

Council Business Meeting

June 21, 2022

Agenda Item	Resolution No. 2022-20 Adopting a Wildfire Mitigation Plan for the City of Ashland's Electric Utility	
From	Tom McBartlett	Director of Electric Utility
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SUMMARY

Oregon Senate Bill (SB) 762, passed in the 2021 session, is comprehensive legislation aimed at modernizing and improving wildfire preparedness. Section 4 of SB 762 requires consumer-owned electric utilities to operate in compliance with a risk-based wildfire protection plan approved by the governing body of the utility. Approved plans are to be submitted to the Oregon Public Utilities Commission by June 30, 2022.

POLICIES, PLANS & GOALS SUPPORTED

Be proactive in using best practices in infrastructure management and modernization.
Reduce wildfire and smoke risk.
Maintain compliance with State and Federal regulations.

PREVIOUS COUNCIL ACTION

N/A

BACKGROUND AND ADDITIONAL INFORMATION

In February of 2022, the City's Electric Utility issued an RFP soliciting qualified firms to complete a SB 762 compliant Wildfire Mitigation Plan. Two qualified responses were received, and Stoddard Power Systems was ultimately awarded the contract.

FISCAL IMPACTS

The contract with Stoddard Power Systems was not to exceed \$25,706.00

STAFF RECOMMENDATION

Staff recommends approval of Resolution No. 2022-20 adopting the plan prepared by Stoddard Power Systems

ACTIONS, OPTIONS & POTENTIAL MOTIONS

I move to approve Resolution No. 2022-20 adopting a wildfire mitigation plan for the City of Ashland's electric utility and to direct staff to make the appropriate filings of the plan with the Oregon PUC.

REFERENCES & ATTACHMENTS

1. Resolution No. 2022-20
2. SB 762 - <https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/SB762>
3. Wildfire Mitigation Plan dated May 2022
 - Appendix A- Wildfire Advanced Report City of Ashland
 - Appendix B- Ashland Terrain Map
 - Appendix C- Substation One-Line Diagrams
 - Appendix D- Reference Product Cut Sheets

1 **RESOLUTION NO. 2022-20**

2 A RESOLUTION ADOPTING A WILDFIRE MITIGATION PLAN FOR THE CITY OF
3 ASHLAND’S ELECTRIC UTILITY IN COMPLIANCE WITH SB762

4 **RECITALS:**

5
6 A. The City of Ashland (City) has an interest in maintaining a safe and reliable electric utility;
7 and

8 B. The City Council shall ensure that the City’s electric utility maintains compliance with
9 applicable laws and regulations; and

10 C. Oregon Senate Bill (SB) 762, passed in 2021, is comprehensive legislation aimed at
11 modernizing and improving wildfire preparedness. SB 762 requires consumer-owned electric
12 utilities to operate in compliance with a risk-based wildfire protection plan approved by the
governing body of the utility.

13 **NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF ASHLAND, OREGON,**
14 **RESOLVES AS FOLLOWS:**

15 SECTION 1. The City of Ashland hereby adopts the final Wildfire Mitigation Plan dated May
16 31, 2022, attached hereto as “Exhibit A” and incorporated herein by this reference.

17 SECTION 2. This resolution is effective upon adoption.

18 ADOPTED by the City Council this _____ day of _____, 2022.

19 ATTEST:

20
21
22 _____
23 Melissa Huhtala, City Recorder

24 SIGNED and APPROVED this _____ day of _____, 2022.

25
26
27 _____
28 Julie Akins, Mayor

29 Reviewed as to form:

30 _____
Katrina L. Brown, City Attorney

WILDFIRE MITIGATION PLAN

May 2022

Prepared For:



Electrical Department,
City of Ashland, Oregon

Version: DRAFT 05/27/2022
FINAL 05/31/2022

Prepared By:



Engineers: Jerry Witkowski, P.E.
Jiajia Song, P.E.
Martin Stoddard, P.E.

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SECTION 1: OVERVIEW

The Pacific Northwest has been experiencing large wildfire seasons over the last few years. Climate changes, low precipitation, and high temperatures have resulted in severe drought conditions which contribute to the increase in fire risk. According to the 2019 to 2021 *Northwest Annual Fire Reports* by Northwest Interagency Coordination Center (NWCC), as summarized in Table 1, Oregon’s 2020 wildfire season became the most destructive in the state’s history, burning about 1.15 million acres, which is 223% more than the 10-year average. The damage from the 2021 wildfire was not as severe as that of 2020 but still about 10 times that of 2019. Being prepared for the wildfire season is important in reducing the risk and impact of wildfires and can help save lives, properties, natural resources, and more. The process of reducing fire risk is an ongoing interagency effort and electric utilities play an important role.

Table 1: Oregon Fire Occurrences and Acres Burned
[Sources: Northwest Annual Fire Report – 2019, - 2020, and - 2021, via:
<https://gacc.nifc.gov/nwcc/admin/publications.aspx>]

Year	Total Fires	Total Burned Acres	% Above 10-Year Average Acres
2019	2,293	79,732	28%
2020	2,215	1,141,613	223%
2021	2,202	828,778	125%

1.1 Regulatory Requirements

1.1.1 2021 Oregon Senate Bill 762

[Source: <https://olis.oregonlegislature.gov/liz/2021R1/Measures/Overview/SB762>]

2021 Oregon Senate Bill (SB) 762 is comprehensive legislation to help Oregon modernize and improve wildfire preparedness through three key strategies: creating fire-adapted communities, developing safe and effective responses, and increasing the resiliency of Oregon’s landscapes.

Section 3 of SB 762 requires public utilities that provide electricity to have and operate a risk-based wildfire protection plan that has been filed with and evaluated by the Public Utility Commission (by December 31, 2021 as indicated in Section 5 of SB 762). The plan must be based on reasonable and prudent practices identified through workshops conducted by the commission pursuant to Section 2 of the Act and on commission standards adopted by rule. The public utility must design the plan in a manner that seeks to protect public safety, reduce risk to utility customers and promote electrical system resilience to wildfire damage. The Act also requires a public utility that provides electricity to regularly update the risk-based wildfire protection plan on a schedule determined by the commission. The plan must, at a minimum:

- a) Identify areas that are subject to a heightened risk of wildfire and are:
 - A. Within the service territory of the public utility; and
 - B. Outside the service territory of the public utility but within a reasonable distance, as determined by the commission, of the public utility’s generation or transmission assets.
- b) Identify a means for mitigating wildfire risk that reflects a reasonable balancing of mitigation costs with the resulting reduction of wildfire risk.
- c) Identify preventive actions and programs that the public utility will carry out to minimize the risk of utility facilities causing a wildfire.

- d) After seeking information from regional, state and local entities, including municipalities, identify a protocol for the deenergizing of power lines and adjusting of power system operations to mitigate wildfires, promote the safety of the public and first responders and preserve health and communication infrastructure.
- e) Describe the procedures, standards and time frames that the public utility will use to inspect utility infrastructure in areas that the public utility identifies under paragraph (a) of this subsection.
- f) Describe the procedures, standards and time frames that the public utility will use to carry out vegetation management in areas that the public utility identifies under paragraph (a) of this subsection.
- g) Identify the development, implementation and administration costs for the plan.
- h) Identify the community outreach and public awareness efforts that the public utility will use before, during and after a wildfire season.

For consumer-owned electric utilities, Section 4 of SB 762 requires them to operate in compliance with a risk-based wildfire protection plan approved by the governing body of the Utility. The bill requires periodic updates of the plan and requires submission of the initial plan to the governing body no later than June 30, 2022, as indicated in Section 6 of SB 762. It also requires that the plan approved by consumer-owned electric utility governing body be submitted to the Public Utility Commission.

1.1.2 Public Utility Commission, Chapter 860, Division 300: Wildfire Mitigation Plans
[Source: <https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=6618>]

Oregon Public Utility Commission (OPUC) Charter 860-300-0020 lists filling requirements for Wildfire Mitigation Plans similar to what's presented in SB 762.

1.1.3 Oregon Executive Order No. 20-04
[Source: https://www.oregon.gov/gov/Documents/executive_orders/eo_20-04.pdf]

Executive Order (EO) 20-04 establishes Oregon State Governor's greenhouse gas emissions goals for Oregon and directs state agencies to identify and prioritize actions to meet those goals. EO 20-04 also provides specific directives to the Oregon Public Utility Commission (OPUC) regarding greenhouse gas emissions, impacted communities, and wildfire safety.

As EO 20-04 directs, OPUC must evaluate electric companies' risk-based wildfire protection plans and planned activities to protect public safety, reduce risks to utility customers, and promote energy system resilience in the face of increased wildfire frequency and severity, and in consideration of the recommendations made by the Governor's Council on Wildfire Response 2019 Report and Recommendations. OPUC is making related rules (Rulemaking AR 638) at present. The objective of the AR 638 rulemaking is to develop permanent administrative rules that address wildfire risk related to utility operations and services. In the short term, OPUC Staff proposes temporary rules related to Public Safety Power Shutoff (PSPS) Protocols and Ignition Reporting Requirements for the 2021 wildfire season.

In addition, OPUC shall convene periodic workshops for purposes of assisting electric companies, consumer-owned utilities, and operators of electrical distribution systems to develop and share best practices for mitigating wildfire risk. The requirement for periodically convened workshops for this purpose is directed in Section 2 of SB 762.

1.2 Purpose of This Effort

The City of Ashland (the City) is located in Jackson County, Southwest Oregon. In October 2020, Federal Emergency Management Agency (FEMA) worked with the City on an environmental assessment with a focus on wildfire mitigation considering many perspectives, including soils, topography, aesthetics, air quality, water, wetland, vegetation, wildlife, hazardous materials, noise, transportation, public utilities, etc. This Wildfire Mitigation Plan focuses specifically on mitigation strategies from the standpoint of electrical utilities.

The City provides all City utilities, including electric service. The City's Electric Department is one of the older municipal electric utilities operating in the State of Oregon and offers power to customers within its service territory. The City's Electric Department, as a public utility, is required to comply with all requirements specified in SB 762, as discussed in Section 1.1. The intent of this wildfire mitigation plan is to document and review the City's existing wildfire policies and procedures and develop an up-to-date wildfire mitigation plan that meets all requirements of the 2021 SB 762 and Oregon Public Utility Commission (OPUC). The overall objective of developing and executing a wildfire mitigation plan is to minimize possible sources of ignition, improve the system resiliency of the electric network, and identify and correct ineffective procedures. The focus of this Wildfire Mitigation Plan effort is the electric service territory of the City's Electric Department.

This report is based on the minimum requirements of a Wildfire Mitigation Plan, as specified in Oregon SB 762, with the remaining sections of the plan organized as follows. Section 2 describes the City's service area, electrical system, and existing fire mitigation programs. Section 3 presents the wildfire risk assessment of the City's service territory and its surrounding area within a reasonable distance. Section 4 introduces the proposed wildfire mitigation strategies based on a review of the City's existing program, electrical assets, wildfire risks, etc. Section 5 presents the mitigation plan from the perspective of public awareness and community outreach.

SECTION 2: SYSTEM AND EXISTING PROGRAM

2.1 The Service Area

The City of Ashland's Electric Department is headquartered at the Operations Center located at 90 North Mountain Avenue within the City limits. The City distributes electric service within a 9.2 square-mile territory, most of which is on the west side of Interstate 5 (I-5). The service territory is shown in Figure 1 and the vast majority of the 12,648 customers are served within the City limits.

The City's electric system supplied approximately 175 million kWh annual retail electric energy for the year ending December 31, 2021, with a 2021 winter peak demand of 35.85 MW and a summer peak demand of 46.15 MW. The City owns and operates its distribution facilities and takes service from three substations:

- Mountain Avenue Substation, which the City is in the process of purchasing from BPA but has not taken ownership to date, serves four (4) City-owned distribution feeder circuits and has two (2) spare positions.
- Ashland Substation, which is owned and operated by PacifiCorp and serves four City-owned distribution feeder circuits.
- Oak Knoll Substation, which is owned and operated by PacifiCorp and serves three (3) distribution feeder circuits.

The transmission source to these substations is fed from a ring bus at PacifiCorp's Baldy Switching Station located in the Medford region. Line 19 originates at the Baldy Switching Station and is then tapped becoming Line 82, providing service to PacifiCorp's Oak Knoll Substation and continuing onto PacifiCorp's Ashland Substation. Between Oak Knoll and Ashland Substations, the line is again tapped to serve the BPA Mountain Avenue Substation. Alternate transmission sources are available to the Ashland area from PacifiCorp's Copco 2 and Sage Road facilities. In addition to the two substations, PacifiCorp owns and maintains a few poles in and adjacent to the City's service territory and city limits, as shown in Figure 2.

The City's distribution system (12.47/7.2 kV) consists of 52.7 miles of overhead three-phase and single-phase primary circuitry; and 79.5 miles of three-phase and single-phase underground primary circuitry. The electric facilities serve 12,648 residential, commercial, and industrial customers. A high-level view of the electrical feeder map is shown in Figure 3.

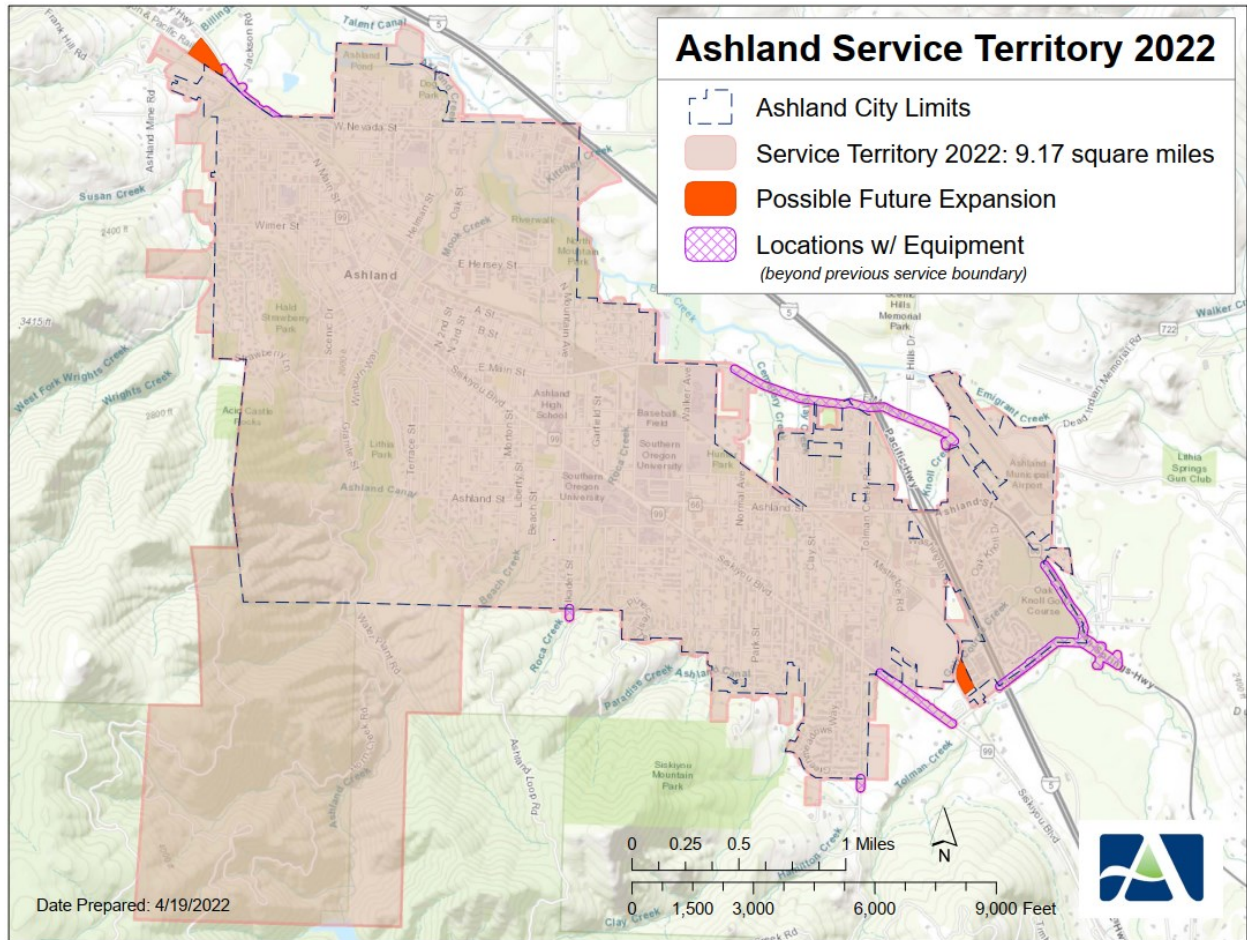


Figure 1: Ashland Service Territory

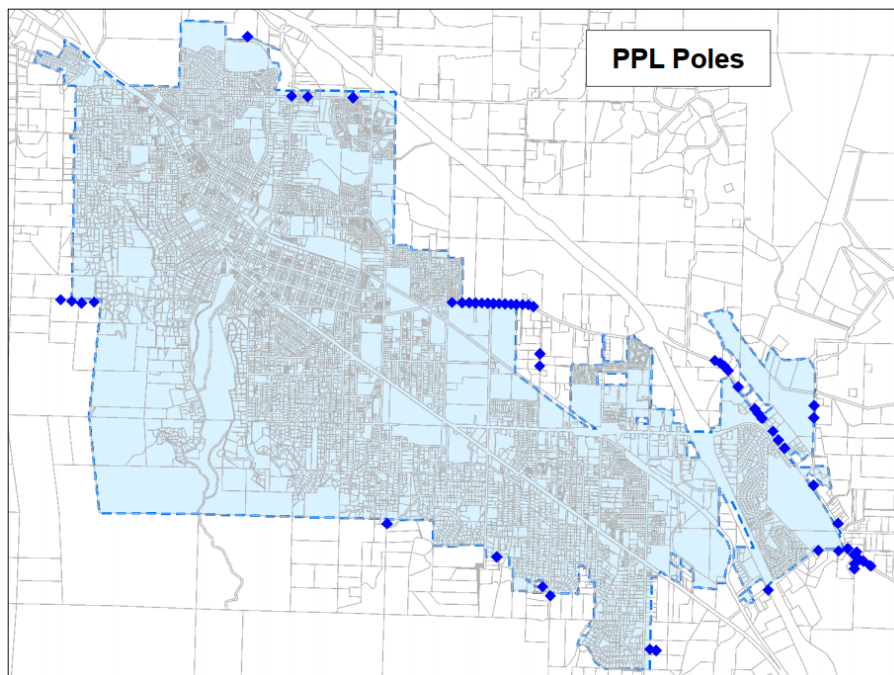


Figure 2: Transmission & Distribution Poles Owned by PacifiCorp

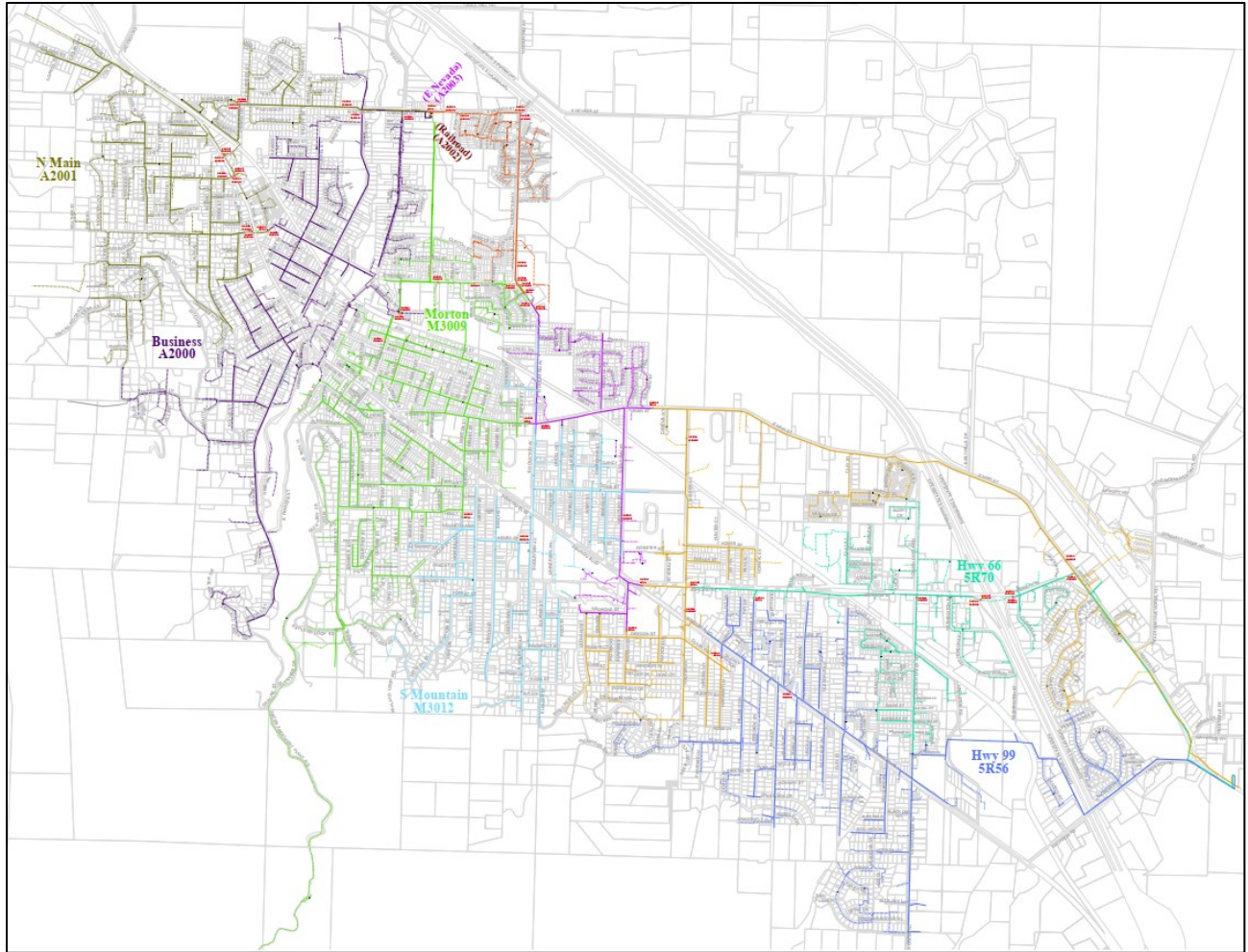


Figure 3: City of Ashland Electrical Feeder Map – City Area Only

2.2 Existing Program

Currently the City's Electric Department has some policies and initiatives in place regarding wildfire mitigation but does not have a documented plan as required by the PUC. The Electric Department has implemented several procedures, as noted below, to directly or indirectly reduce wildfire risks.

- Due to the utility's recent awareness of fire risk potential through the use of expulsion fuses in which the molten metal combined with ventilated gas could be a source of ignition for fire, the City has begun to change out expulsion fuses with current-limiting fuse (CLF) replacements in their western and southwest areas of the service territory. Expulsion fuses are not a good choice in areas that have high fire risks, and non-expulsion fuses or current-limiting fuses (CLF) are recommended replacements.
- In addition, due to the potential fire risk resulting from the use of wood cross-arms, the City has begun the replacement of wood cross-arms with fiberglass cross-arms and extensions to eliminate the potential of components prone to fire.
- The City has increased the installation of squirrel guards on pole tops to prevent animal contact resulting in short-circuits and potential fire ignition.
- The City has an aggressive right-of-way vegetation management program, focusing on the prevention of vegetation contact with overhead conductors and the reduction of fuel within the right-of-way in compliance with IEEE C2, *National Electrical Safety Code* (NESC), and the

requirements for public safety and fire prevention as defined in OPUC OAR 860.024.0016/0017. Crew personnel conduct right-of-way inspections annually and increase inspections during heavy growth seasons. This includes identifying vegetation and fire risk concerns during routine maintenance or service calls and taking corrective action.

- The City has circuit reclosers with reclosing relays installed for every City distribution feeder served out of Ashland, Mountain Avenue, and Oak Knoll substations. The City has an integrated system with all recloser controls through a centralized SCADA system. The SCADA system is capable of displaying fault alarms from all recloser relays and provides the ability to remotely operate all reclosers. This allows the City to disconnect any feeder quickly in case of a fire emergency.
- The City currently has three circuit reclosers installed outside substations on feeder circuits located within congested service areas to isolate portions of a circuit under faulted conditions. These circuit interrupters do not have reclosing enabled.
- The Electric Department is currently investigating the use of drone inspections to monitor and inspect the pole top and line conditions.
- The City has multiple cameras situated in and around the City that are available to monitor smoke and fire conditions. Presently cameras are placed at the following locations:
 - Water Treatment Plant Reservoir, two (2) cameras, one of them with rotating capability
 - Water Treatment Plant, two (2) cameras, one of them with rotating capability
 - East of I-5 (Squirrel Ranch) one (1) fixed direction camera with a viewing angle toward the City and one (1) camera with zoom/pan/tilt rotating capability
 - Downtown City Hall vicinity, two (2) cameras, one of them with rotating capability
- The Electric Department has performed a 10-year system planning study in 2014 and is planning to update that in two years.

These existing programs by the Electrical Department are beneficial in wildfire mitigation but they are not sufficient to meet the minimum requirements in Oregon SB 762 for a risk-based wildfire mitigation plan for electric utilities. However, the Electrical Department is adopting additional measures to bring its program into compliance and is open and willing to adopt advanced wildfire mitigation plans and other modern technologies in power system protection and fire monitoring to further reduce the potential for wildfires.

SECTION 3: WILDFIRE RISK EVALUATION

Typically, risk is a function of the probability of occurrence and the resulting cost/impact of the event. For a specific area, the overall wildfire risk depends on both the likelihood of a wildfire and the exposure and susceptibility of valued resources and assets combined. Within the City's service territory and the surrounding areas, the primary risk drivers for wildfire are the following:

- Weather and drought due to climate changes
- Terrain
- Fire history
- Vegetation type & density
- Communities at-risk – population and housing density

The Oregon Wildfire Risk Explorer (OWRE) is an open-source tool providing useful information for a customized area of interest to support Community Wildfire Protection Plans and other plan and policy developments. Most of the following figures and tables are statistics and illustrations generated for the area highlighted in the box shown in Figure 4. The full report is attached in Appendix A. The focus of this Wildfire Mitigation Plan for the City is primarily the electrical service area, which is mostly an urban area and has an irregular shape as shown in Figure 1. The boxed area in Figure 4 covers not only the City's service territory (boxed area) but also its surrounding area within a reasonable distance where wildfires are more likely to occur. The OWRE report provides statistics from the year 2008 to 2019 that can be used to develop an understanding of the wildfire risks within the area of interest.

