

N 15227

AAR S-580.

EST Eisenbahn-Systemtechnik GmbH

Bombardier Transportation, Alstom, Dellner, Voith Turbo Scharfenberg, Siemens.

SCRRA Metrolink

Desiro RUS (“ ”) 1,  
1520

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N 15227

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SCRRA Metrolink

Desiro RUS (“ ”) 1,

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The existing concepts of a passive protection of passenger trains are analyzed considering requirements of the European Standard EN 15227 and the American Standard AAR S-580. Conceptual schemes of passenger trains of locomotive traction with passive safety systems are considered for the equipment of railway vehicles with separate impact-traction devices and automatic coupler drawbars, which can move back at emergency collisions with an obstacle. A concept of the German company EST Eisenbahn-Systemtechnik GmbH for a passive protection of the passenger train operating on European railways is described. A concept of a passive protection of the passenger train of locomotive traction for US railways is considered. The existing concepts of a passive protection of a diesel passenger train of constant forming are analyzed. Different technical designs of the leading world companies, including Bombardier Transportation, Alstom, Dellner, Voith, Turbo Scharfenberg, Siemens, are presented. A design of a passive protection of the SCRRA Metrolink diesel train for US railways is examined. Designs of a passive protection of electric trains Desiro RUS (“ Swallow”) and EKr1 operating on railways with 1520 mm gauge are given. Based on the results of world experience in a passive protection of passenger trains at emergency collisions, the basic concepts of a passive protection of a high-speed train operating on railways with 1520 mm gauge are developed.

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2008 .

EN 12663 [1]

EN 15227 [2]

TSI [3]

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EN 12663 EN 15227.

N 15227 [1]

AAR S-580 [4].

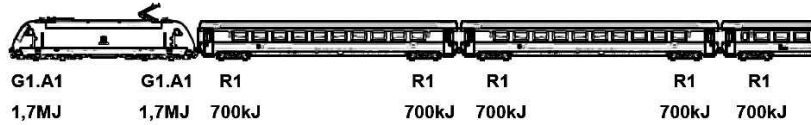
( ),

GmbH [5]

EST Eisenbahn-Systemtechnik  
Inter city.

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InterCity/  
High-speed



. 1 -

Inter city

(EST Eisenbahn-Systemtechnik GmbH)

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[6]

[4]

(push-back coupler).

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push-back

coupler

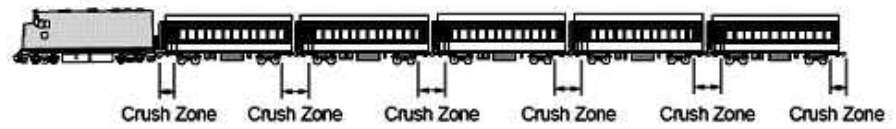
-3

1520

push-back coupler

(Crush Zone)

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422,

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422

422 [7, 8],

Alstom Bombardier Transportation,

140 / .

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Scharfenberg 10

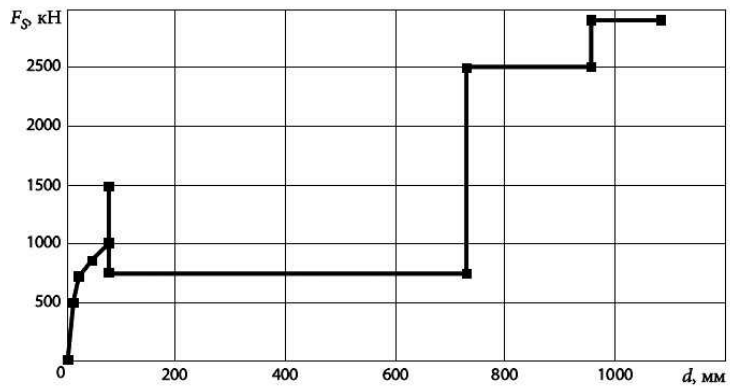
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EN 12663

$F_s$  [8] ( )  
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 422 . 4. ( -  
 1000 80 ). ( -  
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 $d = 750$  ,  
 $F_s$  2500 . -  
 $d = 955$  ,  $F_s$   
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Bombardier Transportation [9, 10],  
 Spacium 3.06 [11], Talent 2 [12], Francilien [13].



