All EHC rollers used in the lift industry are designed and tested to meet the following general criteria. Other specific test requirements are conducted as identified by the customer or the EHC drawing.

1 Testing Criteria

For roller testing the following calibrated equipment is required:

- Shore hardness measuring gauge (Durometer)
- Instruments for the measurement of geometrical dimensions
- Tensile and compression tester
- Dynamic life testing equipment
- Temperature controlled bath.

2 Materials

2.1 The properties of the tread material and test parameters to be met shall be as specified in the appropriate EHC part drawing.

- The raw material supplier delivers the raw material with a compliance certificate. The required specification values are to be shown in the CQ together with actual results for the batch.

2.2 All ball bearings shall conform to international ISO & DIN standards.

3 Standard Roller Tests

3.1 Hardness Test:

- The tread is tested on the face and side using a calibrated Durometer and shall be within +/-3° Shore of the hardness specified in the EHC drawing.

3.2 Geometrical Test: (See Appendix 2)

The geometry of a roller is measured in accordance with the EHC part drawing using suitable fixtures.

- Outside diameter
- Tread width
- Hub width where applicable
- Inner diameter of bearing
- Tread concentricity
- Tread axial run-out
- Tread radial run-out

3.3 Standard Dynamic Test: (See Appendix 3)

- Drum diameter: 500 mm
- Circumferential speed: 0.76± 0.04m/s
- Surface roughness: Ra. approx. 3 µm
- Typical drum temp: 40 ºC

5 rollers are run on the drum tester for 1000 hours at the pressure indicated on the EHC part drawing without the tread loosening from either the bearing or hub; and without any significant change to the tread or bearing beyond these acceptable limits

- Concentricity up to 0.4mm
- Axial run-out up to 0.6mm
- Dimensional changes up to 1%

4 Additional Tests as Required by Drawing

4.1 Hydrolysis Test: (See Appendix 4)

5 rollers to be run on drum test for 250 hours each at pressure indicated on part drawing without the tread loosening from the bearing or hub after roller has been submerged in water at 70ºC for the time specified in the EHC part drawing.

Typical pre-treatment time in 70 ºC water is:

- 150 hours for hydrolysis stabilized material
- 300 hours for hydrolysis resistant material

4.2 Oil Resistance Test: (See Appendix 4)

5 rollers are run on the drum tester for 250 hours at the pressure indicated on the EHC part drawing without the tread loosening from either the bearing or the hub after soaking in the oil or grease specified at 50 ºC for 48 hours.

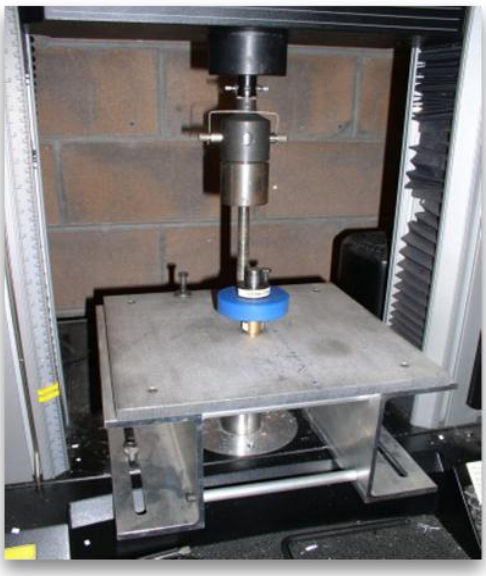
4.3 Lifetime Dynamic Test: (See Appendix 3)

5 rollers are run on the drum tester at the pressure indicated on the EHC part drawing for 2500 hours (or other time required by drawing), or until the failure of the tread or bearing, by the tread separating from the hub or deteriorating significantly beyond these levels:

- Concentricity up to 0.4mm
- Axial run-out up to 0.6mm
- Dimensional changes up to 1%

4.4 Tread Pop-Off Test: (See Appendix 5)

- This test is for rollers where the tread material contacts directly with the bearing. The tread must not separate from the bearing using the axial force specified in the EHC drawing.



4.5 Tread Peel Test: (See Appendix 6)

This is the standard test used to determine the adhesion level between the tread and hub materials.

