

Recommendation for Harmonization of Denton and FTSS Brand Vinyl Material

NOTE: Please review and be ready to vote at
March 14, 2011 meeting

Topics

- ▶ Comparison of current vinyl flesh materials
 - Mechanical properties
 - Color
 - Attribute feedback
 - Shrinkage
- ▶ Compare Molded w/Foam part stiffness's
- ▶ Recommendation from production for best processing
- ▶ Final Recommendation

COMPARISON OF CURRENT VINYL FLESH MATERIALS, MECHANICAL PROPERTIES, COLOR, & SHRINKAGE ISSUE

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Vinyl Materials of Denton and FTSS

1. Both brands have used vinyl from the same supplier.
 - a. Same PVC resin used in both formulation
 - b. Same Plasticizers used in both formulation (More plasticizer used in Denton formulation, that is why it has a 45 durometer and FT brand is 52)
 - c. Same pigment types are used in the formulations. (just differences of the amount of orange)
2. FT brand Feet and head have a different smell from Denton brand because it uses a DOP plasticizer in vinyl

NOTE: DOP can no longer be sold into California, other places are also discussing not letting products with DOP into certain states or countries
3. FT brand foam has been discontinued, have been using Denton brand foam since Summer 2010. Both brands now use the same urethane foam in all the vinyl components
4. Both brands certification testing is very similar, based on recent round robin testing between labs

Users Feedback for vinyl flesh

Attribute	Denton Brand	FTSS Brand
Color of vinyl (FTSS or Denton?)	No Preference	No Preference
Vinyl Surface (shiny vs. mat finishes, feel) Denton is shiny and FTSS has a mat finish	Reduce Shiny surface, if possible	Mat finish ok, but oily surface causes targets to fall off
Current Mold sets (age, patterns,)	Newer molds in some cases for dummies in this process	Older molds for the dummies for this review
Vinyl Shrinkage (Data on vinyl part shrinkage)	No reported shrinkage	Shrinkage of chest jackets and lower legs reported
Shape effects (hands, feet vs headskin, pelvis etc...)	Headskin for Hybrid III 50 th has hollow hose	Headskin for Hybrid III 50 th has solid hose
Interchangeability (weight fit between flesh parts?)	Weight of Hybrid III 50 th lighter than FT brand (no weight spec on this part)	Weight of Hybrid III 50 th heavier than FT brand (no weight spec on this part)

Users Feedback for Vinyl flesh Attributes

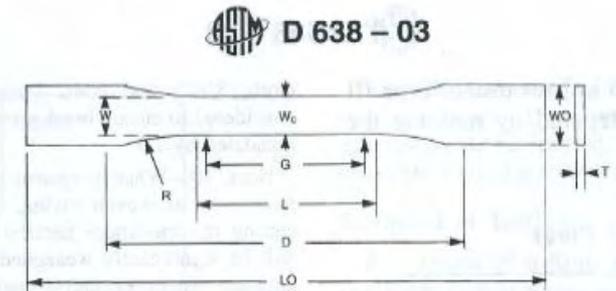
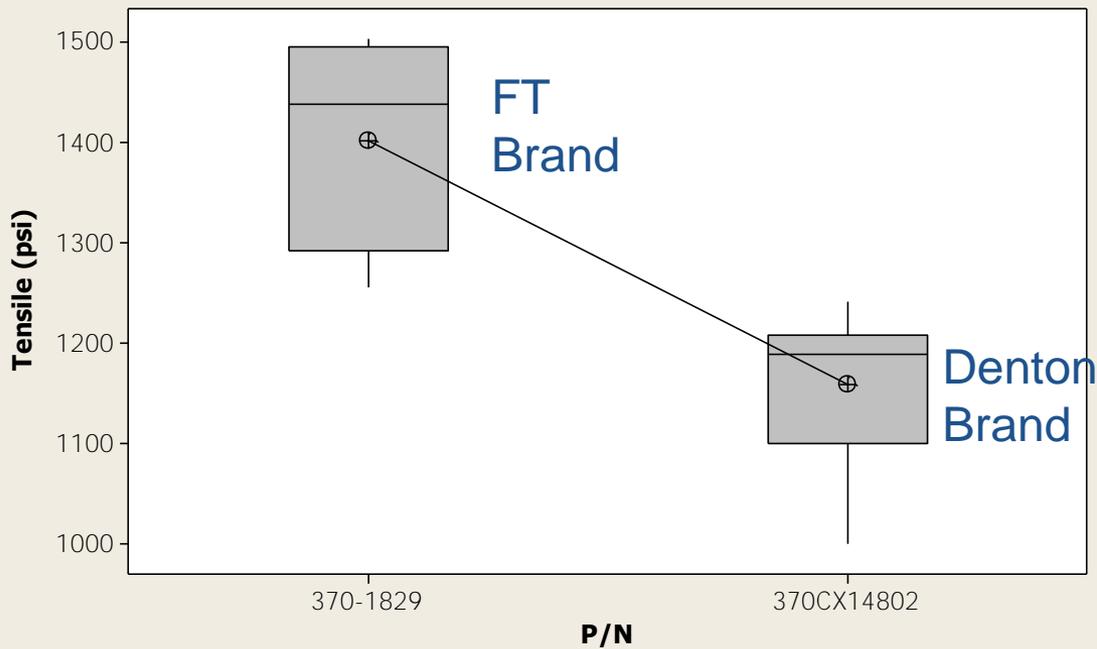
Attribute	Denton Brand	FTSS Brand
Durability Data (breakage, cuts, long term certification test changes, foam break down, damping material glue failure,)	No issues	No issues
Reparability (which vinyl is easier to repair in the field)	No issues	No Issues
Interchangeability (Can parts bolt on each Brand, external vs internal)	Head skin for Hybrid III 50 th Chest jackets, small female, 6 YO, 50 th and 95 th	Head skin for Hybrid III 50 th Chest jackets, small female, 6 YO, 50 th and 95 th

