INSTRUCTION TO SERVICE

ITS: 60596	December 21, 2022
SECTION:	350-Driver's Controls
WRITTEN BY:	Troy Stutsky
SUBJECT:	Movement in Steering Column to Upper Steering Drive Shaft Joint
ISSUE:	An under torque on the pinch bolt between the steering column & upper steering drive shaft has caused movement and wear in the joint.
SUMMARY:	Torque existing hardware to specification and inspect joints. Remove the steering column & upper steering drive shaft & replace parts if required.

ITS60596

Ref. NHTSA Recall No.	Ref. Transport Canada Recall No.
22V-943	2022-732

THIS ITS DOCUMENT SHOULD BE RETAINED AND REFERRED TO FOR FUTURE MAINTENANCE UNTIL THE NEW FLYER PARTS AND/OR SERVICE MANUAL IS UPDATED TO REFLECT WORK DONE AS A RESULT OF THIS DOCUMENT. ENSURE THAT THIS DOCUMENT IS AVAILABLE FOR PARTS AND MAINTENANCE STAFF GOING FORWARD.

☞ **NOTE: Please note, New Flyer will allow the use of a combination of new parts, existing parts and / or welded parts as long as they meet the requirements that are outlined in the procedures written in this document ITS-60596.**

PROCEDURE:

1. Set park brake and chock wheels.
2. Turn the main battery disconnect switch to the “OFF” position.
3. On the steering assembly of the bus with the steering assembly still installed in the bus, please torque the hardware in the four locations shown in Figure 1 to 70±4Ft/Lbs dry. Please ensure that the bolts are 7/16” – 20 X 2.00”; Grade 8; Zinc (NF PN 6444255) & the nuts are 7/16” – 20; Self Locking; Zinc (NF PN 6444254). If any 10MM hardware is found in any of these four locations it should be removed and replaced. Remove existing torque witness marks and re-mark after new torque has been applied.