- The force required to break the adhesive bond of the tread to the hub's outer surface will be greater than 35N per mm width of tread. **(Note: It may be necessary to cut the tread into narrower strips prior to testing to measure peel force rather than tread breakage or tear).**
- The roller is located on a fixture by means of a shaft which allows the roller to turn freely. The tread is cut from the roller, until there is sufficient tread free to be clamped by the jaws of the tensile tester. The force required to peel the tread from the hub, after the roller has rotated approximately 40º is recorded. The crosshead speed of the tester should be 50mm/min.

5 Door Roller Tests

5.1 Door Roller Dynamic Life Tester Data:

- Disc diameter: 500 mm
- Circumferential speed: 1 meter/second
- Load per roller: 40 kgf
- Track dimensions to match roller.

5.2 Full Life Dynamic Test

Roller to run on life tester for 1000 hours at pressure indicated on the EHC part drawing without tread separation from hub or any other significant change to roller, beyond the acceptable limits described below.

The following changes are acceptable:

- Concentricity up to 0.4mm
- Axial run-out up to 0.6mm
- Dimensional changes up to 1%

5.3 Hydrolysis Test

Rollers are run on life tester for 250 hours at 40 kgf per roller without tread separation from the hub or other significant damage after roller has been submerged in water at 70ºC for the time specified in the EHC part drawing.

Typical pre-treatment time in 70 ºC water is:

- 150 hours for hydrolysis stabilized material
- 300 hours for hydrolysis resistant material

5.4 Flat Spot Test

On the life tester the roller is held stationary for 24 hours under a 40 kgf load and the flat spot measured. The roller is then run again for 1 hour on the life tester, at the end of which the flat spot must have disappeared.

5.5 Fire Resistance Testing

Materials to be used for the tread in fire resistant rollers must be certified to have been tested to meet the requirements of UL94 V-0 rating, at a maximum thickness of 2mm.
(See Appendix 1)

APPENDIX 1
UL94-V0 CERTIFICATION

TEST RESULTS

UL 94 - Test for Flammability of Plastic Materials for Parts in Devices and Appliances
50W (20 mm) Vertical Burning Test - Paragraph 8

Tested Before Aging: Specimen Conditioning: Minimum 48 hours at 23 ± 2°C and 50 ± 5% RH.

	Afterflame Time (s) First application	Afterflame Time (s) Second application	Burns to holding clamp?	Flaming particles ignite cotton?	Glowing time after second application (s)
1:	0.0	0.0	No	No	0.0
2:	0.0	0.0	No	No	0.0
3:	0.0	0.0	No	No	0.0
4:	0.0	0.0	No	No	0.0
5:	0.0	0.0	No	No	0.0
Total:		0.0			

After Aging (168 hours @ 70°C)

	Afterflame Time (s) First application	Afterflame Time (s) Second application	Burns to holding clamp?	Flaming particles ignite cotton?	Glowing time after second application (s)
1:	0.0	0.0	No	No	0.0
2:	0.0	0.0	No	No	0.0
3:	0.0	0.0	No	No	0.0
4:	0.0	0.0	No	No	0.0
5:	0.0	0.0	No	No	0.0
Total:		0.0			

CONCLUSIONS

When tested according to the UL 94 vertical burning test procedure, the material identified in this report meets the criteria to qualify for a 94V-0 classification.

Victor Tarcenco,
Fire Testing.

Ian Smith,
Fire Testing.

Note: This report and service are covered under Exova Canada Inc. Standard Terms and Conditions of Contract which may be found on the Exova website (www.exova.com), or by calling 1-866-263-9268.

APPENDIX 2

ROLLER GEOMETRY PROCEDURES

PURPOSE: To determine the major dimensions, concentricity, axial run-out and radial run-out of EHC rollers.

