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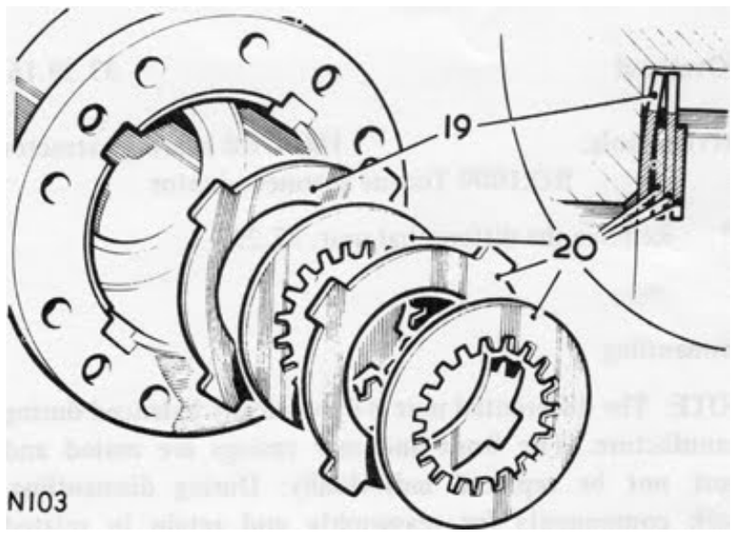
LT95 Salisbury Powr-Lok lockable limited-slip center differential - LSD

The legendary first few 1970 Range Rover's with limited slip center differential gearbox

The first Range Rovers built in 1970, both the pre-production with reg numbers YVB1**H, the press vehicles NXC2**H and the early vehicles for sale to customers had the legendary Salisbury Powr-Lok lockable limited slip center differential in the LT95 4 speed gearbox.
In addition to the limited slip function in center differential, the center differential could also be locked via a vacuum actuator knob close to the gear shift lever, exactly as we know about with all later manual 4 speed Range Rovers during the 1970s.

Salisbury POWR-LOK limited slip differential

It is not clear exact how many Range Rover's that had the limited slip differential, but most sources say it was delivered against the end of 1970. Most probably maximum around 300 vehicles.



The LT95 4 speed gearbox with integrated transfer box for high and low range selection was developed to suit two Land Rover projects - the Range Rover and the military Land-Rover Forward Control FC101. To achieve best possible strength to withstand the power from the V8 engine the transfer box was designed with permanent four-wheel drive via a third centre differential. This center differential had both limited slip function with friction discs to secure best possible traction during regular driving. In addition the center differential could be locked to secure that both axles had drive under extreme slippery conditions or if one wheel had no traction at all.

Salisbury Transmissions in UK developed and supplied the center differentials to the new LT95 gearbox. Salisbury had for many years been a trusted supplier of axles and axle differentials to Land Rover. The Salisbury differentials are easily identified by its red color, either used in the axles or in the LT95 gearbox.

All Range Rover with Suffix A LT95 gearbox was originally produced with red Salisbury center differentials. Important here is to be aware that the Range Rover #VIN Suffix A serial numbers and the LT95 Suffix A serial numbers did not follow the same path and are not compliant to each other serial numbers. LT95 Suffix B and later serial number gearboxes had a different type of center differential.

Carbodies Ltd - UK
Carmichael Ltd - UK
Chameleon Ltd - UK
Chris Humberstone - UK
Con-Moda GmbH - GE
Duncan Hamilton Ltd - UK
Elektiar Ltd - UK
Emil Frey - CF
FLM Panelcraft Ltd - UK
Garage Boursault - FR
Glenfrome Ltd - UK
Gloster Saro Ltd - UK
Grand Prix Metalcraft Ltd - UK
Heinel Specialbilar AB - SW
Herbert Lomas Ltd - UK
Janspeed Ltd - UK
J E Motors Ltd - UK
JNR Motors Group Ltd - UK
Lahav Inc - US
Lichfield TVR Ltd - UK
MacNeillie - Armoured
Merlin Automotive Ltd - UK
Monteverdi - CF
Nova Swiss Turbo - CH
Overfinch Ltd - UK
Panther Westwinds Ltd - UK
PAO Allard Turbo - UK
Penman Hotspur Ltd - UK
Pilcher-Greene Ltd - UK
Pullman Ltd - UK
Range Rover - Police
Rapport Ltd - UK
Schuler Presses Ltd - UK
Scottorn Trailers Ltd - UK
S.M.C. Engineering Ltd - UK
Spencer Abbott & Co - UK
SVC Ltd - UK

Symbol Ltd - UK
Townley Ltd - UK

The red Salisbury center differential that was installed in all Suffix A LT95 gearboxes are identical either with the Powr-Lok limited slip function of the very early Range Rovers or the later Suffix A LT95 gearboxes without the limited slip function. Only the setup with limited slip friction discs in limited slip version differ from the later one without the limited slip function.
The vacuum actuated lockable center differential lock function are identical.