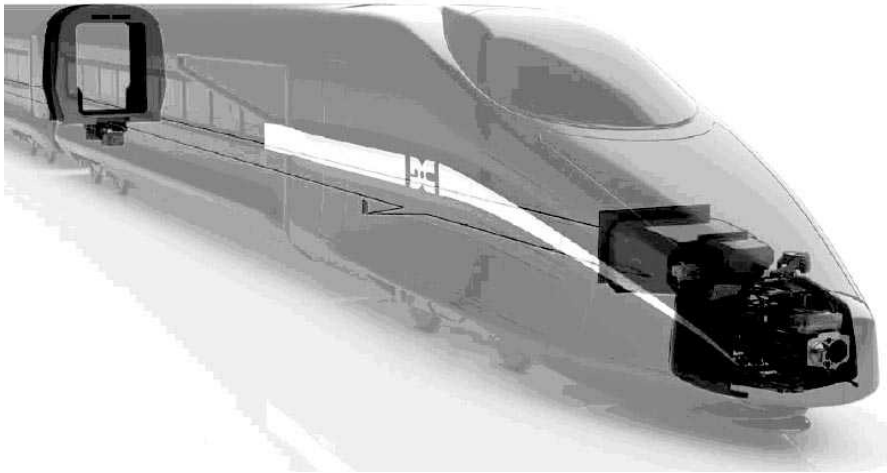
. 4 –  $F_s$   $d$   
 422

Dellner ( ) [14].

Dellner . 5.



. 5 – Dellner



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Dellner D-BOX

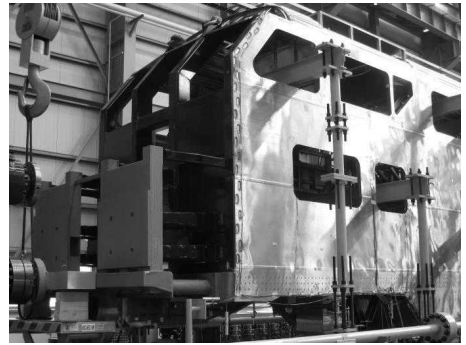
Dellner D-BOX

SCRRRA Metrolink ( ) [15, 16] ( .7).  
Hyundai Rotem,

Voith Turbo Scharfenberg.

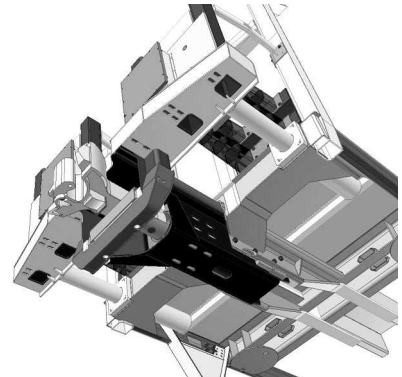
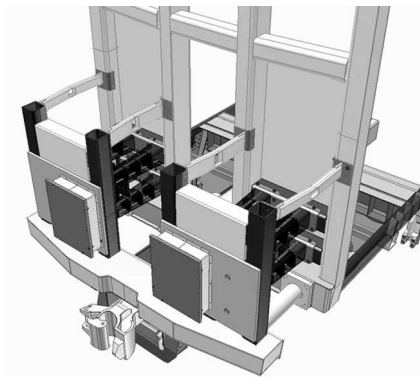
( push-back coupler);

Siemens  
 Desiro RUS (“ ”) ( . 8),  
 160 /



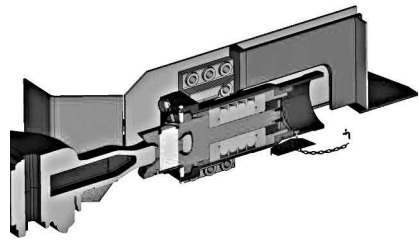
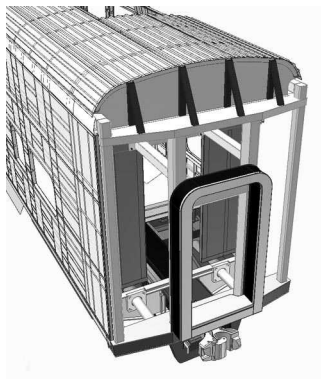
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SCRRA Metrolink;

( );  
 ( );

; (ush-back coupler)

.7 -

SCRRA Metrolink



. 8 – Desiro RUS (“ ”)

Desiro ML  
 “ ” (Velaro RUS)  
 Desiro RUS, Desiro ML,

[17, 18, 19, 20].