APPLICATION:

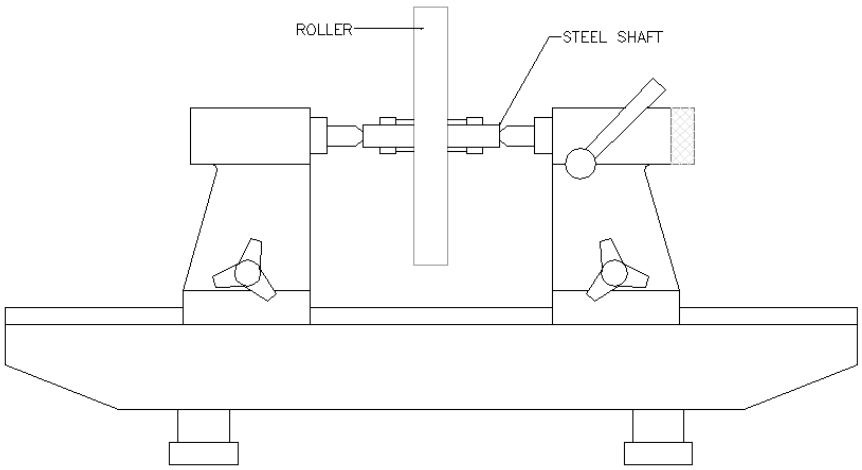
Unless otherwise specified in the drawing, all EHC rollers are manufactured to meet the following geometrical limits:

- Total Radial Run-Out 0.4mm max.
- Concentricity (half of radial run out) 0.2mm max.
- Total Axial Run-Out 0.4mm max.
- Outside diameter of flat roller +/-0.7mm.
- Tread Width +/-0.3mm.
- Machined OD's +/-0.25mm.
- PU Tread Hardness +/-3° Shore A.

ASSOCIATED MATERIAL:

- Digital caliper
- Bench centre with transfer stand and dial indicator
- Precision steel shaft; plain sleeve bearing; one-piece clamp on collar (if necessary)

See equipment set-up below:



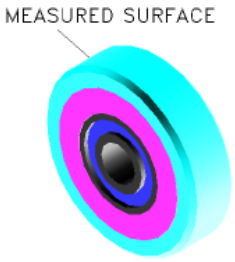
APPENDIX 2 (Cont.)

PROCEDURE:

Major Dimensions

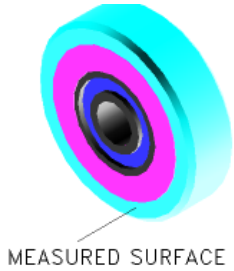
1. Measure the outside diameter, tread width, hub width where applicable and inner diameter of bearing.
2. Record the type of bearing.

Radial Run-Out



1. Position the roller with the bearing between the two contact points of the bench centres. A precision steel shaft may be required if the bearing internal diameter is greater than 17mm.
2. Position the measuring tip of the dial indicator until it comes in contact with the top surface of the roller (tread). Reset the dial indicator to zero. Slowly rotate the roller by 1 full turn taking note of the minimum and maximum reading. Record the total indicator deflection.
3. Repeat the measurement above on 3 different contact points of the roller being measured left, middle and right.

Axial Run-Out



1. Position the roller with the bearing between the two contact points of the bench centres. A precision steel shaft may be required if the bearing internal diameter is greater than 17mm.
2. Position the measuring tip of the dial indicator until it comes in contact with the side surface of the roller (tread). Reset the dial indicator to zero. Slowly rotate the roller by 1 full turn taking note of the minimum and maximum reading. Record the total indicator deflection.
3. Repeat the measurement above on 3 different contact points of the roller being measured top, middle and bottom.

Concentricity

To determine concentricity of a roller, take half of the radial run-out measurement determined above.

REQUIREMENT:

The result meets the value indicated on the EHC part drawing.

APPENDIX 3

STANDARD ROLLER DYNAMIC TESTING

ASSOCIATED MATERIAL:

- Roller drum test machine
- Data sheet
- Summary data sheet

PROCEDURE:

Standard Test

1. 5 rollers to be run on the drum test machine for 1000 hours each at pressure indicated on the EHC part drawing.

2. Before the rollers are installed on the drum test machine, measurements of outside diameter, tread width, tread hardness, concentricity and axial run-out are recorded in the summary data sheet.

3. The tread temperature, hub temperature (if applicable), outside diameter, tread width, and tread hardness will be measured at suitable intervals and the results will be recorded in the data sheet along with the results of a visual inspection for breaks or other failures.

4. Step #2 is repeated at the end of the test with all data and results of visual inspection being recorded in summary data sheets.

