

Clear heights beyond 36'



The HPA white paper from 2012 on going to 36' clear height in large scale distribution buildings is already a bit behind the times. This document presents a brief discussion about issues specific to configurations of ESFR that allow for 40' clear and 43' clear buildings.

The keys to clear height decisions are in weighing the added cost to go higher with the potential gain in capacity the increase brings. The discussion below looks at the constraints imposed by ESFR systems at high clear heights, the possible caveats of capacity increase, an issue with plastic commodities, and the wave of new e-commerce distribution models.

Our conclusion is that there is a good case for 40' clear when e-commerce models are forefront but a less compelling case in conventional distribution.

ESFR as of today; July 19, 2015

This table shows the current state of the art for using ESFR systems in distribution buildings. It shows that a 36' clear building with a maximum roof deck height of 45' can be designed using several ESFR configurations to cover class I through class IV commodities.

We show two lines with 45' maximum deck height to differentiate between the 36' clear configuration that can be used in a deep building and a normal roof structure. The 40' clear version requires a slimmer building and a more expensive roof system.

ESFR design standards							
Required pressure at sprinkler head specified by FM Global Rev 5 May 20 2014							
For class I-IV, Group A plastic heights vary by configuration							
40' deck height allows 35' maximum storage height							
45' deck is 40' maximum storage height							
48' deck is 43' maximum storage height, note that this configuration is not recognized by FM							
Max deck Ht	Bldg clear ht	K-14.0 head	K-16.8 head	K-22.4 head	K-25.2 head		
30	26	50 psi	35 psi	25 psi	15 psi		
40	32	75 psi	52 psi	40-50 psi	25-60 psi		
45	36	NA	NA	40 psi	40 psi		
45	40	NA	NA	40 psi	40 psi		
48	40	NA	NA	55 psi	45 psi		

The last line shows that there is now a UL approved ESFR configuration to go to 43' clear height and maximum 48' deck height with two ESFR configurations. There are restrictions on the rack systems in this configuration that allow only single deep racks and require 8' minimum aisle widths. This limits a tenant's options. These 48' deck configurations are not recognized by FM at this time making buildings configured with these systems unsuitable for FM underwriting by a tenant.

This above table is for Type I through type IV commodities but there are tenants who need to deal with Group A plastics as well. There are 4 types of Group A plastic commodities to consider:

- Unexpanded carton enclosed plastics
- Unexpanded exposed plastics
- Expanded carton enclosed plastics
- Expanded exposed plastics

Expanded plastics either carton enclosed or exposed are only approved for ESFR with a special rack configuration in a 36' clear building that includes vertical barriers. We can concentrate then on the issues of unexpanded plastics in ESFR high clear buildings.

ESFR and Plastics

The following set of tables indicate the ESFR configurations that can accommodate the Group A plastics to take advantage of the clear height:

35' maximum deck height (28' clear) and Group A plastics					
		Unexpanded Max height		Expanded Max height	
Head design	PSI	Carton	Exposed	Carton	Exposed
K 14	75	30'	30'	NA	NA
K 16.8	52	30'	30'	NA	NA
K 22.4	35	30'	NA	NA	NA
K 25.2	20	30'	NA	NA	NA

40' maximum deck height (32' clear) and Group A plastics					
		Unexpanded Max height		Expanded Max height	
Head design	PSI	Carton	Exposed	Carton	Exposed
K 16.8	52	35'	35'	NA	NA
K 22.4	40	30'	NA	NA	NA
K 22.4	50	30'	35'	NA	NA
K 25.2	25	35'	NA	NA	NA
K 25.2	50	30'	35'	NA	NA
<i>With special rack requirements</i>					
K 25.2	60	35'	35'	35'	35'

45' maximum deck height (36' & 40' clear) and Group A plastics					
		Unexpanded Max height		Expanded Max height	
Head design	PSI	Carton	Exposed	Carton	Exposed
K 22.4	40	40'	NA	NA	NA
K 25.2	40	40'	NA	NA	NA