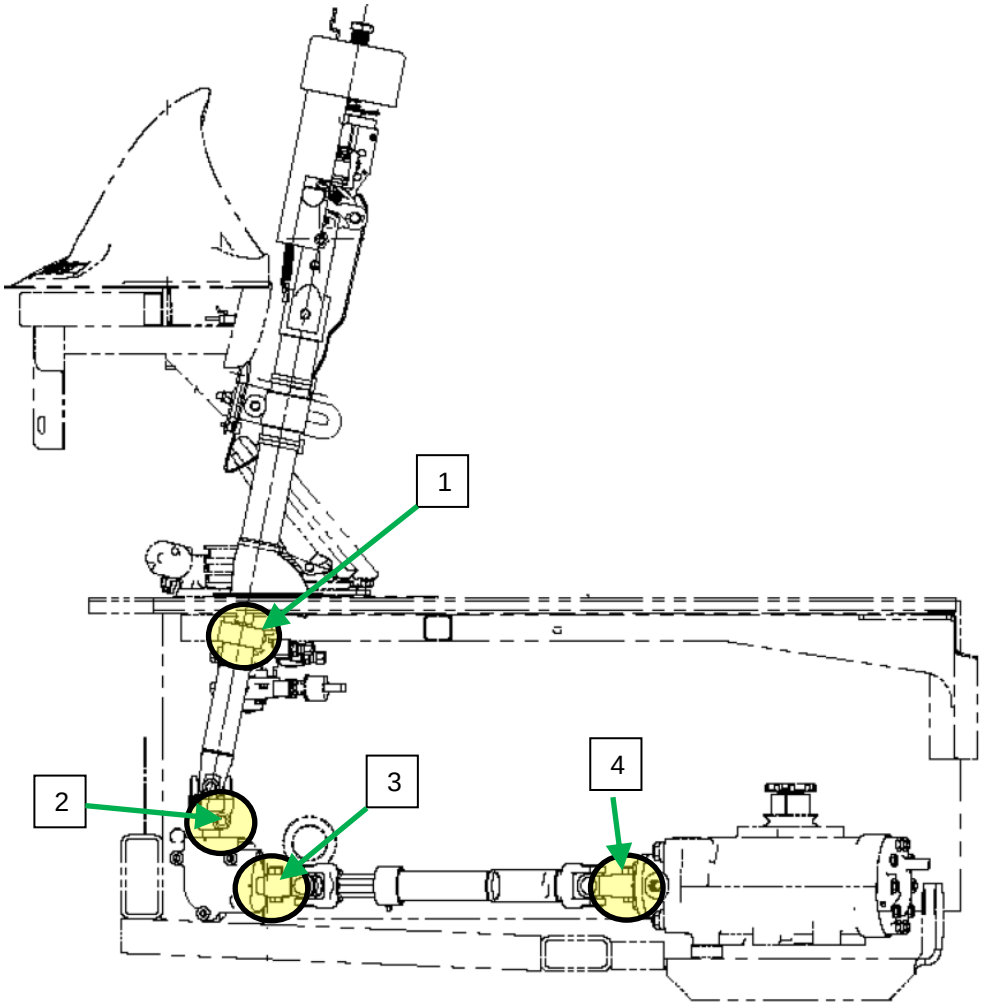


Figure 1: Locations to Torque on Steering System

4. After the new torque has been applied, inspect for any free play at the splined, torqued joint between the steering column and the upper steering drive shaft, which is identified as Area #1 in Figure 1, by grasping the drive shaft mid-length and applying a lateral force. There should be no free play in this torqued joint. If no free play has been found, the bus is safe to return to service.
5. If free play is found at the splined, torqued joint between the steering column and the upper steering drive shaft, which is identified as Area #1 in Figure 1, please proceed to remove the steering column & upper steering drive shaft from the bus for closer inspection on the shop bench.
6. With the steering column and the upper steering drive shaft removed from the bus and on the bench, please separate the steering column from the upper steering drive shaft.
7. Using the PSS Go/No Go Plug tool measure the solid, splined end of the upper steering drive shaft. See Figure 2.
    a. If the Go/No Go Plug **will not fit** into the splined portion of the drive shaft, the upper steering drive shaft is a pass and can be reused as required.
    b. If the Go/No Go Plug **does fit** into the splined portion of the drive shaft, the upper steering drive shaft is a fail and will need to be safely stored for using in a welded assembly if required.

