TR250/TR6 Clutch Release Measurements

February 2002 update: Mark Riddle of Asheville, NC submitted some data he measured on a couple clutches. Mark used more precise instruments and took more data points than I did. Rather than integrating his data with mine at the risk of loosing precision, I chose to show it separately at the end. So , the further you read, the better it gets.

Dick Taylor and I have been exchanging emails discussing release bearing failures. In one Dick mentioned measuring the force and displacement needed to release a clutch pressure plate. My reaction --- how'd you do that? He responded that he used the drill press as a press to push against a release bearing to open the clutch pressure plate. He said he sandwiched a bathroom scale between the drill chuck and bearing to measure the force. He also said he put pieces of 2X4s on each side of the scale to spread the force.

I tried a similar setup using an hydraulic press and our bathroom scales. It worked fine except that the scale become erratic at about 270 pounds. (The wife had been complaining about our scale and wanted a new one. I suspect that she wanted one that reads less, after all she was very trim when married 40+ years ago and has put on all of about 5 pounds since.) I bought a $15 one that was supposed to operate to more than 300 pounds but the highest it would read was 267 pounds. When I took it back the gal at the service desk asked why I was returning it. I explained that it wouldn't read about 267 pounds. She gave me a funny look as I'm not near that heavy. I didn't want to tell her I was squeezing the thing in a hydraulic press so I implied that the wife needed a big scale. The replacement, an electronic type that claimed to work to 330 pounds cost $40. That one quit at exactly 300 pounds and the digital readout went to EE. I expect the designers and the marketing department were marching to a different tune. Took that one back too --- used the same excuse again. After explaining this problem to some Buckeye Triumph friends, one volunteered that he had a high quality scale from Sam's Club. I borrowed that and it worked fine. This scale seem works to about 400 pounds. The price is right too.

The photo below shows the setup I'm using. The larger capacity scale allowed me to place the flywheel with clutch attached on top the scale and then zero the scale. This provides a fairly stable arrangement. The dial indicator is used to measure the displacement. Another of Dick Taylor's suggestions was to place a feeler gauge between the clutch disk and flywheel to determine at which point the clutch releases. I copied this using a strip of .005 brass shim stock, visible on the left side of the pressure plate. The strip is pulled on as the clutch displacement increased. The freeing of the disk occurs over about 0.01 inch displacement, initially the strip can be moved with some force; an addition 0.01 inch displacement allows the strip to be slid in and out rather easily.

The following table shows the measurements made to date. I will update as I can get my hands on more clutches. A plot of the data is shown after the table. A short description and photo of each clutch measured is shown at the end. Note that the data was updated on November 17th 2001 when the LUK clutch was measured. One of the clutches measured earlier was measured again to verify everything was the same. It wasn't --- the measurements were different at the larger forces. Investigation revealed that this time I used a board under the flywheel. Apparently the scale was distorting slightly during the earlier measurements because the force was concentrated in one spot. The board between the flywheel and scale distributed the force. The previous measurements could be reproduced (approximately) if the board was removed. I measured all the clutches again with a board between the flywheel and scale and replaced the earlier measurements in the table below. The difference from the previous measurements is a larger force for the new B&B pressure plate (#1) Note that several readings for the used LUK clutch (#4B) exceeded the maximum scale reading of 403 pounds. My guess based on the other LUK clutch is that the maximum force is about 425 pounds.

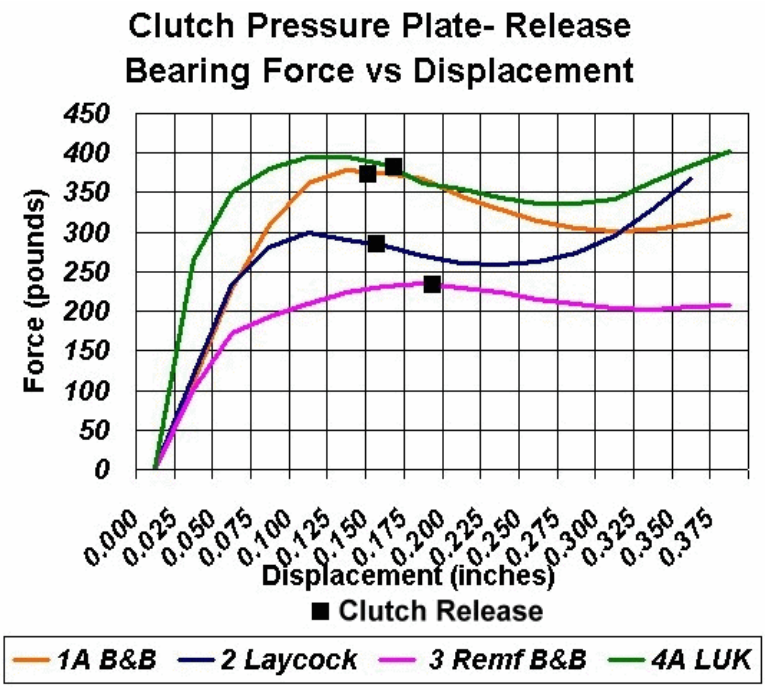
It's good to have an idea of the accuracy of the measurements. I compared the scale used for the measurements with our bathroom scales and found they read the same at 250 pounds (weighed myself while holding a huge weight). From this, I think the force measurement error is less than 5%. The dial indicator used to measure the displacement is very accurate. However, there is likely some flexing of the part of the plate where the magnetic base was attached. Also, it was impossible to put the indicator point on the center of the bearing; it was toward one side so if the bearing tilted slightly, the measurement would be in error. Taking all this into consideration, the displacement error is probably less than 10%. The shape and general magnitude of the curves present a more accurate view of the various pressure plates than the individual entries in the table.

