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ATD Harmonization Meeting - ATD Brand Consolidation Task Group HYIII 95th Large Male

MEETING MINUTES
January 13, 2011
6:00am- 12:00pm EST
Humanetics Headquarters in Plymouth, Michigan

Attachments: HIII 95th Voting Record
HYIII 95th Presentation
ATD Brand Integration Process

Attendees:

In Person:
Jack Jensen (General Motors)
Steve Rouhana (Ford)
Dave Majka (Ford)
Brian Grenke (Chrysler)
Michael Jarouche (Humanetics)
Paul Depinet (Humanetics)
Michael Beebe (Humanetics)
Joe Bastian (Humanetics)
Mark Brown (Humanetics)

Via WebEx:
Marvin Hatchett (IIHS)
Hiroyuki Asada (Mitsubishi) [2-hr]
Akihiko Akiyama (Honda) [2-hr]
James Elroy (EuroNCAP)
Mitsutoshi Masuda (Toyota) [2-hr]
Philipp Wernicke (BMW)
Bruce Donelly (VRTC)
Joe McFadden (VRTC)
Ron Burton (VRTC)
Edward Probst (VRTC)
Tara Amenson (VRTC)
Leonhard Ferdinand (Porsche)
Klaus Bortenschlager (PDB)
Suzanne Tylko (TC)
N. Rangarajan (GESAC)
Yuji Okuda (Humanetics)
Philipp Bonin (Renault) [1-hr]
Joon-Geun Cha (Hyundai)

Introductions

Introductions of members in person and *WebEx* were conducted.

Agenda Review

Jack Jensen of *General Motors*, chair of this meeting, reviewed the purpose of the Harmonization Task Group *(please also reference the 'ATD Brand Integration Process').* Jack explained that as a group, we only have to make a decision based on the information we have, and the current status of the dummy. We are not obligated to make a decision or recommendation if we do not wish to. A quick voting member review took place to confirm the participants.

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Preliminary JAMA Meeting

A *JAMA* pre-Harmonization meeting was held on January 12th in Japan with the following participants: Mr. Takahashi (Nissan), Mr. Asada (MMC), Mr. Akiyama (Honda Tochigi), Mr. Masuda (TMC), Messrs Ichikawa and Yazawa (Nissan), Mr. Tanahashi (Honda Tochigi), and Yuji Okuda (Humanetics Japan)

The Summary of their meeting as submitted by Yuji Okuda of *Humanetics Japan* follows:

1. About Harmonization material prepared by Humanetics - Prior to Harmonization Meeting of HIII-95th Dummy from January 13, JAMA members discussed ideal operation of the meeting. Member appointed to the meeting are all executive so all items to be reviewed should be obvious at a glance for more efficient consideration. Suggested Items to be reviewed would be "structure", "characteristics (certification data of dummy)", "compatibility", and "prices" between FTSS and Denton.

Members believe review of each item will be based on the comparison chart of above items prepared by Humanetics, ranking into three categories, "A. Technical discussion is necessary", "B. Partially technical discussion is necessary" and "C. Technical discussion is not necessary". Especially regarding characteristics, as there are few companies possessing dummies of both brands, Humanetics are considered to be able to provide fair certification test data of both brands under the same test condition. It would be ideal if comparison chart of two brands including above items are prepared by Humanetics. It would be easier for non-English speaking members to understand the material correctly and eliminate misunderstanding of the contents. It is very important point.

2. JAMA member prefers to vote about each item by e-mail. The member would like Humanetics to prepare ballot form.

3. Opening time of the Meeting. Japanese company's working regulation specifies operations after 10pm requires a special notification to department of general affairs as well as approval by supervisor. It is usually time consuming process to get authorization and operation after midnight is prohibited. Thus members appreciate your cooperation for wrap up the Meeting before 10pm. Otherwise members request Okuda to stays at the Meeting and to report them later.