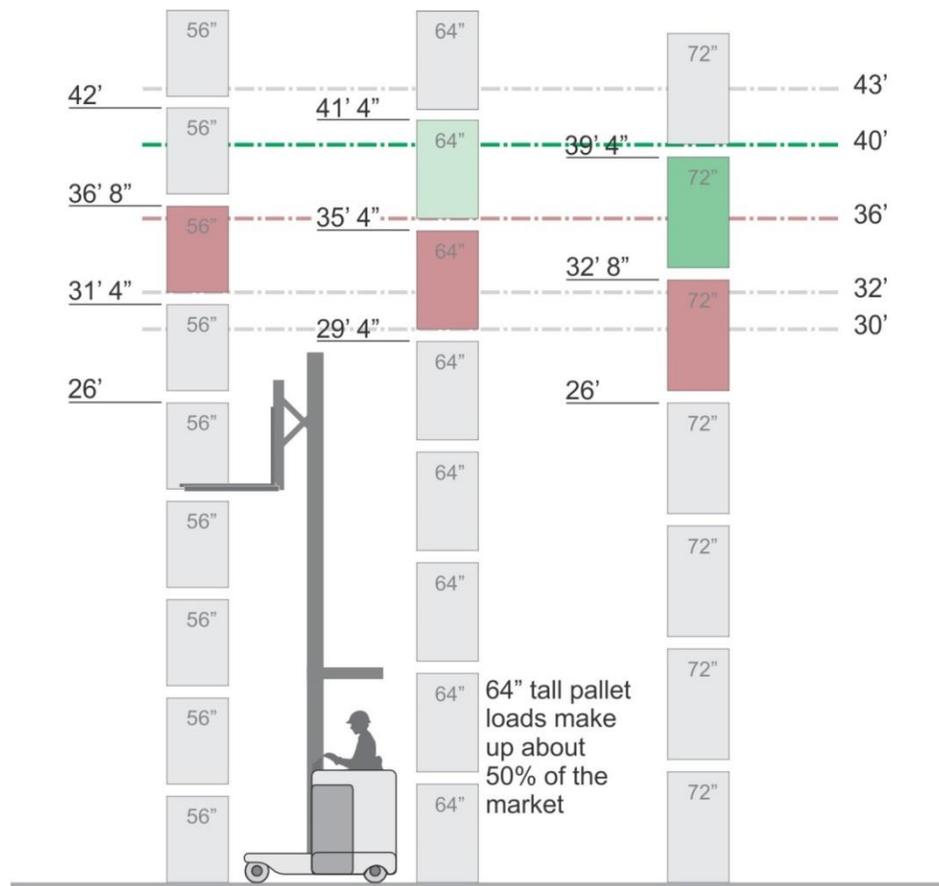
Let's not forget the 48' deck height UL listed configuration on the next page:

48' maximum deck height (40' clear) and Group A plastics					
		Unexpanded Max height		Expanded Max height	
Head design	PSI	Carton	Exposed	Carton	Exposed
K 22.4	55	43'	NA	NA	NA
K 25.2	45	43'	NA	NA	NA

These tables indicate that moving above 40' deck height eliminates the possibility of storing unexpanded exposed plastics above 35' without in-rack systems. That may not be an issue for many tenants and plastics can always be accommodated with an in-rack system in specific areas of a building.

Rack storage capacity increases

In terms of the actual pallet stacking dimensions there is some increase in capacity moving from 36' clear to 40' clear but it is generally less dramatic than the increase that can be gained going from 32' clear to 36' clear. The diagram below is an update from the HPA 2012 paper:



This shows the 3 most common pallet load height in use. While the move from 32' clear to 36' clear shows easy increases for all three load heights, the move from 36' clear to 40' is a clear increase for only the 72" load height. There are many different load heights in use however, and many tenants mix load heights within their operations so it is still possible for many tenants to optimize for a 40' clear building as well as a 36' clear building.

The theoretical increase for going 40' clear over 36' clear appears to translate to somewhere between 0% and 20% depending on how a tenant can configure load heights.

It should be noted that in these high buildings top of the line reach fork lift equipment is necessary to pick that top level. This equipment needs an aisle close to 10' wide to operate. This aisle is most efficiently accommodated with a 56' structural bay, a bit larger than standards from a year or two ago. Of course, very narrow aisle equipment that is significantly more expensive can take advantage of the clear height and use 5' or 6' aisles.

E-Commerce

So far we have seen that the move to 40' clear narrows the options for ESFR configurations and for stacking unexpanded exposed plastics. We have also seen that 40' clear can provide capacity increases, but it depends on manipulating pallet load heights.

There is, however, another way to look at the clear height increase in light of recent trends in e-commerce distribution. A number of e-commerce distribution centers (sometimes referred to as fulfillment centers) look to replace tall racking and high reach fork lifts with picking individual product units by hand. These tenants look to use clear height to put in working platforms so they keep the pick height to 6' or under.

In a seismic zone like the west coast structural requirements make it difficult to squeeze more than one working platform into a 36' clear building cost effectively. The extra 4' in a 40' clear building provides enough relief to use more efficient structural systems and reduces the overall cost of the working platforms significantly. When working on a build to suit facility with two levels of working platforms above grade, 40' clear provides the best configuration.

When does 40' clear make sense?

Our analysis looks at both 36' clear and 40' clear in buildings using the 45' maximum deck height ESFR systems. The difference between these two configurations is in the roof structural systems. A large cross dock distribution building is typically over 600' wide. To achieve a clear height of 36' and an economical roof system the deck height at the ridge climbs over 40' and the 45' ESFR system comes into play. If a building width is limited to 600' and a more expensive roof system, or possibly using an interior drain system, it is possible to get 40' clear into a 45' maximum deck height system. The 40' clear proposition then becomes an economical calculation of increased utility versus increased expense.

If a building is to be marketed for an e-commerce user that wants to use two levels of working pick platforms, then 40' clear is the best solution.

If that market is not of high consideration then there is a muddier picture. There is a potential capacity increase of up to 20% over a 36' clear building but it would take the right pallet load height configurations to take advantage of it.

The restrictions on the 48' high deck ESFR system that has UL approval only means using it to go over 40' clear has significant risks.