The link http://www.luk.de/english/Produkte/index.html (click on diaphragm Spring Clutches and then Product Details) shows similar data for a generic LUK clutch. If that data are converted from metric to English units one finds the forces and distances are similar to those measured here. That is reassuring as it shows we're in the right ballpark.

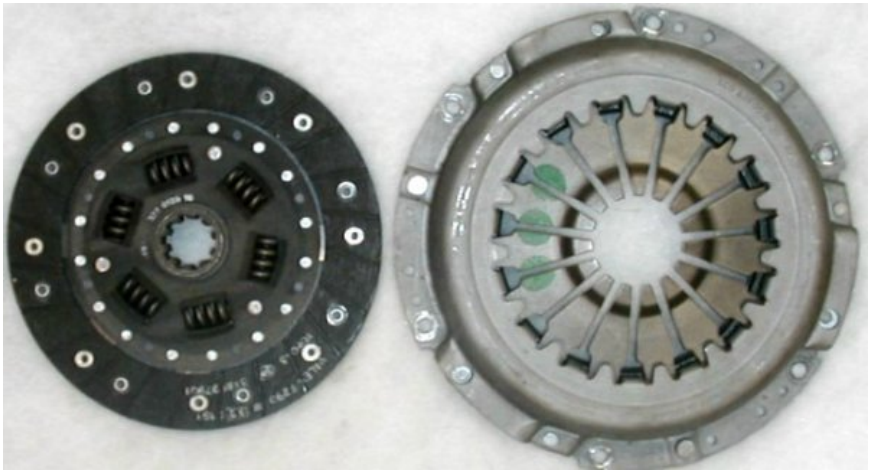
Clutch Pressure Plate -- Force (lbs) vs Displacement (inches)							
Displacement (in)	#1A New B&B	#1B New B&B	#1C Used B&B	#2 Used Laycock	#3 Remf B&B	#4A New LUK	#4B Used LUK
0	0	0	0	0	0	0	0
0.025	110	117	72	120	101	265	130
0.050	230	220	173	235	172	350	260

Clutch Measurements

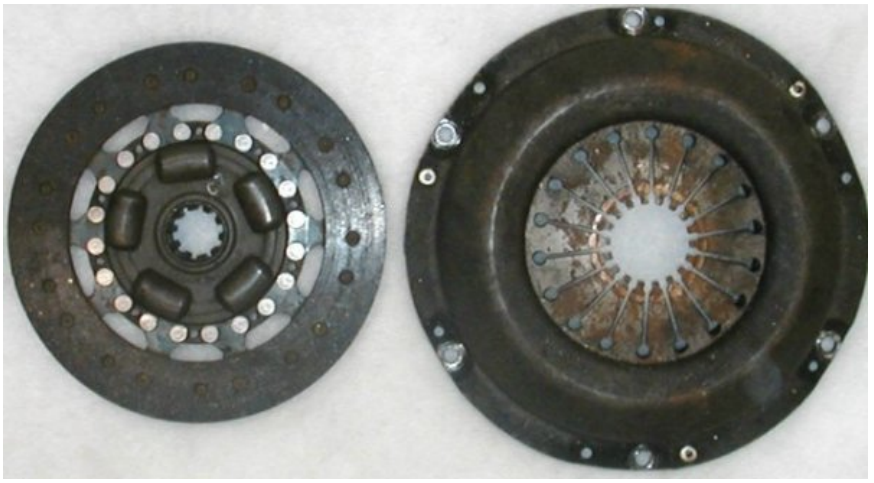
0.075	308	310	255	281	192	380	356
0.100	361	362	303	300	210	395	393
0.125	378	377	324	290	224	395	403*
0.150	375	373	322	282	232	386	403*
0.175	367	361	311	270	236	361	403*
0.200	345	340	297	261	230	354	396
0.225	328	322	281	259	225	343	377
0.250	315	308	263	262	215	337	357
0.275	305	298	250	274	210	337	340
0.300	302	295	241	295	204	342	330
0.325	303	299	238	328	202	363	323
0.350	310	309	238	367	205	383	322
0.375	322	325	248	-	207	403*	322
Release Displacement (in)	0.17-0.18	0.17-0.18	0.19-0.20	0.15-0.16	0.18-0.19	0.16-0.17	0.16-0.17
Measurement date	11-19-01	11-19-01	12-15-01	11-19-01	11-19-01	12-15-01	11-19-01
* Maximum scale reading, scale bottoms.							



