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February 2, 2011

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Engineering Research Section
201 N. Figueroa St., Room 880
Loa Angeles CA 90012

Subject: COLA RR 25480 Renewal

Attached is COLA Research Report 25480 with limited revisions as follows:

Table 1: Rod: Additional rod sizes and materials added (A108-C1045 and F1554 Gr. 105). Changes are detailed in *AutoTight System IBC 2009 Rod Capacity Calculations*. Rev 3 dated 1/17/2011. An Excel spread sheet is available.

Table 2 Bearing Plates. Additional bearing plate sizes added. All sizes are listed in *Bearing Plate allowable loads, Dated* 1/24/2011. An excel spread sheet is available if desired.

Table 3. AutoTight Shrinkage Compensator. Four new shrinkage compensators have been added. They fit ½" and ¾" diameter rod and expand 1-1/2" and 2-1/2". All devices meet or exceed ICC ES AC 316 requirements based on the June 2010 revisions. A revised ICC ESR 1344 is pending, copy enclosed. Requested COLA RR 25480 values are identical to pending ICC values

1. Testing is per Krazan & Associates Testing Report dated July 27, 2010. KA No. 096-09289. The Aluminum AT Shrinkage compensators values are as determined in table #1.
2. Table 2 includes $\triangle r$ Information as required in AC316. Additional support material is enclosed. Advise if additional information is required.

Last week I sent a letter outlining suggested changes for tie-down systems. The report includes current rod stretch requirements. If COLA will be requiring system stretch (Per AC391) rather than rod only stretch I suggest that now is the time for the change.

Respectively submitted.

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Enclosures

Item	**Pages**
Revised RR 25480	5
Rod Calculations, IBC 2009 AISC 360	2
Bearing Plate Allowable Loads. IBC 2009,2005 NDS	1
ICC ESR 1344 Pendng	3
Krazan & Associates AT4 and AT6 Test Report inc Δ_r	
Includes Materials Certifications, Part Drawings Graphs etc.	20
PSI Testing for the AT75, AT100 and AT125 Shrinkage Compensator	
Previously listed items included to insure completeness.	29 I

COLA currently requires rod-only elongation of 0.2" and ignores elongation contributions from take-up deflection, take-up delta-r and bearing plate deflection.

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DIVISION: 06—WOOD AND PLASTICS
Section: 06090—Wood and Plastics Fastening

Report Holder:

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1.0 EVALUATION SCOPE

1.1 Compliance with the following code:

2011 International Building Code® (IBC)

1.2 Evaluated in accordance with:

- ICC-ES AC391 Acceptance Criteria for Continuous Rod Tie-Down Runs and Continuous Rod Tie-Down Systems used to resist Wind Uplift, June 2010

Property evaluated

- Structural Capacities

2.0 USES

Commins AutoTight® Tie-Down system is used to connect light frame buildings to a concrete foundation, wood beams or steel beams. The system resists uplift forces resulting from lateral wind or seismic forces and from wind uplift.

3.0 DESCRIPTION

The AutoTight® Tie-Down systems consists of threaded rod, bearing plates, shrinkage compensation devices and standard hardware that form a continuous load path from the foundation to reaction points.

3.1 Product Information

3.1.1 AutoTight® Rod: The AutoTight® Holdown System threaded rod conforms to: ASTM A36/A307, ASTM F1554, ASTM 193-B7, ASTM A449, ASTM A325, ASTM A108-C1045 or ASTM A354-BD. See Table 1 for materials, sizes capacities and elongation information.

3.1.2 AutoTight® Bearing Plates: The AutoTight® Bearing Plates conform to ASTM A36 material. See Table 2 for materials, sizes, capacities and deflection (elongation) information.