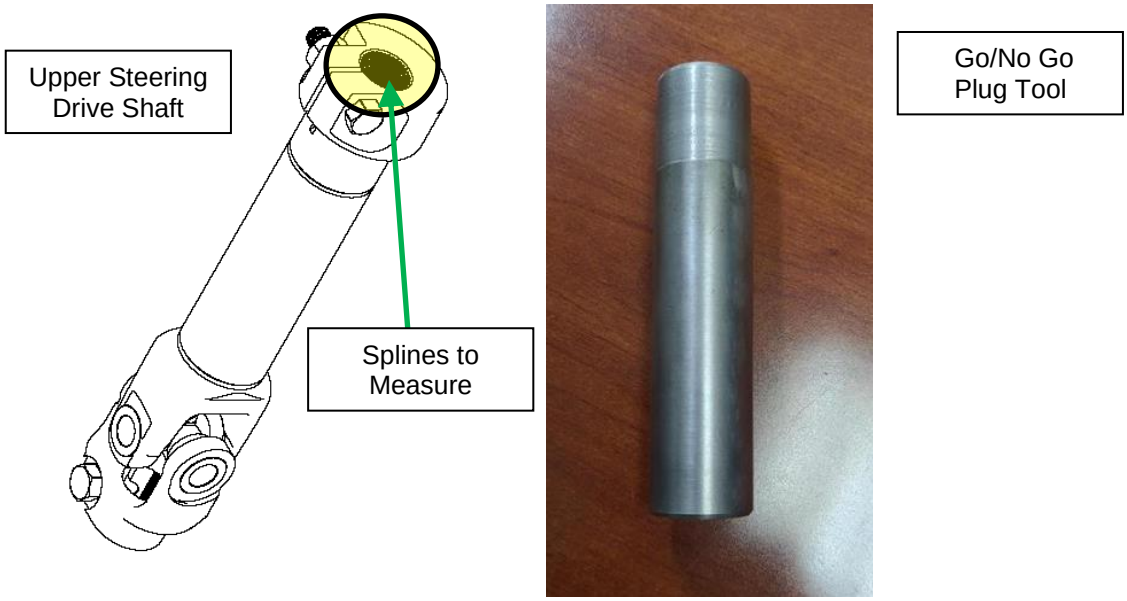


Figure 2: Upper Steering Shaft Measurement

8. Using the No Go Gauge measure the splined end of the steering column. See Figure 3.
    a. If the **No Go** Gauge **will not fit** over the splined portion of the steering column, the steering column is a pass and can be reused as required.
    b. If the **No Go** Gauge **does fit** over the splined portion of the steering column, the steering column is a fail and will need to be safely stored for using in a welded assembly if required.