The limited slip friction discs in the Range Rover LT95 gearbox

In the 'Range Rover - Technical Details' publication 789 from June 1970 is written;

*'Transfer Box: Two-speed reduction on main gearbox output. Front and rear drive permanently engaged via a **lockable limited slip differential**.'*

The discontinuation of the limited slip function in the center differential was a last-minute decision because already in July 1970 a new 'Range Rover - Technical Details' publication 789A was issued with this interesting changes:

*'Transfer Box: Two-speed reduction on main gearbox output. Front and rear drive permanently engaged via a **lockable third differential**.'*

In the official workshop manual 'Range Rover - Repair Operational Manual' - Issue 1 from 1970, in section 37.01 is written:

Red Salisbury differentials used in all Suffix A LT95 gearboxes - visible for the trained eye; a non-Limited Slip version

'Gearbox differential lock switch
*The Range-Rover has permanent four-wheel drive, achieved by using a **limited slip differential** fitted in the transfer gearbox. This allows a high degree of mobility in 'off' road use and also prevents transmission 'windup'.*
*Upon encountering conditions in which the maximum amount of traction is required, the **limited***

TWR Special Vehicles - UK
Vantagefield of London - UK
Wadham Stringer Ltd - UK
Wood & Pickett Ltd - UK

Range Rover Classic Special Theme

Don Safety Trophy - 1971
Range Rover Conversions
Range Rover Advertisement
Range Rover Camel Trophy
Range Rover CKD Assembly
Range Rover Darien Gap
Darien Breakthrough
Land-Rover Series S1 S2 S3
Land Rover Defender
Ferguson Formula
Schuler - Ferguson Formula - Service and Maintenance Instructions
LT95 Salisbury Powr-Lok lockable limited-slip center differential - LSD

Range Rover Classic by Year

Range Rover 1970
Range Rover 1971
Range Rover 1972
Range Rover 1973
Range Rover 1974
Range Rover 1975
Range Rover 1976
Range Rover 1977
Range Rover 1978
Range Rover 1979
Range Rover 1980
Range Rover 1981
Range Rover 1982
Range Rover 1983

slip differential can be 'locked' by means of the differential lock switch. This ensures that all road wheels revolve the same speed.

In Issue 2 from October 1970 the '***limited slip differential'*** was replaced by '***lockable differential'***.

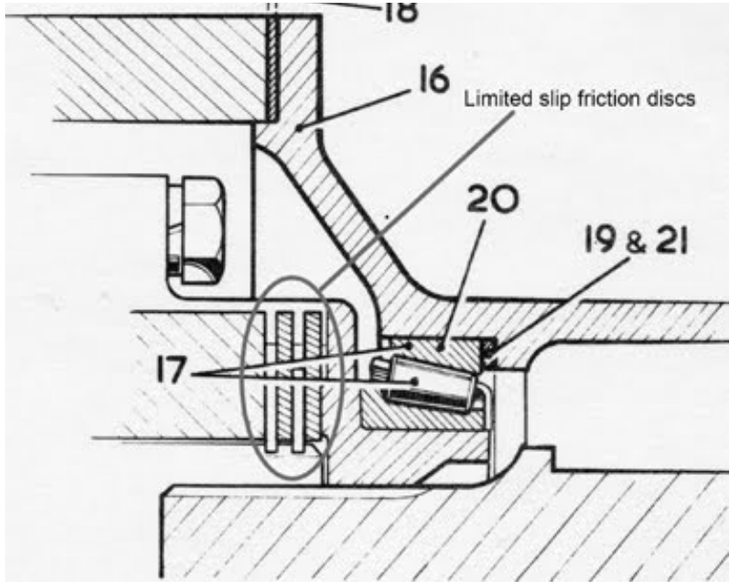
The first Range Rover's with limited slip gearbox had different Recommended Lubricants than the later vehicles.

In the 'Range Rover - Repair Operational Manual' - Issue 1 1970 the following oils where required:

Engine:	BP Super Visco-Static 10W/40	Castrol GTX	Duckhams Q20/50 Motor Oil
Main gearbox:	BP Gear oil SAE 80EP	Castrol Hypoy-Light	Duckhams Hypoid 80
Transfer gearbox:	BP Limslip Gear Oil 90/1	Castrol Hypoy LS Limited Slip	Duckhams ?