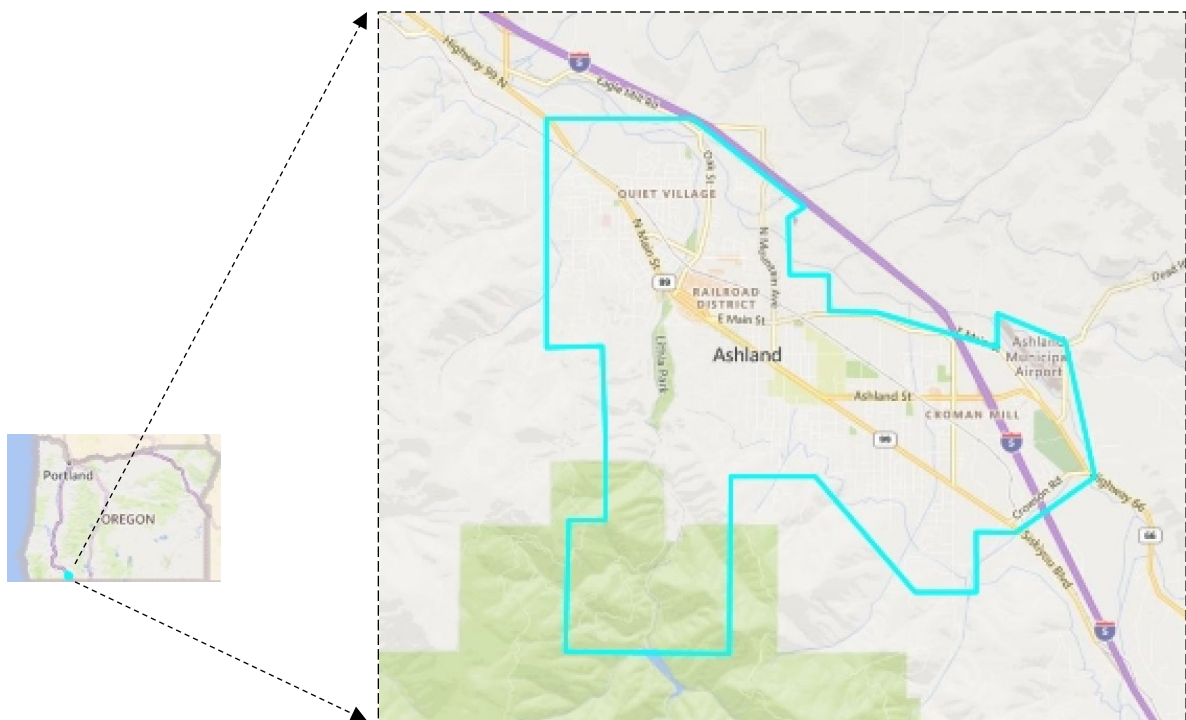


Figure 4: Ashland Wildfire Mitigation Plan – Area of Interest

3.1 Weather and Drought

In the past few years, the Pacific Northwest has experienced an increase in the occurrence and intensity of wildfires. There are a variety of factors including climate changes, topography, land and vegetation management, human activity in wildland, etc. that contribute to this trend. Global climate changes have caused increased temperatures and temperatures are projected to continuously increase for the remainder of the 21st century [Source: <https://cig.uw.edu/learn/climate-change/>]. According to the Climate Impact Group at the University of Washington, the Pacific Northwest warmed about +1.3°F (or +0.13°F/decade warming) between 1895 and 2011 (Figure 5) with statistically-significant warming occurring in all seasons except for spring. Figure 6 and Figure 7 show the monitored drought conditions in Oregon State and the City of Ashland from 2000 to present. These figures show that the most intense period of drought occurred in August 2021, where D4 (Exceptional Drought) affected 26.59% of land in Oregon and D3 (Extreme Drought) affected 90% of the Ashland and surrounding area in Jackson County. D3 (Extreme Drought) and D4 (Exceptional Drought) have persisted into 2022.

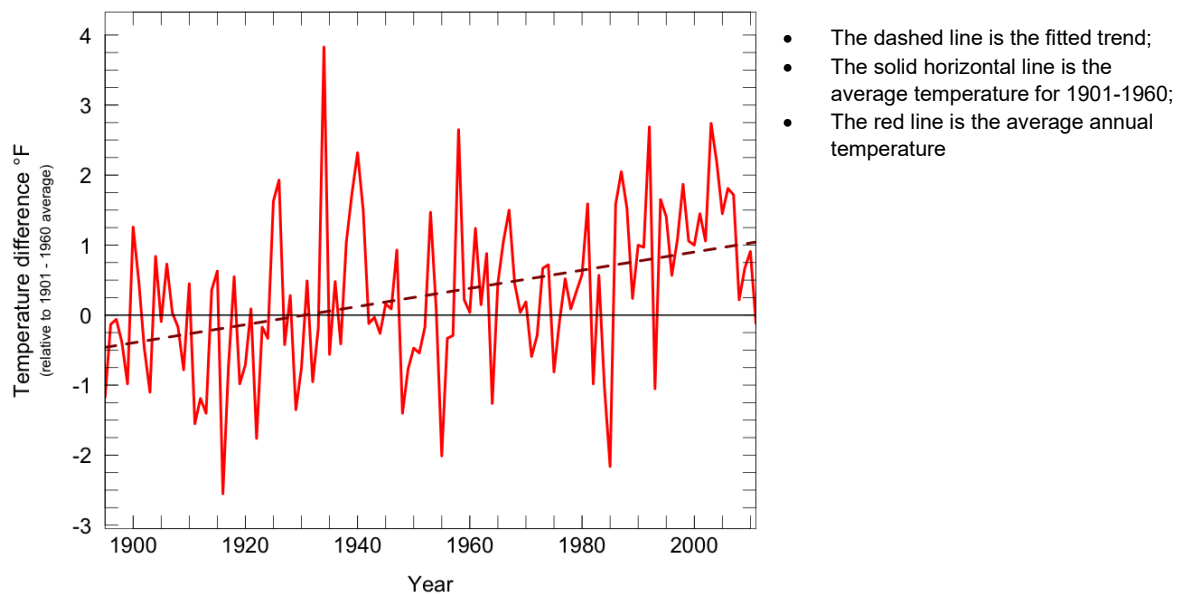


Figure 5: Rising temperatures in the Pacific Northwest.
[Source: <https://cig.uw.edu/learn/climate-change/>]

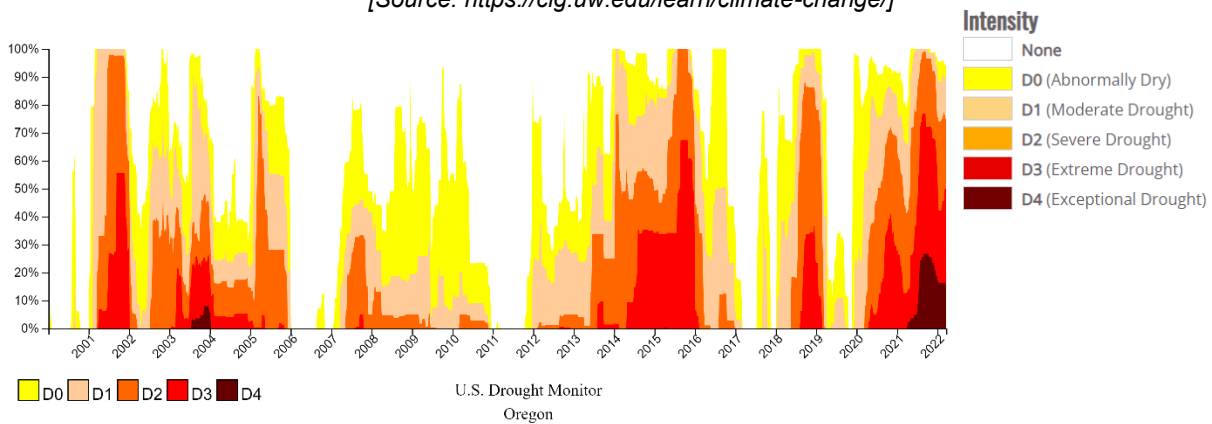


Figure 6: Drought in Oregon from 2000 to Present
[Source: <https://www.drought.gov/states/oregon#historical-conditions>]

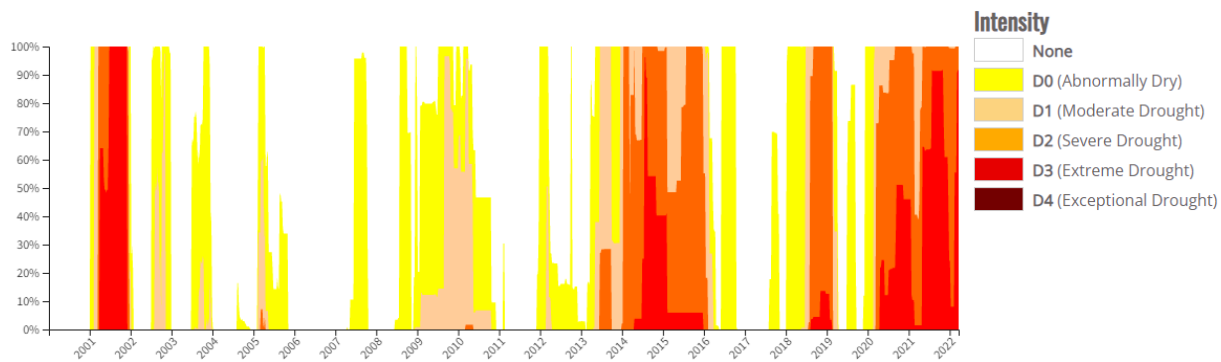


Figure 7: Drought in Jackson County from 2000 to Present
 [Source: <https://www.drought.gov/location/Ashland%2C%20Oregon>]

3.2 Terrain

Although the City of Ashland is essentially urban with populated residential neighborhoods, it is a small community and abuts portions of heavily wooded regions of Siskiyou National Forest toward the southwest. Its service territory toward the east, north, and south are sparsely wooded and mostly surrounded by open space consisting of gentle rolling hills predominately made up of farmland (Figure 8), the majority of which are orchards and vineyards.

Detailed USGS topographical maps of the area can be found in Appendix B. Because of the region’s western forested condition, the overgrowth of trees and ladder fuels needed to support fires are very prevalent.



Figure 8: Google Earth 3D View from I-5 Towards South Direction

3.3 Fire History

Knowing locations of higher risk and the probable causes of fires is important in developing awareness, prevention, and mitigation. According to the Oregon Department of Fire, 71% of fires recorded in Oregon are human-caused. Many of these fires are near populated areas, where fire suppression assistance is available in a timely manner. Lightning caused fires are about 29% of fire starts but tend to have more damage as they are often located in rural areas. Figure 9 illustrates the number of fire ignitions and their associated locations from 2008 to 2019 in the proximate area of the City of Ashland. There were 17 fires within the City’s service territory in that period. None of them were considered large wildfires (>250 acres in one fire that is classified as a wildfire threat) and all of these fires were human-caused. During the same time period, Jackson County had approximately 2200 fires (Figure 10) with about 40% being caused by lightning, and more than 130,000 acres of trees were affected. The fires outside of the service territory could spread into the City’s proximity quickly due to the density and continuity of the wooded area. It is important that the City collaborate with Jackson County on wildfire mitigation.

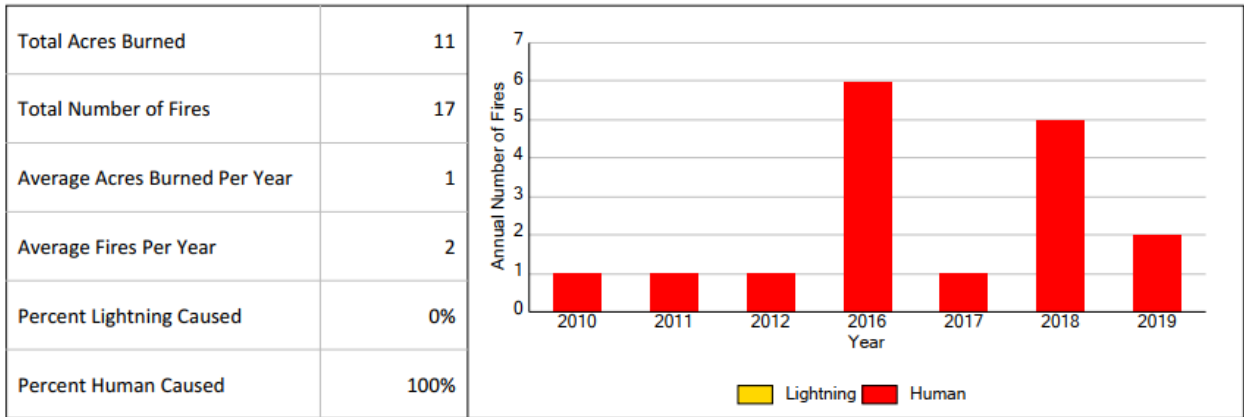
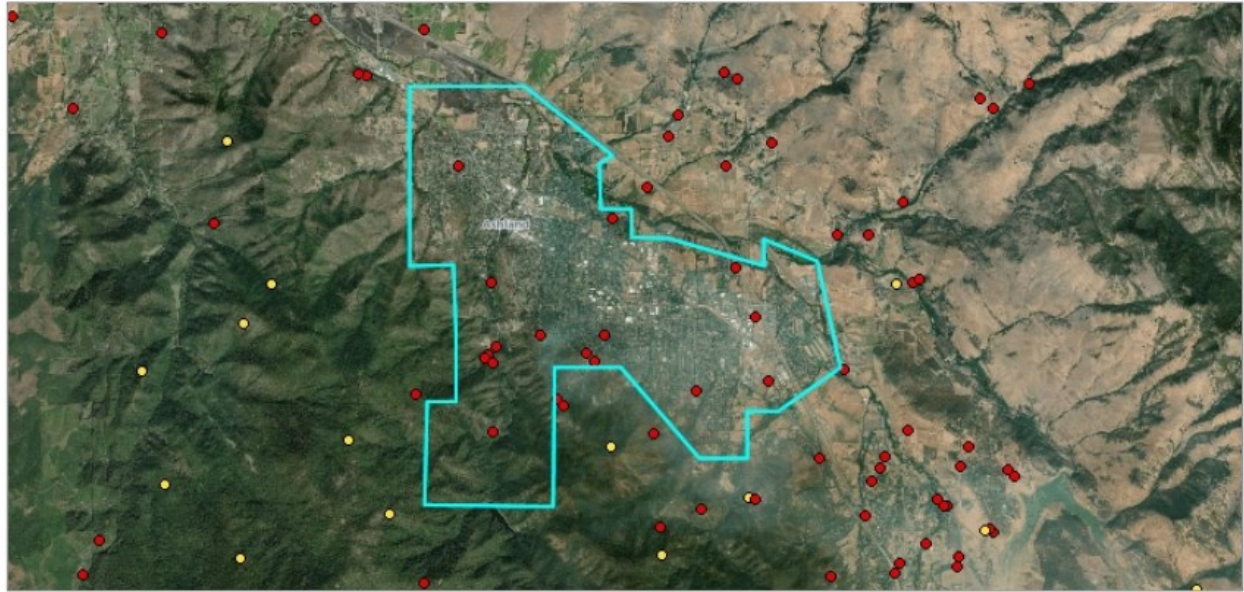


Figure 9: Ashland - Number and Location of Fire Ignitions From 2008 to 2019
 [Source: Appendix A “Oregon Wildfire Risk Explorer- Advanced Report - Ashland”]

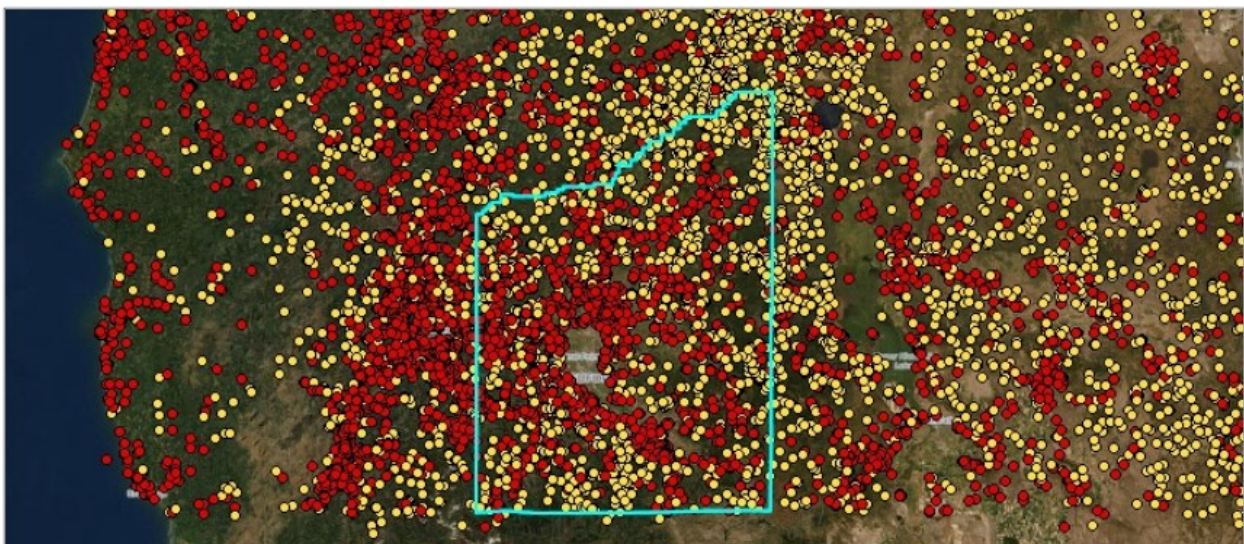


Figure 10: Jackson County - Number and Location of Fire Ignitions From 2008 to 2019
 [Source: https://tools.oregonexplorer.info/oe_htmlviewer/index.html?viewer=wildfireplanning]

3.4 Vegetation

Vegetation has important influences on potential wildfire behavior and understanding the dominant vegetation type in an area is helpful in understanding the corresponding historical fire regime, which is the pattern, frequency, and intensity of the bushfires and wildfires that prevail in an area over long periods. Within the area of interest (Figure 11), 22% of the vegetation is conifer and located in the southwest of the area; 11% of the vegetation is agricultural and mostly located in the north of the area. The tree coverage outside of the service territory to the south and west directions is heavy. The vegetation type is one of the impacting factors in wildfire risks and fuel models. It forms the fire-carrying materials that make up surface fuels. Detailed fire model groups for this area can be found in Appendix A.

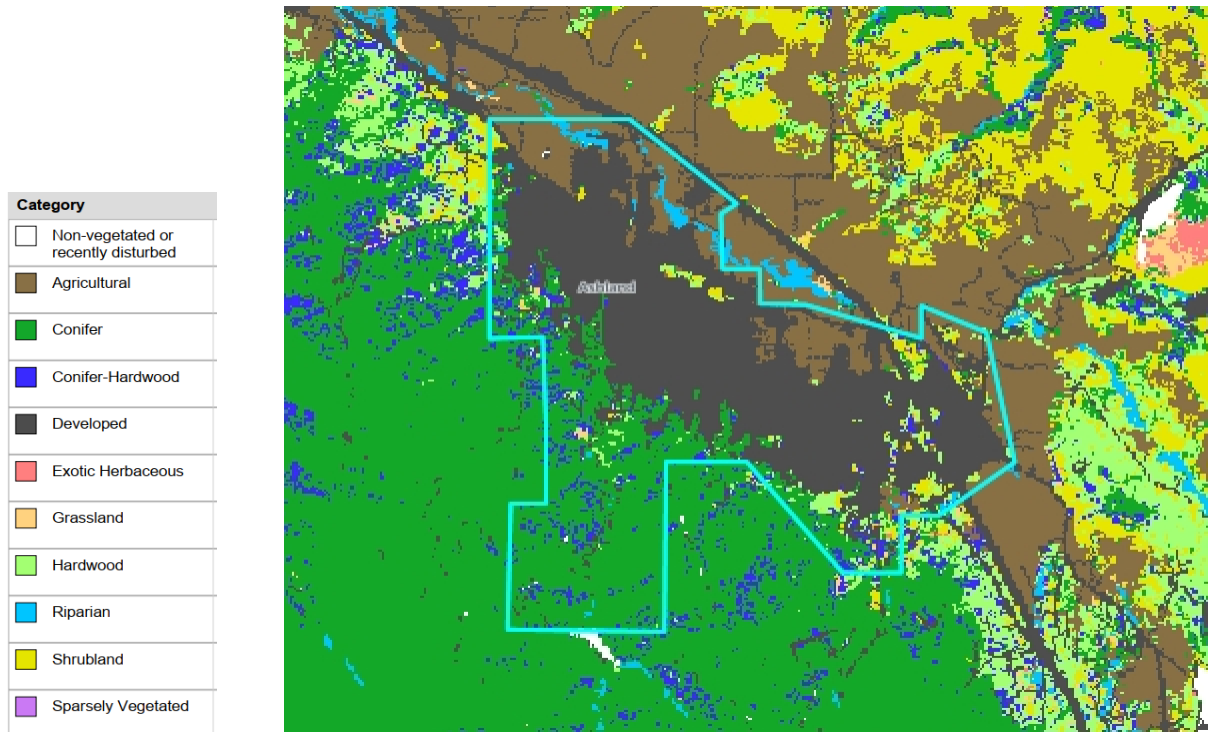


Figure 11: Ashland - Vegetation Types [Source: Appendix A]

3.5 Housing Density

Population density or housing density is one of the major concerns when assessing wildfire risk. It is especially critical in areas where houses and other developments meet or mix with undeveloped natural areas, for example in locations where houses and infrastructure are close to flammable wildland vegetation. Within the area of interest for this wildfire mitigation plan, the majority of the houses and populations are located in or near the Ashland city limits with an average household size is about 2.1 persons.

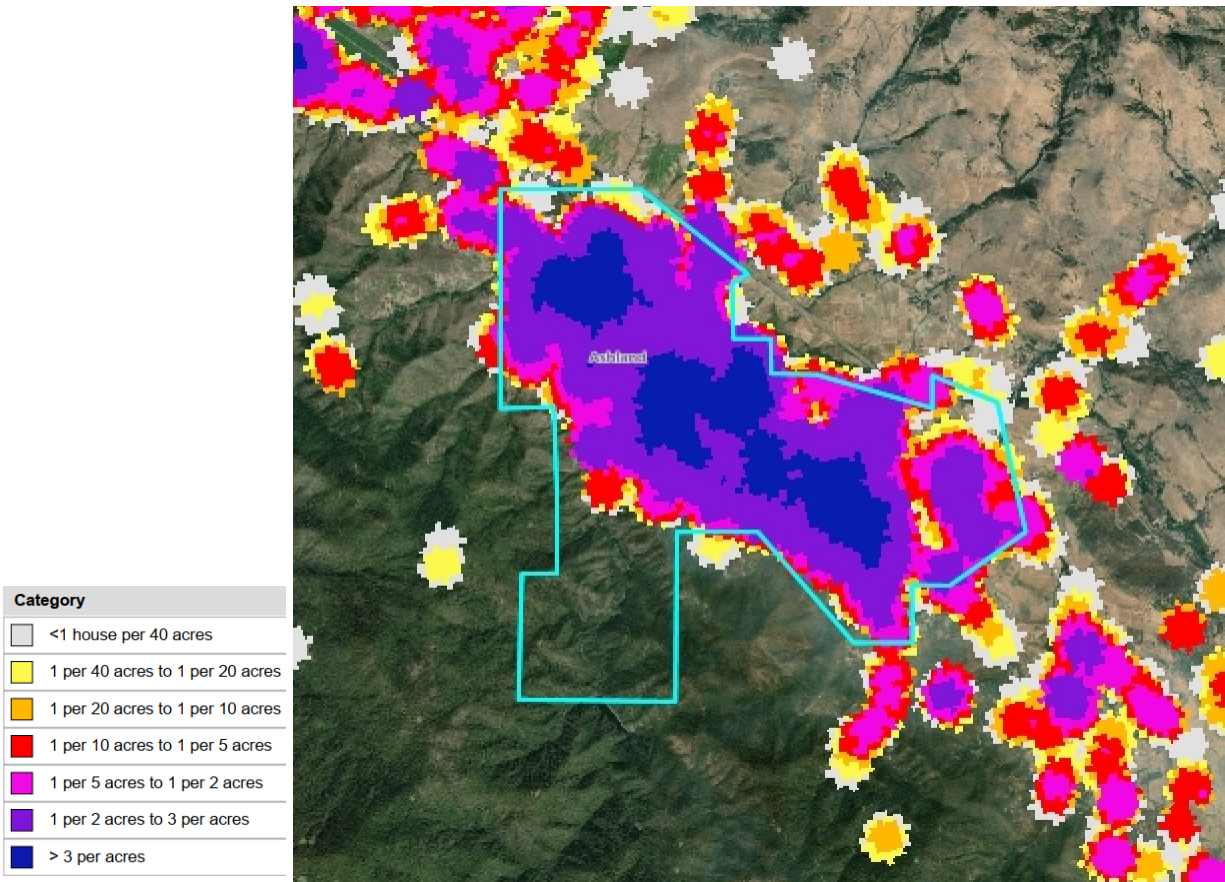


Figure 12: Ashland - Housing Density [Source: Appendix A]

3.6 Wildfire Risk Evaluation

As discussed previously the overall wildfire risk depends on both the exposure and susceptibility of valued resources and assets combined and the likelihood of a wildfire. The OWRE database provides information about the wildfire's potential impact on people and property, as well as critical infrastructures in this area.

3.6.1 Potential Impact

Potential Impact information classifies exposure and susceptibility only and does not include the possibility of an area burning. As can be seen in the legend, the data values reflect a range of impacts from very high to low negative consequences. Positive benefits of wildfire are not included assuming that any impact of wildfire on people's assets and infrastructure is negative.

Figure 13 illustrates wildfire's potential impact or consequence of wildfire on people and property including housing unit density and USFS private inholdings. Considering that the City's core urban area is more of a controlled environment covered by the City's Fire Department and Emergency Operations Plan, the wildfire's potential impact on the urban area is not shown. In the outskirts of the City where residential development transits to the area with more vegetation coverage (a.k.a., wildland-urban interface), the fire impact tends to be higher.

Figure 14 represents the exposure or consequence of wildfire on highly valued infrastructure, developed recreation, housing unit density, orchards, and historic structures. In this area, most of the highly valued infrastructure (i.e., freeway, transmission line, gas pipeline, etc.) is located north of the City.

Category	Description
Very High	Wildfire risk is very highly negative to people and property (top 5%).
High	Wildfire risk is highly negative (80-95th percentile).
Moderate	Wildfire risk is moderately negative (50-80 percentile).
Low	Wildfire risk is slightly negative (0-50 percentile).
No Data	There are no highly valued resources or assets mapped in the area, or it is considered non-burnable.

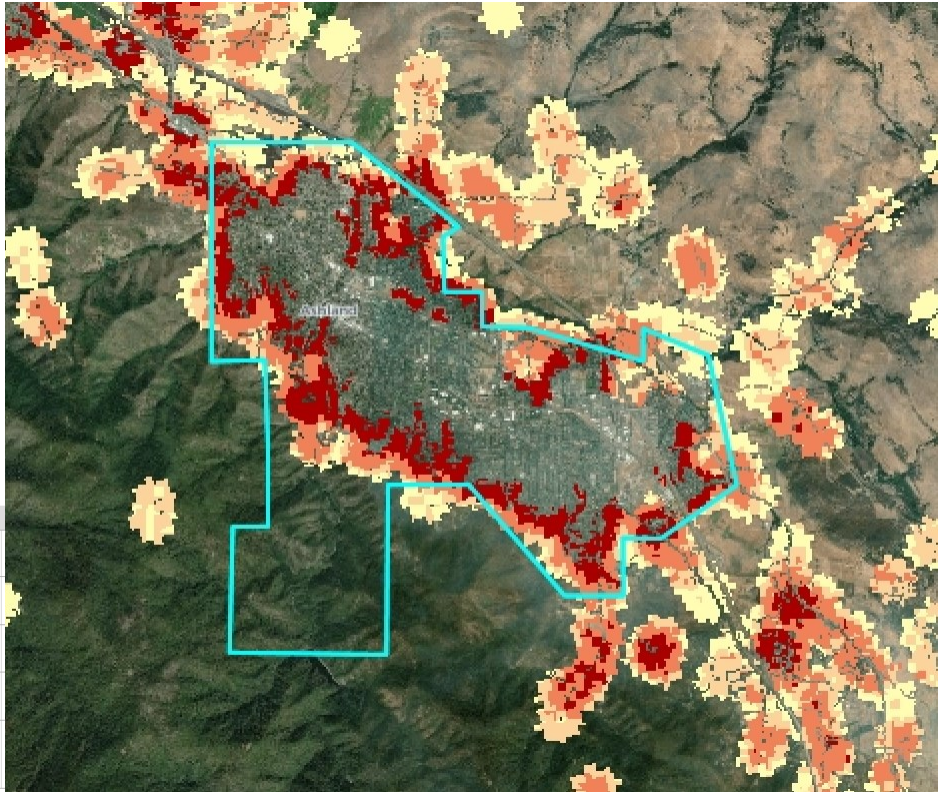


Figure 13: Ashland - Wildfire Potential Impact on People and Property [Source: Appendix A]

Category	Description
Very High	Potential impact is very highly negative (top 5%).
High	Potential impact is highly negative (80-95th percentile).
Moderate	Potential impact is moderately negative (50-80th percentile).
Low	Potential impact is slightly negative (0-50th percentile).
No Data	There is no infrastructure mapped in the area or it is considered non-burnable (urban, agriculture, barren, etc.).



Figure 14: Ashland - Potential Impact on Infrastructure [Source: Appendix A]

3.6.2 Burn Probability

Burn probability, as indicated in Figure 15, shows the annual possibility of occurrence of a wildfire greater than 250 acres in size, and considers various factors including weather, topography, fire history, and fuels (vegetation). Only large wildfires are considered because they have the most impact on the landscape. Smaller fires have a low influence on the broader landscape, but they can have significant impacts in areas with human activity and infrastructure. In this area, the majority of the fire occurrences in the past 10 years are less than 250 acres, and the burn probability is considered High in the wooded area south and west of the City.