5. The following changes are acceptable at the completion of the test:
   - Concentricity up to 0.4mm
   - Axial run-out up to 0.6mm
   - Dimensional changes up to 1%

Lifetime Test

1. 5 rollers to be run on the drum test machine for 2500 hours each at pressure indicated on the EHC part drawing.

2. Before the rollers are installed on the drum test machine, measurements of outside diameter, tread width, tread hardness, concentricity and axial run-out are recorded in the summary data sheet.

APPENDIX 3 (Cont.)

3. The tread temperature, hub temperature (if applicable), outside diameter, tread width, and tread hardness will be measured at suitable intervals and the results will be recorded in the data sheet along with the results of a visual inspection for breaks or other failures.

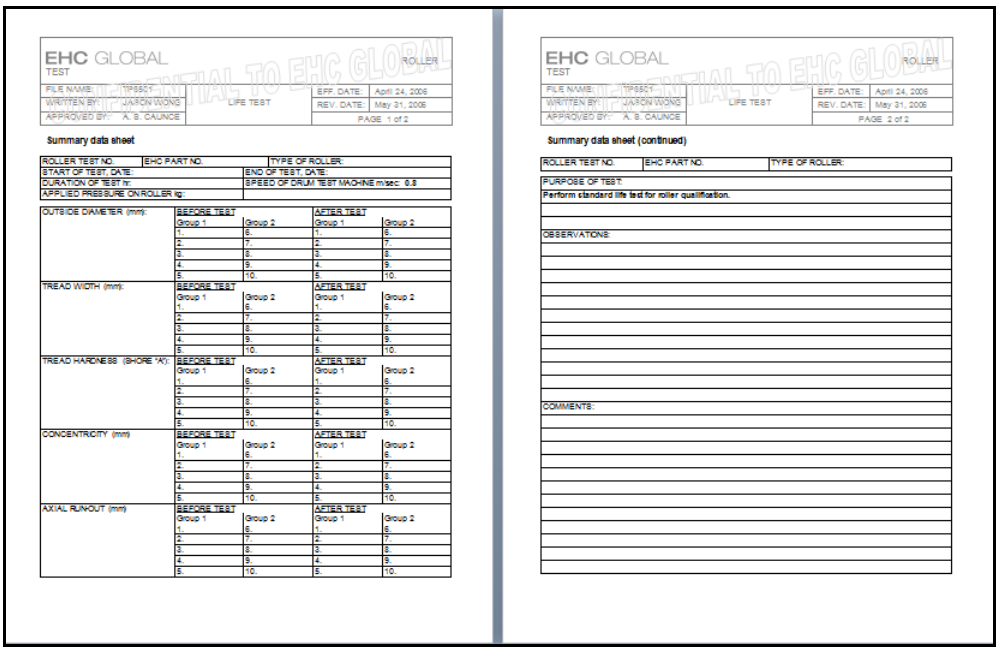
4. Step #2 is repeated at the end of the test with all data and results of visual inspection being recorded in summary data sheets.

5. The following changes are acceptable at the 2500 hour level:
   - Concentricity up to 0.4mm
   - Axial run-out up to 0.6mm
   - Dimensional changes up to 1%

6. Test is continued to 5000 hours or to significant failure whichever comes first and results documented in format similar to below

REQUIREMENT:

At the completion of the test, the roller is still functional without tread loosening from bearing or hub or other significant change.



EHC GLOBAL
TEST ROLLER

FILE NAME:		EFF. DATE:	April 24, 2006
WRITTEN BY:	JARON WONG	REV. DATE:	May 31, 2006
APPROVED BY:	A. S. CAUNCE	PAGE 1 of 2	

LIFE TEST

Summary data sheet

ROLLER TEST NO.	EHC PART NO.	TYPE OF ROLLER:
START OF TEST, DATE:		END OF TEST, DATE:
DURATION OF TEST hr:		SPEED OF DRUM TEST MACHINE m/sec: 6.8
APPLIED PRESSURE ON ROLLER kg:		