Material property comparison of Vinyl Material

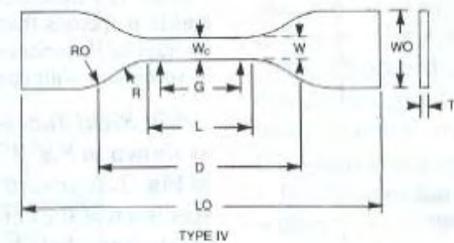
Attribute	Denton Brand	FTSS Brand	European Brand	Original Formulation
Color of vinyl (FTSS or Denton?)	Light Brown	Pink	Brown	Pigment Ratios provided
Resin, Plasticizer, Ratios	40.5% Resin 53.5% Plasticizer	47.2% Resin 40.14% Plasticizer	40.5% Resin 53.5% Plasticizer	44% Resin 42.4% Plasticizer
Durometer Shore A	45 +/- 3	52 +/- 3	45 +/- 3	Estimated to be 48 +/-5
Tear Strength	71 pli	125 pli	71 pli	NO Spec provided
Tensile Strength	1159 psi	1401 psi	1093 psi	NO Spec provided
Elongation	400%	400%	400%	NO Spec provided

Comparison of several batches of Tensile measurements for Denton and FT brand vinyl flesh

Boxplot of Tensile (psi) by P/N



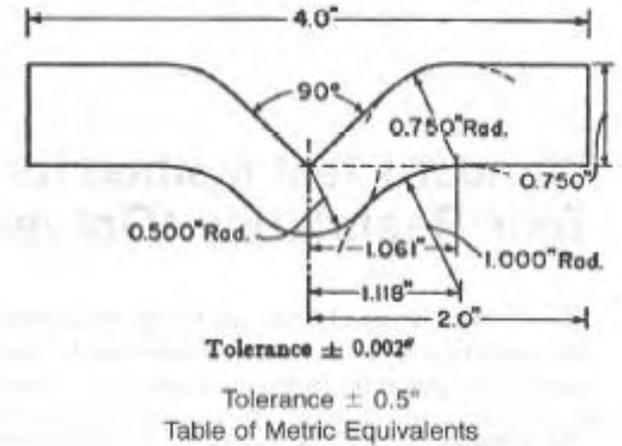
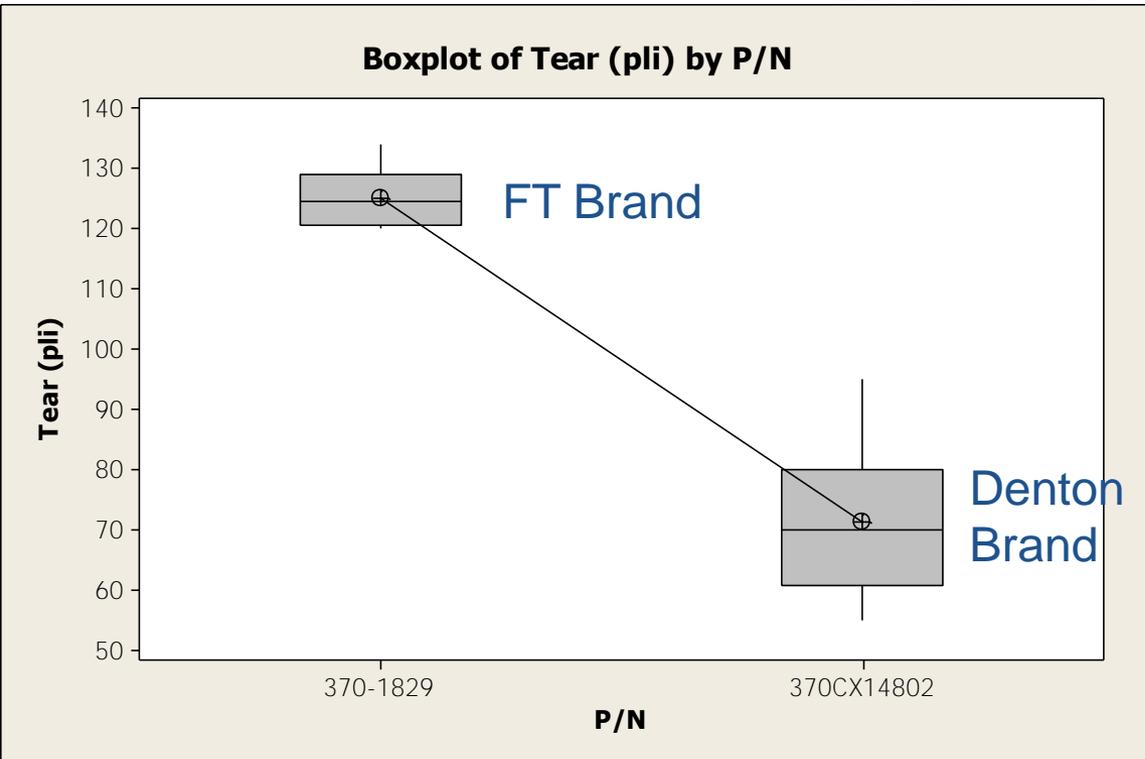
TYPES I, II, III & V