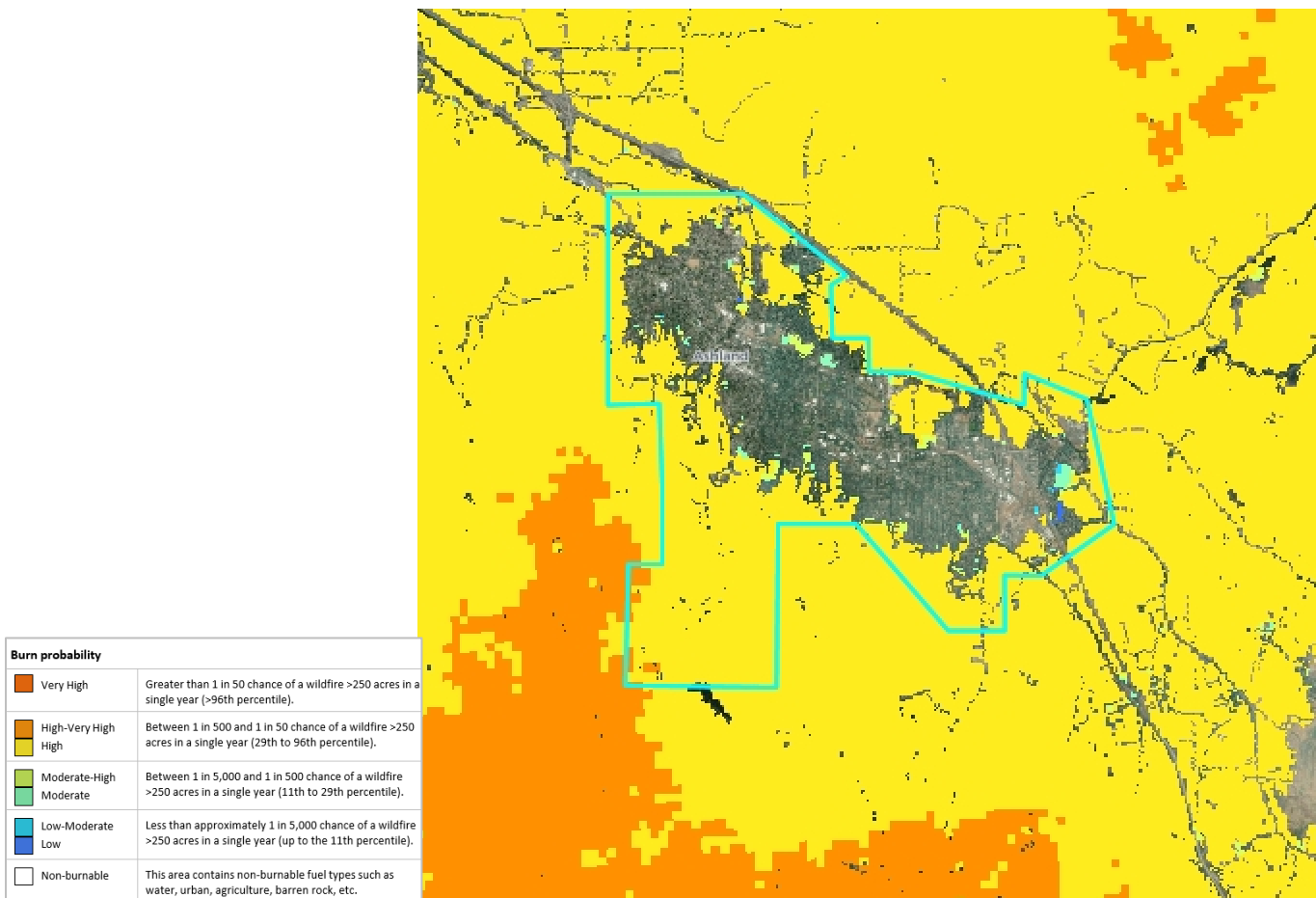


Figure 15: Ashland - Burn Probability or Likelihood of Large Wildfire [Source: Appendix A]

3.6.3 Overall Wildfire Risk

Figure 16 shows the overall wildfire risk, which combines both the probability of a wildfire and the expected impacts of a wildfire on highly valued resources and assets. Overall wildfire risk also reflects the susceptibility of resources and assets to wildfires of different intensities and the likelihood of those intensities. As indicated, the High and Very High wildfire risk areas are located around the borders of the core city area toward the south and west with residential development mixed with tree coverage, as well as the areas that have highly valued infrastructures, such as I-5 and the transmission lines in the northeast direction. The rest of the areas are classified primarily as Moderate or Low risks.

There are many areas in Jackson County that are classified as High and Very High risks. Fire can spread quickly during dry, hot, and windy weather. It is recommended that the City not only monitors the wildfire conditions within the service area but also in the surrounding areas and performs the mitigation as a collaborative effort.

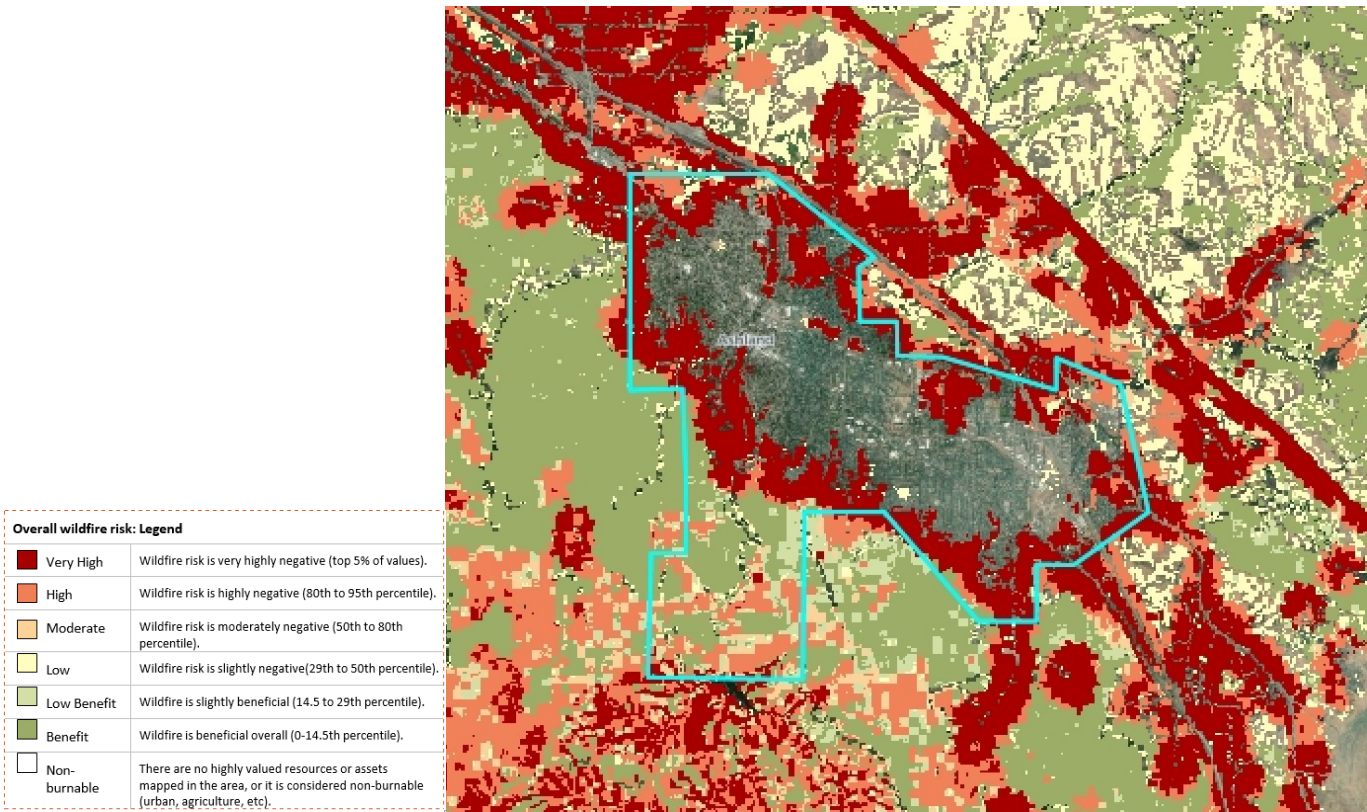


Figure 16: Ashland - Overall Wildfire Risk [Source: Appendix A]

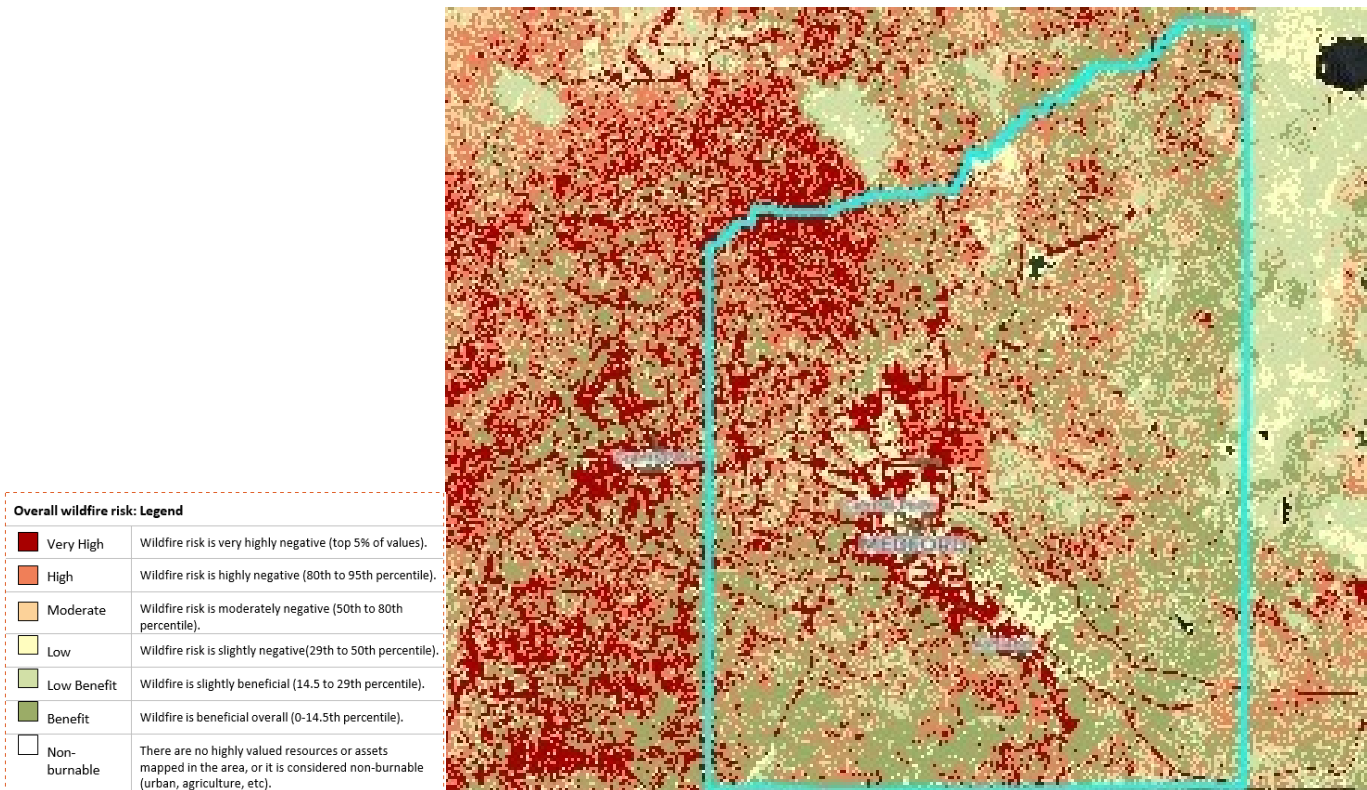


Figure 17: Jackson County - Overall Wildfire Risk [Source: https://tools.oregonexplorer.info/oe_htmlviewer/index.html?viewer=wildfireplanning]

SECTION 4: WILDFIRE MITIGATION STRATEGIES

The ultimate goal of the development and implementation of a wildfire mitigation plan is to protect people’s life, property, infrastructure, and resources within and around the City’s service area by reducing wildfire risk. The City can work towards this goal through the following perspectives.

- Minimize the source of the ignition while reducing or at least managing the fuel (vegetation) for the high-risk areas. This will require a series of wildfire mitigation strategies, which are built upon various asset management programs, vegetation management programs, equipment condition evaluation and upgrades, etc. to maintain a more safe, reliable, and resilient electrical system from the perspective of wildfire risk mitigation. These strategies will help not only reduce the number of wildfires caused by electric systems, but also prevent the spread of wildfires.
- React rapidly when electrical faults or fires occur by improved situational awareness, operational readiness, public safety power shutoffs, communication, crew training, etc. to minimize fault or fire duration. Interact with other emergency management agencies within and near the City’s service area to consolidate the City’s emergency response to wildfires.
- Maintain the developed wildfire mitigation plan. The plan should be evaluated and updated periodically regarding its effectiveness, and new industry practices and technologies that provide better risk reduction should be evaluated and added to the plan when necessary. This will help ensure the wildfire mitigation plan remains relevant and effective.

This wildfire mitigation plan defines the City’s strategies for reducing fire risk such as situational awareness, defining a fire precautionary season, asset inspection and maintenance programs, system improvement plans, vegetation management, operational practices (e.g., reclosing relay setting protocols, restoration of service), and public safety power shutoff plans. These strategies can be organized in a hierarchical structure, as shown in Figure 18, with consideration for both the effectiveness and relative cost and impact of each strategy. Public Safety Power Shutoff is considered the last resort due to its disruptive impact. Detailed costs should be evaluated by the City depending on specific activities the City elects to perform. Additionally, the plan outlines roles and responsibilities for its implementation, performance metrics, deficiency identification, and an audit process.

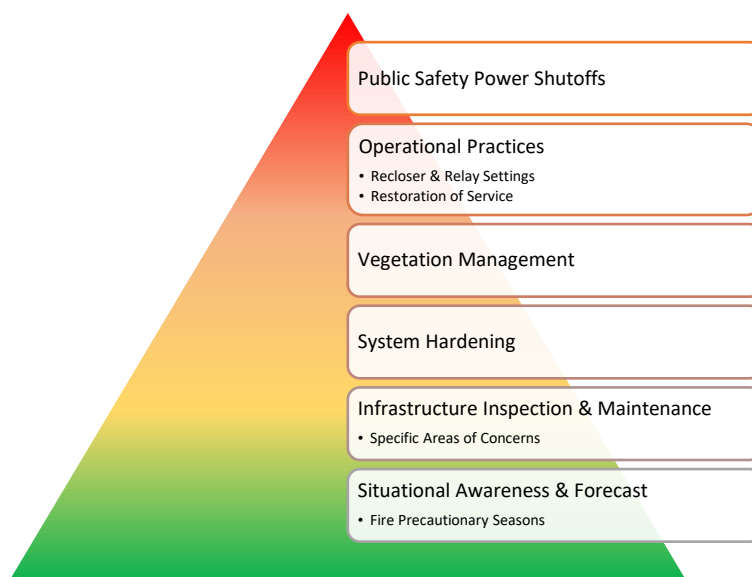


Figure 18: Wildfire Mitigation Strategy Hierarchy

4.1 Situational Awareness and Forecast

May is Wildfire Awareness Month in Oregon. The City's Electric Department utilizes various operational and situational awareness means to determine when de-energization or alternative operational practices are appropriate. These situations include:

- Weather data such as wind speed, wind direction, air temperature, barometric pressure, and relative humidity.
- City's SCADA system, and Camera Monitoring System
- Oregon Wildfire Response & Recovery
- Oregon Real-time Wildfire Mapping
- US Forest Service – Wildland Fire Assessment System.
- Red Flag Warning Map
- National Weather Service
- National Oceanic and Atmospheric Administration, Fire Weather Outlook

Fire Precautionary Season

Historically, southwest Oregon's fire season occurs between July and September, with mid-August to late-September producing the most vulnerable conditions for elevated fire risk. This wildfire mitigation plan considers the Fire Precautionary season to range from April 1st to November 1st of any year.

During the Fire Precautionary Season the City's Electric Department crews shall:

- Observe the requirements of the wildfire mitigation plan to patrol and prevent fires caused by vegetation management activities.
- Take steps necessary to ensure employees and subcontractors prevent ignitions directly or indirectly during work activities.
- Permit and assist with periodic testing and inspection of required fire equipment, and ensure any required compliance with specific fire precautionary measures of the wildfire mitigation plan prior to beginning operations during the Fire Precautionary Season. Ensure certification is updated when operations change.
- All fuel storage, service, and parking areas shall be cleared of flammable materials and debris within a radius of 15-feet unless otherwise specified.

4.2 Infrastructure Inspections and Maintenance

The City's Electric Department performs periodic inspections on its distribution facilities, which have an essential role in wildfire prevention. In recognition of the hazards possible from equipment that operates high voltage lines, the City maintains a formal inspection and maintenance program for distribution and switch station equipment. It currently patrols the system regularly and has increased the frequency of inspections in high-risk areas.

Service Area Concerns

Several areas of the City's circuits toward the western outskirts of town (Wildland-Urban Interface areas as shown in Figure 19) are constructed along heavily wooded regions that are susceptible to fire concerns. The electric system does have circuitry that enters these wooded areas served by the feeders noted below and adjacent to the following streets:

- N. Main Feeder – Thorton Way, Wright Creek Drive, and Westwood Street.

- Business Feeder – Strawberry Lane and Granite Street.
- Morton Feeder – Glenview Drive and Ash Loop Road.
- S. Mountain Feeder – Morton Street.

These areas and connecting tap streets are exposed to higher elevations and forested terrain. In addition, the City owns an overhead 'backup' three-phase circuit that extends 1 mile along Water Treatment Plant Road toward the west to the water treatment plant, which is normally de-energized but could be placed in service if needed.

These areas of wildfire potential can be minimized with the installation of weather monitoring and sectionalizing devices where circuits enter heavily wooded areas.

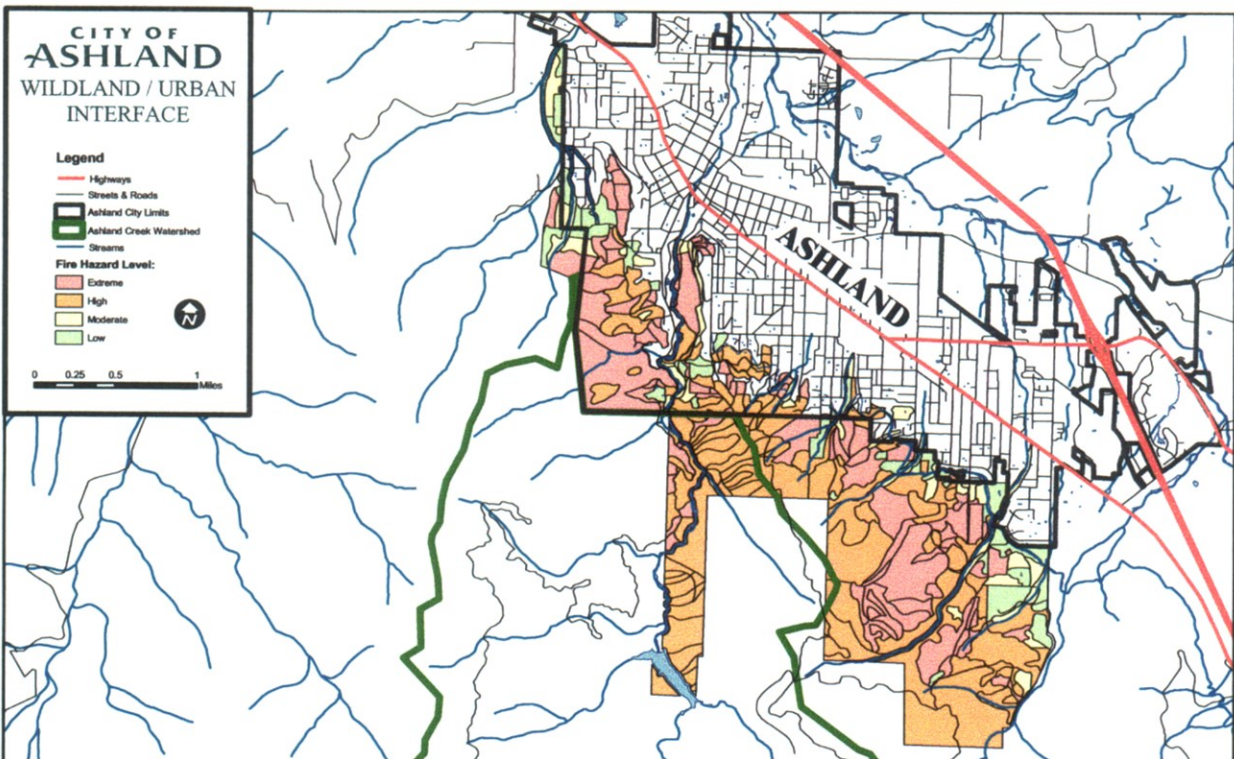


Figure 19: City of Ashland Wildland Urban Interface and Fire Hazard Zones – v2002 [Source: <https://www.ashland.or.us/Files/Ashland%20Wildland%20Urban%20Interface%20Analysis,%20Hazards,%20and%20Opportunities.pdf>]

Inspections and Maintenance Schedule

The following table outlines inspection practices for the Electric Department. It summarizes the inspection schedule for all assets and provides inspection requirements for electric facilities. The schedule requires that an operator of electric facilities:

- Construct, operate, and maintain its facilities in compliance with the NERC, OPUC, OAR, and ORS wildfire mitigation rules.
- Conduct detailed inspections of its overhead facilities to identify violations of the safety rules.

Table 2: Asset Inspection Schedule

INFRASTRUCTURE ASSET	INSPECTION TYPE	INSPECTION FREQUENCY
Overhead Distribution	Safety Patrol Inspection	Every 2 years
	Detail Inspection	Once every 5 years
	Intrusive Pole Test	Every 10 years
Underground Distribution	Safety Patrol Inspection	Every 2 years
	Detail Inspection	Once every 5 years
Substations	Detail Inspections	Monthly

NOTES:

- 1.) Safety Patrol Inspections: consist of visual inspections of structures and equipment intended to discover any obvious physical problems and safety hazard concerns and can occur at the frequency noted above or during other electric department activities.
- 2.) Detailed Inspections: consist of careful examination of individual structures and equipment using specific site inspection tables, including device diagnostic testing as appropriate.
- 3.) Intrusive Pole Testing: consists of excavation and inspection of pole base to a depth of 18", inspections of pole exterior for decay and sound, and bore testing to determine voids with treatment to prolong life as appropriate.

4.3 System Hardening

The City’s Electric Department has already begun to take measures toward system hardening of the electric facilities. These measures include system inspections, 10-year system planning study for upgrades (https://www.ashland.or.us/SIB/files/Administration/Electric_10_yr_study_2014.pdf), fault response, protective device coordination, and the implementation of fire-resistive treatments and equipment installations.

The following fire mitigation measures have been recently performed by the Electric Department toward the implementation of a wildfire mitigation plan:

- Because of the Electric Department’s awareness of fire risk potential through the use of expulsion fuses, the department has begun to change out expulsion fuses with current-limiting fuses (CLF) replacements in their west and southwest service territory. Expulsion fuses are not a good choice in areas that have high fire risks, and non-expulsion fuses or current-limiting fuses (CLF) are recommended replacements. The electric department should continue to install CLF fuses with installation concentrated on overhead three-phase and single-phase circuit taps that extend west into heavily wooded areas.
- Due to the potential fire risk that can result from wood cross-arms the Electric Department has begun the installation of fiberglass cross-arms and extensions to eliminate the potential of components prone to fire. This practice should be continued especially in heavily wooded areas.
- Due to the potential fire risk that can result from squirrel contact created faulted conditions, the Electric Department has begun the installation of protective squirrel guards to eliminate this potential cause of fire. This practice should be continued especially in heavily wooded areas.

The Electric Department may want to consider the following fire mitigation measures to aid in expanding their approach toward greater implementation of a wildfire mitigation plan:

- The installation of wildfire detection devices at specific locations, such as substations and on poles situated in areas that could be prone to wildfires. These unmanned devices continuously monitor the surrounding area, and ensure fast wildfire detection and notification, including weather data. They support both cellular and satellite communications and can be solar-powered. One such device is the Lindsey Firebird System.

- The Electric Department may want to investigate inserting a screen within the SCADA system that has access to the City's multiple monitoring cameras for fire notification and possibly to initiate an alarm if smoke or fire activity is noticed.
- The Electric Department may want to investigate the ability to upgrade the SCADA system to include control of the substation and field recloser. During initial installation remote control was inhibited until the department was comfortable with use of the SCADA systems. Implementing control would allow the department to initiate fast remote changes, such as changing settings, eliminating reclosing, or tripping open a circuit.
- The Electric Department may want to investigate the ability to install smoke/fire detection monitoring cameras with alarm capability at the northern water reservoir located at 201 Hitt Road, and the southern water reservoir located at 1511 Toleman Creek Road. Once installed, alarming and possibly monitoring should be integrated into the SCADA system.
- The installation of compact modular reclosers, breakers, or self-resetting vacu-fuse interrupters on three-phase and single-phase feeders that have circuits extending into wooded areas or beyond the city limits and/or in areas where the line crosses farmland or orchards. Example products are presented in Appendix D. These additional devices would allow one-shot operation in areas of high risk while allowing the more reliable reclose operation to continue for the remainder of the circuit not located in high-risk areas.
- The Electric Department uses both Type T and K expulsion style fuses for tap line protection and transformer protection. They are typical protective fusing for distribution systems. Expulsion fuses are fire-safe per the manufacturers' catalog. However, their primary characteristic is that they are vented devices in which, after their fuse element melts and arcs, the expulsion effect of the gases produced by the interaction of the arc with other parts of the fuse results in the current interruption in the circuit. The molten metal combined with ventilated gas could be a source of ignition for fire. These fuses are not a good choice in areas that have high fire risks. Non-expulsion fuses or current-limiting fuses (CLF) are recommended in the high-risk area. **Note:** for large and rural electrical systems, the current-limiting feature of the CLF may not be triggered due to low fault currents, but the non-expulsion feature is what provides the most benefit with regard to wildfire mitigation and the City should continue with its strategic installation.
- The installation of surge arresters with an arc protection system to eliminate the potential of molten metal ignition on ground cover in areas prone to wildfires.
- The application of an intumescent coating at the base of wood poles in areas prone to potential fire hazards. Such as Genics Cobra™ SHIELD II a versatile and effective wood pole fire retardant product. The intumescent coating reacts to the fire or heat by expanding many times the original dry thickness limiting heat and oxygen to wood pole surfaces.
- The installation of flame retardant (FR) insulators on all new distribution construction. The insulators selected, such as Hendrix FR, should be tested in accordance with UL 94.
- Ensure that line construction conforms with NESC required component grade strengths and standards.
- Ensure that line construction conforms with NESC clearances and right-of-way requirements.
- In heavily wooded areas, and in particular areas with overhead exposed conductors passing through areas of very high risk as indicated in Figure 16, the City should consider undergrounding the primary conductor or installing insulated 'tree-wire' and 'transformer riser wire' for primary, secondary, and transformer connections where limited right-of-way space is available to prevent contacts.
- Consider the use of fiberglass cross-arms. The utility industry offers a wide variety of fiberglass cross-arms with built-in UV and fire resiliency protection for power systems. These levels of protection significantly extend the cross-arms life in harsh environments and formulated resins give cross-arms a V-0 fire-resistant rating.

- Wood poles treated with preservatives remain the choice for most utilities, and there is no data available that compares the fire resistance of alternate galvanized steel, concrete, or fiber-reinforced poles. Poles of any material have wildfire risk minimized when vegetation is kept a safe distance away from the pole, regulations vary but maintaining 6-10 feet horizontal clearance around poles is suggested.

