



**CALIFORNIA
ENERGY**
CODES & STANDARDS

A STATEWIDE UTILITY PROGRAM

2019 Title 24, Part 6 Codes & Standards Enhancement (CASE) Proposal

Loading Dock Seals

December 12, 2016

John Arent
NORESKO
jarent@noresko.com



Proposed Code Change Overview

- Add a mandatory requirement for loading dock seals on dock doors adjacent to conditioned or partially conditioned spaces
 - Proposed change impacts warehouses, some large retail, some large hotel
- Warehouse and large retail buildings considered for analysis
 - Refrigerated warehouses would likely be added as well
- Anticipate a mandatory requirement for applicable building types and conditions
- Description of change
 - Loading dock doors adjacent to fully conditioned or partially conditioned spaces shall have loading dock seals [with an air leakage no greater than TBD cfm/sf]
 - Exceptions: likely for doors adjacent to unconditioned spaces

Proposed Code Change History

- Why are we proposing this measure?
 - Loading dock seals have significant savings potential at reducing heating and cooling energy and improving thermal comfort
 - Several manufacturers offer dock sealing products that are used in the market today
 - No requirement currently exists in Title 24, Part 6, but a requirement exists in ASHRAE 90.1-2013 for some climates
 - Secondary non-energy benefits: improved security, inhibits pest entry, restricts visual access to cargo during unloading

Current Code Requirements

- Existing Title 24, Part 6 Requirements
 - None
- Existing Model Code Requirements
 - ASHRAE 90.1-2013 – mandatory requirement for colder climates
 - 5.4.3.3 Loading Dock Weatherseals. In Climate Zones 4 through 8, cargo doors and loading dock doors shall be equipped with weatherseals to restrict infiltration when vehicles are parked in the doorway.
- Other regulatory considerations if appropriate (preemption, precedent to cover systems that are not currently covered by Title 24, Part 6)

Typical Practices

- **Dock seals** are foam pads that the trailer compresses into when it backs in and comes to rest against the dock bumpers, thus forming a gasket-type seal around three sides of the trailer.
 - Good seal at a relatively low price
 - Wear from repeated access
 - Impede a small portion of truck during loading/unloading
 - Best used with a minor variation in truck sizes
- **Dock shelters** enclosure the perimeter of the trailer when pressure is applied to industrial fiberglass-reinforced curtains
 - Fit a wide range of door openings and more easily adapted to varying truck sizes
 - Generally more expensive than dock seals, and can have a less effective seal
 - Can be more resilient under repeated impacts

Typical Practices

- Current practices
 - Dock seals and dock shelters more common in colder climates
 - Some limited use in California – extent to be determined
 - Common use in refrigerated warehouses; dock areas often conditioned to 40F
 - Typical dock door size is 8' wide x 10' high, but can vary
- Trends
 - Some limited use of dock seals, without incentives
- Do you agree with this description?
 - Are dock seals used in California warehouses?
 - Are they used in specific applications: refrigerated warehouses, industrial, large retail, or others?
 - Are they used in new construction, as a retrofit measure, or both?

Typical Practices



Dock Shelter



Dock Seal

Typical Practices: Dock Seals and Dock Shelters

- Dock seals cause a seal when the truck compresses the bladder:
 - Pros: creates a good seal
 - Cons: the impact of the truck over time causes damage to the product, and impacts product life; dock seal impedes the back of the trailer, restricting access slightly
- Dock Shelters are rigid materials that link to the top and sides of the truck
 - Pros: compatible with differing truck heights, provides the greatest access when the truck is docked
 - Cons: not as effective at restricting air infiltration as a dock seal, resiliency upon impact depends upon materials used
- Do you agree with this description?
 - What kinds of seals and related technologies are used in industry?