AK5 Recommendations

Klaus Bortenschlager of *Porsche* and Leonhard Ferdinand of *PDB* emphasized the importance of fit. Two recommendations made by the German AK5 Dummy Working Group consortium (part of the FAKRA German standards committee for automotive technology) were submitted by Leonhard Ferdinand and are entered below:

1. Chest Jacket / Rib-Set : We prefer the Denton Version because it fit much better than the FTSS Version.

In 6 Certification-Test (Rib-Set FTSS) with the two Jacket shows in Average a difference of 1.3 mm. Between the two Test series we had a Temperature change of 0.8 °C. which is mainly responsible for the higher Displacement of the Denton Version.

Test No.	Displ.[mm]	Temp. [°C.]	
1	-66,2	20,6	
2	-66,4	20,6	FTSS Jacket
3	-66,8	20,6	
Average	**-66,5**		
4	-67,2	21,4	
5	-67,9	21,4	Denton Jacket
6	-68,4	21,4	
Average	**-67,8**		

2. Lower Leg Flesh : We prefer the Denton version because the design gives room for additional Equipment if used with Lower Leg Transducers for Cable, ID-Moduls etc.

95th Background Presentation

Mike Beebe of *Humanetics* began with a background slide presentation of the HYIII 95th ATD. For more detail please reference the HYIII 95th Presentation attachment.

The 95th is currently not a regulated dummy, but has been under review for the past ten years. A commonized drawing package was released in 2005 and the 95th task group has continued the review process since. Ron Burton of *VRTC* stated that the final drawing package was ready to go to the SAE website for comment.

Mike Beebe pointed out that the 95th was the first dummy to utilize 3D drawings for a greater level of detail and shape definition, and the first to have a high level of commonization effort put forth already from both manufactures. But as Jack asserted, there are still two manufacturers with two sets of tooling, processes, and molds. This fact still creates possible variances in manufacturing any ATD.

Lessons Learned

Mike Beebe continued his presentation on the 95th with a discussion of the lessons learned from working together as *two* companies to commonize the drawing package in the past, and working together in the last six months as *one* company to understand the materials and processes involved with both brands of ATD's. Mike points out that in the last six months we have been discovering more similarities than differences.

The question of vinyl and other material compositions ensued. Mike explained that both the *FTSS* and *Denton* brands have the same vinyl supplier, use the same rubbers, damping materials, and now the same urethane foams. Jack asked if the vinyl between the two brands have different recipes or formulations. Mike explained that the plasticizer and resins are similar, just mixed differently. The major control verification is durometer (hardness) based on the drawing specifications. With the basic ingredients the same, they can be mixed differently with one having more plasticizer, etc. Joe Bastian pointed out that the *FTSS* brands may be post mixed more often as well; i.e. a 40 durometer vinyl mixed with a 50 durometer vinyl to get a 45 durometer vinyl. Color is just a choice of pigment and no preference was given.

There are also process variations that can yield different surface finishes and 'feel.' Different molds, different cure times, different heat distributions, different gel times, different mixing chambers and

varying humidity can all affect the final product. More research has been initiated in the past several years to try and understand the effects of all the process variables.

The final surface polish finish is also different for each brand. The *FTSS* brand uses acetone for final conditioning once vinyl parts have been trimmed and imperfections sanded out. Acetone produces a duller, matte surface finish. The *Denton* brand uses methyl ethyl ketone (MEK) to condition the surface, which produces a shiny finish and a more uniform etching of the surface than acetone. Initial concerns about photography and shiny surfaces were voiced, but no customers have had complaints. Dave Majka of *Ford* pointed out that their heads, for example, may be chalked or shamied, thus making surface reflections a non issue. Steve Rouhana from *Ford* volunteered to look at some films to see if any difference could be noticed in the reflectivity of the vinyl. Brian Grenke of *Chrysler* asked if either process helped protect the vinyl more, prevented damage, or has any advantages over the other. Whether using acetone or MEK, one method does not have a protective advantage over the other. Joe Bastian suggested that from a commercial standpoint, acetone may be easier to handle for the manufacturer. Brian Grenke also asked about the coefficient of friction between these two different vinyl surface finishes. Mike Beebe stated this was an unknown, and feedback on this attribute is relatively non-existent.