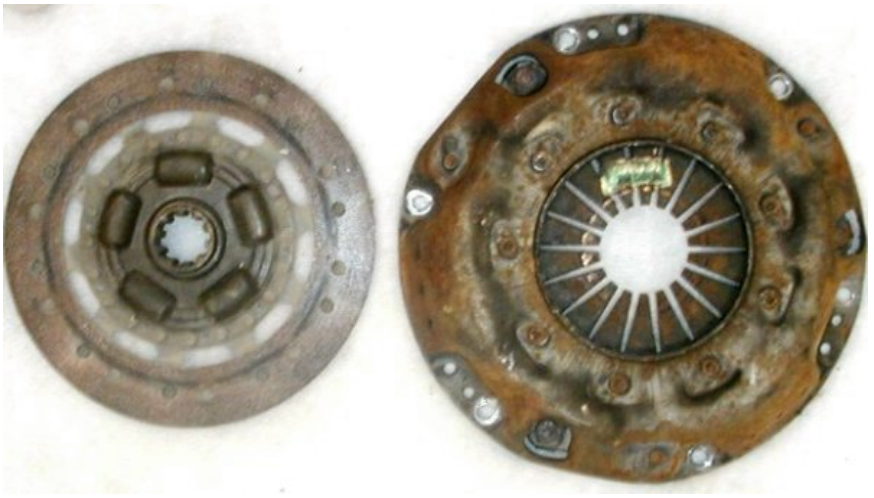
#1A/B/C New style B&B: Two of these are new Borg & Beck pressure plates purchased about 2 years ago from TRF. They are identified as AP number HE5132Q and TRF number 214321. They came with a LUK clutch disk. The disk thickness is 0.294inches. I have two of these unused pressure plates and both were measured (#1A & #1B). From the measurements one can see that the two are essentially identical. Only #1A was graphed. #1C is a used clutch removed from a TR6 in December, 2001. The used disk was of Borg & Beck Brand and had a 0.280 inch thickness. My guess is that the clutch had about 20 K miles use.



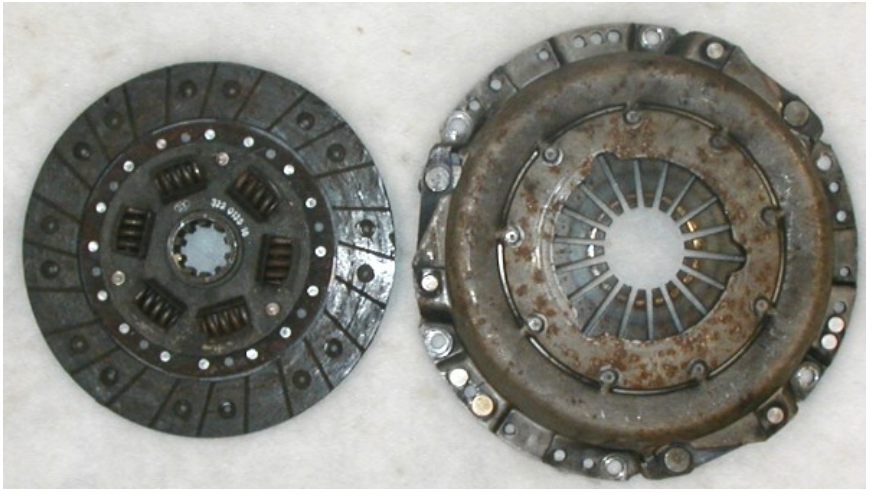
#2 Used Laycock: This clutch was removed from a '76 TR6 a number of years ago. It seems to have very little use based both on the thickness of the clutch disk and the depth of the grooves in the pressure plate springs. The disk is also a Laycock brand and has a thickness of 0.282 inches.