Market Overview and Analysis

- Current Market
 - TBD
 - No utility incentive offered currently (Focus on Energy incentive in Wisconsin)
- Market impacts
 - Energy consumption by this product in new construction will be determined later
- Market barriers
 - Not more broadly used, perhaps, because of perceived lack of benefits, or any impact of seal on loading and unloading operations
- Other market information sources we should know about?

Information Gaps and Planned Actions

Gap Identified	Research Plan Actions
<p>What types of door sealing options are currently in use?</p>	<p>Interview warehouse owner operators and SMEs.</p>
<p>Are the leakage rates well established? What factors affect the different door sealing approaches?</p>	<p>Identify typical leakage rates for existing loading dock door installations with and without dock seals through onsite testing.</p>
<p>Operational data on prevalence of conditioned vs. unconditioned storage; dock door number per 1000 sf; frequency of loading/unloading</p>	<p>Literature review; develop survey instrument for online participation and/or phone interviews</p>
<p>What are the maintenance costs?</p>	<p>Review cost literature.</p>
<p>Can building inspectors identify critical features of door seals?</p>	<p>Interview designers, contractors, and building departments. Research best practices for training.</p>

Incremental Cost Estimation

- How we will collect costs of base case technology and proposed technology
 - Interviews with manufacturers, distributors or contractors
 - Costs will include:
 - Material Costs and Installation Costs
 - Maintenance Costs and Replacement Costs (Expected Life)
- The primary difference in costs between similar products is their sealing effectiveness
 - Do you agree with this statement?
- What components of costs did we leave out?

Methodology for Savings Analysis

- Methodology for energy and demand Impacts
 - Energy and demand savings will be estimated using one or more building prototypes for simulation
 - Baseline infiltration rates will be based on field measurements of air leakage through closed loading dock doors
 - Proposed infiltration rates will be based on field measurements of air leakage through dock doors with seals installed
 - Prototype buildings may include:
 - Warehouse building with conditioned storage space
 - Large (big box) retail or supermarket with conditioned storage space
 - Refrigerated warehouse
 - Operating schedules and other inputs may require customization

Assumptions for Energy Impacts Analysis

- Key assumptions developed/vetted by stakeholder surveys
 - Operating hours
 - Prevalence of conditioned and unconditioned storage
 - Prevalence and relative cost of dock seals and dock shelters
 - Feedback on expected life of dock seals and shelters
 - Configuration of loading dock: number of dock doors
- Key assumptions developed by field measurement
 - Dock seal infiltration rate
 - Dock shelter infiltration rate
 - Untreated dock door infiltration rate
- Key assumptions developed by prior research:
 - Warehouse envelope configuration and other simulation parameters developed from existing prototypes modified to conform with T24 requirements

Assumptions for Energy Impacts Analysis

- Modeling assumptions:
 - LPD from Title 24 prescriptive requirements
 - Heating and cooling efficiencies from Title 24, Part 6 prescriptive requirements
 - Air leakage rate*:
 - Baseline:
 - 0.4 cfm/sf for closed dock door (32 cfm per door)
 - 783 cfm per open dock door (loading/unloading)*
 - Proposed case:
 - 0.28 cfm/sf for closed door
 - 203 cfm per open dock door
 - Daytime and 24/7 operating schedules tested to bound the analysis
 - Door schedules developed from existing literature and survey data

* Liu, B, et. al. 2007. *The Development of the Advanced Energy Design Guide for Small Warehouse and Self-Storage Buildings*, PNNL-17056, Dec. 2007.

Incremental Cost Savings

- Approach
 - Incremental cost savings are calculated based on TDV cost savings associated with energy savings over the entire period of analysis.
 - Present TDV cost multiplier (\$/TDV kBTU)
 - Expected life of dock seals and any maintenance costs will be factored in the LCC, as available
 - Typical analysis period is 15 years
 - Expected life may vary by product

Initial Data and Findings

- Preliminary results from savings analysis: TBD
- Preliminary results from cost-effectiveness analysis (Benefit-Cost Ratio): TBD
- Assumptions for energy, cost, market, or environmental impacts analysis
- *Preliminary savings estimate and cost effectiveness analysis will be determined as the project progresses*

Compliance and Enforcement- Market Actors

- Who would be involved in implementing this measure?
 - Manufacturer
 - Building Owner
 - General Contractor
 - Architect
 - Tenants
 - Commissioning Agent (possibly)
 - Building Enforcement Agency
- Others?