General Visual and Attribute Review

Mike Beebe presented a 95th dummy population slide detailing the numbers of each brand and the regions where they reside *(The population slide can be found at the end of this document)*. There were about twice as many *FTSS* brand dummies manufactured during the last twenty years than *Denton* brand, but it is unknown how many of the combined total are still in service. The last dummy build, SBLD, was created circa 2005. A number of existing dummies may have been upgraded to this build, but that number was not reported. Paul Depinet pointed out that many of the parts would not necessarily require updates, i.e. welded skeletal components, and that testing corridors have been frozen for the last eight to ten years.

Mike Beebe presented a 95th Attribute Chart *(The Attribute Charts can be found at the end of this document)* outlining many of the visual and fit questions. The first three attributes are met by both manufactures. The remaining are discussion points. Interchangeability is a concern brought up by a few members – if one brand is chosen; will the other brand's parts fit on existing dummies? Is it OK to continue to use the other brand for the near future? If both brands meet part 572 and still certify, then OK? Michael Jarouche and Jack pointed out that for the moment, the 95th is still only used for 'due care' testing of overall restraint systems.

Hiroyuki Asada of *Mitsubishi* asked about cost consideration for each brand. Michael stated that cost structures for both brands are currently similar and not a factor for *Humanetics*, nor the customer. There are a number of things on the table in regards to cost that could prompt future changes, regardless of the brand chosen. The group's choices would not be a factor in future cost increases and process choices will be made on reproducibility, not cost. Michael and Joe Bastian pointed out that the process costs are fairly close for both brands.

The group was reminded that auto manufacturers cannot collaborate on costs and piece prices from a supplier. As such, piece costs will not be part of the decision process for this group. However, *Humanetics* may make recommendations to the group concerning which manufacturing process is more

repeatable or efficient, which in turn may reduce costs in the long run. Piece costs, however, should not be discussed.

Another factor to consider is the age and condition of the molds for the vinyl, rubber, and urethane parts of the dummy. Paul Depinet voiced the opinion that as a company we would like to use the newest and most reliable sets of molds. In regards to the head skin, the *Denton* brand has multiple molds in service that are newer and in better condition.

Mike Beebe stated that there is no difference in fasteners used between the brands; they are all called out the same. He also noted that the foaming process may vary slightly because of the internal shapes of the molded parts and the difference in foam packing to achieve the final weight specifications. These processes, combined with the vinyl surface finish, can produce the 'feel' variability some customers have questioned.

Head and Neck Assembly Review

The meeting continued with a discussion of the head and neck assemblies. The head skins had several differences noted. There are different wall thicknesses between the brands, and the nose is filled on the *FTSS* version and hollow on the *Denton* version. These differences produce different weights for the head skin, but the final head assembly weight still falls within the specification for both brands. Joe McFadden made note that mixing head skins on different skulls could produce an out-of-weight assembly. Mike Beebe explained that the head specification allows for ballasting and the weight difference is controlled through this means. Changing head skin brands may require some re-ballasting of the skull.

The filled or hollow nose was discussed further. Mike Beebe pointed out that the *Denton* 50th uses the same pattern as the *Denton* 95th, so the *Denton* brand HYIII 50th also has the hollow nose. The specification for the head skin references the *General Motors* pattern, which has the hollow nose. This may infer that the *Denton* brand is closer to the spec. But as Jack pointed out, there is a lot of ambiguity with the older drawings and the lack of 3D shapes. These deficiencies have left manufacturers with the task of making interpretations that have produced differences in brands. Jack noted that newly designed dummies, i.e. THOR, have left the nose off of the face. This eliminates any influence or variability the nose could cause in out-of-position tests, for example. Even in lieu of this fact, Jack reminded the participants that this committee will not make a third design choice; leaving the nose off of a current design ATD is not an option for this group to propose. Joe Bastian also added that the HYIII 5th female has a solid nose as well.

Ron Burton of *VRTC* said they had done a limited variability study on the necks in 2007 that showed one brand barely passing the certification corridors and the other brand passing satisfactorily. When these tests were repeated more recently, they found both brands had comparable results in satisfactorily meeting the corridors.