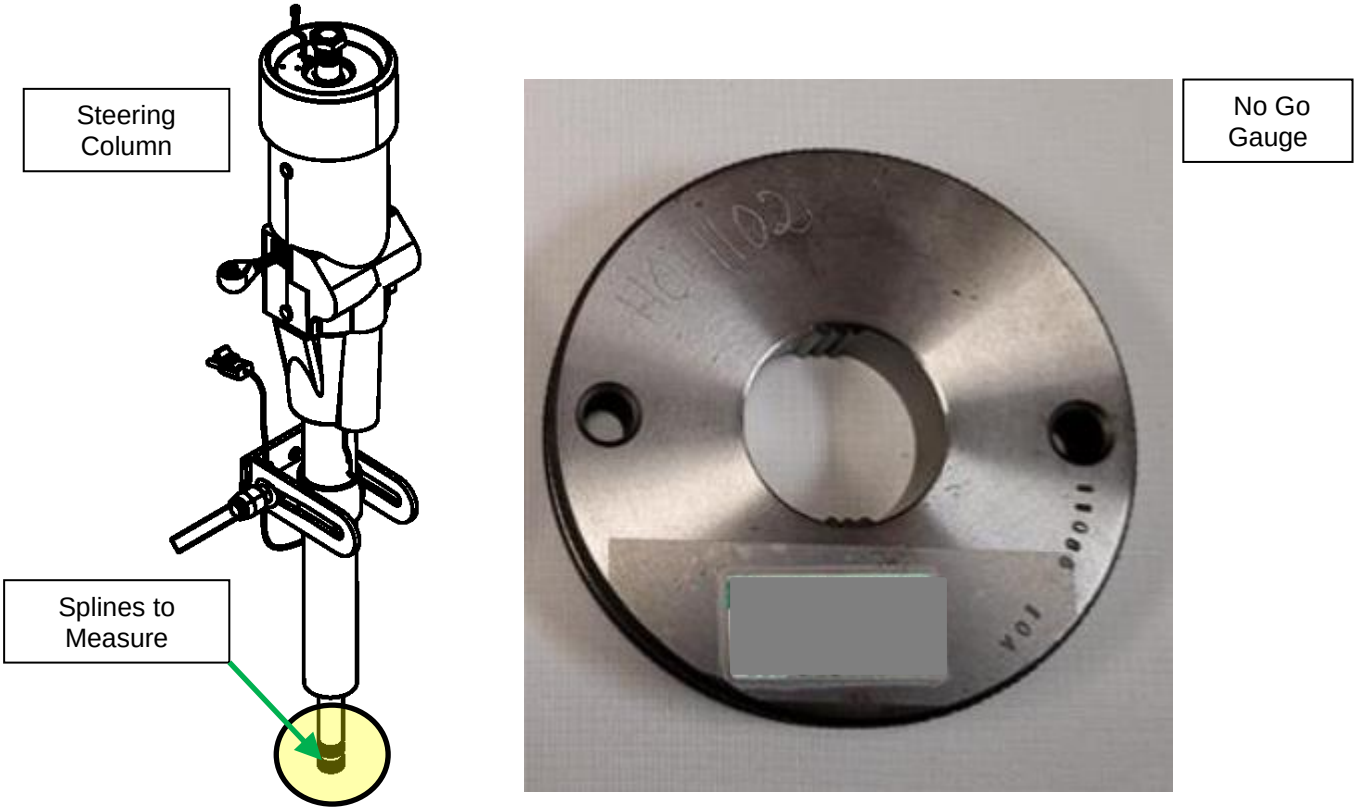


Figure 3: Steering Column Measurement

9. Any combination of new or used parts that are available and that have deemed as a pass using the above Go / No Go measurements can be used to repair the buses. When refastening the verified good upper steering drive shafts to the verified good steering columns please use new hardware bolt 7/16" – 20 X 2.00"; Grade 8; Zinc (NF PN 6444255) & nut 7/16" – 20; Self Locking; Zinc (NF PN 6444254) at the joint between the upper steering drive shaft and the steering shaft shown in Figure 4. Torque the hardware to 70±4Ft/Lbs dry. Remove existing torque witness marks and re-mark after new torque has been applied.
10. Re-install the steering column with upper steering drive shaft back into the bus. Torque the hardware where the upper steering drive shaft fastens to the miter box to 70±4Ft/Lbs dry. Remove existing torque witness marks if required and re-mark after new torque has been applied. The bus is safe to return to service.
11. The steering columns and upper steering drive shafts that were deemed to be failed, as tested by the Go / No Go measurements, may be used together as a welded assembly as required. To weld together one steering column and one upper steering drive shaft, please follow the instructions in Appendix A with welding procedure data sheet provided in Appendix B.

☞ **NOTE: When welding the steering colum and the upper drive shaft please place heat sinks next to the steering column bearing, adjacent to the weld area, to prevent the heat from traveling further up the steering column to protect any adjacent components. Copper or aluminum blocks would be great options.**

☞ **NOTE: When pre-heating the steel to 200F before welding, a digital temperature gun or temperature stick rated to 200F should be used.**

☞ **NOTE: Given that one of the steels being welded is 1141, we request an MPI inspection on the first 10 welded assemblies and if all 10 are OK then complete 1 in 10 for the remainder.**

12. When the steering column and upper steering drive shaft welded assy is complete and has passed MPI inspection it can be re-installed in the bus. Torque the hardware where the upper steering drive shaft fastens to the miter box to 70±4Ft/Lbs dry. Remove existing torque witness marks if required and re-mark after new torque has been applied. The bus is safe to return to service.
13. After any procedure has been completed please clean up all tools and debris and return the bus to service condition.
14. Turn the main battery disconnect switch to the “ON” position.

LABOUR ESTIMATE				
	Operation	Number of Technician(s)	Hours	Labor Time T X HR
1	Torque existing hardware to specification and inspect joints	2	0.5	1.0
2	Remove and replace the steering column & upper steering drive shaft if required	2	1.5	3.0

PARTS REQUIRED					
Item	Part Number	Description	Qty. per Coach	Units	Notes
1	536446	COLUMN-STEERING DBL TILT 9204	1	EA	If Required
2	6447692	STEERING COLUMN, SERVICE ASSEMBLY	1	EA	If Required
3	532703	JOINT-U STRG DBL TILT	1	EA	If Required
4	068035	BOOT TAPERED 1.56&4.5ID	1	EA	If Required
5	50S00016	SCREW FH CROSS RECESS TPG. TYPE AB #10 X 1" LG.	4	EA	If Required
6	004944	SCREW-TPG CSK 10-32X1.0LG	2	EA	If Required
7	6444255	BOLT, HEX 7/16" - 20 UNF X 2" LG.	4	EA	If Required
8	6444254	NUT, HEX 7/16" - 20 UNF	4	EA	If Required