Compliance and Enforcement—Tasks

Market Actor	Task(s)	Success Criteria
Building Owner	<ul style="list-style-type: none"> - Provide Owner Project Requirements - Provide appropriate budget for dock seals where required 	<ul style="list-style-type: none"> - Do this with minimal paperwork - Do this virtually/ remote
General Contractor	<ul style="list-style-type: none"> - Manage construction of building or retrofit - Coordinate and manage trades 	<ul style="list-style-type: none"> - Complete project on time and budget - Complete project with no construction issues or change orders
Architect	<ul style="list-style-type: none"> - Specify appropriate dock seal or shelter that is compatible with dock doors 	<ul style="list-style-type: none"> • Compliance document passes code check • Dock seal does not inhibit loading and unloading operations
Commissioning Agent	<ul style="list-style-type: none"> - Performs installation checks and field measurements as needed 	<ul style="list-style-type: none"> - Review of applicable products - Report to client and general contractor - Verify that building meets code and design intent

Compliance and Enforcement—Tasks

Market Actor	Task(s)	Success Criteria
Tenants	<ul style="list-style-type: none"> - Manage inventory and loading and unloading operations 	<ul style="list-style-type: none"> - Safe storage and transport of product - Safe working conditions for operators
Manufacturer	<ul style="list-style-type: none"> - Develops products that meet T24 specifications - Establishes Price and sells to appropriate markets 	<ul style="list-style-type: none"> - Do this quickly - Do this within current work tasks - Do this cost-effectively
Building Enforcement Agency / Inspector	<ul style="list-style-type: none"> - Verify dock seal equipment meets specs - Issue Certificate of Occupancy 	<ul style="list-style-type: none"> - Do this with minimal paperwork - Do this virtually/ remote

What are we not capturing?

Compliance and Enforcement—Resources

Market Actor	Resource(s)
Building Owner	<ul style="list-style-type: none"> - EnergyCodeAce - Cost sources: RS Means, quotes
General Contractor	<ul style="list-style-type: none"> - Cost sources - Product specs
Mechanical Engineer / Designer	<ul style="list-style-type: none"> - Title 24 Standard and supporting documents
Commissioning Agent	<ul style="list-style-type: none"> - OPR - Plans and product specs - Title 24 Standard - EnergyCodeAce

Compliance and Enforcement—Resources

Market Actor	Resource(s)
Manufacturer	- None?
Building Enforcement Agency	- Title 24 Standard and supporting documents - EnergyCodeAce - Training - CEC Resources

- What resources or tools are typically used for compliance?
- Are there an industry standards for measuring or reporting air leakage (ASTM 283, others)?

Strawman Code Change Language

- Title 24 Standards (*preliminary*)
 - All loading dock doors that open to conditioned or partially conditioned spaces greater than 1,000 sf in floor area shall have permanently installed dock seals on all doors. Dock seals shall be capable of limiting infiltration rates to 0.XXX cfm/sf when closed.
- Title Appendices (JA, RA, or NA)
 - *Possible language in Nonresidential Appendix to verify dock seal is installed for applicable doors. (to be determined)*
- Alternative Compliance Method (ACM) Technical Manual
 - No ACM Reference Manual language revisions expected

Feedback Request from Stakeholders

- Information requested from stakeholders:
 - How often are dock seals currently used? What kinds of products are used? How durable are they – what is their expected life?
 - How often are storage areas conditioned or partially conditioned?
- Call or email CASE author

Thank you.

John Arent
NORESKO
jarent@noresko.com