Already in the Issue 2 from October 1970 the 'Range Rover - Repair Operational Manual' changed the Recommended Lubricants and Fluids away from light EP80 hypoid gear oil in the main gearbox and EP90 hypoid gear oil special version for limited slip differential in the transfer gearbox - to recommend regular SAE20 motor oil in the engine, main gearbox and transfer gearbox with regular center differential:

Engine:	BP Super Visco-Static 10W/40	Castrol GTX	Duckhams Q20/50 Motor Oil
Main gearbox:	BP Super Visco-Static 10W/40	Castrol GTX	Duckhams Q20/50 Motor Oil
Transfer gearbox:	BP Super Visco-static 10W/40	Castrol GTX	Duckhams Q20/50 Motor Oil



Technical; the friction discs structure - from RR Workshop book

Why was the limited slip function discontinued ?

Range Rover 1984
Range Rover 1985
Range Rover 1986
Range Rover 1987
Range Rover 1988
Range Rover 1989
Range Rover 1990
Range Rover 1991
Range Rover 1992
Range Rover 1993
Range Rover 1994
Range Rover 1995
Range Rover 1996

Range Rover Classic US by Year

Range Rover US 1987
Range Rover US 1988
Range Rover US 1989
Range Rover US 1990
Range Rover US 1994

Land Rover - Special

Land Rover-Leyland Group
Range Rover 1985 Salesman

The idea with the limited slip function in the center differential was to achieve best possible traction with a permanent 4x4 drive system. On the market in mid-60s there were not many modern leisure four-wheel drive vehicles, called SUV today. Most common were the US Ford Bronco, Chevrolet Blazer, Jeep Wagoneer and Toyota Land Cruiser, in addition to the Land Rover Series II. All of those rather rugged driveline system compared to the refined and sophisticated driveline for the projected Range Rover.
Only really sophisticated four-wheel drive system on the market was the Ferguson Formula - FF - which was low scale production, more seen on Formula 1-testing and Jensen FF in the 60s.
The Ferguson Formula system is explained in detail here.

Since there was not many comparable permanent four-wheel-drive system on the market with center differential, the development engineers at Land-Rover worked with the permanent 4x4 driveline to both have the limited slip function as well as the lockable function to totally lock the center differential, the latter to have direct drive front and rear like the Land-Rover system and the US systems.

Back in the later part of the 60s the new Range Rover was seen as a more luxury vehicle for the farmer, engineering companies etc for with need for off-road driving or driving on rough roads.
What went out to be instantly after the launch of Range Rover in 1970 was that the new vehicle was used more than 99% on paved roads, often by people the never before had drove a 4x4.
Maybe the need for better wheel traction was only needed on a slippery car-park at a sport event or gymkhana.

In the time of launch, just before and right after, at lot of the automotive magazines made test drives of the new Range Rover. The reaction to the new Range Rover was very positive, but the gearbox sometimes got comments about gear whine noise and rather rugged agricultural feeling.

Another comment was problems often found around the steering. In 1970 Range Rover had only a manual steering box no servo-assisted steering, and the Range Rover felt often problematic to hold a straight steering at speed.

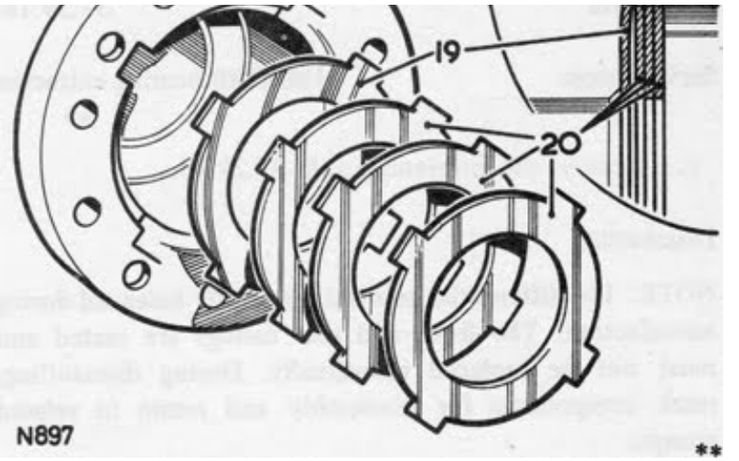
When driving with full steering to left or right around corners or obstacles, the vehicle starts with **uncomfortable jerking** in the driveline system.

Also when driving at speed on slippery ground the car likely tended to get fish-tail feeling.