SPECIAL TOOLS REQUIRED					
Item	Part Number	Description	Qty.	Units	Notes
1	NPN	Welding Wire	0.01	EA	If Required
2	NPN	Welding Gas	0.01	EA	If Required
3	NPN	Torque Paint Marker	0.01	EA	If Required

Appendix A

This weld procedure is written in response to the request to reinforce a splined connection in a New Flyer steering column with weld metal. The splined connection has been reported to have deteriorated, necessitating the exploration of a welded connection. A photo of the connection under review is shown below.

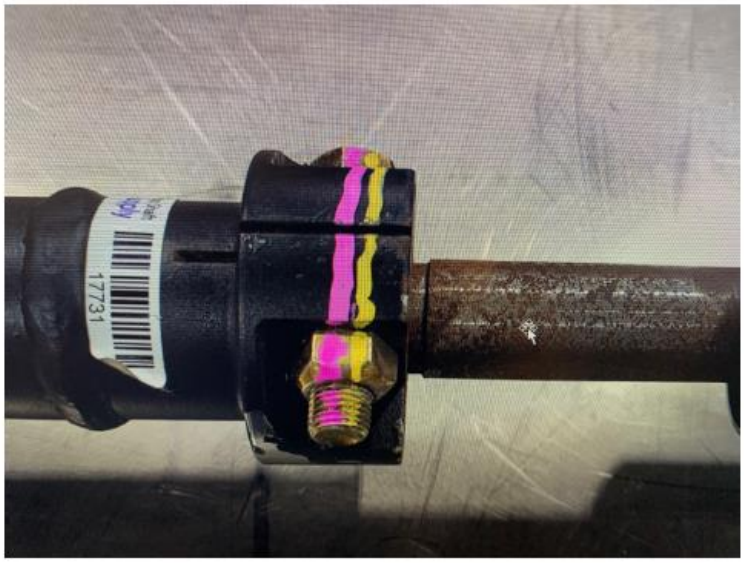


Photo of steering column connection under review in this report.

Appendix A Continued…

The driveshaft component (at left on photo above) is reported to be fabricated out of 1141 steel, which is a steel formulated with high sulfur content to aid in machining. The steering column (at right on photo above) is reported to be fabricated out of 1018-1020 steel. These materials were identified by the specific suppliers of these parts to New Flyer specific to coaches built for Seattle.

A review of the maximum torque of the steering column suggests that a 5/16" all around fillet weld could be used to transmit the torque through the joint.

Welding of 1141 steel requires consideration for the high amount of sulfur. It is required that a lower heat input process be used to minimize base metal dilution, as well as allowing for a slow cooling rate to allow the sulfur containing compounds to fully freeze during the time of solidification and weld shrinkage. An electrode with a higher Mn content is recommended to be used as a mechanism to tie up sulfur in MnS compounds so that less is available to form the more deleterious FeS compounds. It is recommended that the GMAW weld process be used with a 0.045" diameter ER-80S-D2 electrode.

Welding is recommended to be performed in the flat or horizontal positions. If possible, the steering column is to be removed from the coach prior to welding. If this is not possible, care shall be taken to protect adjacent components during welding operations.

Based on the thickness of the components, a pre-heat of 200 °F is recommended to ensure good weld fusion. This will also reduce the cooling rate, which is beneficial, however the dilution may slightly increase.

It is critical that the weldment be allowed to air cool to room temperature. The weldment is not to be quenched or transferred to a colder location during cooling, as this will greatly increase the risk of solidification cracking.

Repair welding shall be performed by companies certified to CSA W47.1 Division 1 or 2, by a CWB certified welder. Alternatively, AWS qualified welders and welding fabricators may be used and are considered an approved equal.