There are no neck interchangeability issues, and currently both brands use the same specified durometer of nodding blocks for the front and rear mountings. At one time, *FTSS* provided two different durometers; a softer gray one and a standard black one. The drawing package now references the standard 50th nodding blocks, with the softer gray ones as an option.

The shape of the chin was briefly explored. At one point in the past there were both angled and squared off versions of the skull and head skin. Currently both brands use the squared off jaw shape, but older versions still in service could run into a fit problem when mixing brands.

Thorax

Mike Beebe displayed some pictorial part breakdowns of the 95th thorax for review. The shoulder clavicles were noted for having different types of castings between the brands. *FTSS* uses an investment casting and *Denton* uses a sand process casting. Investment castings are a little more repeatable to manufacture and have a better grain structure, but they are also more costly to produce. Some larger casted parts do not necessarily merit investment castings. Mike Beebe suggested we should use the shoulder investment castings regardless of the final brand chosen. The group agreed.

The interchangeability of the rib set and chest jacket combination when conducting the thorax impact certification was questioned. Some users found that keeping the brand combination together produced the most consistent test results. Some users said they have mixed the brands and have had no test issues, while some users have used only one or the other brand and have no experience with interchanging rib sets and chest jackets. Mike Beebe acknowledged that the thorax is a system test and some differences in the jacket's ensolite pad, lab test variability, and the age of the parts could have effects on the test results.

The group was asked if there were any know durability issues with the HYIII 95th thorax. The main concern voiced was the fit of the chest jacket. Both Dave Majka and Marvin Hatchett of *IIHS* have seen larger amounts of shrinkage from the *FTSS* brand jacket and believe the *Denton* version may fit better. Vinyl shrinkage over time in general was a concern with some *FTSS* parts. Paul Depinet stated that from a strictly molding preference, the *Denton* brand molds were in better shape and would prefer using them.

VRTC said they have had a few rib stiffeners bend after some NCAP tests. No belt fit issues with the thorax were voiced by the members of this group.

Lower Torso

Mike Beebe started off the lower torso discussion with the assurance that the shape of the molded pelvis should be the same. The size and design of the pelvis has been commonized since 2005.

Both Paul Depinet and Joe Bastian acknowledged that customers have voiced concerns about size and angle differences noticed with the rubber lumbars. Jack Jensen and Brian Grenke also confirmed they have noticed these differences and have made their past part choices based on this observation. In general, the *Denton* lumbar appears slightly taller – about 3mm, according to Paul. The defined angle of the lumbar is 45 degrees with a half degree tolerance. Joe Bastian added that the height and angle were difficult measurements to take, but the *FTSS* mold has been reviewed and found to be correct in its angle. Some rubber splitting has also been observed in both brands. Paul Depinet requested this topic be tabled for a separate discussion because the lumbar issues have been brought up by the *SAE* committee. Jack agreed for now; he said we don't want to make a wrong decision but we also don't want this committee to wait for what another committee is doing.

VRTC talked about some previous dummy inspection data they would submit for review. They noticed some differences in the ASIS load cell replacements; the weight holes appear to have different sizes between brands. They showed a difference in femur holes in the molded pelvis, but the dummy referenced may have been a pre-2005 version. They showed some out-of-spec hip pivot seated measurements, but those have been resolved with a seated measurement procedure. They also recorded some out-of-spec head circumference measurements. Joe Bastian assured this group that no dummy is shipped out-of-spec from either brand, but acknowledged that there are many variables to consider when doing the external measurements that could vary results.

Paul and Joe asked that an evaluation on the pelvis molds be conducted to determine which one is in better shape since both are approximately the same age. The *FTSS* mold has had more parts produced, so it may show more wear. The other consideration is whether the mold was initially cast or machined.