Desiro RUS  
 Siemens.

Desiro RUS

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2013 .

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[21, 22, 23],

IC enginering [24].

( .9).

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160 / ,  
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( .10).



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**1520**

[23, 92, 119]

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EN 15227.  
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EN 12663

EN 15227,

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### EN 12663.

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1. EN 12663. Railway applications – Structural requirements of railway vehicle bodies. – Brussel : European committee for standardization, 2000. – 18 p.
2. EN 15227. Railway applications – Crashworthiness requirements for railway vehicle bodies. – Brussel : European committee for standardization, 2008. – 37 p.
3. Technical specification for interoperability relating to the rolling stock subsystem of the trans-European high-speed rail system ( ) [ ]. – : <http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:245:0402:0506:EN:PDF>
4. Locomotive Crashworthiness Requirements : AAR S-580 Standard. – Association of American Railroads. – 2008. – 44 .
5. The EST crash buffer (EST ) [ ]. – : <http://www.crashbuffer.com/index.htm>.
6. *Tyrell D.* Overview of a Crash Energy Management Specification for Passenger Rail Equipment / *D. Tyrell, E. Martinez, K. Jacobsen, D. Parent, K. Severson, M. Priante, A. B. Perlman* // American Society of Mechanical Engineers. – 2006. – RC2006-94044. – . 38 – 48.
7. // . – 2008. – 9. – . 48 – 55.
8. *Bruggemann A.* 422 / *A. Bruggemann* // . – 2010. – 5. – . 37 – 49.
9. Bombardier Commuter and Regional Trains (Bombardier ) [ ]. – : <http://www.bombardier.com/en/transportation/products-services/rail-vehicles/commuter-and-regional-trains.html>.
10. : V “ ” , 28 2007 . [ ]. – : <http://www.businessdialog.ru/files/rtu-2007/sannikov.pdf>.
11. *Robinson M.* Transport of de-light: the design and prototyping of a lightweight crashworthy rail vehicle driver's cab / *M. Robinson, J. Carruthers, O'Neill C., Ingleton S., Grasso M.* // *Procedia - Social and Behavioral Sciences* 48. – 2012 – P. 672 – 681.
12. Talent 2 Bombardier // – 2009. – 12. – . 39 – 43.
13. Le Francilien Plate-forme de produits Spacium (Francilien Spacium) [ ]. – : <https://transfer.bombardier.com/download/get/CBFXRL9F83lzyY4izbCo1M9IMKYy9VdFq11eRCWTa2es7amFPo>.
14. Dellner – Train connection systems couplers (Dellner – ) [ ]. – : [http://www.dellner.se/Train\\_connection\\_systems\\_couplers.html](http://www.dellner.se/Train_connection_systems_couplers.html).

15. *Jarboe G. General Vehicle Design Technologies / G. Jarboe // Presentations from the APTA Rail Conference June 6-9, 2010 in Vancouver, British Columbia. – Vancouver : APTA. – 2010. – 21 p.*
16. [ ] –  
: [http://resource.voith.com/vt/publications/downloads/1994\\_r\\_g1712\\_rus\\_2013-03.pdf](http://resource.voith.com/vt/publications/downloads/1994_r_g1712_rus_2013-03.pdf).
17. “Desiro rus” – / . ,  
// . – 2012. – 4. – . 35 – 38.
18. “Desiro rus” – /  
// - . – 2012. – 10. – . 20 – 24.
19. Velaro / . , . , . . //  
. – 2009. – 1. – . 36 – 50.
20. Velaro RUS / . . , . . , . .  
. // . – 2009. – 1. – . 37 – 49.
21. . . / . . // - .  
– 2012. – 10. – . 28 – 33.
22. . . / . . // - .  
– 2012. – 11. – . 54 – 58.
23. . . / . . // - .  
– 2012. – 12. – . 16 – 19.
24. IC engineering digital engineering solution (IC ) [ -  
]. – : <http://www.icej.co.jp/en/digital/>.

01.12.14,  
22.01.15