4.4 Vegetation Management

The City has an aggressive right-of-way vegetation management program, focusing on prevention of vegetation contact with overhead conductors and the reduction of fuel within the right-of-way in compliance with IEEE C2, *National Electrical Safety Code* (NESC), and the requirements for public safety and fire prevention per OPUC OAR 860.024.0016/0017. The approach consists of hand-cutting vegetation and dangerous trees in and along the outskirts edges of the right-of-way plus the application of herbicides to prevent re-growth. Crew personnel conduct right-of-way inspections annually and increase inspections during heavy growth seasons. This includes identifying vegetation and fire risk concerns during routine maintenance or service calls and taking corrective action.

Vegetation in proximity to power lines is trimmed with work performed to the noted guidelines to provide reasonable service continuity, public safety, and guard against forest fire damage caused by supply conductors. When conducting routine maintenance of power lines and equipment, Electric Department crews also identify and remove high-risk fuel sources, plus address vegetation concerns during routine service calls to remove at-risk vegetation.

The crews perform scheduled ground-based inspections of tree and conductor clearances and hazard tree identification to ensure all lines are inspected for vegetation hazards and trimmed on a regular 10-year timeline. The inspections target areas for vegetation pruning or removal to ensure compliance with state and federal regulatory requirements and standards in OAR 860-024. The objective is to achieve up to 10-feet of clearance during tree work, and includes vegetation removal from secondary voltage, service drops, and pole climbing space performed to conform with *the American National Standards Institute* (ANSI) A300 concepts and utility pruning.

4.5 Operational Practices

As fire season approaches each year, fire precaution levels increase. The City's Electric Department should adjust work practices and system operations accordingly. These adjustments are coordinated with Industrial Fire Precaution Levels (IFPL) and escalate with increasing wildfire danger. Some practices are intended to mitigate the risk of fire ignition and others are in place to control and extinguish any accidental fire before it grows out of control. During the Fire Precautionary Season the City's Electric Department crews shall:

- Comply with the wildfire mitigation plan requirements and responsibility for patrolling and preventing fires caused by vegetation activities.
- Ensure City employees and subcontractors prevent ignitions directly or indirectly during their work activities.
- Update certification tag with periodic testing and inspection of required fire equipment.
- Ensure equipment service areas, parking areas, gas/oil storage areas are cleared of flammable material for a safe radius of at least 10-feet.
- Coordination with other entities that work to minimize the possibility for the electric utility to cause a wildfire.

Proactive, day-to-day actions include safety training and involvement in emergency management planning. Measures to mitigate wildfire risks are taken to ensure preparedness in high-risk situations, such as dry and windy climatological conditions.

Recloser Operational Practices

There are circuit reclosers with reclosing relays on all City's distribution feeders. Reclosing helps keep the circuits energized after momentary faults and trip a circuit off-line when a permanent fault occurs. The City does not typically disable automatic reclosing functions at substations due to weather-related conditions. However, before line work or field operations work begins, reclosers are set to the 'one-shot' alternate setting (or Hot-Line Tag) to block the reclosing function. In addition, the configuration of a circuit determines the reclosing cycle. For example, for a fully undergrounded circuit, reclosing should not be enabled; while for a partially undergrounded circuit, the reclosing cycle is carefully set to provide proper protection for the circuit. Similar considerations apply if any feeder goes into a heavily wooded area.

In accordance with the wildfire mitigation plan, the City's Electric Department personnel will assess resetting reclosers serving high-risk areas to Hot-Line Tag mode when conditions suggest a potential for fire danger. By placing reclosers in Hot-Line Tag mode, they become sensitive to line disruptions and protect the system with rapid disconnect/de-energization of power lines. See additional discussion on this topic in Section 4.3 System Hardening.

Restoration of Service

After a fault the City's Electric Department shall not restore service until the area of trouble is fully patrolled, repaired or isolated, and tested by following the City's operation and maintenance procedures. The City should follow this same protocol in the event of a wildfire.

4.6 Public Safety Power Shutoffs

One of the most effective and highly scrutinized mitigation measures is the Public Safety Power Shutoff (PSPS). PSPS is the proactive de-energization of power lines that are forecasted to be in the path of critical fire weather conditions. For utilities that strive to provide reliable electric energy to customers 100% of the time, intentionally turning off the power is the last resort. However, removing these vulnerable lines from service eliminates the risk of ignition. While effective in protecting customers, first responders, and property, PSPS events are extremely disruptive to customers' lives.

Electric utilities are undertaking risk-based initiatives to limit the scope, duration, and frequency of PSPS events to minimize impacts. These initiatives include system hardening, installing additional sectionalizing devices, installing weather stations, high-definition cameras, and using data to predict high fire threat areas and areas of increased risk of fire spread.

This wildfire mitigation plan details the City's electric utility initiatives and activities for reducing the risks of its circuits and equipment from igniting wildfires in high fire risk areas of the utility service territory. These risks associated with equipment vary depending upon several factors: age and condition, population density (ingress and egress), surrounding climate, terrain and vegetation, voltage class, type of construction, and policies and regulations around land/forest management.

Newer technologies and increased data capture enable utilities to perform risk analysis at the asset level, allowing them to prioritize activities and develop initiatives for specific circuits and equipment. This provides for more effective and efficient mitigation.

PSPS is a recent development in the strategies used by electric utilities to help keep the public and communities safe. A PSPS proactively de-energizes power circuits during high wind events combined with hot and dry weather conditions. The City's Electric Department in consultation with the local Public Safety Providers will evaluate the value of a PSPS. When considering a PSPS, the City will also examine

the impacts on fire response, water supply, public safety, and emergency communications. In addition, the City will consider the external risks and potential consequences of a PSPS while striving to meet its main priority of protecting the communities it serves. These include:

- Potential loss of water supply to fight wildfires due to loss of power at wells and pumping facilities.
- Negative impacts on emergency response and public safety caused by power outages and disruptions to the internet and phone services.
- Loss of community infrastructure services that occurs during power outages.
- Medical emergencies for the community requiring powered medical equipment or refrigerated medication needs, plus the loss of air conditioning impact on medically vulnerable community.
- Negative impacts on medical facilities.
- Traffic disruption and congestion from de-energized areas resulting in reduced response times for emergency providers.
- Economic impacts on businesses due to closure during an outage.
- Inconveniences to community due to the loss of electric facilities during a wildfire event that can lead to injuries and fatalities.

The risks and potential consequences of initiating a PSPS are significant and extremely complex. Based on the considerations noted previously, the City reserves the option of implementing a PSPS when conditions dictate. While the City may consider the risks of implementing a PSPS outweigh the probability of its electric overhead distribution system igniting a catastrophic wildfire, the PSPS provides a fallback means option during a crisis.

On a case-by-case basis, the City's Electric Department has historically and will continue to consider de-energizing a portion of its system in response to public safety issues or in response to a request from outside emergency management agencies. If conditions on the ground indicate that a wildfire threat is imminent, the City has the authority to de-energize select distribution circuits. A decision is based on multiple initiations accompanied by the City's Electric Department's unique understanding, including any risks involved. The City relies on weather data from various sources, including the National Weather Service, NDFRS, and the City's weather station data. Criteria that can cause a potential to de-energize circuits include:

- Imminent fire danger
- Crucially dry vegetation that could serve as fuel for a wildfire
- High temperatures along with low humidity levels
- Red Flag Warning declaration by the National Weather Service
- Forecast high wind events in high-risk areas
- Agency Incident Command mandated fire orders
- City crew or other agency field staff on-the-ground observations
- Active wildfire in the service area

The Electric Department should advise customers that PSPS could occur without any action taken by the City, since power is purchased and transmitted over transmission lines owned by others. And the City shall continue to monitor the evolution of PSPS implementation in Oregon and the Northwest by other electric utilities to continue to refine its strategies for wildfire mitigation.

4.7 Roles and Responsibilities

The developed and adopted Wildfire Mitigation Plan should be reviewed and updated every five years to meet the updated code requirements and potentially improved system components or other technologies for reducing fire risk.

The City's Electrical Department is governed by the City Council and managed by the City Manager with daily operations handled by the Director of Electric and Operations Superintendent. City staff that has responsibilities for wildfire prevention activities include:

- **City Manager:** Assumes overall responsibility for the City's planning and mitigation activities, including maintaining compliance with state and federal safety and operating requirements. The City Manager is responsible to the City Mayor and governing council.
- **Director of Electric:** Responsible for the safe operation of the Electric Department's distribution system, equipment, and service.
 - The Director of Electric supervises the department's Electric Superintendent, Line Foreman and Line Crew and is primarily responsible for ensuring that all circuits and equipment are inspected and maintained.
 - The Director of Electric is also responsible for the reliable operation of the entire electric system, including all distribution equipment and switching facilities served by three substations.
 - The Director of Electric is responsible for safety programs, including wildfire prevention training, evaluation, and installation of new protective and system hardening equipment to reduce fire risk.
 - The Director of Electric maintains compliance with federal, state, and local fire management personnel to ensure that appropriate preventive measures are in place.

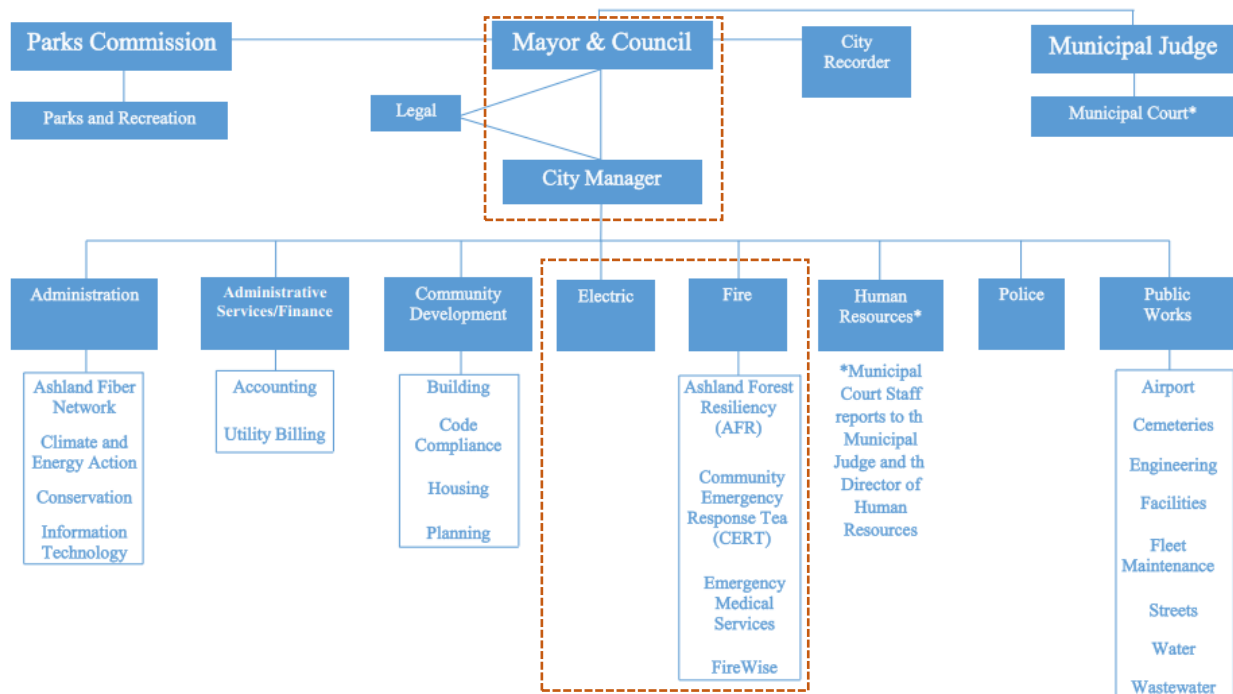


Figure 20: City of Ashland Organizational Chart

[Source: https://www.ashland.or.us/SIB/files/Administration/Handbook/Organizational_Chart.pdf]

4.8 Wildfire Mitigation Cycle

The process of reducing fire risk is a repeating process. To ensure the process is diligently executed and action items are completed the City Electric Department may want to organize a fire mitigation committee that meets periodically to complete a review of the mitigation cycle. Figure 21 shows a graphic of a possible mitigation cycle with each step defined as follows:

1. **Identify** – The areas of highest concern are identified by periodically reviewing environmental conditions and fire risk levels. For example, the risk graphic in Figure 13 can be used to identify areas with the highest overall wildfire risk. From this information, all areas of the electric department service territory can be given priority levels. The risk map should be updated any time OWRE makes an update that may affect areas in Ashlands territory.
2. **Evaluate** – Each area of elevated risk is evaluated for City electric resources that may contribute to the elevated risk and may need additional measures to reduce risk. The highest priority areas are addressed first and all areas are evaluated to identify City electric equipment that could contribute to fire risk.
3. **Mitigate** – For each area with elevated risk for which City electric equipment or systems may contribute to that risk, the mitigation strategies outlined in Section 4 should be considered. Each mitigation strategy is considered based on a balance of cost and risk reduction.
4. **Prioritize** – The risk reduction strategies are prioritized from most effective to least effective.
5. **Implement** – The strategies are implemented based on available resources and budget starting with the highest priority strategy.
6. **Review** – The implemented strategies are reviewed for effectiveness and the wildfire mitigation plan is updated based on lessons learned from each cycle.

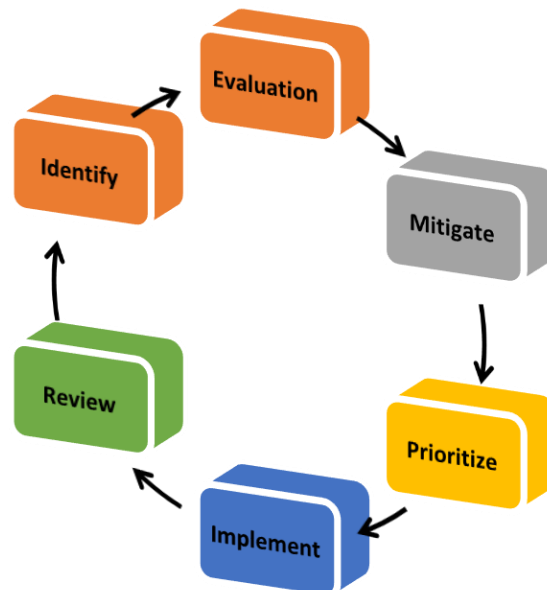


Figure 21: Wildfire Mitigation Step Cycle

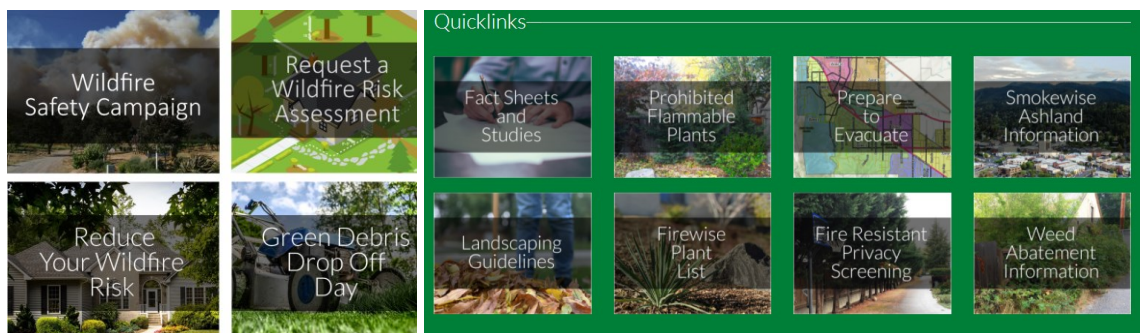
SECTION 5: PUBLIC AWARENESS

5.1 Public Awareness

As required by Section 2 of SB 762, OPUC shall convene periodic workshops for purposes of assisting electric companies, consumer-owned utilities, and operators of electrical distribution systems to develop and share best practices for mitigating wildfire risk. Meanwhile, it is significantly important for the City to be proactive in building and increasing public awareness of wildfire risk. This helps the City’s residents to better understand how to prepare for outages and wildfires and how to report an observed incident and/or potential hazard that can cause a fire.

The City currently has web pages for Electric Department and Fire Department, which contain useful information including the City zoning map (Figure 22), contact means, emergency management plans, home fire prevention, emergency evacuation zones & routes (Figure 23), etc. The City has developed brochures, training lectures & videos, and other interactive media to assist in public awareness of wildfire hazards and mitigation strategies. Major programs are listed below. These are also essential parts of a complete Wildfire Mitigation Plan.

- The City has established a Wildfire Safety Commission in 2014 that can ‘provide advice and support to the Council and City departments and education to the community on wildfire issues and plans for mitigation action. Specifically, the Commission will function as the entity to foster the efforts of the city of Ashland to adopt and achieve the goals set forth in the Fire Adapted Communities program.’
[Source: <https://www.ashland.or.us/CCBIndex.asp?CCBID=235>]
- The City has an alerting system, *Nixle*, that can be used to to alert city residents in real-time for emergency situations including fire and other community advisories such as power outages, street closures, etc. City residents have to sign up to receive these alerts via text message or cellphone applications.
[Source: <https://www.ashland.or.us/Page.asp?NavID=17635>]
- The City of Ashland has developed and adopted Wildfire Safety Ordinance that provides standards and restrictions for new development.
[Source: <https://www.ashland.or.us/Page.asp?NavID=17670>]
- The City has a Fire Adapted Communities program providing many useful resources to communities on how to prepare for wildfire, Firewise Communities, codes, and evacuation plans. The City’s Fire Department does not allow debris burning inside the city limits and through this Fire Adapted Ashland program the City has prepared Green Debris Drop-Off bins and arranged multiple annual free Green Debris Drop Off Days to remove & reduce the fuel from a potential wildfire.
[Source: <https://www.ashland.or.us/SectionIndex.asp?SectionID=539>]



- The City is proactive in planning for emergencies and has developed an *Emergency Operations Plan* for City emergency conditions
[Source: <https://www.ashland.or.us/Page.asp?NavID=16612>].

- The City also started a CERT-Disaster Preparedness program that provides training to volunteers, news, and emergency kit instructions to the communities.
[Source: <https://www.ashland.or.us/Page.asp?NavID=541>]
- The Ashland Forest Resiliency program is ‘working to create safer communities and healthier forests by using proactive wildfire planning and best practices for restoring a healthy forest in the Ashland watershed using ecological thinning and prescribed fire.’
[Source: <https://www.ashland.or.us/Sectionindex.asp?SectionID=503>]
- The City of Ashland is bordered by Jackson County Fire District No. 5 and by areas that are not receiving structural fire protection. Although the Oregon Department of Forestry provides wildland fire protection in these areas, they do not provide structural protection. The City of Ashland is a signatory along with all the other cities and fire protection districts of the Jackson/Josephine County Mutual Aid Agreement. The agreement provides for automatic and/or mutual assistance for structural and wildland protection within fire districts and cities, and for wildland protection in "unprotected" areas outside the boundaries of fire districts or cities. Unprotected areas receive wildfire protection from the Oregon Department of Forestry or federal agencies.
[Source: <https://www.ashland.or.us/Page.asp?NavID=13572>]
- In addition to the City’s emergency operations plan and programs, Jackson County has a separate Emergency Management program that provides useful resources about wildfire awareness, alerting system, preparation for wildfire and other hazards, evacuation plans, and emergency operations plan.
[Source: <https://jacksoncountyor.org/emergency/>]

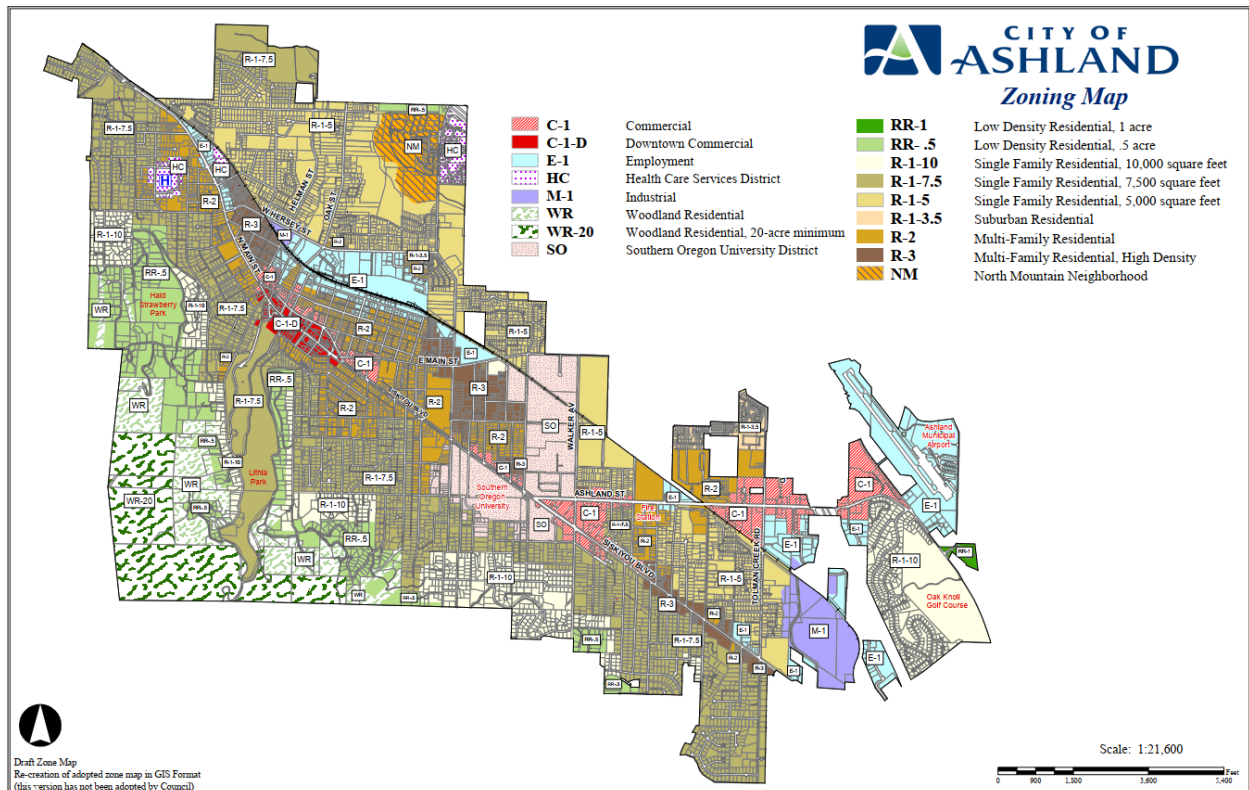


Figure 22: City of Ashland Zoning Map [Source: https://www.ashland.or.us/Files/Official_Zoning.pdf]

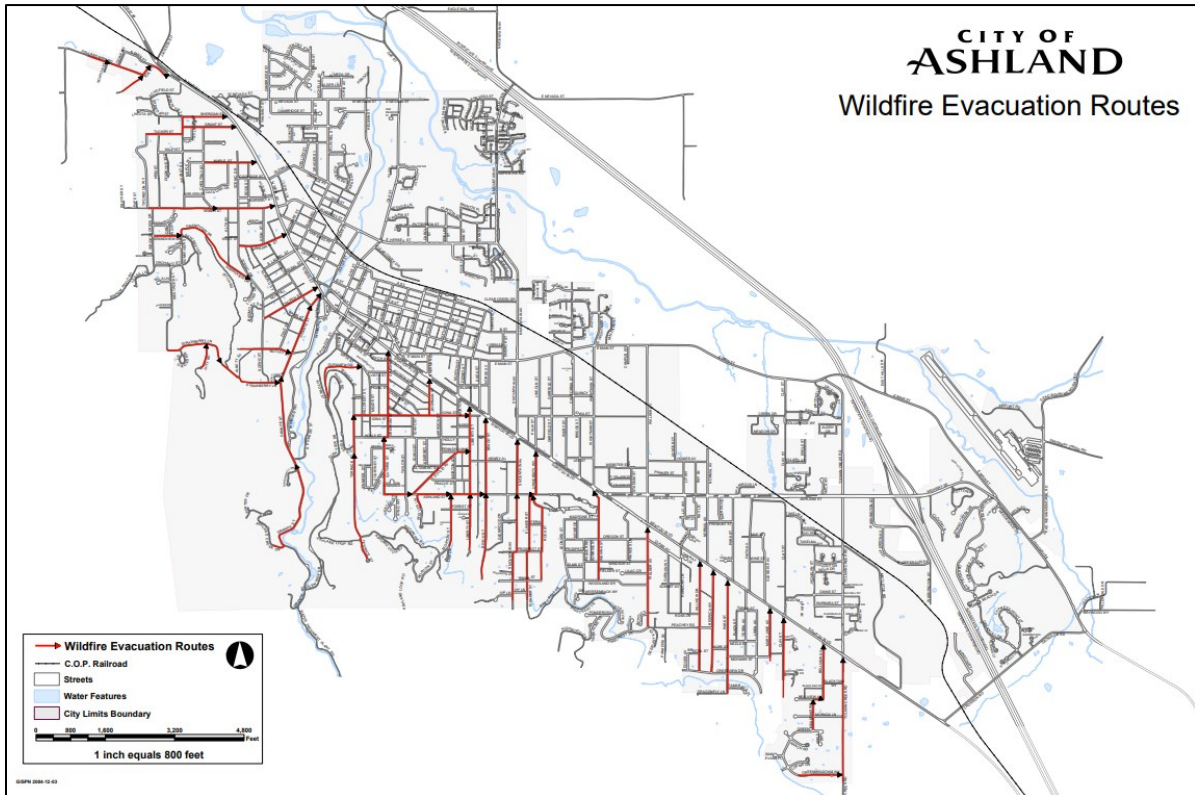
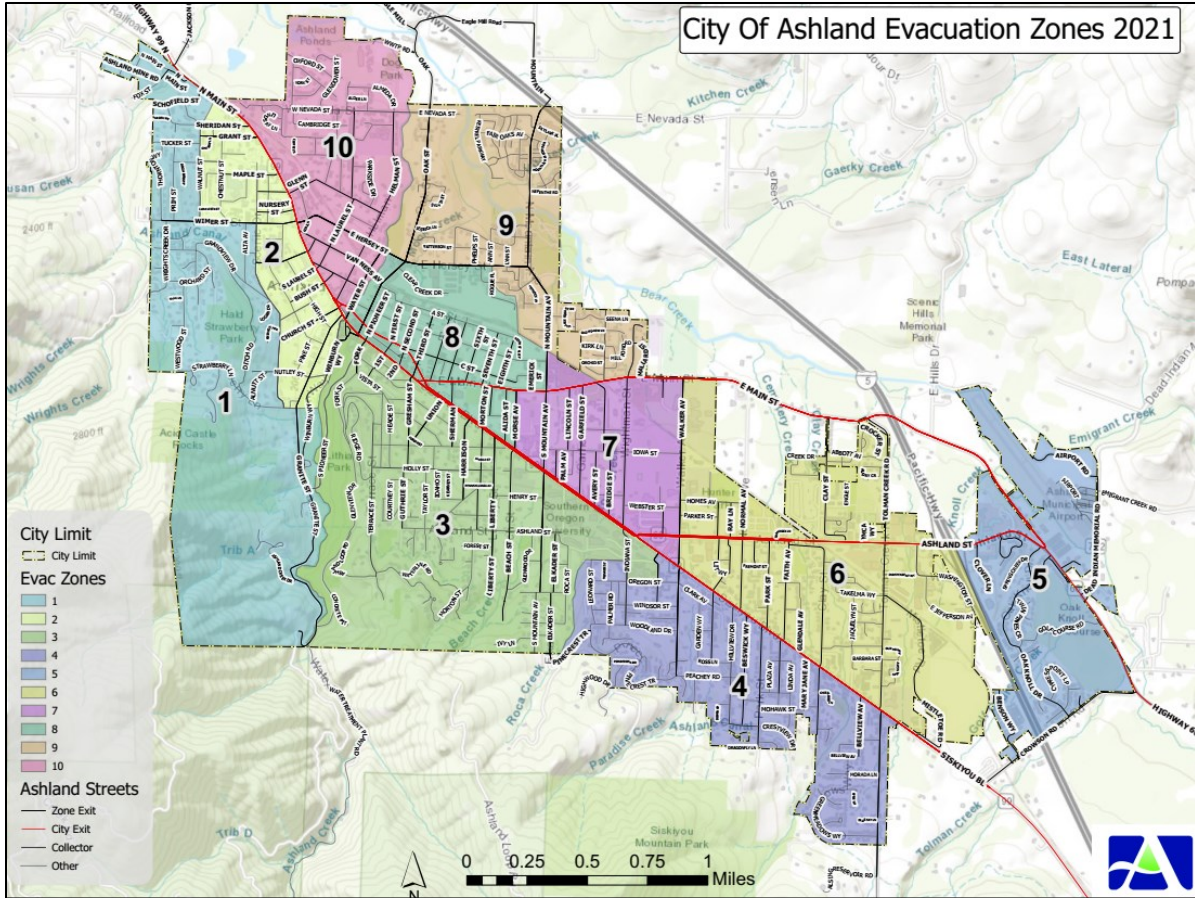


Figure 23: City of Ashland Emergency Evacuation Zones & Routes Agencies

[Source: <https://www.ashland.or.us/Page.asp?NavID=18126>, https://www.ashland.or.us/Files/Wildfire_Evac_Routes.pdf]

The City coordinates with local emergency response agencies and other relevant local and state agencies as affiliates. In response to emergency events, the City collaborates with the Oregon Department of Forestry and Jackson County Emergency Management to ensure effective communication and coordination.