Leg Assemblies

Mike Beebe started the discussion on the leg assemblies with a general question based on the attribute list; are there any known issues with fit, shrinkage, certification, or durability with either brand?
Ed Probst from *VRTC* cited a 2007 comparison study that they did showing both brands of knees passed certification, but had two different distributions. *VRTC* also noted some knee stops shearing and the 1 ¼" inch slot on the upper leg flesh was not to the drawing on the *FTSS* version. Also noted was some lower leg flesh tearing issues, mainly with the clevis region of the *FTSS* brand. As previously mentioned they had also found the foot accelerometer mounting slightly different, with the *Denton* brand meeting the current drawing.

The ball bearing knee sliders have slightly different designs between the brands, but both complete assemblies will interchange between knees. Joe Bastian acknowledged that the *Denton* brand knee sliders have proven to be more robust and that *FTSS* has had difficulties with manufacturing inefficiency. Dave Majka said they've had metal parts break and rubber tear out in the past.

Paul Depinet suggested that the flesh parts from one brand of the leg should be kept together for better fit between segments. The *FTSS* lower leg mold has also proven to have better manufacturing results than the *Denton*.

The assessment of the group leaned toward recommending a best combo scenario for the leg assemblies. The *FTSS* brand leg with the *Denton* ball sliders and *Denton* Foot was the preference.

Arm Assemblies

Mike Beebe once again started the discussion on the arm assemblies with a general question based on the attribute list; are there any known issues with fit, shrinkage, or durability with either brand?
Paul Depinet said the *Denton* molds were newer and in slightly better shape. The group did not have any interchangeability issues to mention, and Joe Bastian confirmed the bones were the same. Mike Beebe suggested picking one brand for consistency in flesh fits.

Additional Attributes

Suzanne Tylko of *TC* asked about the chest jacket length differences they've noticed. Foam pad location variations on the inside of the chest jacket have also been observed. The common drawing package should call these dimensions out and an internal review of manufacturing would be required to address these issues.

Joon Geun Cha of *Hyundai* asked how to acquire shape data in relation to vinyl shrinkage over time. Although digitizing the shape is one way to determine the overall shape, there is no good study to determine or predict shrinkage over time, or a way to conduct an accelerated shrinkage test. Joe Bastian suggested a mandrel as a go no-go gage for certain parts like the chest jacket. It was also noted that there is a small amount of shrinkage build into the mold designs, so using molds as mandrels may not be as accurate for aged parts.

Ed Probst of *VRTC* noted some other subtle differences observed between brands. He gave the example of the accelerometer feet incorporated into the drawing package. *FTSS* and *Denton* provide slightly different ways of mounting. He suggested we perform a final check to the drawing package to isolate any other subtle differences. Joe McFadden volunteered to supply some inspection records from both brands of 95th dummies purchased by *VRTC*.

Final Discussions and Voting

Joe McFadden asked if this process should also include instrumentation. Michael Jarouche explained that since the instruments were not regulated, *Humanetics* was reviewing both brands internally to decide which yields the best product and has the most efficient manufacturability.

Some discussion on voting policy was initiated since the Japanese members had to end their attendance two hours into the meeting. It was decided that voting members who could not finish will be allowed to cast their ballots later by email, but should do so by copying all of the participating members. Today's vote would also be an interim vote and all voting members will be allowed to change their votes by email. If no further response is sent by the member after the meeting, then their vote stands.

The committee will review the final voting tally during the opening of the next Harmonization meeting and hear any opposition at that time. Jack also commented that if no consensus was met with the two-thirds majority, then the group should consider the worldwide inventory of 95th dummies.
Please reference the Voting Record attachment.

Revised Schedule

Ed Probst of *VRTC* suggested to the group that we change the ATD schedule and review the HYIII 10YO child during the next meeting. The 10YO is being readied for the NPRM and could be released for comment very soon. The group agreed that this was a good idea, so the schedule has been updated.