Weld Procedure – Steering Column Connection

1. Identify the location of the weld joint to be made. Ensure that the parts are properly located as per the New Flyer installation drawing.
2. To prepare for welding, remove any paint, grease, rust, or other contaminants to a distance of 2" away from the area to be welded.
3. Pre-heat the steel to 200 degrees F to a distance of no less than 3" away from the zone to be welded, in any direction.
4. Using the GMAW weld process with a 0.045" diameter ER-80S-D2 electrode, first weld the seam on the driveshaft side so that the fillet weld has full backing about the circular fillet weld. Tack welds may be used to secure the driveshaft to the steering column. Once the backing weld has been placed, proceed to weld the circumference of the weld joint with a 5/16" fillet weld. Weld in the flat or horizontal positions.
5. Allow the welded assembly to slow cool.
6. After the repaired area has cooled to ambient temperature, perform an MPI inspection to confirm that a sound weld has been placed.
7. Re-paint the area where welding has taken place in conformance with client requirements.

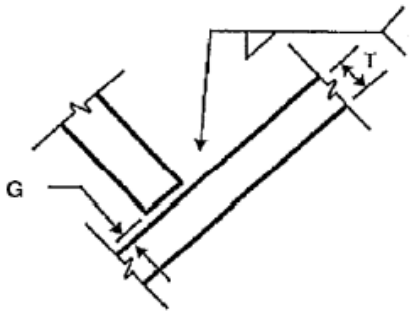
Appendix B

WELDING PROCEDURE DATA SHEET

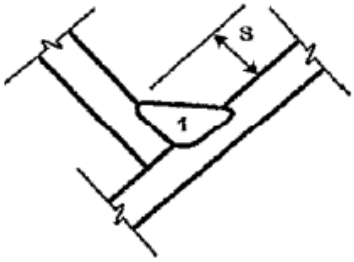
Company Name:	**New Flyer Industries**			WPDS #:	1-FFc GMAW 045
Company Addresses:	711 Kernaghan Ave; Winnipeg, MB; R2C 3T4	6200 Glenn Carlson Dr; St Cloud, MN; 56301 USA	2145 5th Avenue SW; Crookston, MN; 56716 USA	106 National Drive; Anniston, AL; 36207 USA	Date: 8-Dec-2022
					WPS: NF-1
					Reference Standards: CSA W47.1, W59

Weld Process:	GMAW - CV	Weld Position:	Flat, Horizontal	Shielding Gas:	90%Ar-10%CO_2
Base Material:	AISI 1018-1020 to AISI 1141	Process Mode:	Semi-Automatic	Shielding Gas Flow Rate:	35 CFH
		Preheat Temperature:	200° F	Interpass Temperature (min):	200° F
Filler Metal:	ER-80S-D2			Interpass Temperature (max):	N/A

Typical Joint Preparation:



Typical Pass and Layer Sequence:



Joint Dimensions:					
G:	0-1/16"	Electrode Stickout:	1/2" ± 1/8"	Weld Type:	Fillet
Q:	N/A	Nozzle Diameter:	5/8" - 3/4"	Joint Type:	Corner / Tee / Lap
Root Face (Rf):	N/A	Current Polarity:	DC+	Note:	Air cool (slow cool) after welding; do not quench

Material Thickness (T) (in)	Weld Size S / ETT (in)	Number of Layers	Number of Passes	Electrode Diameter (in)	Root Face (Rf):	Current (A)	Wire Feed Speed (in/min)	Voltage (V)	Travel Speed (in/min)
0.375+	0.250	1	1	0.045	N/A	300	375	27	14 - 20
0.500+	0.313	1	1	0.045	N/A	300	375	27	14 - 20
0.750+	0.375	2	3	0.045	N/A	300	375	27	14 - 20
1.000	0.375	2	3	0.045	N/A	300	375	27	14 - 20

Revision Date:	Initials:	Explanation:	Company Authorization:	CWB Approval:
8-Dec-2022	BSE	Original WPDS	[redacted]	
13-Dec-2022	BSE	Wire change		
13-Dec-2022	BSE	Reduce parameters		
[redacted]				