5.1.1 Fire Report

The reporting of fires requires the City dispatch call 911 and then notify the fire department and if applicable the Forest Service of any fires in the operating area or along the roads used by the operators.

All fires must be reported as soon as possible to the personnel listed below.

- **Name:** City of Ashland Dispatch Center
Emergency Area: City and Rural Fire
Telephone: Emergency 911, non-emergency 541-488-2211 (Tighe O’Meara, Chief)
- **Name:** Jackson County Dispatch Center
Emergency Area: City and Rural Fire
Telephone: 541-774-6800 (Nathan Sickler, Sheriff)

When reporting a fire the Electric Departments crews or Contractors are to provide the following information:

Report A Fire			
Name:		Agency:	
Title:		Call-back Phone No.:	
Fire Location:			
Fire Information:	Including approximate acreage, rate of spread, and wind conditions.		

After the initial notification, the following list of emergency services should be notified of the wildfire event.

- **Agency:** Jackson County Emergency Management
Contact/Title: Emergency Manager
Telephone: 541-774-6035
Address: 10 S Oakdale 214 Medford, Oregon 97501

The City has adopted a policy of proactive planning and coordinating closely with local government, critical agencies, and first responders. The following list identifies key agencies and franchises in the service area that should receive fire danger notification:

Table 3: Key Agencies and Franchises in The Service Area

Stakeholder Group	Description
Critical Agencies	<ul style="list-style-type: none"> • Ashland School District, 541-482-2811 Superintendent Samuel Bogdanove, 541-482-2811 Ext. 1101 • Ashland Police Department Chief of Police, Tighe O’Meara, 541-488-2211 • Ashland City Hall, 541-488-6002 • Ashland, Public Works Department, Director, Scott Fleury, 541-488-5587 • Southern Oregon University Campus Public Safety, 541552-6258 • Ashland, Water Division, Director, Scott Fleury, 541-488-5353 • Ashland, Wildfire Information, Chris Chambers, Division Chief of Forestry Division, 541-552-2490 • Ashland, Fire Department, 541-482-2770 Fire Chief Ralph Sartain • Greensprings Ashland, Rural Fire Department 541-488-0911
Communications	<ul style="list-style-type: none"> • Telecommunication companies: Spectrum, 855-492-2475 Century Link, 844-749-1408 • Oregon Public Broadcasting Station, Ashland, OR 800-241-8123 • Local News KDRV-TV, Ashland OR 541-773-1212
First Responders	<ul style="list-style-type: none"> • USFS, Jackson, OR, 541-899-3880 • USFS, Ranger District, Ashland OR 541-522-2900 • Bureau Of Land Management, Medford, OR 541-618-2200
Local Government	<ul style="list-style-type: none"> • Ashland, OR, City Hall 541-488-5311 • Medford, OR, City Hall 541-774-2000
Utilities	<ul style="list-style-type: none"> • Ashland, Utilities Customer Service, Bryn Morrison, 541-488-6004 • Ashland, Electric Utility, Director, Thomas McBarlett, 541-488-5357 • Avista Natural Gas, 877-427-8326 • Pacific Power, 888-221-7070
Safety Councils	<ul style="list-style-type: none"> • Jackson County, Natural Hazard Mitigation Plan 541-774-6035 • SOU, Ashland Oregon, Natural Hazard Mitigation Plan 541-552-7672

SECTION 6: APPENDIX

6.1 Appendix A – Oregon Wildfire Risk Explorer- Advanced Report

Attached externally.

6.2 Appendix B – Ashland Terrain Map

Attached externally.

6.3 Appendix C – Substation One-Line Diagrams

Attached externally.

6.4 Appendix D – Reference Product Cut Sheets

Attached externally.



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



Generated: April 8, 2022

Weather and vegetation conditions vary daily and seasonally. For current conditions and local fire restrictions, contact your local fire district or visit: www.keeporegongreen.org/current-conditions

INTRODUCTION

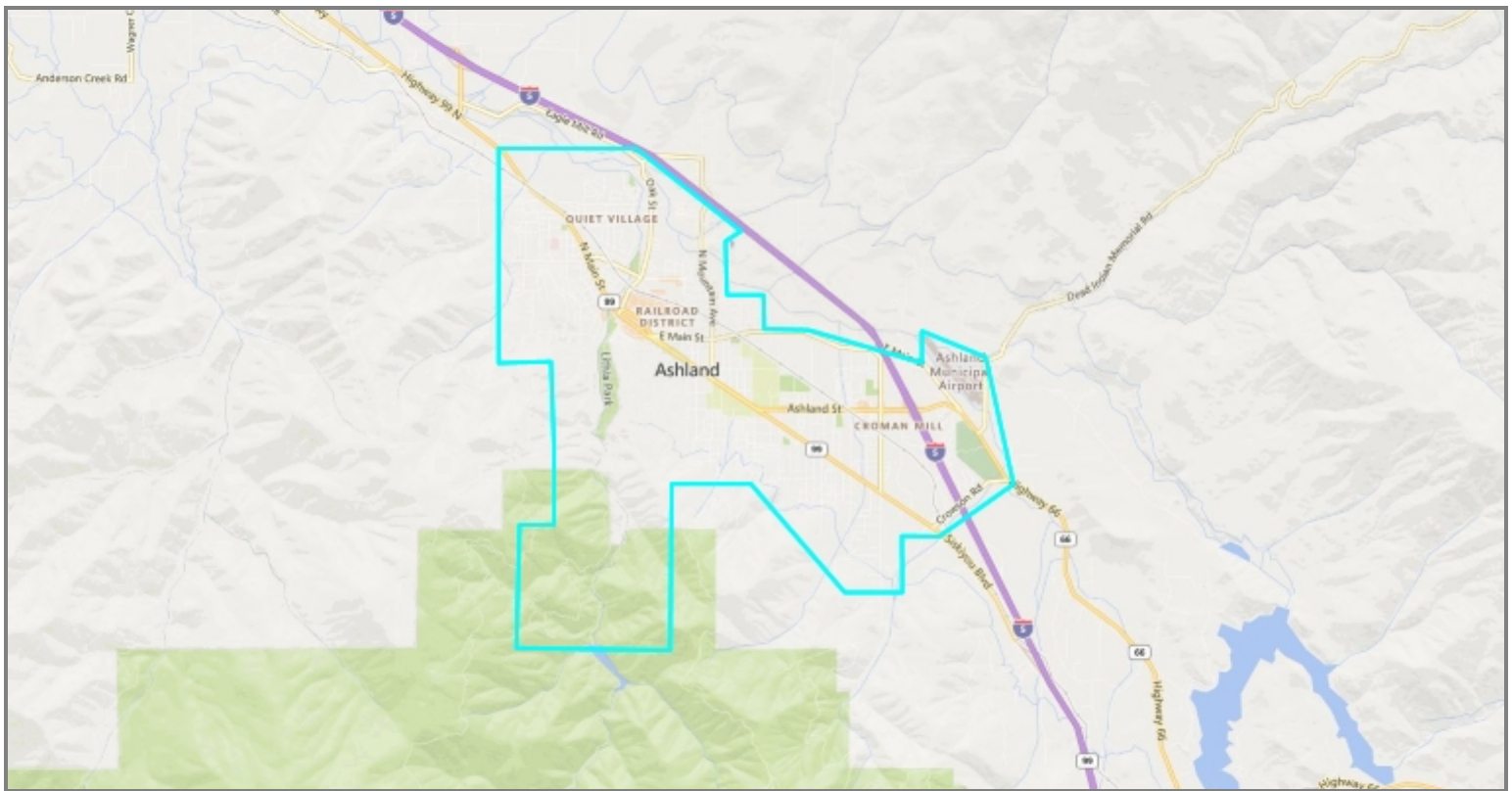
This report summarizes wildfire risk in **City of Ashland** from the [Advanced Oregon Wildfire Risk Explorer map viewer](#) (OWRE). Wildfire risk combines the likelihood of a fire occurring with the exposure and susceptibility of valued resources and assets on the landscape.

Nearly all areas in Oregon experience some level of wildfire risk. Conditions vary widely with local topography, fuels, and local weather, especially local winds. In all areas, under warm, dry, windy, and drought conditions, expect higher likelihood of fire starts, higher fire intensities, more ember activity, a wildfire more difficult to control, and more severe impacts.

City of Ashland in Oregon



City of Ashland Reference Map



REPORT CONTENTS

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3	Concepts	13	Fire Intensity - Flame Lengths	25	Potential Impact to People and Property
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GUIDELINES

The OWRE Advanced Report provides wildfire risk information for a customized area of interest to support Community Wildfire Protection Plans (CWPPs), Natural Hazard Mitigation Plans (NHMPs), and fuels reduction and restoration treatments in wildfire-prone areas in Oregon. Here are some things you need to know about this information:

The Advanced OWRE map viewer provides **wildfire risk assessment** data primarily from the 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, produced by the US Forest Service with a coalition of local fire managers, planners, and natural resource specialists in both Washington and Oregon. The assessment uses the most current data (incorporating 2017 fires) and state-of-the-art fire modeling techniques, and is the most up-to-date wildfire risk assessment for Oregon. The assessment characterizes risk of large wildfires (>250 acres). Data also comes from the 2013 West Wide Wildfire Risk Assessment, Oregon Department of Forestry (ODF), and other sources.

Wildfire risk is modeled at a landscape scale. The data does not show access for emergency response, home construction materials, characteristics of home ignition zones, or NFPA Firewise USA® principles. For CWPP and NHMP updates you may want to **consider two scales**:



- first, use data from the OWRE to characterize and understand the fire environment and fire history in your area broadly at a landscape scale, focusing on watersheds or counties;
- then, overlay local knowledge, focusing on communities, fire protection capabilities, local planning areas, and defensible space concepts for neighborhoods and homes.

The OWRE Advanced Report will provide the landscape context of the current fire environment and fire history upon which you can build your local plans toward resilience by preparing and mitigating the larger landscape wildfire risk.

The OWRE Advanced Map Viewer and Report will not replace local knowledge of communities you may consider high risk. Continue to use local Fire Department and ODF knowledge to generate CWPP concern areas. OWRE will produce broad scale maps for your CWPP area as a whole, but maps and data will contain some inaccuracies, which are most prevalent at fine scales.

Recommended additional information sources for wildfire planning:

- Oregon Department of Forestry CWPP list - <https://www.oregon.gov/ODF/Fire/Pages/CWPP.aspx>
- Oregon Explorer Communities Reporter - demographic and other data for counties and communities
<https://oe.oregonexplorer.info/rural/CommunitiesReporter/>
- Wildland Urban Interface Toolkit - https://www.usfa.fema.gov/wui_toolkit/wui_planning.html
- Wildland Urban Interface Wildfire Mitigation Desk Reference Guide -
<https://www.nwcg.gov/sites/default/files/publications/pms051.pdf>
- Oregon Spatial Data Library - <https://spatialdata.oregonexplorer.info/geoportal/>
- NFPA Firewise USA® - teaching people how to adapt to living with wildfire and encouraging neighbors to work together and take action to prevent losses. - <https://www.nfpa.org/Public-Education/By-topic/Wildfire/Firewise-USA>
- Headwaters Economics - Full Community Costs of Wildfire -
<https://headwaterseconomics.org/wildfire/homes-risk/full-community-costs-of-wildfire/>

This Advanced Wildfire Risk Report was generated from the Advanced Oregon Wildfire Risk Explorer map viewer at: tools.oregonexplorer.info/OE_HtmlViewer/index.html?viewer=wildfireplanning. This site is intended for wildfire professionals and planners. For a basic summary of wildfire risk geared toward a public audience, visit the basic OWRE map viewer: tools.oregonexplorer.info/OE_HtmlViewer/index.html?viewer=wildfire.



Oregon Wildfire Risk Explorer- Advanced Report

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WILDFIRE RISK ASSESSMENT CONCEPTS & DATA

The Advanced Oregon Wildfire Risk Explorer (OWRE) map viewer organizes data into folders based on wildfire risk concepts. All OWRE advanced reports will include information about Overall wildfire risk, Burn probability, Flame length, Overall potential impact, Hazard to potential structures, Fire history, Land management, and Estimated housing density. Users can select additional data layers of interest, which will appear after the layers listed above.

Wildfire Risk

Overall wildfire risk takes into account both the likelihood of a wildfire and the exposure and susceptibility of mapped valued resources and assets combined. The dataset considers (1) the likelihood of wildfire >250 acres (likelihood of burning), (2) the susceptibility of resources and assets to wildfire of different intensities, and (3) the likelihood of those intensities. Blank areas either have no currently mapped assets or resources and/or are considered a non-burnable fuel in terms of wildfire. Note that agricultural lands are considered non-burnable in this map, even though fires can occur in these areas and may spread into more typically considered burnable areas such as forested lands. Data layers include: Overall wildfire risk, Wildfire risk to assets, and Wildfire risk to people and property.

Wildfire Threat

Wildfire threat shows the likelihood of a large wildfire, the average intensity and the likelihood of higher intensities, conveyed by flame length. Data layers include: Burn probability, Average flame length, Probability of exceeding 4' flames, and Probability of exceeding 8' flames. Additional data layers that show wildfire threat are found under the Fire History and Active Fires folder, where historical fire starts and historical fire perimeters are located.



Wildfire Potential Impacts

Wildfire potential impacts shows the actual exposure of mapped resources and assets. The data layers do not incorporate the likelihood of burning, they only show the consequence of wildfire if it were to occur. Data layers include: Overall potential impact, Potential impact to people and property, Potential impact to infrastructure, Potential impact to timber resources, Potential impact to wildlife, and Potential impact to forest vegetation. The layers (Potential impact to timber resources, wildlife, and forest vegetation) may be useful when targeting fuels treatment. These layers are influencing the "Benefit" areas in the Overall wildfire risk map - they show areas where there is ecological opportunity to restore historical or desired conditions and/or potentially reduce the risk of catastrophic wildfire with managed fire use or other management. The Potential impact to forest vegetation optional report element is coupled with historical fire regime information to give basic context when comparing historical and current conditions.

Hazard to Potential Structures

Hazard to potential structures depicts the hazard to hypothetical structures in any area if a wildfire were to occur. This differs from Potential Impacts, as those estimates consider only where people and property currently exist. In contrast, this layer maps hazard to hypothetical structures across all directly exposed (burnable), and indirectly exposed (within 150 meters of burnable fuel) areas in Oregon. As with the Potential Impacts layers, the data layer does not take into account wildfire probability, it only shows exposure and susceptibility.

Fire Model Inputs and Fuelscape

These layers are the fuels and topography used to run the fire model in the 2018 Pacific Northwest Quantitative Wildfire Risk Assessment. Data layers include: Fuel models, Fuel model groups, Forest canopy base height, Forest canopy height, Forest canopy cover, Forest canopy bulk density, Slope, Elevation and Aspect. Fuel models and groups characterize local surface vegetation composition relative to carrying fire more precisely than a basic land cover or vegetation maps. Fuel models indicate the type of potential wildfire based on the fuels that will ignite and spread fire. Canopy data layers characterize vegetation structure for fire modeling: base height, cover, and bulk density estimates can show where there may be propensity for ladder fuels (ground vegetation and trees that reach up to tree branches and upper forest canopy), and where contiguous forest canopies have potential for canopy fire. Note that not all of these layers are available to select for use in the OWRE advanced reports, but all of them are available for download and they are described in the metadata. Also note that weather, the third part of the three major elements that determine wildfire occurrence and intensity, is not included in this data distribution - please see the full report to understand the weather parameters used in the assessment.

For more detailed information, please see the full 2018 PNW Quantitative Wildfire Risk Assessment report:

oe.oregonexplorer.info/externalcontent/wildfire/reports/20170428_PNW_Quantitative_Wildfire_Risk_Assessment_Report.pdf



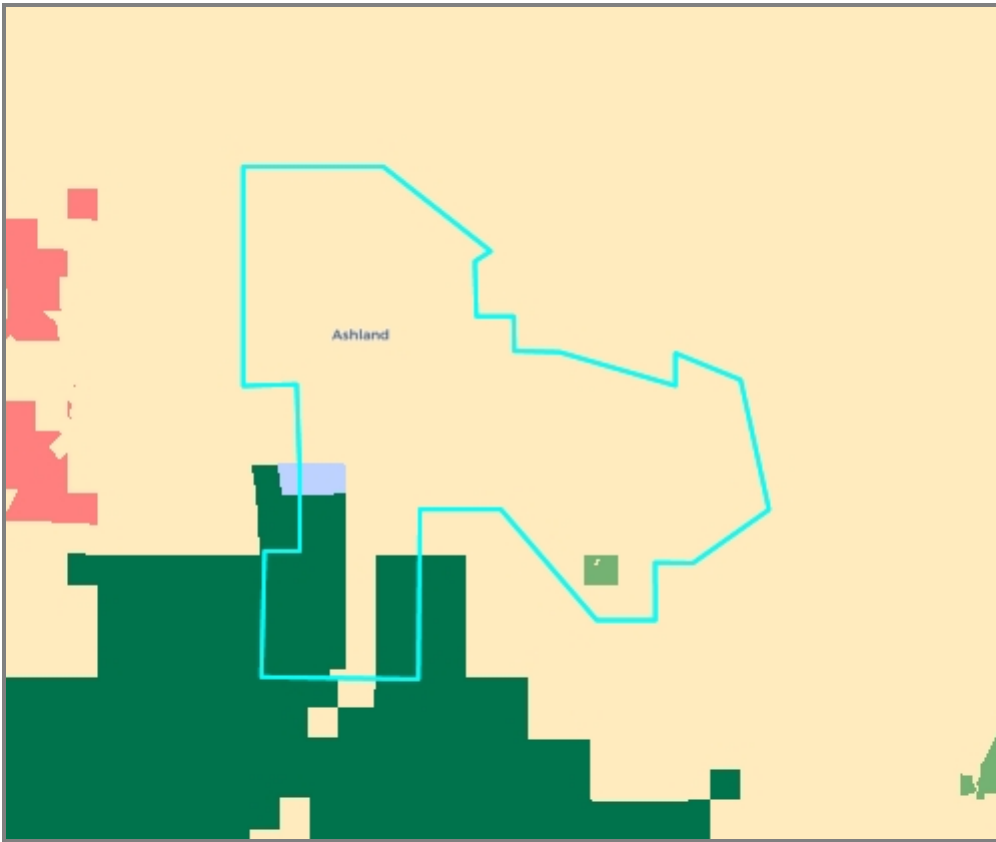
Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



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LAND OWNERSHIP AND MANAGEMENT

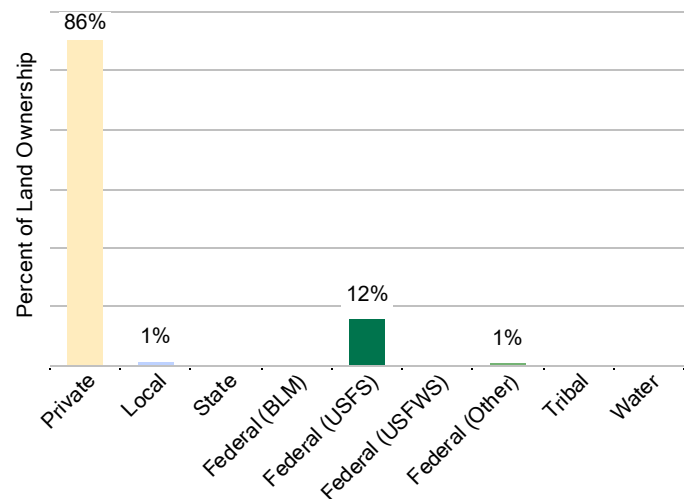


Knowing the land ownership and management in an area is important for hazard planning and awareness when wildfires occur. Oregon has a complete and coordinated wildfire management system between local, private, tribal, state, and federal agencies. These entities participate to fight fire in local areas and throughout the state according to their jurisdictions and protection responsibilities. Different land owners and managers have a variety of highly valued resources and assets to protect. Agencies differ in land use and overall management, including fire management.

The map, table and charts below show the breakdown of ownership types in your area.

City of Ashland

	Major Landowner/Manager	Acres
	Private	5,715
	Local	61
	State	0
	Bureau of Land Management (BLM)	0
	US Forest Service (USFS)	795
	US Fish & Wildlife (USFWS)	0
	Other Federal	45
	Tribal	0
	Water	0



Source: Bureau of Land Management, 2015

* Values may add up to over 100% due to rounding precision



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City of Ashland
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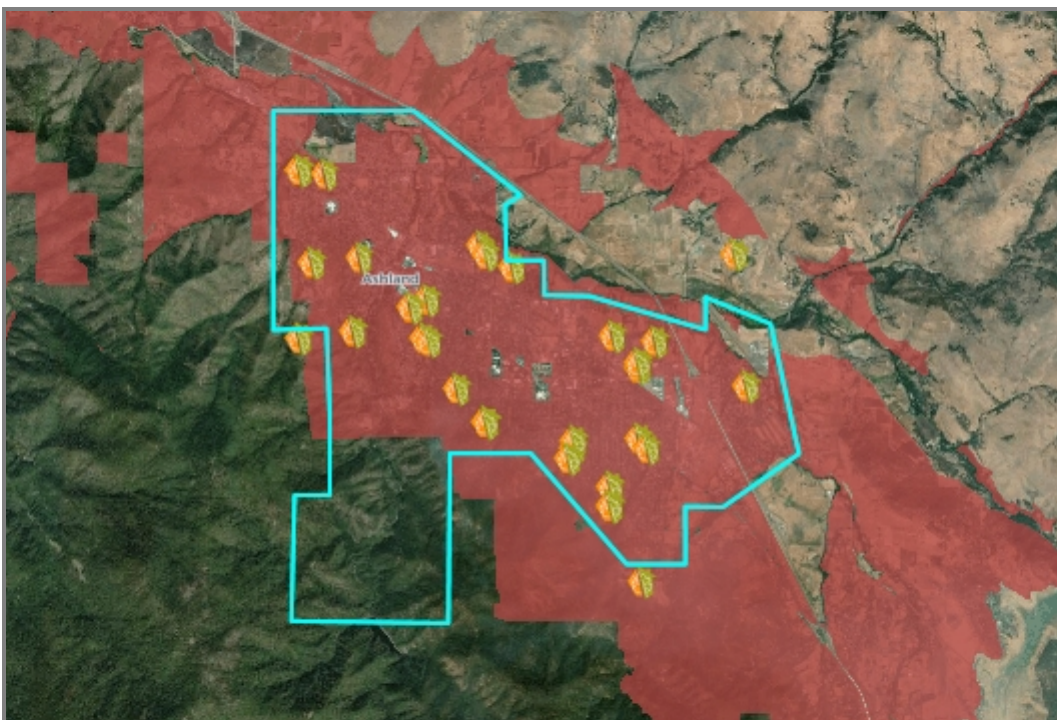
OREGON WUI COMMUNITY HAZARD RATINGS

Counting locally identified communities and neighborhoods, there are up to 6.9 million acres of Wildland Urban Interface (WUI) areas in Oregon. These areas were identified using a base WUI dataset from Radeloff, V.C., et. al, 2017 (published by USFS RDA), which incorporated 2010 census and 2011 land cover data. Locally mapped communities from Community Wildfire Protection Plans (CWPPs) from 2008 through 2013 were associated with the WUI geography. Department of Land Conservation & Development 2017 Oregon Land Use Zoning was also included for recent residential and developed or developing rural growth since the 2010 census. A cross-check was also made with the “100 Communities at Risk” report from the QWRA. Note that this WUI acreage contrasts with the 2.4 million acres from the West Wide Risk Assessment (Where People Live/Wildland Development Areas). The source Radeloff et. al WUI data used census block housing counts and land cover as opposed to WWRA Landsat night lights and housing densities. Acreage is larger in this Oregon WUI due to some rural areas having built environments along roads that spline two or more large census blocks, and we erred on the side of inclusion to add those entire areas to the dataset and not disrupt the original WUI geography. Also very small rural town centers that can potentially be encompassed by catastrophic wildfire, are kept whole in the Oregon WUI dataset.

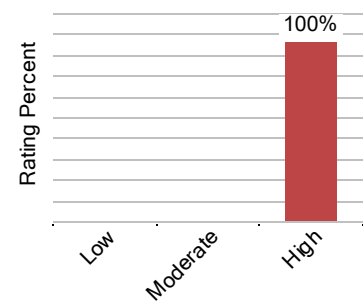
Burn Probability from the QWRA was used to assign a wildfire hazard rating to the built environment and homes in these areas. Hazard levels are based on modeled vegetation, not on building construction materials or ingress/egress issues. For a comprehensive analysis of wildfire risk and understanding of the potential threat of wildfire to your community, view the WUI combined with local fire starts and information in your Community Wildfire Protection Plan. A Community Wildfire Protection Plan (CWPP) is the product of collaboration between local communities and agencies interested in reducing wildfire risk and addressing response in a comprehensive plan. It also allows counties to prioritize and mitigate high risk areas, enhance safety and better protect themselves and their forested landscapes from wildfire.

Even in areas where risk is high, defensible space and Firewise USA® principles can be incredibly useful in minimizing the risk to homes in the Wildland Urban Interface.