	BEFORE TEST		AFTER TEST	
OUTSIDE DIAMETER (mm):	Group 1	Group 2	Group 1	Group 2
	1.	6.	1.	6.
	2.	7.	2.	7.
	3.	8.	3.	8.
	4.	9.	4.	9.
	5.	10.	5.	10.
TREAD WIDTH (mm):	BEFORE TEST		AFTER TEST	
	Group 1	Group 2	Group 1	Group 2
	1.	6.	1.	6.
	2.	7.	2.	7.
	3.	8.	3.	8.
	4.	9.	4.	9.
	5.	10.	5.	10.
TREAD HARDNESS (SHORE "A"):	BEFORE TEST		AFTER TEST	
	Group 1	Group 2	Group 1	Group 2
	1.	6.	1.	6.
	2.	7.	2.	7.
	3.	8.	3.	8.
	4.	9.	4.	9.
	5.	10.	5.	10.
CONCENTRICITY (mm)	BEFORE TEST		AFTER TEST	
	Group 1	Group 2	Group 1	Group 2
	1.	6.	1.	6.
	2.	7.	2.	7.
	3.	8.	3.	8.
	4.	9.	4.	9.
	5.	10.	5.	10.
AXIAL RUNOUT (mm)	BEFORE TEST		AFTER TEST	
	Group 1	Group 2	Group 1	Group 2
	1.	6.	1.	6.
	2.	7.	2.	7.
	3.	8.	3.	8.
	4.	9.	4.	9.
	5.	10.	5.	10.

EHC GLOBAL
TEST ROLLER

FILE NAME:		EFF. DATE:	April 24, 2006
WRITTEN BY:	JARON WONG	REV. DATE:	May 31, 2006
APPROVED BY:	A. S. CAUNCE	PAGE 2 of 2	

LIFE TEST

Summary data sheet (continued)

ROLLER TEST NO.	EHC PART NO.	TYPE OF ROLLER:

PURPOSE OF TEST:
Perform standard life test for roller qualification.

OBSERVATIONS:

COMMENTS:

APPENDIX 4

MEASURING THE HYDROLYTIC OR OIL RESISTANCE OF ROLLERS

ASSOCIATED MATERIAL:

- Temperature controlled container for the pre-treatment of water or oil.

PROCEDURE:

Hydrolysis Stability Test

1. 5 rollers to be submerged in water at 70 ºC for 150 hours.
2. Following the 150 hour submersion in 70°C water, 5 rollers to be run on the drum test machine for 250 hours each at pressure indicated on the EHC part drawing.
3. Before the rollers are installed on the drum test machine, measurements of outside diameter, tread width, tread hardness, concentricity and axial run-out are recorded in the summary data sheet.
4. The tread temperature, hub temperature (if applicable), outside diameter, tread width, and tread hardness will be measured at suitable intervals and the results will be recorded in the data sheet along with the results of a visual inspection for breaks or other failures.
5. Step #3 is repeated at the end of the test with all data and results of visual inspection being recorded in summary data sheets.

Hydrolysis Resistance Test

1. 5 rollers to be submerged in water at 70 ºC for 300 hours.
2. Following the 300 hour submersion in 70°C water, 5 rollers to be run on the drum test machine for 250 hours each at pressure indicated on the EHC part drawing.
3. Before the rollers are installed on the drum test machine, measurements of outside diameter, tread width, tread hardness, concentricity and axial run-out are recorded in the summary data sheet.
4. The tread temperature, hub temperature (if applicable), outside diameter, tread width, and tread hardness will be measured at suitable intervals and the results will be recorded in the data sheet along with the results of a visual inspection for breaks or other failures.
5. Step #3 is repeated at the end of the test with all data and results of visual inspection being recorded in summary data sheets.

APPENDIX 4 (Cont.)

Oil Resistance Test

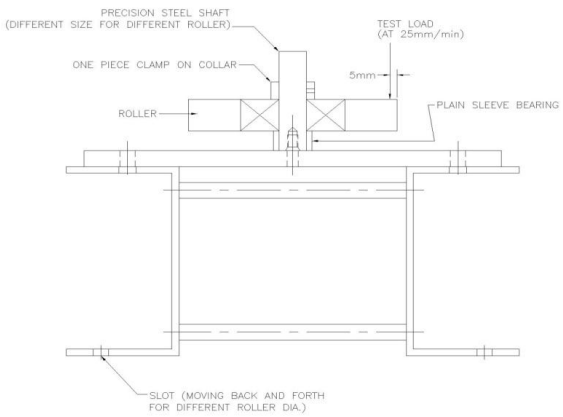
1. 5 rollers to be treated in oil at 50 ºC for 48 hours.
2. 5 rollers to be run on the drum test machine for 250 hours each at pressure indicated on the EHC part drawing.
3. Before the rollers are installed on the drum test machine, measurements of outside diameter, tread width, tread hardness, concentricity and axial run-out are recorded in the summary data sheet.
4. The tread temperature, hub temperature (if applicable), outside diameter, tread width, and tread hardness will be measured at suitable intervals and the results will be recorded in the data sheet along with the results of a visual inspection for breaks or other failures.
5. Step #3 is repeated at the end of the test with all data and results of visual inspection being recorded in summary data sheets.