3.1.3 AutoTight® Shrinkage Compensators: The AutoTight® shrinkage compensating device is a preloaded drop-on axial expanding compression-controlled washer. The shrinkage compensator self-adjusts for wood shrinkage and settlement. The devices may be used on steel bearing plates or code listed holdowns or tie-downs. Products and/or packaging are marked with the model and the code listing number. Rod sizes from ½" to 1-1/4" are accommodated. Maximum take-up expansion is 2-1/2" or stacked for additional take-up capacity. See table #3 for materials, dimensions, load capacities and deflection characteristics. The maximum out-of-plumb is 3 degrees or 6-1/4" in 10'

4.0 DESIGN AND INSTALLATION

4.1 Design

4.1.1 Tie-Down Assemblies: consist of threaded rod that connect reaction points, bearing plates (or tie-downs) and shrinkage compensation devises that distribute loads into reaction points. Systems are designed based on job specific requirements including uplift demand, system elongation and expected shrinkage or settlement. Each run shall be analyzed for strength, elongation and shrinkage between reaction points. Systems shall be designed and performance limited based on the following:

System Strength shall be evaluated for all components between reaction points. Strength shall be limited by the lowest capacity component. Components include: tension rod, bearing plates, shrinkage compensators and hold downs or tie-downs. Nuts and coupler nuts shall be grade compatible and shall conform to ASTM A563.

System elongation shall be evaluated for components elements between reaction points. Elongation calculations shall include the sum of the: rod, plate compression, shrinkage compensator deformation and shrinkage compensator Δ_r (average travel and seating increment). Rod elongation shall be calculated per table 1 notes 4 & 5. Plate and shrinkage compensator elongation shall be calculated based on actual load/rated load. Exception: Δ_r (average travel and ratchet increment) is independent of load and is added in full. (See AC 155, July 1, 2010, Section 6.2.6.3; AC 316 November 2009, Section 1.4.7; and AC 391 section 3.1.1, 3.2.1.1 and 3.2.2.2)

Rod and/or system elongation shall be specified by the engineer-of-record. If not specified, the default elongation between reaction points is: 0.200" for shear walls and 0.250" if resisting wind uplift only.

System Shrinkage shall be analyzed per section 2304.3.3 of the IBC and specified by the engineer-of-record. If not specified, the default shrinkage shall be ½" per floor. Shrinkage is cumulative.

4.1.2 Detailing. Drawings and calculations that detail system strength, elongation and shrinkage must be provided to the building department.

4.1.3 Anchorage to Concrete or Masonry: a registered design professional, in accordance with Chapters 19 or 21 of the IBC must determine anchorage details, including edge, end distances and reinforcement as applicable.

4.2 Installation: Installation of the AutoTight tie-down system must be in accordance with the manufacturers published installation instructions and this evaluation report. Where a conflict exists between this report and the manufacturers published installation instructions, this report shall prevail.

5.0 Conditions of Use

5.1 The tie-down system must be manufactured, identified and installed in accordance with the AutoTight published installation instructions and this report. During installation a copy of the instructions must be available at all times.

5.2 Calculations must be submitted to the code official showing compliance with this report. Wood shrinkage, wood deformation under load and fastener slip shall be analyzed and added to the overall deformation under load. The tabulated allowable (ASD) loads are obtained from calculations and tests on the individual components making up the CRTR. Other variables that may further limit capacities, such as anchorage strength in tension or hear, and stresses within the wood or steel members of the wall in which the CRTR is installed, shall be analyzed by the registered design professional.

5.3 When using the basic load combinations in accordance with IBC Section 1605.3.1, the tabulated allowable (ASD) loads for the CRTR shall not be increased for wind or earthquake loading. When using

the alternative basic load combinations in IBC Section 1605.3.2 that include wind or earthquake loads, the tabulated ASD loads for the CRTR shall not be increased by 33-1/3 percent, nor shall the alternative basic load combinations be reduced by a factor of 0.75.

5.4. When the evaluated CRTR includes high strength threaded rod and/or components manufactured to an applicants published specification a statement that the report applicant shall have available, upon request by the code official, current mill certificates and mechanical property test reports to demonstrate compliance with the applicable specification for each batch or heat lot to be used in the field. The statement shall also indicate that the high-strength threaded rod and/or components manufactured to an applicant's published specification must be identified with the information required.

5.5 The tabulated ASD CRTR tension loads and corresponding elongations are not intended to represent the capacity or deflection of the framing systems, or any other portion of the wall in which the CRTR is installed. Design of the framing systems is the responsibility of the design professional and must be performed in accordance with the applicable code, taking into account all of the design considerations given in Section 4.0 of this report.

5.3 Connected wood members and fasteners shall comply with the code and is the responsibility of the registered design professional.