#3 Remf B&B: This is a remanufactured earlier Borg & Beck clutch pressure plate. (The sticker with green print identifies the unit as a remanufactured unit.) It was taken from my '70 TR6 and had been installed by the PO. I know none of the history. It appears to have a new diaphragm spring with very little wear. The accompanying disk is the Laycock brand identical to #2 with a thickness of 0.257 inches.



#4A & 4B New style LUK: I have the original LUK boxes for both these; they are identified as part number 19-030 for Triumph TR4/TR6. The new one was purchased from TRF in December 2001. The box for the used one was dated 11/27/91and I'm pretty sure was also purchased from TRF. The disks are identical to the new disk shipped with the #1 B&B pressure plates. The thickness of both the new and the used disks are ~ 0.295 inches, indicating that the used clutch had very little use. The new clutch #4A is plotted on the graph. The photos are of #4B, the used clutch.

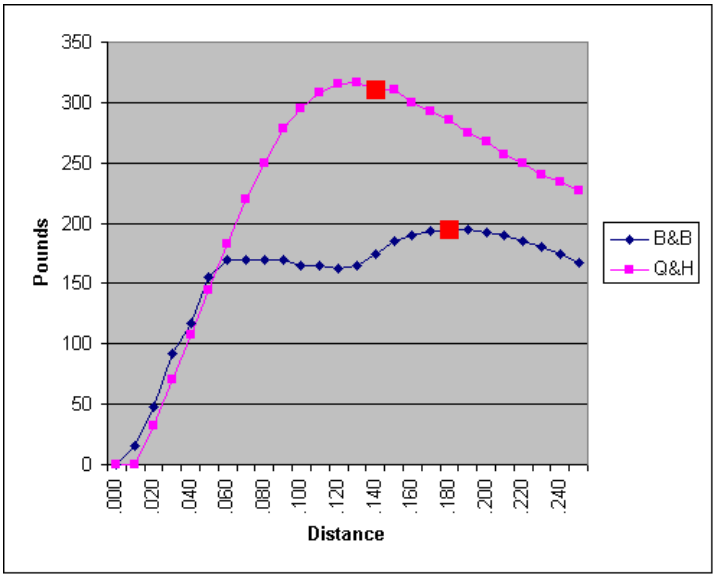


Mark Riddle's (dunamis6@juno.com) **data:** I had access to a large hydraulic "arbor press", with a deep throat or

reach that would accommodate the flywheel/clutch assembly. I placed the flywheel on the base-two rails that cradled the back of the flywheel very well. Then placed the bearing/sleeve assembly in the center of the clutch fingers. Then on top of the sleeve I was able to put a steel plate(4"x4"x1"), and on the top of the plate I was able to use a force measurement gauge (Dillion 500lb. capacity see photo). I was able to apply force on the "ball point" of the gauge. Along with the force measurement, I used a magnetic base dial gage, that was "zeroed" at the point where the ram came into contact with the force gauge.

I took force readings every 0.010" of bearing travel. As Nelson and Dick did, I also noted the distance at release of the disc. I only checked readings through .250" of bearing travel, as it appeared that peak forces were falling off, and release points had been established.

distance	B&B	Q&H
.000	0	0
.010	15	0
.020	48	32
.030	92	70
.040	117	108
.050	155	145
.060	170	183
.070	170	220
.080	170	250
.090	170	278
.100	165	295
.110	165	308
.120	163	315
.130	165	317
.140	175	310
.150	185	310
.160	190	300
.170	194	293
.180	195	285
.190	195	275
.200	192	268
.210	190	257
.220	185	250
.230	180	240
.240	175	234
.250	167	227



The clutch release point is shown in **RED.**

The Disk: The clutch disc used for both measurement "sets" was the plate that was on the car when I bought it, a "Laycock" friction disc. This friction plate measured .270" thickness, and had been rebuilt by Beck and Arnley.

The B&B Pressure Plate: This pressure plate was on the car when I bought it. Also curious was the "Laycock" disc was with a Borg & Beck pressure plate. In years past, I have noticed that the Big Three stated not to mix brands of clutch and pressure plate, but this "pair" coexisted very well for at least 3 "driving" years.

The Q H Pressure Plate: The Quinton Hazell unit shown below was purchased from NAPA as a rebuilt, but from its appearance, it looks to be a new unit, probably supplied during a shortage of rebuildable cores at the time.