REQUIREMENT:

At the completion of the test, the roller is still functional without tread loosening from bearing's outer surface, or from the hub or other significant change.

APPENDIX 5

PURPOSE: To determine the ability of the roller tread to resist displacement when subjected to a constant axial load. Typically used on rollers with bearings and no hub.



PROCEDURE:

1. Determine the inner diameter of the roller. Obtain a 800mm long steel shaft with the correct diameter and fasten one end of the steel shaft to the centre of the test jig.

2. Insert the correct inner diameter of the plain sleeve bearing onto the steel shaft.

3. Slide the roller onto the steel shaft where the inner ring of the bearing is supported by the plain sleeve bearing.

4. Insert a correct dimension steel collar onto the steel shaft and tighten the cap screw to secure the collar onto the shaft.

5. Position the test jig by aligning the slots on both sides over the screw locations at the base of the tensile and compression tester. Loosely fasten two M10-1.5 socket head cap screws through the slots onto the thread holes.

6. Slide the jig forward or backward until the side of the roller is 5mm in from the outer diameter of the tread in line with the direction of an axial load being applied.

7. Secure the test jig by tightening the socket head cap screws.

8. Run the tensile and compression tester with the required axial force given in the EHC part drawing at a constant speed of 25 mm/min.

REQUIREMENT:

The roller tread should not separate from the bearing.

APPENDIX 6

PURPOSE: To determine the adhesion level between the tread material and the hub material of EHC rollers.

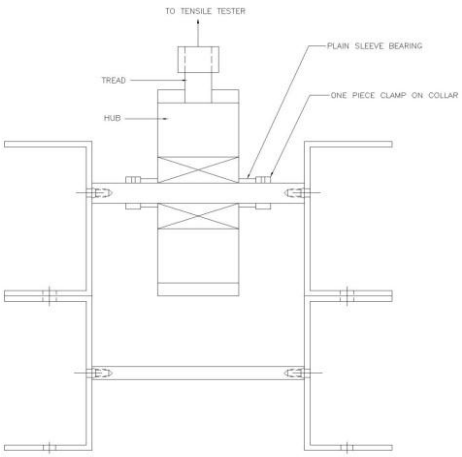
APPLICATION:

All EHC rollers with hub.

ASSOCIATED MATERIAL:

- Tread peel test jig.

See equipment set-up below:



PROCEDURE:

1. Determine the inner diameter of the roller and slide the roller into the proper diameter of a 200mm long steel shaft.

2. Insert the correct inner diameter of the plain sleeve bearing and steel collar onto the steel shaft from each end.

3. Centre the roller onto the shaft and tighten the cap screws of the steel collar to secure the roller from moving side to side but the roller can be rotated freely.

4. Secure the steel shaft onto the tread peel test jig by inserting and tightening two socket head cap screws onto the steel shaft from each end.

APPENDIX 6 (Cont.)

5. Position the tread peel jig and align the holes on both sides onto the screw locations at the base of the tensile and compression tester. Fasten two M10-1.5 socket head cap screws through the holes onto the thread holes.

6. Clamp the tread material from the roller onto the tester. (Prior to the test, the tread is cut along its whole width from the hub until it is long enough to be clamped onto the jaw of the tensile and compression tester. It may also be necessary to cut the tread into narrower strips prior to testing).

7. Run the tensile and compression tester at the constant speed of 50 mm/min. The force required to peel the tread from the hub after the roller has rotated approximately 40 º is recorded.

REQUIREMENT:

The force required to separate the tread from the hub should be greater than 35 N per mm width.