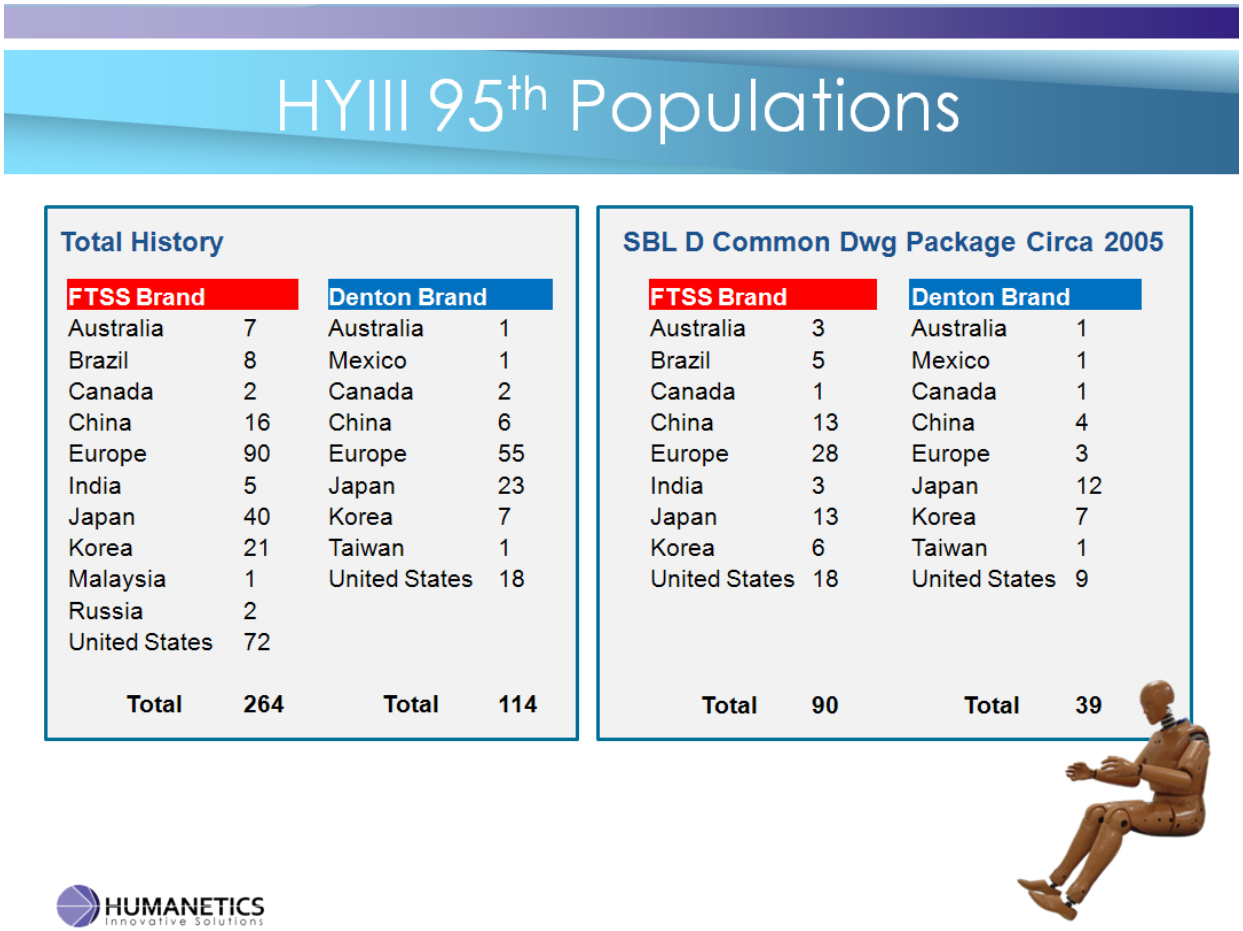
The revised schedule is as follows:

January 13th – HYIII 95th Large Male
February 10th – HYII 10YO Child
March 10th / April 14th – HYIII 50th Male
May 12th – EuroSID 2
June 9th – 5th Small Female
July 14th – HYIII 6YO Child
Aug 11th - HYIII 3YO Child
Sept 8th – CRABI
Oct 13th - SID
Nov 10th - FMH / Misc.

Meetings are held the 2nd Thursday of each month. Locations to be determined.

