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## Durability Testing on Adjustment Ring Sample

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## 1.0 INTRODUCTION

At the request of Ipex Management Inc. (Ipex), Exova performed Physical Testing on Adjustment Ring samples, according with specifications provided by the client.

Ipex submitted one (1) full size adjustment ring specimens for testing. One samples of 12 in length was cut off from the full size specimen and allocated with Exova Sample Number below:

<u>Exova Sample #</u>	<u>Samples Description</u>
13-06-C0158-1	Sample of 12 in (304.80 mm) length, 4.875 in (123.82 mm) depth and 1.9685 in (50 mm) thickness

## 2.0 OBJECTIVES

The objective of the proposed work was to provide information needed to evaluate the properties of the adjustment ring samples, when subjected to durability compression load testing.

## 3.0 INSTRUMENTATION

The following instruments were used to measure and record the load values:

10 Kip load cell	MII # B06835
MTS 407 signal conditioner	MII # B06081

## 4.0 TEST PROCEDURE

The durability compression test set-up was designed using a servo-hydraulic actuator and a calibrated load cell installed in vertical orientation on a super structure. The sample was seated on the bottom steel plate which was placed on the test bed and the compression load was applied using an additional steel plate attached to the load cell (support and loading fixtures designed and fabricated by Exova).

The photos of the compression test set-up are presented in Figures 1 to 3.

The sample was tested for compression durability at ambient temperature.

The test was performed using a smaller sample cut off from full size adjustment ring specimen. The required compression durability load was calculated based on full compression durability load design of 98 KN (for a full size specimen) to develop the same stress on the smaller size sample as explained below.

- Full size specimen area  $A_f = 360,142.75$  sq-mm (558.1875 sq-in)
- Load bearing surface area of the mini specimen  $A_{ms} = 37,744.20$  sq-mm (58.5 sq-in)
- Compression durability load on full size adjustment unit  $L = 98$  KN (22,030.4 lbs)
- Durability stress on full size adjustment unit  $S = L/A_f = 271.98$  KPa (39.4677 Psi)
- Compression durability load on small size sample adjustment unit  $L_s = S \cdot A_{ms} = 10.27$  KN (2,308.9 lbs)

The compression durability test was performed using a sine wave of 0/10.27 KN (0/2,308.9 lbs) at a frequency of 1 Hz (1 cycle/ second) until failure occurs or maximum required number of cycles of 1,000,000 was achieved.

The sample was periodically inspected (once per day or every 86,400 cycles) for deformations and cracks (test stopped, sample removed from set-up and visually inspected) then the test was resumed.

At the test completion (1,000,000 cycles achieved) a throughout inspection regarding deformations and cracks was performed on the sample using a magnifying glass.

## 5.0 RESULTS

No deformations, cracks or other failures were observed during durability testing and at the final inspection.

The photo of the sample after durability test completion is presented in Figure 5.

The compression durability test was performed at Exova Mississauga facility on between September 06 and September 19, 2013.

## 6.0 CONCLUSIONS

The sample meets the "EPS and HDPE Test Procedure 24 Dec 2012", Section TBD.01.01b) regarding the pass/fail criteria at the compression durability test.

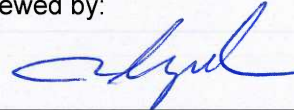
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**Figures**

(3 Pages)





Figure 1 : Sample before durability testing

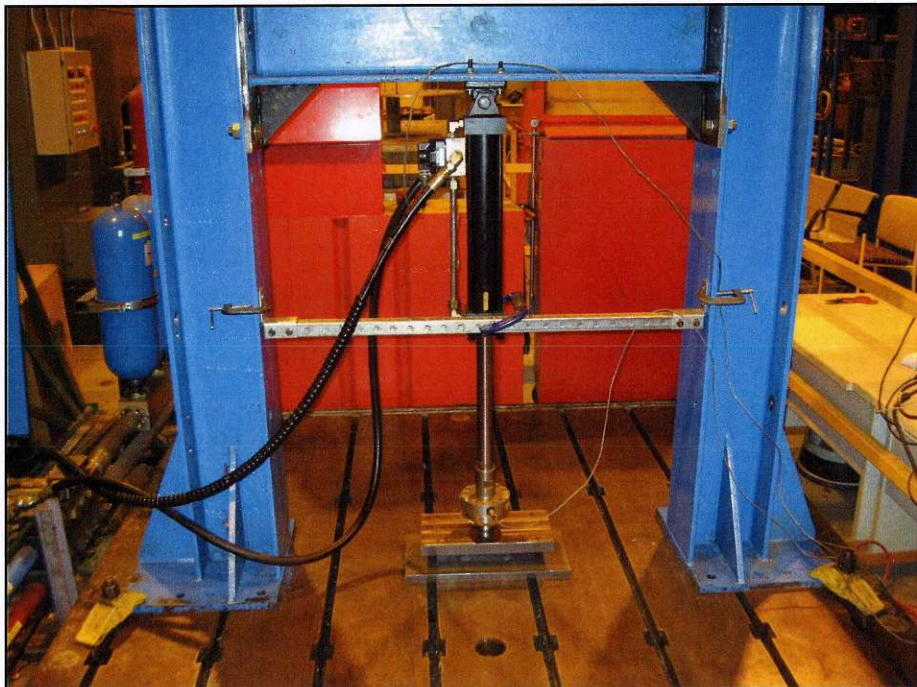


Figure 2 : Compression durability test set-up – General view