City of Ashland



WUI Hazard Area Acres in City of Ashland



	Rating	Acres
	Low	0
	Moderate	0
	High	4,944
	Firewise Site	



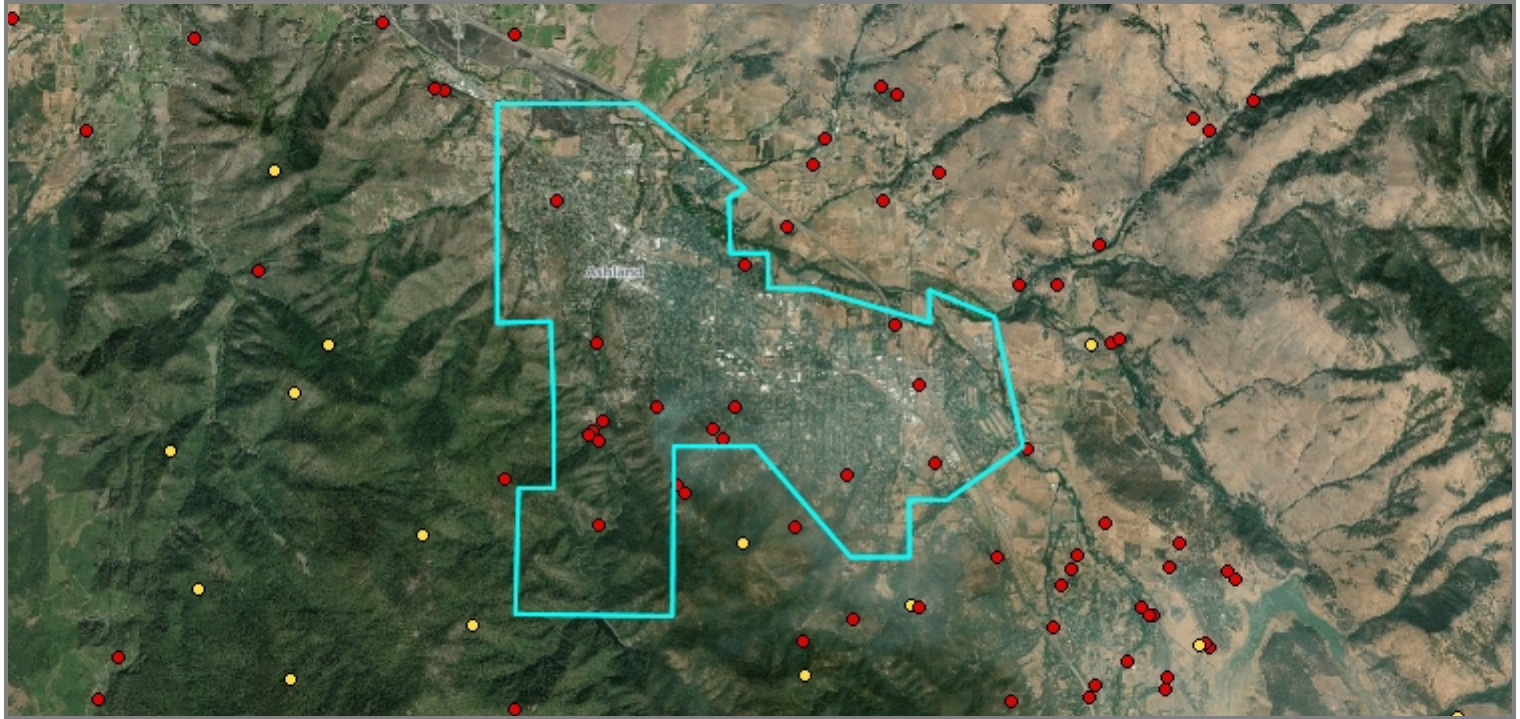
Oregon Wildfire Risk Explorer- Advanced Report

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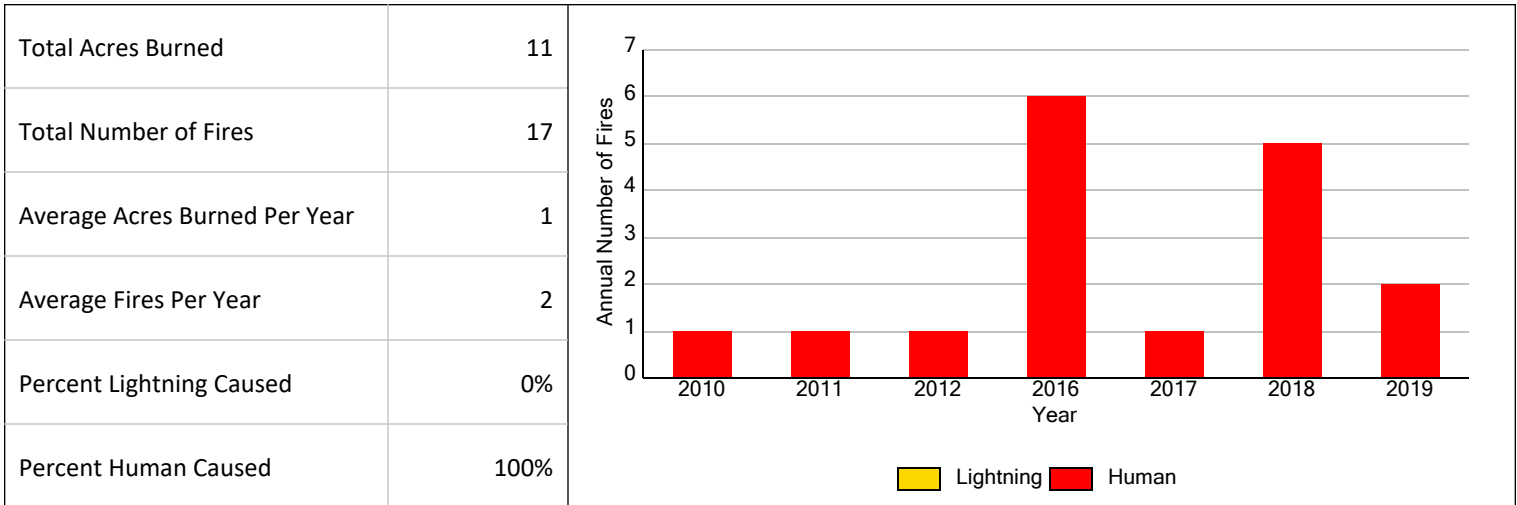


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FIRE HISTORY - FIRE IGNITIONS



City of Ashland fire starts between 2008-2019



Knowing where and why fires start is the first step in awareness, prevention, and mitigation. Viewing local fire starts in conjunction with burn probability (provided later in this report) provides a comprehensive view of local fire history and potential.

Statewide, 71% of fires recorded by ODF are human-caused, and many of these fires are near populated areas. Lightning caused fires make up only 29% of fire starts, but tend to burn more acres as they are often located in remote areas.

The map, table and charts on this page show the cumulative number fire starts in your area.

Source: Short, K. and Oregon Department of Forestry, 2019



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
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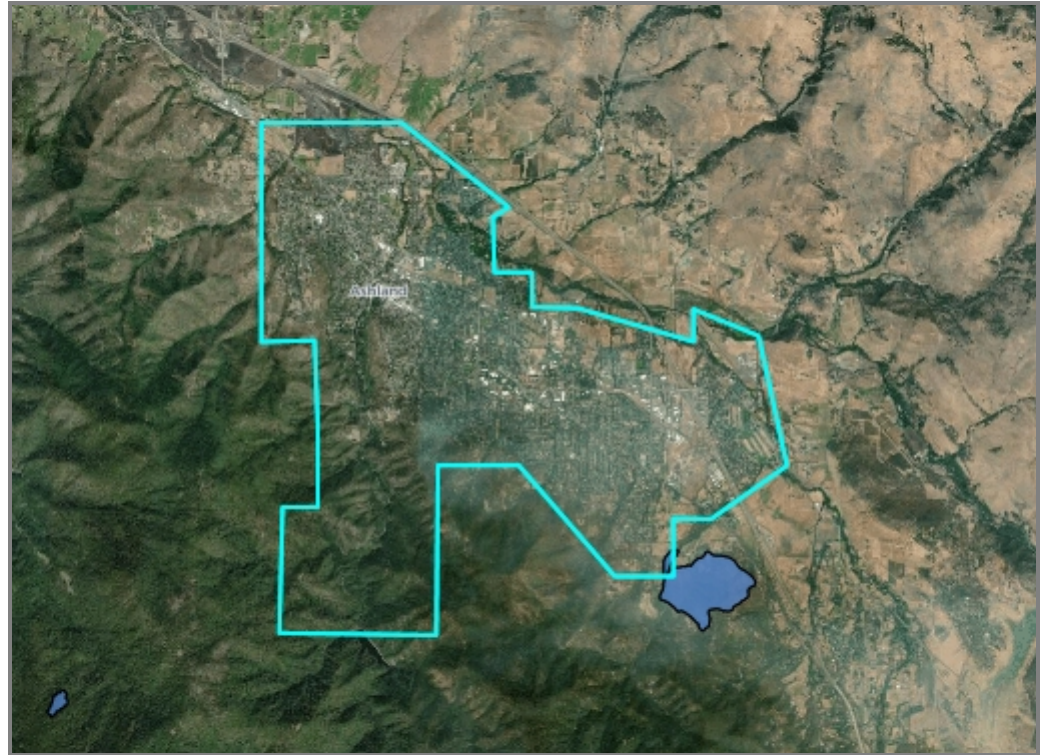


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FIRE HISTORY - FIRE PERIMETERS

Although most wildfires in Oregon are human-caused and suppressed quickly while small, Oregon has experienced many large wildfires. The map and table below show the footprints of fires that have occurred in your area since 2000.

 Perimeter



Wildfires in City of Ashland

Wildfire Name	Year	Acres Burned
Siskiyou	2009	191

Source: National Interagency Fire Center: <https://www.nifc.gov/>

For more information about previous large wildfires, see: National Interagency Fire Center https://www.nifc.gov/fireInfo/fireInfo_main.html



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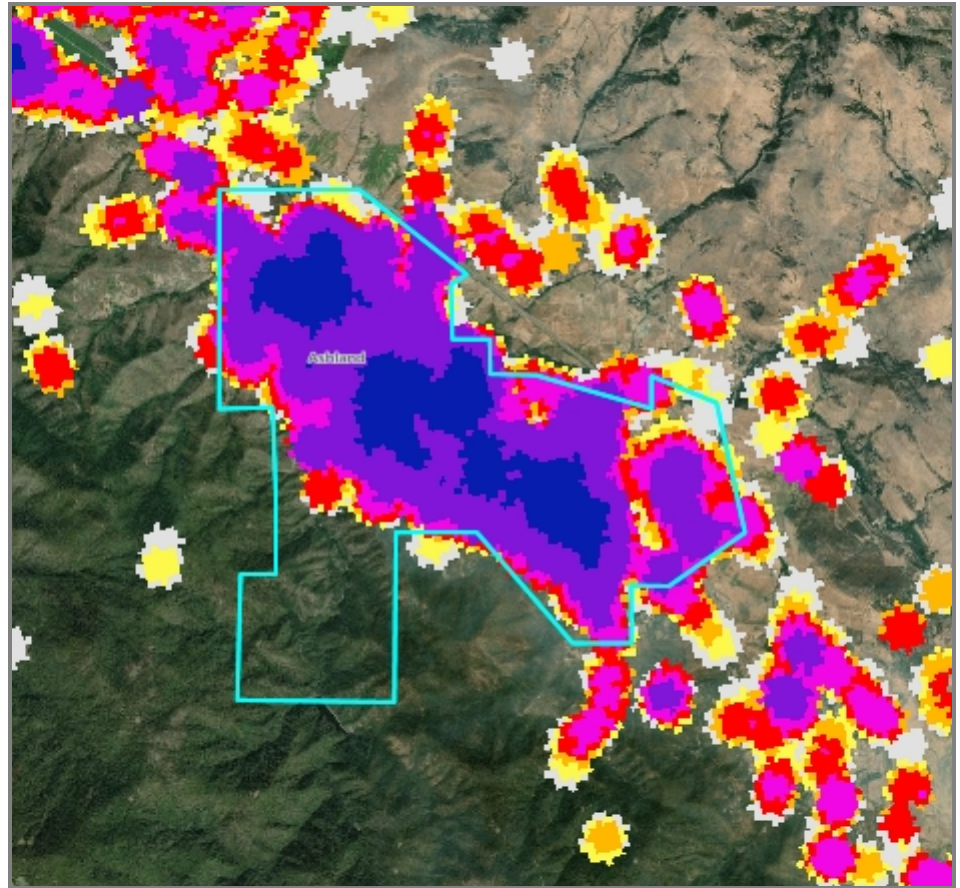
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HOUSING DENSITY - WHERE PEOPLE LIVE

Areas where people live are a primary concern when assessing wildfire risk. Especially critical is the Wildland Urban Interface (WUI) - areas where houses and other development meet or mix with undeveloped natural areas, with a close proximity of houses and infrastructure to flammable wildland vegetation.

In the U.S., the number of homes in the WUI increased by 13.4 million since 1990. This expansion of the WUI poses particular challenges for wildfire management, creating more structures and populations at risk in environments where firefighting is often difficult. In Oregon, nearly 2.4 million acres are considered WUI areas, about 3.8% of the state. Of the nearly 1.7 million homes in Oregon, over 603,000, or 36%, are in the WUI.

The map and table on this page shows the location and density of where people live in your area.



City of Ashland housing density

Category	Acres	%*
<1 house per 40 acres	154	2
1 per 40 acres to 1 per 20 acres	122	2
1 per 20 acres to 1 per 10 acres	141	2
1 per 10 acres to 1 per 5 acres	335	5
1 per 5 acres to 1 per 2 acres	683	10
1 per 2 acres to 3 per acres	2,574	39
> 3 per acres	1,189	18

Source: 2013 West Wide Wildfire Risk Assessment, ODF

* Values may add up to over 100% due to rounding precision



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



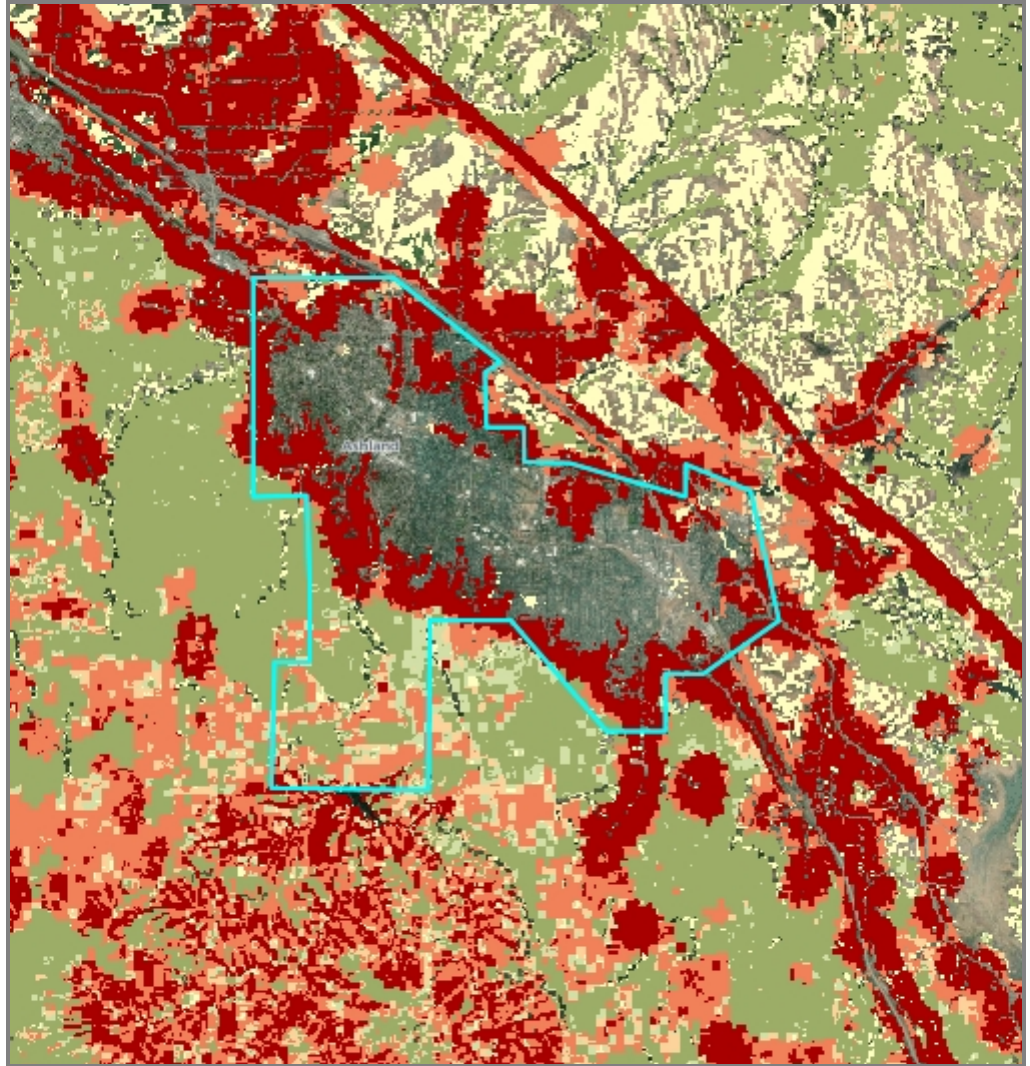
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OVERALL WILDFIRE RISK

Overall wildfire risk combines both the likelihood of a wildfire and the expected impacts of a wildfire on highly valued resources and assets. (See other sections for more information on Burn probability and Overall potential impact.) Overall wildfire risk also reflects the susceptibility of resources and assets to wildfire of different intensities, and the likelihood of those intensities.

Mapped resources and assets include critical infrastructure, developed recreation, housing unit density, seed orchards, sawmills, historic structures, timber, municipal watersheds, vegetation condition, and terrestrial and aquatic wildlife habitat.

The data values in the overall wildfire risk map and chart reflect a range of impacts from a very high negative value, where wildfire is detrimental to one or more resources or assets, to positive, where wildfire has an overall benefit (e.g., forest health or wildlife habitat).



Overall wildfire risk: Legend

	Very High	Wildfire risk is very highly negative (top 5% of values).
	High	Wildfire risk is highly negative (80th to 95th percentile).
	Moderate	Wildfire risk is moderately negative (50th to 80th percentile).
	Low	Wildfire risk is slightly negative (29th to 50th percentile).
	Low Benefit	Wildfire is slightly beneficial (14.5 to 29th percentile).
	Benefit	Wildfire is beneficial overall (0-14.5th percentile).
	Non-burnable	There are no highly valued resources or assets mapped in the area, or it is considered non-burnable (urban, agriculture, etc).



Oregon Wildfire Risk Explorer- Advanced Report

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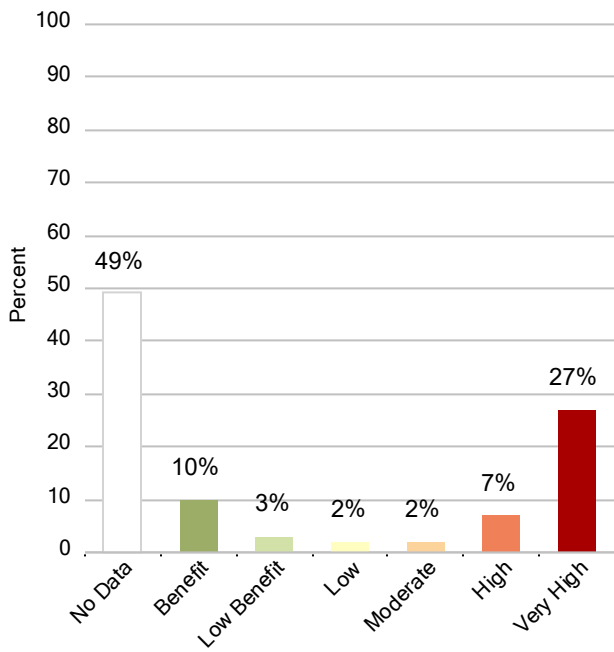
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This page contains additional information about overall wildfire risk, including a table of classes by ownership to determine the distribution of categories across ownerships, and a chart of overall percentages of classes across the area. The inset box displays sub-watershed summaries for landscape-scale prioritization.

Overall wildfire risk in City of Ashland: estimated acres by ownership

Category	Total	Private	Local	State	BLM	USFS	USFWS	Other Fed	Tribal
Very High	1,818	1,744	15	0	0	33	0	26	0
High	471	249	4	0	0	218	0	0	0
Moderate	111	46	1	0	0	64	0	0	0
Low	122	96	2	0	0	23	0	1	0
Low Benefit	180	69	4	0	0	107	0	0	0
Benefit	661	291	32	0	0	338	0	0	0
No Data	3,252	3,223	0	0	0	13	0	16	0
Total Area	6,615	5,718	58	0	0	796	0	43	0

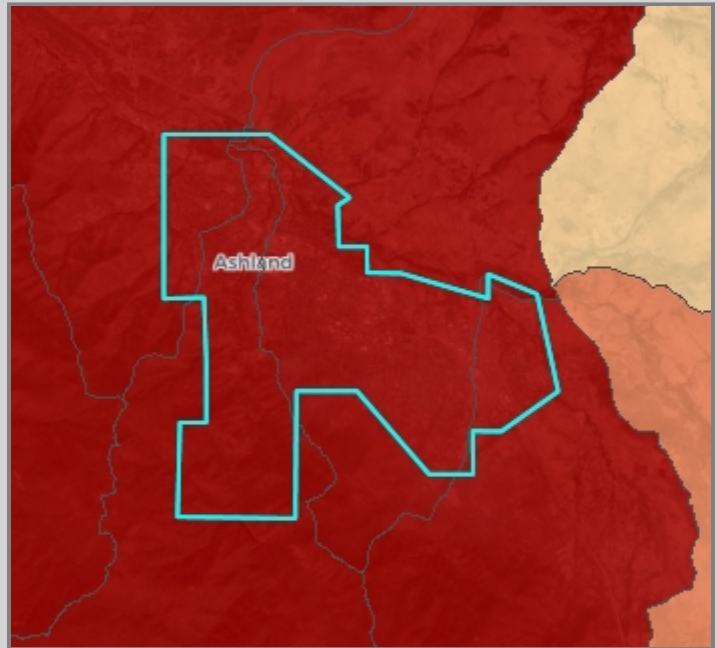
Overall wildfire risk in City of Ashland *



Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision

Overall wildfire risk in City of Ashland: sub-watershed summary map. Overall wildfire risk is summarized at the sub-watershed (6th field Hydrologic Unit Code, HUC12) level. Watershed summaries enable you to view the landscape context and identify and compare sub-watersheds for prioritization.





Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)

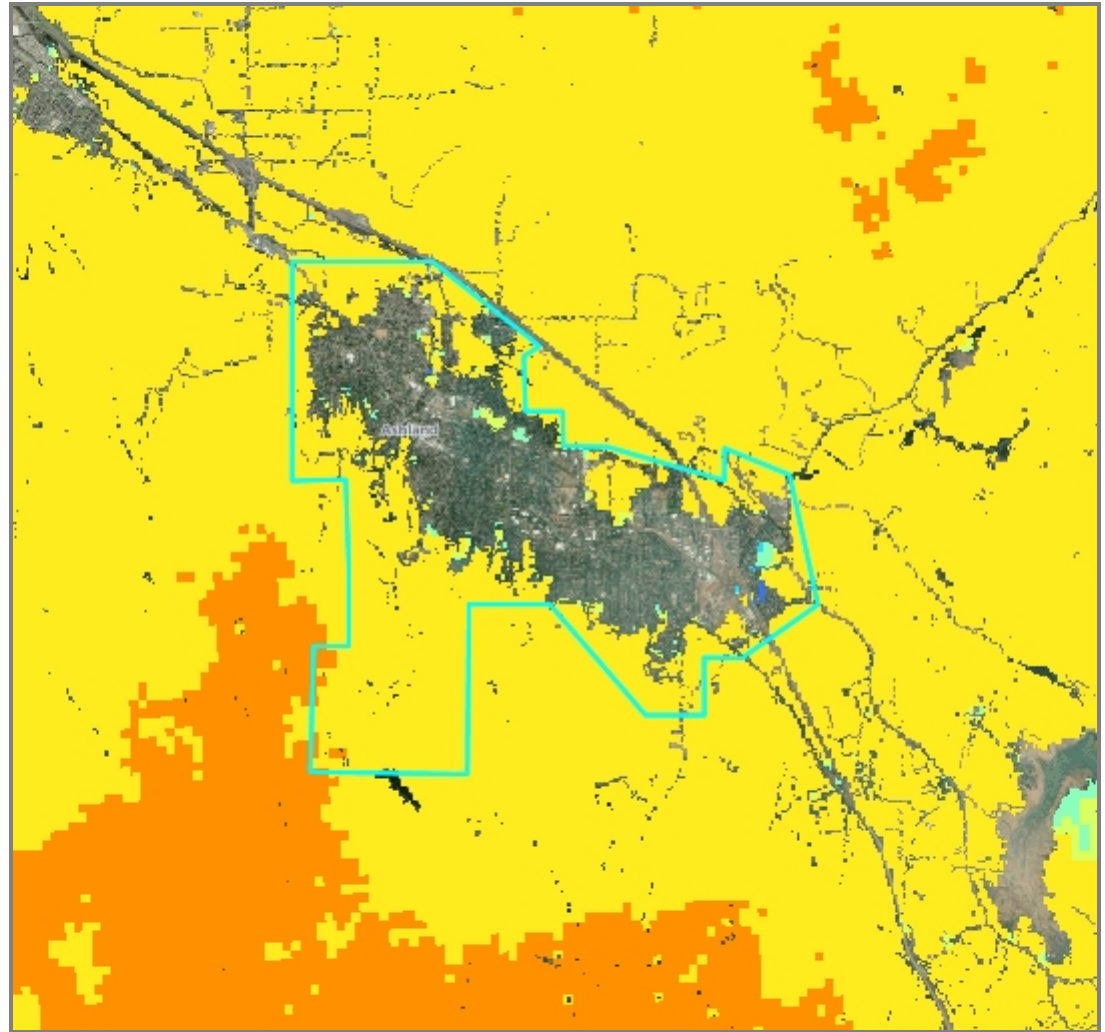


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BURN PROBABILITY

Burn probability shows the annual likelihood of a wildfire greater than 250 acres in size occurring, considering weather, topography, fire history, and fuels (vegetation). This estimate includes fire history from 1992 through recently disturbed fuels from large Oregon wildfires in notable years 2013, 2014, 2015, and 2017.

Only large wildfires over 250 acres in size are included because they are the most influential on the landscape and they can be simulated using computer software. Most fire occurrences are less than 250 acres (see fire history section). Although these smaller fires have a low impact on the broader landscape, they can have significant local impacts, especially in areas with human activity and infrastructure.



Burn probability	
Very High	Greater than 1 in 50 chance of a wildfire >250 acres in a single year (>96th percentile).
High-Very High High	Between 1 in 500 and 1 in 50 chance of a wildfire >250 acres in a single year (29th to 96th percentile).
Moderate-High Moderate	Between 1 in 5,000 and 1 in 500 chance of a wildfire >250 acres in a single year (11th to 29th percentile).
Low-Moderate Low	Less than approximately 1 in 5,000 chance of a wildfire >250 acres in a single year (up to the 11th percentile).
Non-burnable	This area contains non-burnable fuel types such as water, urban, agriculture, barren rock, etc.



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
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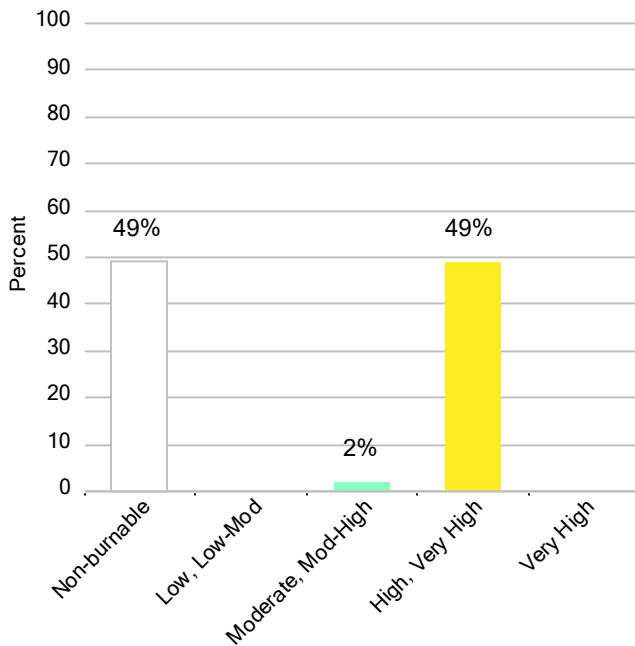
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This page contains additional information about burn probability, including a table of classes by ownership to determine the distribution of categories across ownerships, and a chart of overall percentages of classes across the area. The inset box displays sub-watershed summaries for landscape-scale prioritization.

Burn probability in City of Ashland: estimated acres by ownership

Category	Total	Private	Local	State	BLM	USFS	USFWS	Other Fed	Tribal
Very High	0	0	0	0	0	0	0	0	0
High, Very High	3,213	2,341	56	0	0	790	0	26	0
Moderate, Mod-High	131	130	0	0	0	0	0	1	0
Low, Low-Mod	12	12	0	0	0	0	0	0	0
Non-Burnable	3,262	3,237	1	0	0	7	0	17	0
Total Area.	6,618	5,720	57	0	0	797	0	44	0

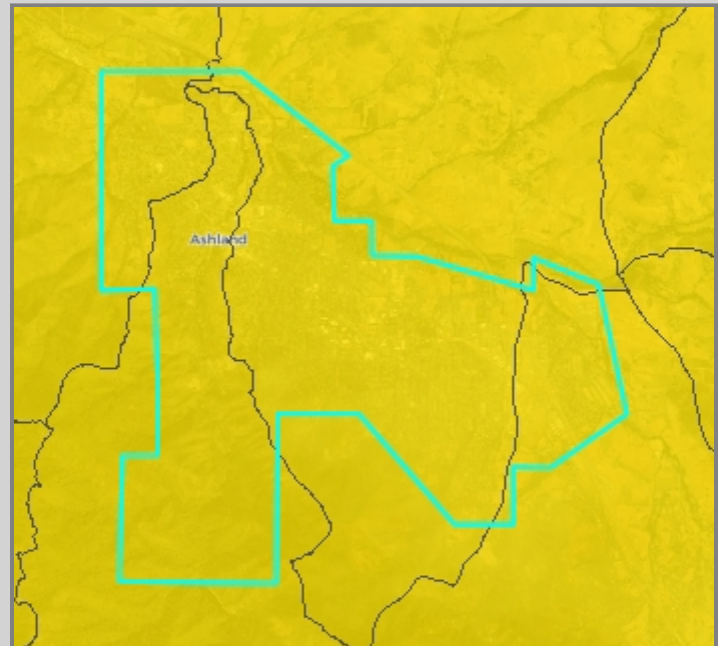
Burn probability in City of Ashland *



Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision

Burn probability in City of Ashland: sub-watershed summary map. Burn probability is summarized at the subwatershed (6th field Hydrologic Unit Code, HUC12) level. Watershed summaries enable you to view the landscape context and identify and compare sub-watersheds for prioritization.