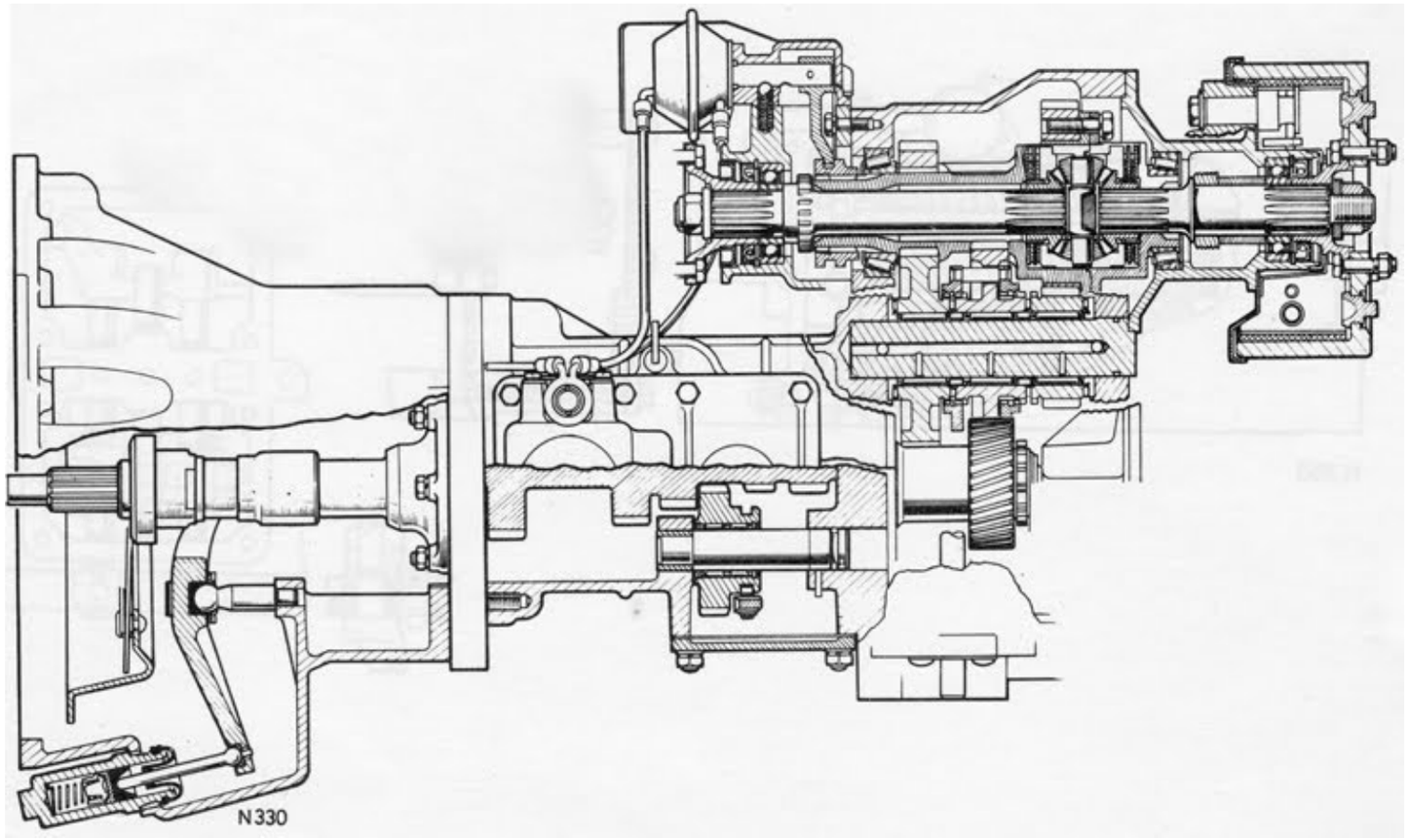
The limited slip in the center differential made the driveline system too 'stiff', so when the Range Rover were driven on delicate surfaces or in special conditions like described here the vehicle became too uncomfortable.

The engineers at Rover found out that the limited slip in the center differential made problems. The recipe to eliminate these unwanted driveline behaviors was to withdraw the friction discs and only have the space rings instead. Then the jerkiness and fish-tail feeling disappeared.

Normally the very slippery conditions, like a muddy park yard or icy road, the length and speed to get back to normal conditions were so short and solved by the lockable differential function.
So it was decided that limited slip in the center differential gave more discomfort than extra benefit.



Later in 1970 the friction discs was replaced by distance discs. No longer with the limited slip function, reason described to left.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