References

HYIII 95th ATD Population



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Attribute Charts

Head and Neck

Attribute	Denton Brand	FTSS Brand
SAE (drawings) (Does each brand meet requirements?)	Yes Will review VRTC inspection reports	Yes Will review VRTC inspection reports
SAE Certification Test (Does each brand meet current corridors?)	Yes	Yes
SAE External Dimensions/Weights/CG Does each brand meet these specs?)	Yes	Yes
Durability Data (breakage, cuts, long term certification test changes, foam break down, damping material glue failure,)	No Issues raised	No Issues raised
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	MEK Cleaning of surface (Shiny Mat) Concerns regarding photo with shiny	Acetone Cleaning of surface (Mat Finish)
Ease of use (seating in vehicle, assembly/disassembly,	No Comments	No Comments
Current Mold sets (age, patterns,)	Molds are in good shape, easier to use to make parts	Molds are older, more difficult to make parts
Dummy Population (total of each currently in the field, since 2005 dwg release)	39	90
Reparability (which vinyl is easier to repair in the field)	Members will ask their lab techs	Members will ask their lab techs
Vinyl Shrinkage(Data on vinyl part shrinkage)	Members will ask their lab techs about headskins	Members will ask their lab techs about headskins
Head skin (nose filled or not)	Hollowed nose, .441 thick, GM pattern has hollow nose	Solid Nose, .5 inch thick
Castings (investment vs. sand)	Same as FTSS	Same as Denton
Shape effects (hands, feet vs headskin, pelvis etc…)	Hollow Nose	Filled Nose
Interchangeability (Can parts bolt on	From Limit samples from both	From Limit samples from both

each Brand, external vs internal)	manufacturing VRTC found to be interchangeable	manufacturing VRTC found to be interchangeable
Final Check of decision to drawing package	Check to 2011 package	Check to 2011 package

Thorax

Attribute	Denton Brand	FTSS Brand
SAE (drawings) (Does each brand meet requirements?)	Yes Will review VRTC inspection reports	Yes Will review VRTC inspection reports
SAE Certification Test (Does each brand meet current corridors?)	Yes Ribs and Jackets need to be tested together	Yes Ribs and Jackets need to be tested together
SAE External Dimensions/Weights/CG Does each brand meet these specs?)	Yes	Yes
Durability Data (breakage, cuts, long term certification test changes, foam break down, damping material glue failure,)	No Issues raised	Rib stiffener bending at NCAP loads
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	MEK Cleaning of surface (Shiny Mat)	Acetone Cleaning of surface (Mat Finish) Change in hardness more than Denton
Ease of use (seating in vehicle, assembly/disassembly,	Jacket fit is easier with new jackets	No Comments
Current Mold sets (age, patterns,)	Molds are in good shape, easier to use to make parts	Molds are older, more difficult to make parts
Dummy Population (total of each currently in the field, since 2005 dwg release)	39	90
Reparability (which vinyl is easier to repair in the field)	Members will ask their lab techs	Members will ask their lab techs
Vinyl Shrinkage(Data on vinyl part shrinkage)	Less shrinkage of jacket Compare initial jacket lengths	Shrinkage has been discovered Compared to initial jacket lengths
Castings (investment vs. sand)	No comments	Prefer investment casting from FT Brand for shoulder components

Shape effects (hands, feet , headskin, pelvis etc…)	Preference Denton Jacket because of fit	No comments
Interchangeability (Can parts bolt on each Brand, external vs internal)	From Limit samples from both manufacturing VRTC found to be interchangeable	From Limit samples from both manufacturing VRTC found to be interchangeable
Final Check of decision to drawing package	Check to 2011 package	Check to 2011 package

Lower Torso

Attribute	Denton Brand	FTSS Brand
SAE (drawings) (Does each brand meet requirements?)	Yes Will review VRTC inspection reports	Hole in illac structural replacement, not per drawing Will review VRTC inspection reports
SAE Certification Test (Does each brand meet current corridors?)	yes	yes
SAE External Dimensions/Weights/CG Does each brand meet these specs?)	yes	Hip pivot height and from backline out of tolerances may be set up procedure issue
Durability Data (breakage, cuts, long term certification test changes, foam break down, damping material glue failure,)	Lumbar will need to be reviewed	Breakage of lumbar, lumbar will need to be reviewed
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		Lumbar has a better surface finish
Ease of use (seating in vehicle, assembly/disassembly,	No issues	No issues
Current Mold sets (age, patterns,)	Newer molds	Older molds
Dummy Population (total of each currently in the field)	39	90
Reparability (which vinyl is easier to repair in the field)	No issues	No issues
Vinyl Shrinkage(Data on vinyl part shrinkage)	No issues	No issues
Castings (investment vs. sand)	No issues	No issues

