them. Lets call it "D".
3) Remove the 3 remaining bolts from each cylinder cap ad remove cylinder from ST3MC shifter base.
4) Take out 3TF and 3TC caps from 3TS06 cylinder,(the ones in the picture).
5) To modify calibration, it is necessary to remove material from the bearing seat of the 3TF (right). The amount of material to be removed is equal to half of the difference taken in #2. Lets say it is D/2.
6) This operation will allow cylinder moves back but an amount of backlash will appear equal to D/2.
7) To release backlash it is necessary to remove D/2 material from the face that contacts shifter in cap 3TC. The lip in 3TC will be D/2 bigger.
8) Repeat 1&2 and if D=0 shifter is now calibrated.

To move shifter forward it is necessary to remove material from the 3TF part that face the shifter and take out same dimension from the lip of the 3TC to lower it.

3 TF

3 TC

SAENZ



CALIBRATION

Dog ring travel from neutral to engaged is determined by the machined slot in the 3TS06 cylinder.

What happens if cylinder is not calibrated?

One dog ring will be far from gear dog teeth causing:

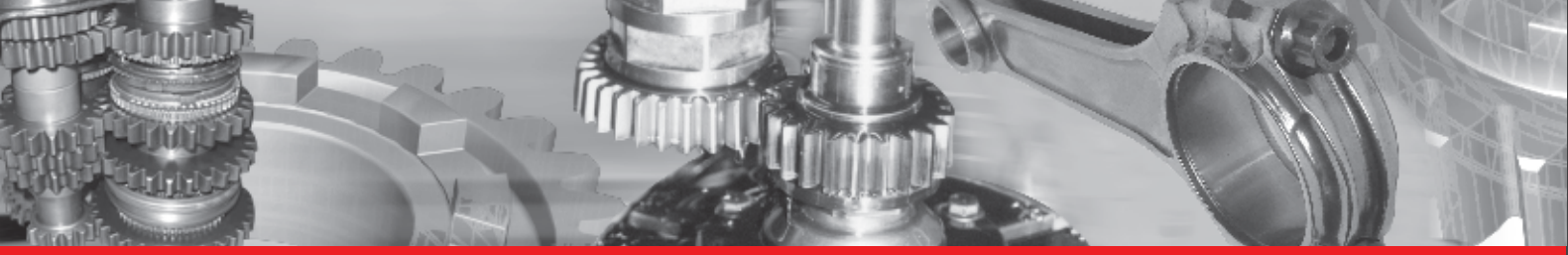
- When shifting, and due to the angle dog teeth have, gear will push dog ring against itself increasing friction and may cause the fork bent or grip.
- Dog ring life will be reduced as it is not fully engaged.

Opposite gear will be at a shorter distance than the one in the slot:

-Dog ring has fully engaged the gear before cylinder has reached the end of the slot travel. So it does not allow continuous turning, increasing fork friction and could cause the fork to bend, or not to shift to next gear.

To avoid this problems to appear, shifters have not to be mixed from one gearbox to other without calibration.

SAENZ



TT3
SERIES

SHIFTER LEVER, TRIGGER, NEUTRAL LOCKOUT

There are three types of shifter lever, made in steel as standard and optional in aluminum or carbon fiber.

Position is decided by driver, just fill in the distance from transmission front (in order) form to receive shifter bar and cable with the proper length.

Neutral & reverse lockout

The Saenz TT3 has a lockout that prevents accidentally shifting to neutral and reverse when downshifting.

Doing so is very simple. A simple trigger moves a locker at the end of a cable.

This lockout does not allow the cylinder to turn to neutral.

Once trigger is lifted, the lockout retracts allowing the cylinder to pass to neutral. It is possible to go into reverse at this moment, just moving the lever forward.

There is no need to use the trigger to shift into 1st .

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