5.4 Use of fasteners with fire-retardant-treated or preservative-treated lumber must be in accordance with the code.

6.0 EVIDENCE SUBMITTED

Data in accordance with ICC-ES Acceptance Criteria for Shrinkage Compensating Devices, Rod and plate calculations in compliance with AISC 360 (13^{th}). Test results are from laboratories in compliance with ISO/IEC 17025

7.0 IDENTIFICATION

Products described in this report are identified with a label or are die-stamped with the name of the manufacturer (Commins Mfg.), model number and the evaluation report number which identifies products recognized in this report.

Table 1. Rod Capacity

Rod Size			Allowable Tension(lbs)					
Diameter (inches)	Model	Diameter & Thread	A36 or F1554 Gr 36	A307	A449 A325	A108-C1045	A193-B7 or F1554 Gr 105	A354-BD
3/8	R3	3/8"- 16 NC	2,400	2,490	4,970	4,970	5,180	6,210
1/2	R4	1/2"-13 NC	4,270	4,420	8,840	8,840	9,200	11,040
5/8	R5	5/8"-11 NC	6,670	6,900	13,810	13,810	14,380	17,260
3/4	R6	3/4"-10 NC	9,610	9,940	19,880	19,880	20,710	24,850
7/8	R7	7/8"-9 NC	13,080	13,530	27,060	27,060	28,190	33,820
1	R8	1" - 8 NC	17,080	17,670	35,340	35,340	36,820	44,180
1 1/8	R9	1-1/8" -7 NC	21,620	22,370	39,140	44,730	46,590	55,910
1 1/4	R10	1-1/4" -7 NC	26,690	27,610	48,320	55,220	57,520	69,030
1 3/8	R11	1-3/8" -6 NC	32,300	33,410	58,470	66,820	69,600	83,530
1 1/2	R12	1-1/2" - 6 NC	38,440	39,760	69,580	79,520	82,830	99,400
1 3/4	R14	1-3/4"-5 NC	52,310	54,120	81,180	108,240	112,750	135,300
Fu (ksi)	minimum properties		58	60	See Note 5	120	125	150
Fy (ksi)			36	43		92	105	130

Notes:

1. Allowable Load (ASD) Capacitates are in Pounds force (lbf). For SI: 1 inch = 25.4mm., 1 lbf = 4.45N., 1 psi = 6.89 kPa.
2. Allowable Rod Capacity per AISC 360-05 J3.6 (page 16.1-108), is the minimum of ASD = 0.75 x Fu x Ag / 2.0 and LFRD = 0.75 x Fu x Ag x 0.75. where nominal Area Ag = π x d^2 / 4 in square inches.
3. Elongation in inches = Δrod = PL/AnE, where P = Tension Demand in rod lbs, L = total Rod Length in inches between connections. A_n=Net Tensile Area square inches, E=Steel Modulus of Elasticity =29,000,000 psi,
4. Net Tensile Area for continuously threaded (all-thread) rod = A_n= 0.7854(D-0.9743/n)^2 in square inches, where D=basic major diameter inch, n=threads per inch of rod length, shall be used for rod elongation. (Per AC391 3.2.1.1 revised 06/2010
5. Net Tensile Area used for full diameter rod elongation = Gross Area = π*(^{2}/4)
6. For A449, A325: F_u; 5/8"-1" = 120 ksi, 1-1/8" - 1-1/2" = 105 ksi, 1-3/4" = 90 ksi.; Fy; 5-8" - 1" = 92 ksi, 1-1/8" - 1-1/2" = 81 ksi.,1-3/4" = 58 ksi.
7. LFRD Capacity = ASD Capacity x 1.4