Shape effects (hands, feet vs headskin, pelvis etc…)	Lumbar	Lumbar Pelvis hole in flesh does not align
Interchangeability (Can parts bolt on each Brand, external vs internal)	From Limit samples from both manufacturing VRTC found to be interchangeable	From Limit samples from both manufacturing VRTC found to be interchangeable
Final Check of decision to drawing package	Check to 2011 package	Check to 2011 package

Leg Assemblies

Attribute	Denton Brand	FTSS Brand
SAE (drawings) (Does each brand meet requirements?)	No issues raised Will review VRTC inspection reports Need to review ball Sliders	Thigh flesh slot not per drawing Slider string pot holder out of drawing Will review VRTC inspection reports Need to review ball sliders
SAE Certification Test (Does each brand meet current corridors?)	Both passed knee test but with different spread	Both passed knee test but with different spread
SAE External Dimensions/Weights/CG Does each brand meet these specs?)	yes	yes
Durability Data (breakage, cuts, long term certification test changes, foam break down, damping material glue failure,)	Metal breakage on ball sliders breakage report, the knee stop stud	Tear of lower leg flesh , top of flesh
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	No Preference	No Preference
Ease of use (seating in vehicle, assembly/disassembly,	LowerLeg Flesh : Prefer the Denton Version because the design gives room for additional Equipment if used with LowerLeg Transducers for Cable, ID-Moduls etc.	No issues
Current Mold sets (age, patterns,)	New foot mold	Lower flesh mold is preferred from manufacturing
Dummy Population (total of each currently in the field)	39	90
Reparability (which vinyl is easier to repair in the field)	No Issues	No Issues

Vinyl Shrinkage(Data on vinyl part shrinkage)	Tibia flesh shrinkage has been found	Tibia flesh shrinkage has been found
Castings (investment vs. sand)	No issues	No issues
Shape effects (hands, feet vs headskin, pelvis etc…)	Foot mold shape found to meet drawing,	Missing cut out for foot accelerometers
Interchangeability (Can parts bolt on each Brand, external vs internal)	From Limit samples from both manufacturing VRTC found to be interchangeable	From Limit samples from both manufacturing VRTC found to be interchangeable
Final Check of decision to drawing package	Check to 2011 package	Check to 2011 package

Arm Assemblies

Attribute	Denton Brand	FTSS Brand
SAE (drawings) (Does each brand meet requirements?)	Yes Will review VRTC inspection reports	Yes Will review VRTC inspection reports
SAE Certification Test (Does each brand meet current corridors?)	No test specified	No test specified
SAE External Dimensions/Weights/CG Does each brand meet these specs?)	yes	yes
Durability Data (breakage, cuts, long term certification test changes, foam break down, damping material glue failure,)	none	none
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	No Preference	No Preference
Ease of use (seating in vehicle, assembly/disassembly,	No issues	No issues
Current Mold sets (age, patterns,)	Molds are newer	
Dummy Population (total of each currently in the field)	39	90
Reparability (which vinyl is easier to repair in the field)	No Issues	No Issues
Vinyl Shrinkage(Data on vinyl part shrinkage)	No issues	No issues

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Castings (investment vs. sand)	No issues	No issues
Shape effects (hands, feet vs headskin, pelvis etc…)	No issues	No issues
Interchangeability (Can parts bolt on each Brand, external vs internal)	From Limit samples from both manufacturing VRTC found to be interchangeable	From Limit samples from both manufacturing VRTC found to be interchangeable
Final Check of decision to drawing package	Check to 2011 package	Check to 2011 package

-END-