TYPE IV
Specimen Dimensions for Thickness, T , mm [in.]⁴

Max Force/ cross sectional area of specimen

Comparison of several batches of Tensile measurements for Denton and FT brand vinyl flesh



Max Force/ material thickness of specimen

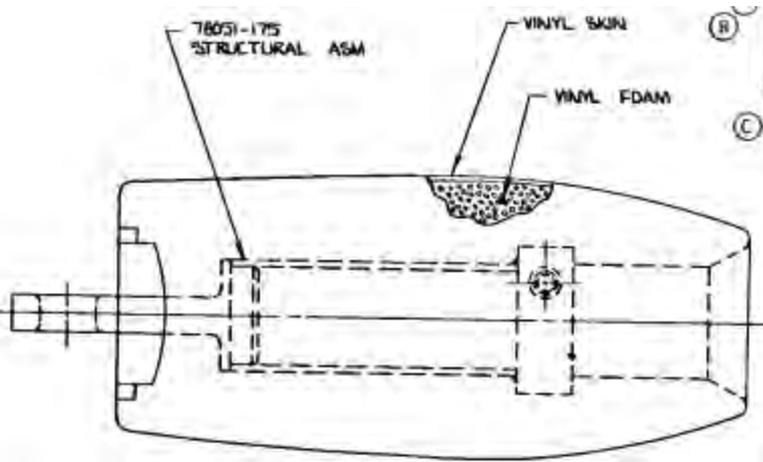
Shrinkage issue

- ▶ **Users have reported that FT brand flesh (primarily chest jackets and lower legs) has a propensity to shrink.**
- ▶ **List of most probable causes**
 - ▶ **Cure state of material**
 - ▶ **Urethane foam interaction with the vinyl**
- ▶ **Humanetics recommendation**
 - **For less variation in material cure: Pick newer molds to reduce leakage. Leakage can cause more variation in mold temperature during processing.**
 - **Chose one vinyl to concentrate on one process to reduce shrinkage**
 - **Have changed to Denton urethane foam because FT brand foam is no longer available**
 - ▶ **Since less reports of Denton shrinkage, therefore the Denton foam may not affected the vinyl and caused as much shrinkage**

COMPARE MOLDED W/FOAM PART STIFFNESS'S

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Example: Comparison of 78051-174 stiffness's between Brands



3.30 upper weight limit



3.10 lower weight limit

Force Value @ 0.5 in defl

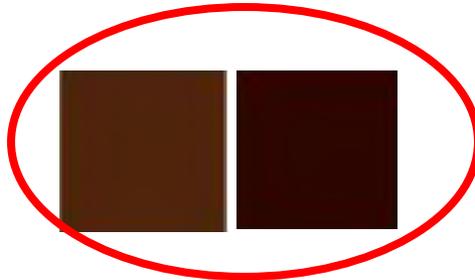
1. FT Brand Vinyl (52) & Mold ■
2. Denton Brand Vinyl (45) & mold ◆
3. Both have the same foam
4. Both made in Huron

HUMANETICS RECOMMENDATION

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Recommendations

- ▶ Newest molds for each dummy type
- ▶ One vinyl (FT Brand)
 - 52 durometer
 - Easier to process for molders
 - Higher Tear Strength
- ▶ Denton Brand Foam
- ▶ Brown color



ADDITIONAL
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RECOMMENDATION
FOR VINYL
COMPONENTS

Component Sealing

1. It is possible to have all parts consistently sealed.
2. European vinyl components have never sealed the holes where foam is poured in. FT brand small female thighs do not have a sealed hole either.

Recommendation: Humanetics would like to recommend that we only patch for now on:

1. Chest Jackets (only for cosmetic reasons)
2. Pelvis backs (only for cosmetic reasons)

NOTE: This will have a major impact on the time it takes to make a component. It will also eliminate the problem of sealing before the foam is fully cured. This will reduce shrinkage and reduce variation of stiffness between parts.