Table 2: Bearing Plate Allowable Loads

Bearing Plate	Plate Dimensions			Hole Dia. (bolt size) (in)	Capacity DFL (lbs)	Wall Size
	Thickness (in)	Width (in)	Length (in)			
S4	3/16	2 1/2	2 1/2	3/4	4,120	4x & 6x
S4.5	5/16	2 3/4	2 3/4		5,003	
S5	1/4	3	3		5,964	
S6	1/4	3 1/4	3 1/4		7,002	
S7	3/8	3 1/2	3 1/2	1	7,863	
S8	3/8	3 1/4	4		8,281	
S10	1/2		5		10,322	
S12	5/8		6		12,360	
S14	3/4		7		13,665	
S16	1		8		15,696	
S7L	3/8	3 1/2	3 1/2	1 1/4	7,540	
S8L	3/8	3 1/4	4		7,962	
S10L	1/2		5		10,009	
S12L	5/8		6		12,051	
S14L	3/4		7		13,373	
S16L	1		8		15,404	
S19		3 1/2	9		18,842	
S22	1 1/4		10		21,029	
S24			11		23,217	
S26	1 1/2		12		25,404	
S28			13		27,592	
S32			15		31,967	
S35			16		34,154	
S39			18		38,529	
S44			20		42,904	
L17	1/2	5	5 1/2		17,282	6x
L20	5/8	5 1/2	6		21,016	
L21	3/4	5	7		21,029	
L25		5 1/2	7 1/2		24,936	
L28	1	5	9		27,279	
L30		5 1/2	9		30,092	
L32		5	11		33,529	
SPW-6	1/4	3	3	3/4	5,964	4x & 6x
SPW-8	3/8	3 1/2	3 1/2	1	7,863	
SPW-10	3/8	3 1/2	3 1/2	1 1/4	7,540	

Bearing Plate Notes:

1. Bearing Plate is based on ASTM A36 Steel, minimum Fy = 36 ksi.
2. Allowable Capacity (ASD) = (F_c perp) * Bearing Area * Bearing Area Factor (C_b)
   where Fc perp for Douglas Fir-Larch (DFL) = 625 psi.
   where Fc perp for Southern Yellow Pine (SYP) = 565 psi = 0.904 x DFL
   where Fc perp for Spruce Pine Fir (SPF) = 425 psi = 0.680 x DFL
   where Fc perp for Hemlock Fir (HF) = 405 psi = 0.648 x DFL
   where C_b = (l_b + 0.375) / l_b for lb < 6", C_b = 1.00 for l_b > 6" per NDS 2005, 3.10.4.
3. Allowable Load based on deformation factor of 0.04" wood crushing per NDS 2005.
4. Bearing Plate Deflection = Plate Load / Plate Allowable Load x 0.04". Bending calculations assume the bearing plate load is distributed. Bending calculations are conservative (don't consider combined wood-steel bending.)
5. LFRD Capacity = ASD Capacity x 1.4
6. Hole sizes are nominal bolt size. Actual diameter of clearance hole is 1/16" oversize.

Table 3: AutoTight Shrinkage Compensator-Dimensions and Capacities

Model Number***	Rod Diameter (Max.)	Matl.	Dimensions (Inches)		Rated Take-Up (Inches)	Allowable Load Pounds	Average Ultimate Pounds	Δ_r (inches) Seating Increment	Δ_A (inches) Deflection at Allowable Load
			O.D.	H					
AT4A-1.5	1/2"	Aluminum	1-1/2	3	1-1/2	7,273	24,857	0.000*	0.014
AT4A-2.5				4-1/16	2-1/2				
AT6A-1.5	3/4"		2-1/8	3-3/16	1-1/2	13,579	40,737		0.014
AT6A-2.5				4-3/16	2-1/2				
AT 75	3/4"	Steel	2	3	1.10"	16,450	50,533	0.002**	0.024
AT 75-2.5				4	2-1/2	15,183	54,728		0.020
AT 100	1"		2-1/4	3-1/8	1.10"	25,300	78,067		0.032
AT 125	1-1/4"		2-3/4		1.12"	34,500	104,683		0.016

Notes:

Δ_r = Average Travel and Seating Increment is the "Lost Motion" with device direction change from advancing to load resistance.

*The AutoTight Aluminum Shrinkage Compensator has 0.0002" backlash (Δ_r). (Less than 0.001")

**The AutoTight Steel Shrinkage Compensator has 0.002" backlash (Δ_r).

***Option Integral Bearing Plate on AT 4A , 2-1/2" sq = 4,369 psi , AT6A, 3" sq = 6,052 psi.Dfl, adjust for other species. Add B to part #. Example AT4A-1.5(B)

LFRD Capacity = ASD Capacity x 1.4