Oregon Wildfire Risk Explorer- Advanced Report

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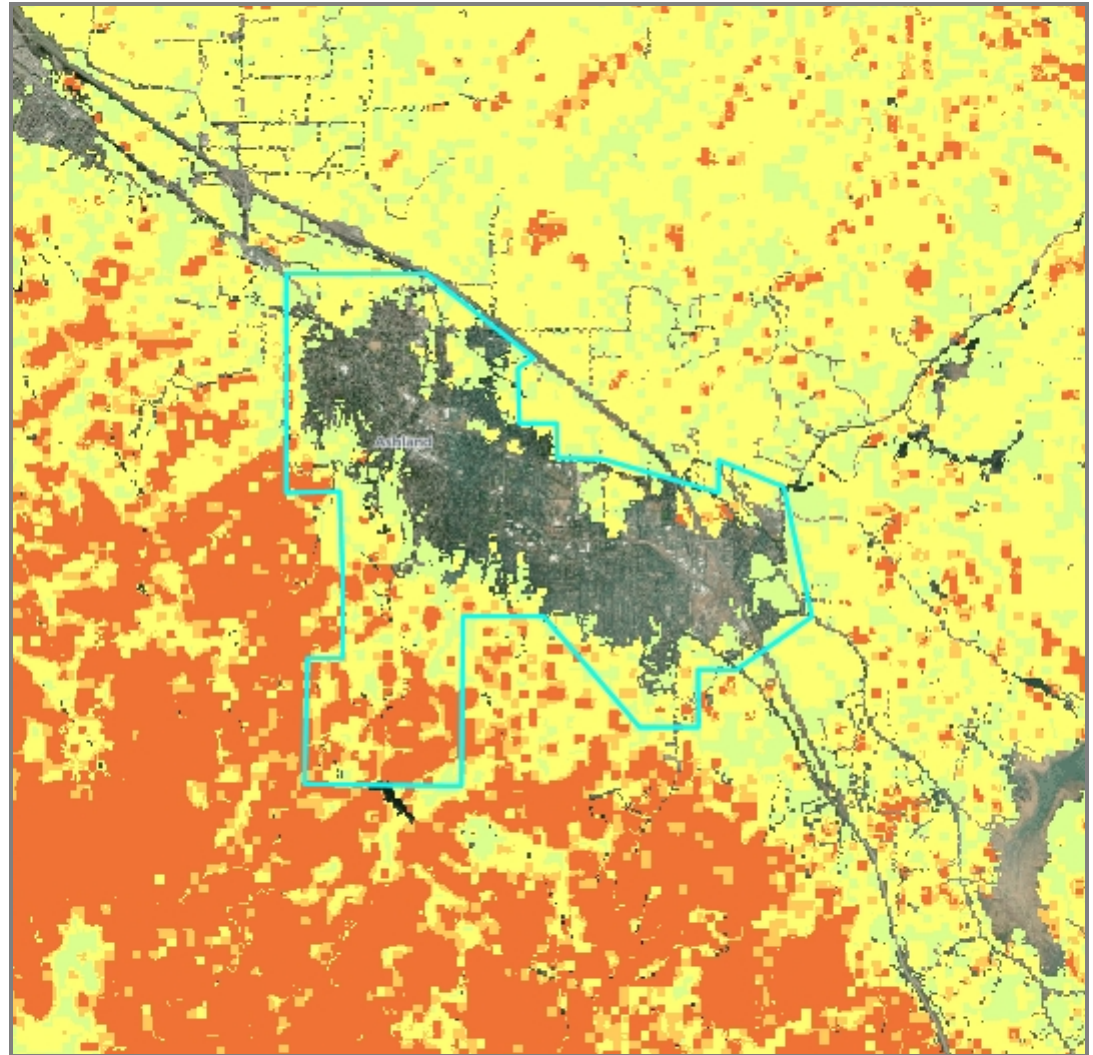
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FIRE INTENSITY - FLAME LENGTHS






Flame length is an indication of fire intensity, which is a primary factor to consider for gauging potential impacts to values at risk and for firefighter safety. It can also guide mitigation work to reduce the potential for catastrophic fires by reducing fire intensity and flame length.

Under normal weather conditions average flame lengths within your area are shown, and the associated table describes the expected fire behavior in each average flame length category.

Conditions vary widely with local topography, fuels, and local weather, especially local winds. In all areas, under warm, dry, windy, and drought conditions, expect higher likelihood of fire starts, higher fire intensities, more ember activity, a wildfire more difficult to control, and more severe impacts.



Average fire intensity - flame lengths under normal weather conditions

	> 11 foot	Fires may exhibit greater than 11-foot average flames with major fire movement, tree crowning, longer-range spotting and ember travel.
	8-11 foot	Fires may exhibit 8-11 foot average flames with tree torching and increased ember travel.
	4-8 foot	Fires may exhibit 4-8 foot average flames, and embers may travel moderate distances.
	4 foot	Fires may exhibit 4 foot average flames.
	Non-burnable	This area contains non-burnable fuel types such as water, urban, agriculture, barren rock, etc.



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



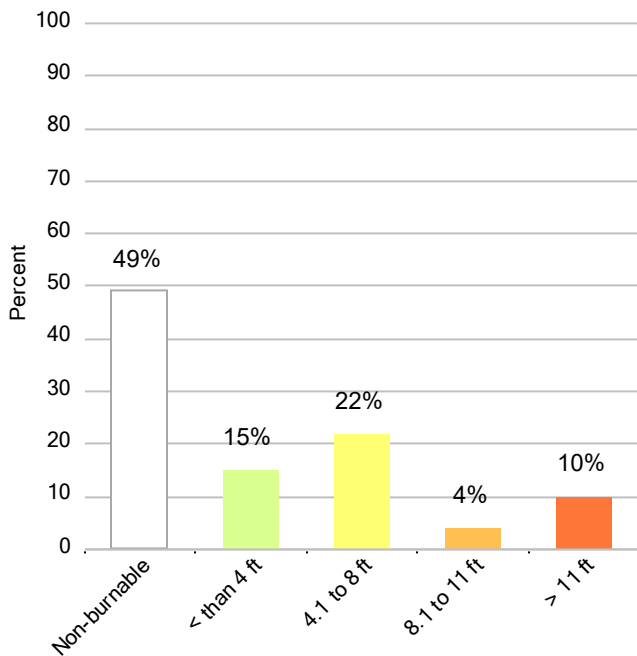
Generated: April 8, 2022

This page contains additional information about fire intensity, including a table of classes by ownership to determine the distribution of categories across ownerships, and a chart of overall percentages of classes across the area. The inset box displays sub-watershed summaries for landscape-scale prioritization.

City of Ashland average fire intensity - flame lengths estimated acres by ownership

Category	Total	Private	Local	State	BLM	USFS	USFWS	Other Fed	Tribal
> 11 ft	647	277	29	0	0	341	0	0	0
8 - 11 ft	272	126	10	0	0	131	0	5	0
4 - 8 ft	1,458	1,174	15	0	0	258	0	11	0
> 0 - 4 ft	976	905	2	0	0	59	0	10	0
Non-burnable	3,262	3,237	1	0	0	7	0	17	0
Total Area	6,615	5,719	57	0	0	796	0	43	0

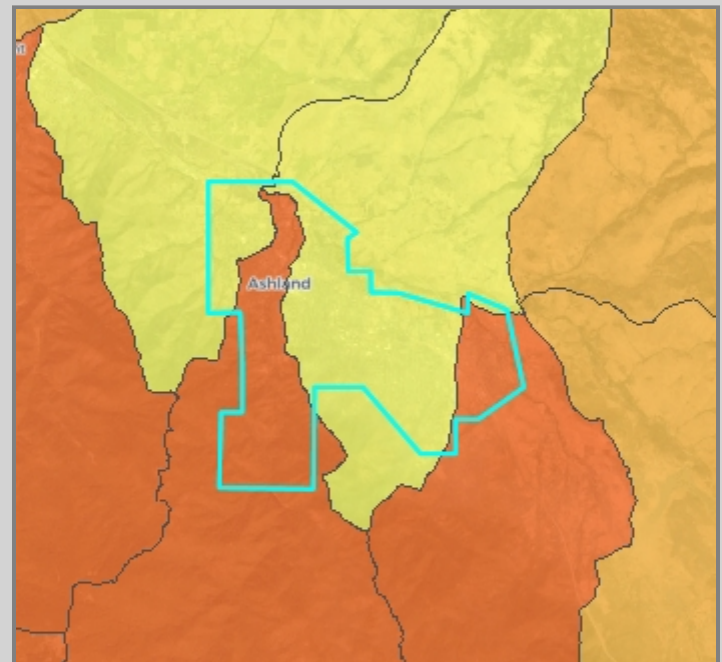
Fire intensity - flame length in City of Ashland *



Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision

Fire intensity in City of Ashland: sub-watershed summary map. Fire intensity is summarized at the subwatershed (6th field Hydrologic Unit Code, HUC12) level. Watershed summaries enable you to view the landscape context and identify and compare sub-watersheds for prioritization.





Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



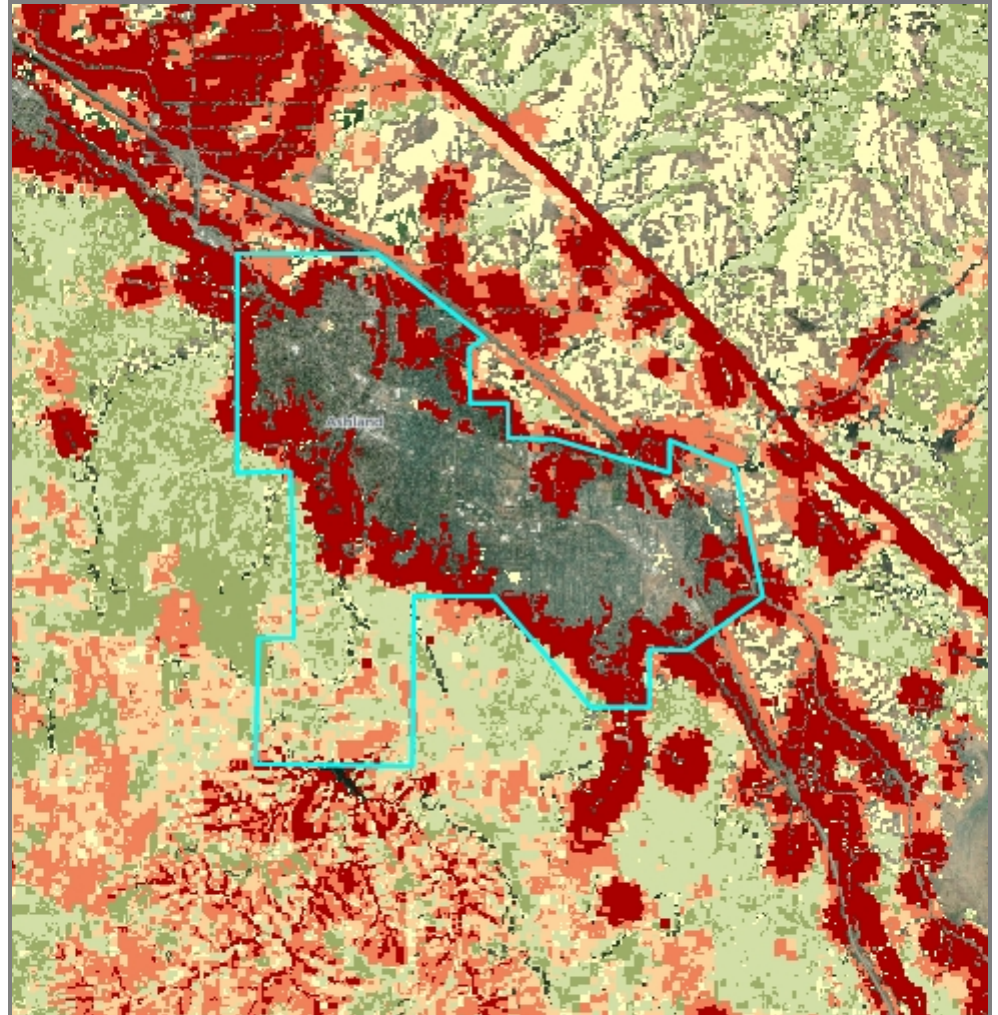
Generated: April 8, 2022

OVERALL POTENTIAL IMPACT

Overall potential impact represents the exposure or consequence of wildfire on all mapped highly valued assets and resources combined, including critical infrastructure, developed recreation, housing density, seed orchards, sawmills, historic structures, timber, municipal watersheds, vegetation condition, and selected terrestrial and aquatic wildlife habitat.

The Potential Impact data layers characterize exposure and susceptibility only, and do not include the likelihood of an area burning. This differentiates the Potential Impact layers from Wildfire Risk layers, which account for the burn probability in the risk rating.

The data values reflect a range of impacts from a very high negative consequence, where wildfire is detrimental (e.g., high exposure to structures, infrastructure, or sensitive habitat), to a positive impact of wildfire, where wildfire will produce an overall benefit (e.g., improving forest health or wildlife habitat).



Overall potential impact (if a wildfire were to occur)

	Very High	Overall potential impact is very highly negative (top 5% of values).
	High	Overall potential impact is highly negative (80-95th percentile).
	Moderate	Overall potential impact is moderately negative (50-80th percentile).
	Low	Overall potential impact is slightly negative (30-50th percentile).
	Low Benefit	Overall potential impact is slightly beneficial at low flame lengths (15-30th percentile).
	Benefit	Overall potential impact is slightly beneficial, with a cumulative positive impact of fire (0-15th percentile).
	No Data (blank)	There are no highly valued resources or assets mapped in the area or it is non-burnable (urban, agriculture, barren, etc).



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



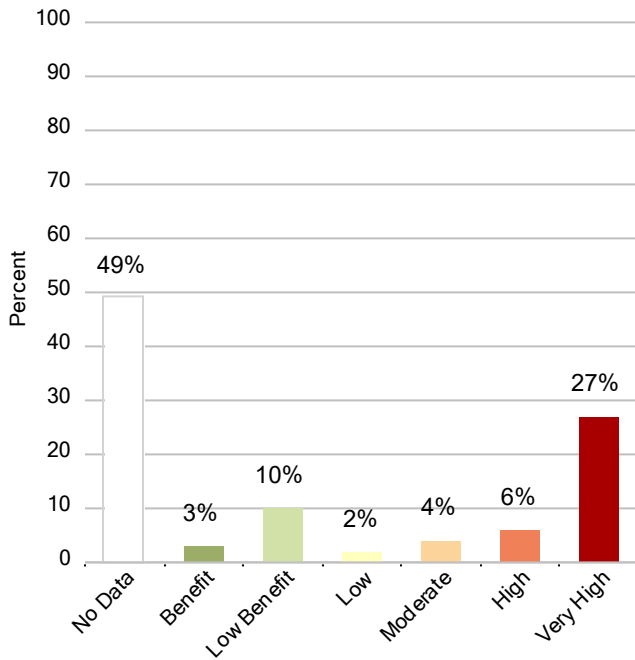
Generated: April 8, 2022

This page contains additional information about overall potential impact, including a table of classes by ownership to determine the distribution of categories across ownerships, and a chart of overall percentages of classes across the area. The inset box displays sub-watershed summaries for landscape-scale prioritization.

City of Ashland overall potential impact estimated acres by ownership

Category	Total	Private	Local	State	BLM	USFS	USFWS	Other Fed	Tribal
Very High	1,765	1,707	15	0	0	17	0	26	0
High	366	252	3	0	0	111	0	0	0
Moderate	249	73	2	0	0	174	0	0	0
Low	141	102	2	0	0	36	0	1	0
Low Benefit	631	285	21	0	0	325	0	0	0
Benefit	211	76	15	0	0	120	0	0	0
No Data	3,252	3,223	0	0	0	13	0	16	0
Total Area	6,615	5,718	58	0	0	796	0	43	0

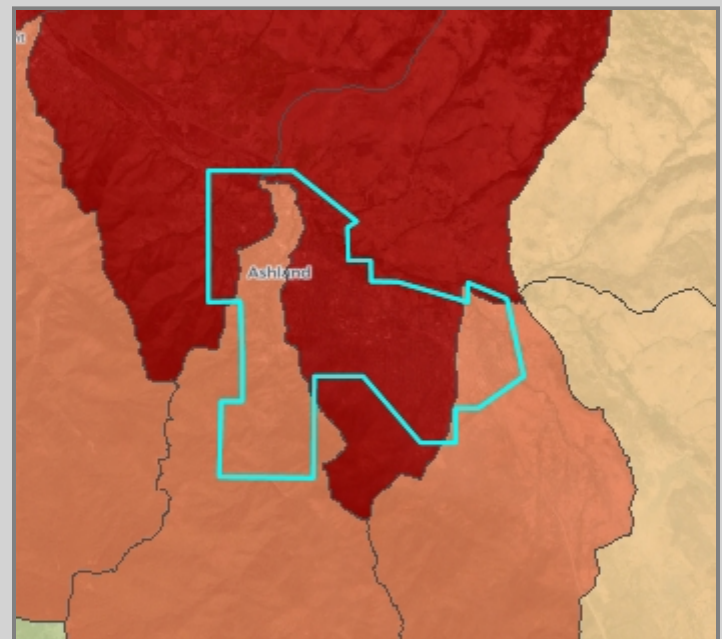
Overall potential impact in City of Ashland *



Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision

Overall potential impact in City of Ashland: sub-watershed summary map. Overall potential impact is summarized at the sub-watershed (6th field Hydrologic Unit Code, HUC12) level. Watershed summaries enable you to view the landscape context and identify and compare sub-watersheds for prioritization.





Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



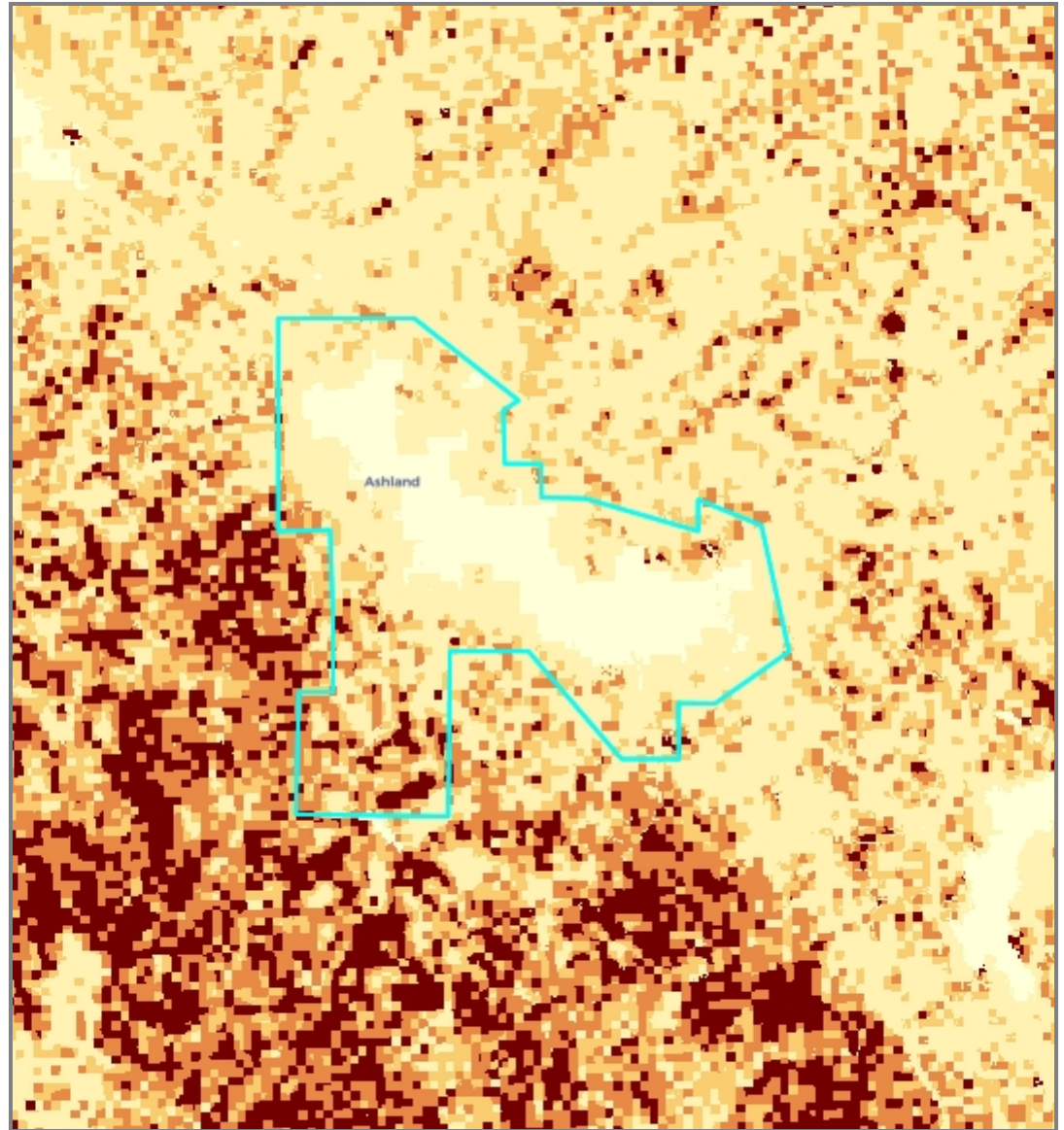
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HAZARD TO POTENTIAL STRUCTURES

Hazard to potential structures depicts the hazard to a hypothetical structure (not necessarily an existing structure) if a wildfire were to occur. Hazard to potential structures differs from overall estimates of wildfire impact or risk, as those estimates only consider where existing structures are currently located.

Community planners can use this information when planning development outside of existing developed, urban or WUI areas. This data provides model-based consideration of wildfire hazard when developing Fire Adapted Communities in Oregon.

As with the other data layers, this layer characterizes the fire environment only and does not consider other important factors in determining structural fire risk such as building construction materials and vegetation within close proximity of a structure.



Hazard to potential structures	
Very High	Potential hazard is very high (top 5 percent).
High	Potential hazard is high (80th to 95th percentile).
Moderate	Potential hazard is moderate (50th to 80th percentile).
Low	Potential hazard is low (up to the 50th percentile).
Non-Burnable	Fuel in the area is largely non-burnable or very sparse.



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



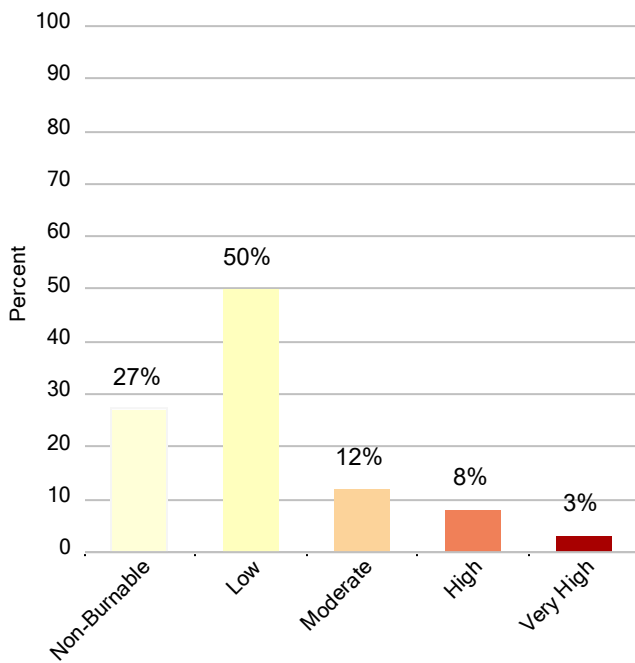
Generated: April 8, 2022

This page contains additional information about hazard to potential structures, including a table of classes by ownership to determine the distribution of categories across ownerships, and a chart of overall percentages of classes across the area. The inset box displays sub-watershed summaries for landscape-scale prioritization.

Hazard to potential structures in City of Ashland: estimated acres by ownership

Category	Total	Private	Local	State	BLM	USFS	USFWS	Other Fed	Tribal
Very High	196	81	12	0	0	103	0	0	0
High	547	275	15	0	0	254	0	3	0
Moderate	761	532	21	0	0	198	0	10	0
Low	3,322	3,040	10	0	0	242	0	30	0
Non-Burnable	1,791	1,791	0	0	0	0	0	0	0
Total Area	6,617	5,719	58	0	0	797	0	43	0

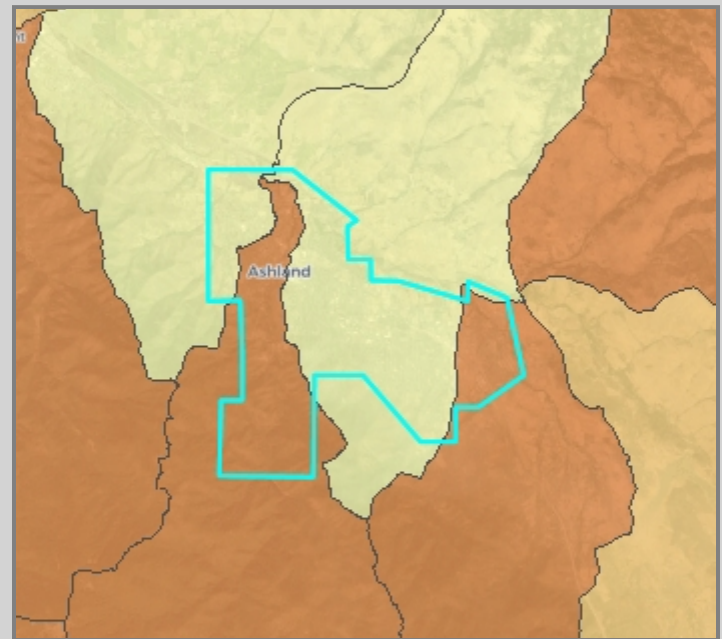
Hazard to potential structures in City of Ashland *



Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision

Hazard to potential structures in City of Ashland: sub-watershed summary map. Hazard to potential structures is summarized at the subwatershed (6th field Hydrologic Unit Code, HUC12) level. Watershed summaries enable you to view the landscape context and identify and compare sub-watersheds for prioritization.





Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



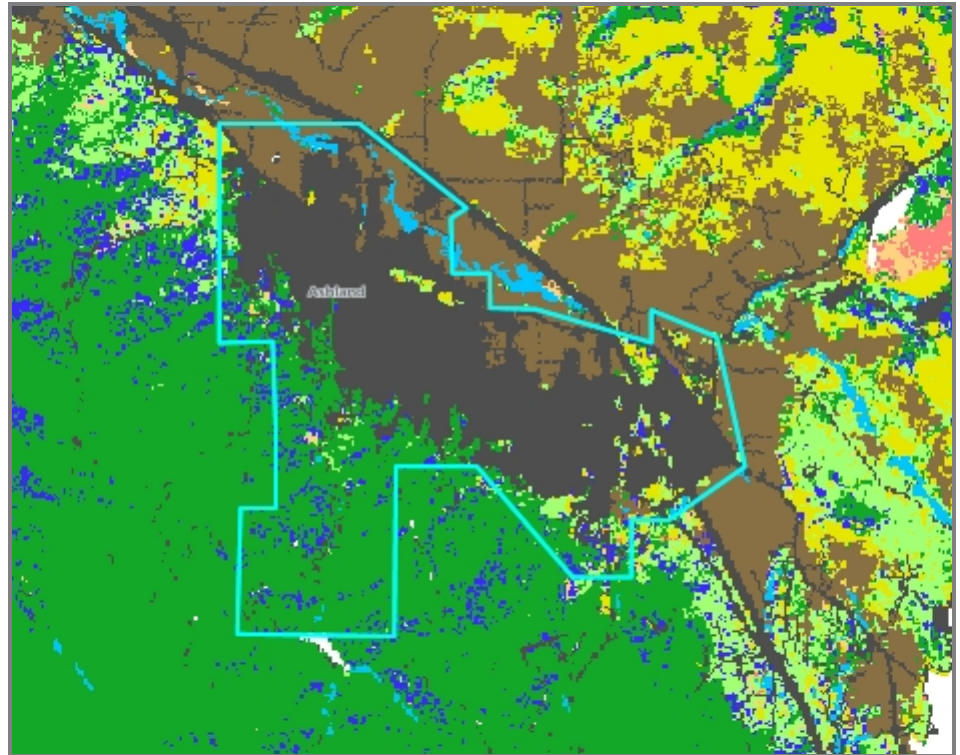
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EXISTING VEGETATION TYPE

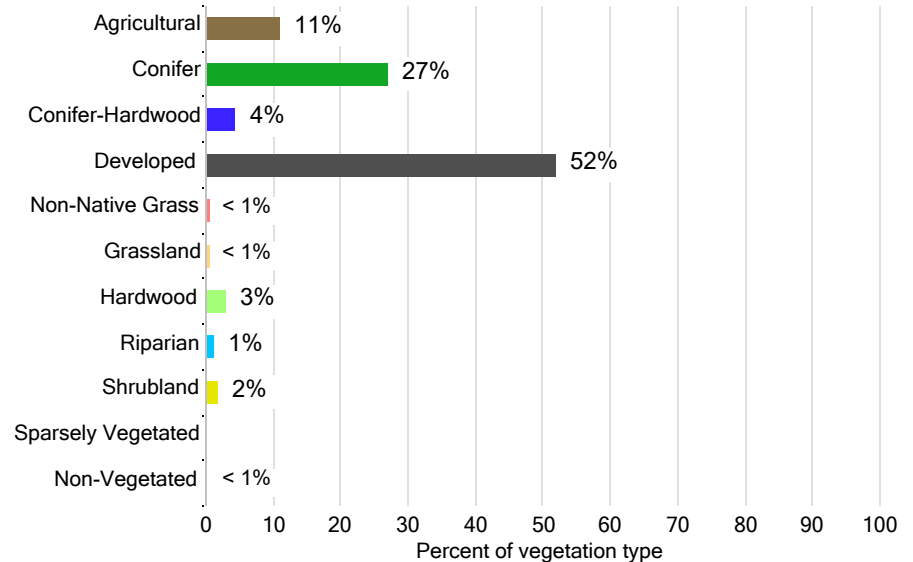
Vegetation is an important influence on potential wildfire behavior. The dominant vegetation type helps us understand the corresponding historical fire regime, a designation of fire frequency and severity. Fire frequency, or burn probability, suggests how often wildfire occurs (see Burn probability data layer). Fire severity tells us how much impact wildfires are likely to have on the vegetation and other elements of an ecosystem (see Potential impact to forest vegetation data layer). The living and dead vegetation below forest canopies (shrubs, grasses, leaf litter, dead tree snags, etc.) also strongly influence fire behavior and impacts in a location (see Fuel models).

Higher frequency fire areas generally have lower severities. Vegetation is continually or often thinned by fire and the remaining vegetation and other ecosystem elements can be considered adaptive or resilient to fire. Examples include Ponderosa pine forests and oak woodlands.

Lower frequency fire regimes experience less fire, but generally have higher severities, with vegetation and other ecosystem elements which can be considered sensitive. Examples include coastal forests, subalpine forests and many stream headwaters and riparian areas.



Vegetation Types in City of Ashland





Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



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City of Ashland vegetation type

Category	Description	Acres	%*
Non-vegetated or recently disturbed	Non-vegetated	6	< 1
Agricultural	Agricultural	722	11
Conifer	Conifer	1,784	27
Conifer-Hardwood	Conifer-Hardwood	279	4
Developed	Developed	3,426	52
Exotic Herbaceous	Non-Native Grass	2	< 1
Grassland	Grassland	16	< 1
Hardwood	Hardwood	193	3
Riparian	Riparian	77	1
Shrubland	Shrubland	112	2
Sparsely Vegetated	Sparsely Vegetated	0	0

Existing Vegetation Type Data Dictionary <https://www.landfire.gov/evt.php>
Source: LANDFIRE <https://www.landfire.gov>

Resource:
US Forest Service Fire Regime Table
https://www.fs.fed.us/database/feis/fire_regime_table/fire_regime_table.html#PacificNorthwest

* Values may add up to over 100% due to rounding precision



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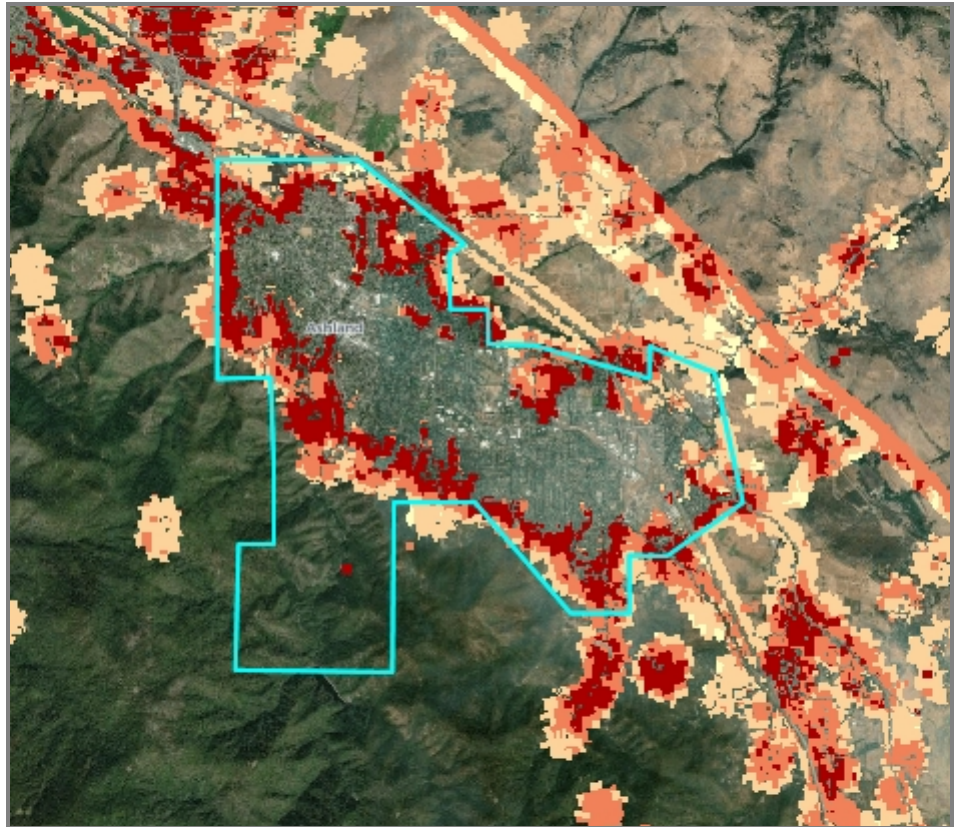
Generated: April 8, 2022

WILDFIRE RISK TO ASSETS

Wildfire risk combines both the likelihood of a wildfire (or Burn probability) and the expected effects of a wildfire on highly valued resources and assets. See the description of Overall wildfire risk for more details.

Wildfire risk to assets maps wildfire risk only in places with the following assets: critical infrastructure, developed recreation, housing unit density, seed orchards, sawmills, and historic structures. Note that these resources and assets were mapped at a broad scale across all of Oregon and Washington, and maps contain errors and omissions, especially at fine scales.

The values in the maps and charts reflect a range of negative impacts from low to very high. Positive benefits of wildfire are not mapped in this layer, assuming that any impact of wildfire to human development is negative.



Wildfire Risk to Assets in City of Ashland

Category	Description	Acres	%*
Very High	Wildfire risk is very highly negative to all combined mapped assets (top 5%).	1,046	16
High	Wildfire risk is highly negative (80-95th percentile).	575	9
Moderate	Wildfire risk is moderately negative (50-80th percentile).	354	5
Low	Wildfire risk is slightly negative (0-50th percentile).	17	< 1
No Data	There are no highly valued resources or assets mapped in the area, or it is considered non-burnable.	4,625	70

Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision



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City of Ashland
6,616 Acres: (10 Sq. Miles)



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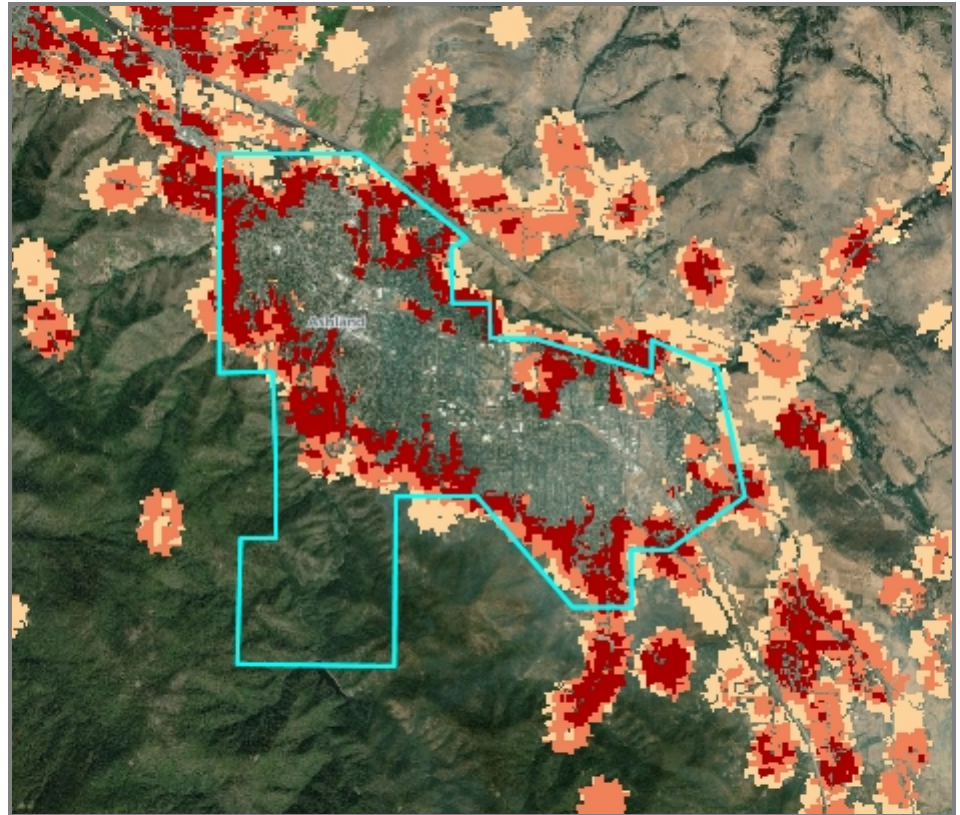
WILDFIRE RISK TO PEOPLE AND PROPERTY

Wildfire risk combines both the likelihood of a wildfire (or burn probability) and the expected effects of a wildfire on highly valued resources and assets. See the description of overall wildfire risk for more details.

Wildfire risk to people and property includes only housing unit density as mapped in the Where people live layer and US Forest Service private inholdings.

Note that these resources and assets were mapped at a broad scale across all of Oregon and Washington, and maps contain errors and omissions, especially at fine scales.

The values in the maps and charts reflect a range of negative impacts from low to very high. Positive benefits of wildfire are not mapped in this layer, assuming that any impacts of wildfire to human development is a negative impact.



Wildfire Risk to People and Property in City of Ashland

Category	Description	Acres	%*
Very High	Wildfire risk is very highly negative to people and property (top 5%).	1,152	17
High	Wildfire risk is highly negative (80-95th percentile).	540	8
Moderate	Wildfire risk is moderately negative (50-80 percentile).	286	4
Low	Wildfire risk is slightly negative (0-50 percentile).	5	< 1
No Data	There are no highly valued resources or assets mapped in the area, or it is considered non-burnable.	4,634	70

Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



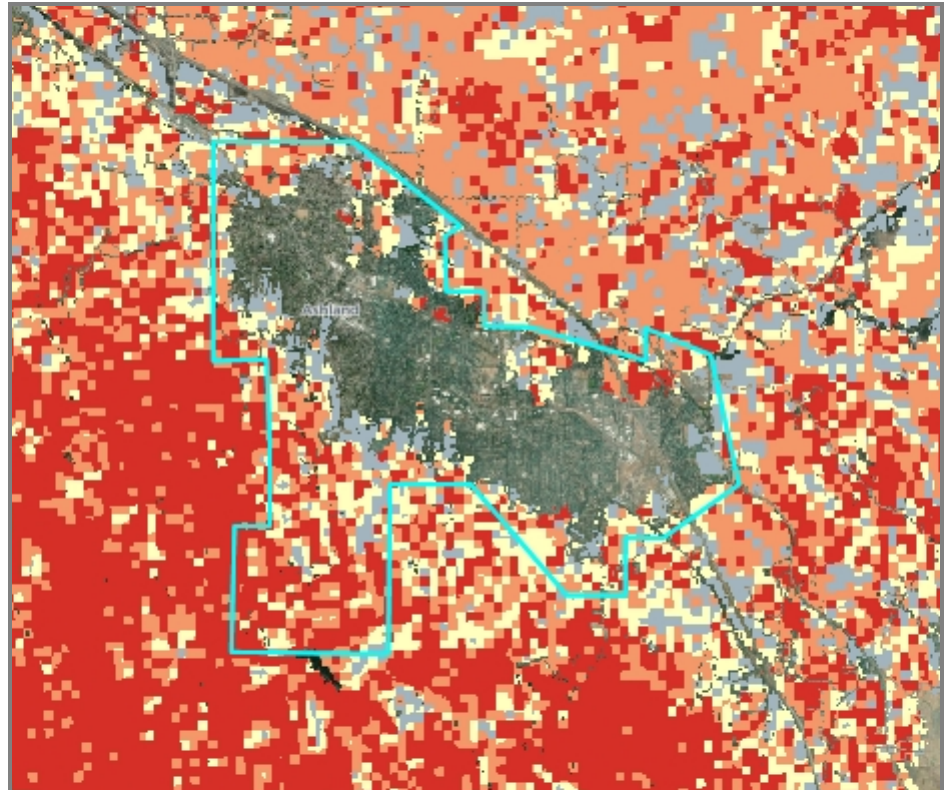
Generated: April 8, 2022

PROBABILITY OF EXCEEDING 4 FOOT FLAME LENGTHS

Flame length is an indication of fire intensity, which is a primary factor to consider for firefighter safety and for gauging potential impacts to values at risk. Fires with greater flame lengths are more intense and difficult to control. At higher flame lengths, firefighters cannot directly approach. As flame lengths increase, tree torching and spotting is expected and ember travel is increased.

Fires with greater than 4' flames are too intense for firefighters to work at the front of the flame using hand tools, and heavier equipment such as bulldozers may be necessary.

Using this layer to help target locations of higher flame length potential, a local assessment might reveal opportunity to reduce fire intensity as a goal of fuels treatment projects by using managed fire and/or other active management activities. Values are expressed as a percent likelihood. These probabilities do not take into account the likelihood of burning (see Burn probability).



City of Ashland probability of exceeding 4' flames

Category	Description	Acres	%*
75-100%	If a fire occurs, there is a very high (>75%) chance that flame lengths will be greater than 4'.	989	15
50-75%	If a fire occurs, there is a high (50-75%) chance that flame lengths will be greater than 4'.	856	13
25-50%	If a fire occurs, there is a moderate (25-50%) chance that flame lengths will be greater than 4'.	833	13
0-25%	If a fire occurs, there is a low (<25%) chance that flame lengths will be greater than 4'.	592	9
0%	This area contains non-burnable fuel types such as water, urban, agriculture, barren rock, etc.	3,348	51

Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision



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City of Ashland
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Generated: April 8, 2022

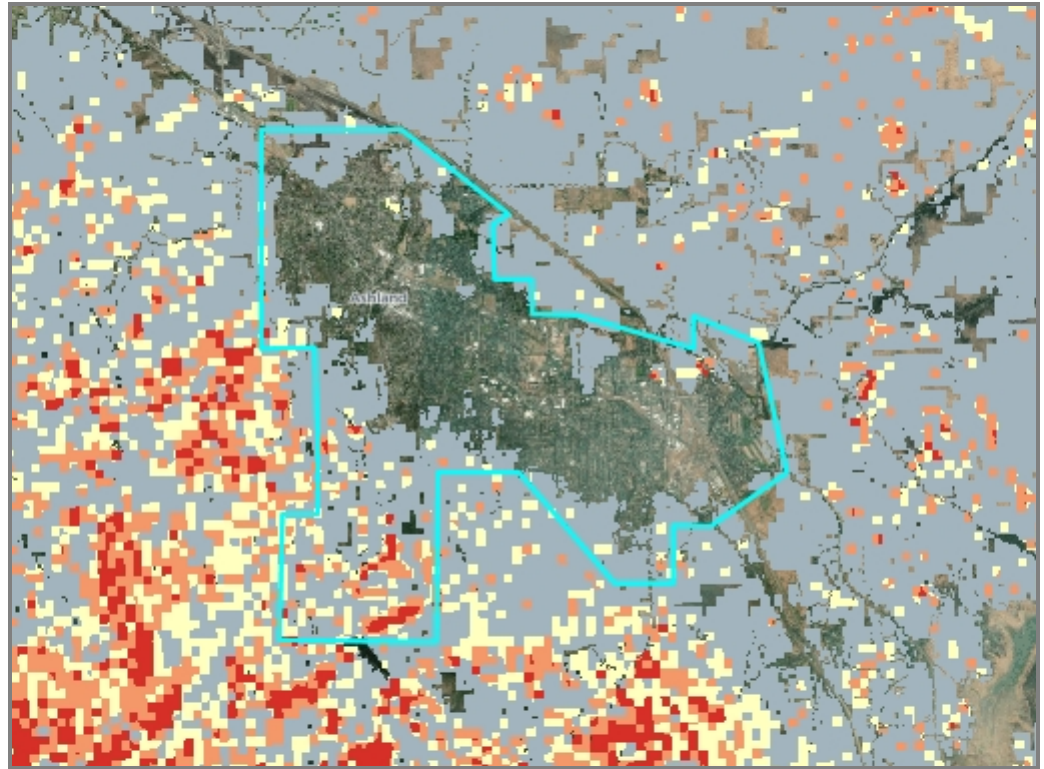
PROBABILITY OF EXCEEDING 8 FOOT FLAME LENGTHS

Flame length is an indication of fire intensity, which is a primary factor to consider for firefighter safety and for gauging potential impacts to values at risk. Fires with greater flame lengths are very intense and are expected to be highly difficult to control -- too intense for firefighters to work at the front of the flame, and they can severely impact values at risk. Tree torching and spotting is expected and ember travel is increased.

Fires with >8' flame lengths may be very difficult to control with little ability to work at the front of the flame, and greater risk of torching, crowning and spotting.

Using this layer to help target locations of higher flame length potential, a local assessment might reveal opportunity to reduce fire intensity as a goal of fuels treatment projects by using managed fire and/or other active management activities.

Values are expressed as a percent likelihood. These probabilities do not take into account the likelihood of an area burning.



City of Ashland probability of exceeding 8' flames

Category	Description	Acres	%*
75-100%	If a fire occurs, there is a very high (>75%) chance that flame lengths will be greater than 8'.	69	1
50-75%	If a fire occurs, there is a high (50-75%) chance that flame lengths will be greater than 8'.	210	3
25-50%	If a fire occurs, there is a moderate (25-50%) chance that flame lengths will be greater than 8'.	308	5
0-25%	If a fire occurs, there is a low (<25%) chance that flame lengths will be greater than 8'.	2,217	34
0%	This area contains non-burnable fuel types such as water, urban, agriculture, barren rock, glacial areas, etc.	3,812	58

Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision



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City of Ashland
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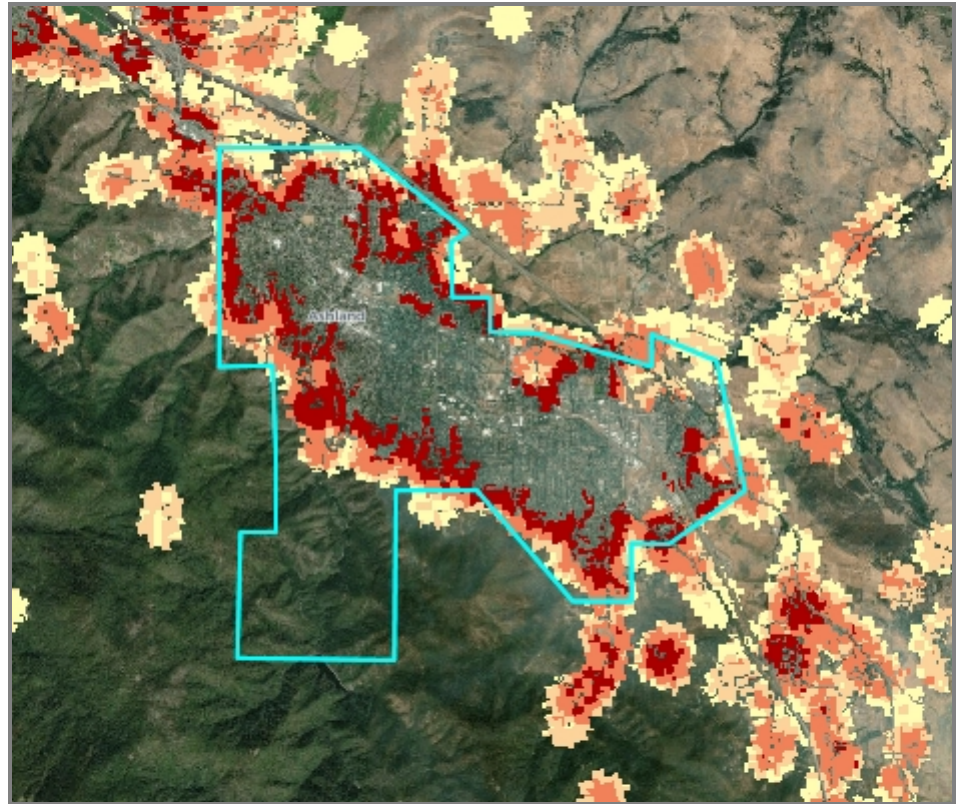
Generated: April 8, 2022

POTENTIAL IMPACT TO PEOPLE AND PROPERTY

Potential impact to people and property represents the exposure or consequence of wildfire on mapped highly valued assets including housing unit density and USFS private inholdings.

The Potential Impact data layers characterize exposure and susceptibility only, and do not include the likelihood of an area burning. This differentiates the Potential Impact layers from Wildfire Risk layers, which account for the burn probability in the risk rating.

The data values reflect a range of impacts from very high to low negative consequences. Positive benefits of wildfire are not mapped in this layer, assuming that any impact of wildfire to human development is negative.



City of Ashland potential impact to people and property, if a wildfire were to occur.

Category	Description	Acres	%*
Very High	Potential impact is very highly negative to people and property (top 5%).	973	15
High	Potential impact is highly negative (80-95th percentile).	580	9
Moderate	Potential impact is moderately negative (50-80th percentile).	260	4
Low	Potential impact is slightly negative (0-50th percentile).	171	3
No Data	There is no people and property mapped in the area or it is considered non-burnable (urban, agriculture, barren, etc).	4,634	70

Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision



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POTENTIAL IMPACT TO INFRASTRUCTURE

Potential impact to infrastructure represents the exposure or consequence of wildfire on mapped highly valued assets including critical infrastructure, developed recreation, housing unit density, seed orchards, sawmills, and historic structures.

The Potential Impact data layers characterize exposure and susceptibility only, and do not include the likelihood of an area burning. This differentiates the Potential Impact layers from Wildfire Risk layers, which account for the burn probability in the risk rating.

The resulting values reflect a range of impacts from a very high to low negative consequences. Positive benefits of wildfire are not mapped in this layer, assuming that any impact of wildfire to infrastructure is negative.



City of Ashland potential impact to infrastructure, if a wildfire were to occur.

Category	Description	Acres	%*
Very High	Potential impact is very highly negative (top 5%).	36	< 1
High	Potential impact is highly negative (80-95th percentile).	16	< 1
Moderate	Potential impact is moderately negative (50-80th percentile).	143	2
Low	Potential impact is slightly negative (0-50th percentile).	246	4
No Data	There is no infrastructure mapped in the area or it is considered non-burnable (urban, agriculture, barren, etc).	6,175	93

Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
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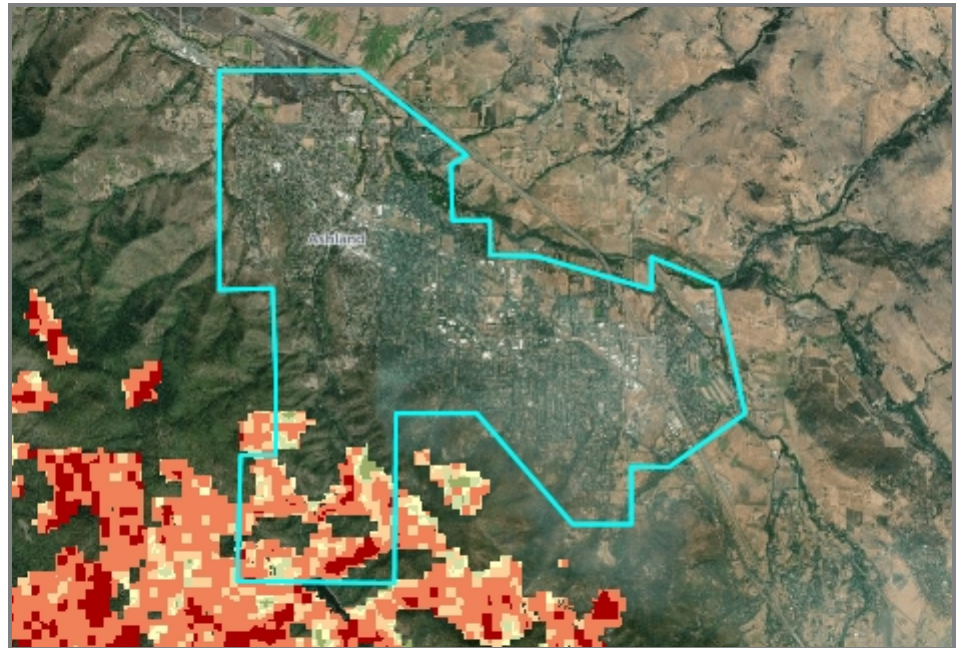
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POTENTIAL IMPACT TO WILDLIFE

Potential impact to wildlife represents the exposure or consequence of wildfire on mapped wildlife habitat for the following species: northern spotted owl, marbled murrelet, sage grouse, chinook salmon, coho salmon, steelhead trout, bull trout, redband trout, coastal cutthroat, and Lahontan cutthroat trout.

The Potential Impact data layers characterize exposure and susceptibility only, and do not include the likelihood of an area burning. This differentiates the Potential Impact layers from Wildfire Risk layers, which account for the burn probability in the risk rating.

The data values reflect a range of impacts from a very high negative consequences, where wildfire is detrimental (for example, sensitive habitat with fire-intolerant species), to a positive impacts of wildfire, where wildfire will produce an overall benefit (for example, improving wildlife habitat for fire-dependent species).



City of Ashland potential impact to wildlife habitat, if a wildfire were to occur.

Category	Description	Acres	%*
Very High	Potential impact is very highly negative (top 5%).	54	< 1
High	Potential impact is highly negative (80-95th percentile).	318	5
Moderate	Potential impact is moderately negative (50-80th percentile).	157	2
Low	Potential impact is slightly negative (17-50th percentile).	32	< 1
Low Benefit	Potential impact is slightly beneficial to wildlife at low flame lengths (8-17th percentile).	36	< 1
Benefit	Potential impact is beneficial, with a cumulative positive impact on wildlife habitat (0-8th percentile).	18	< 1
No Data	There is no wildlife habitat mapped in the area, or it is considered non-burnable (urban, agriculture, barren, etc).	6,001	91

Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision



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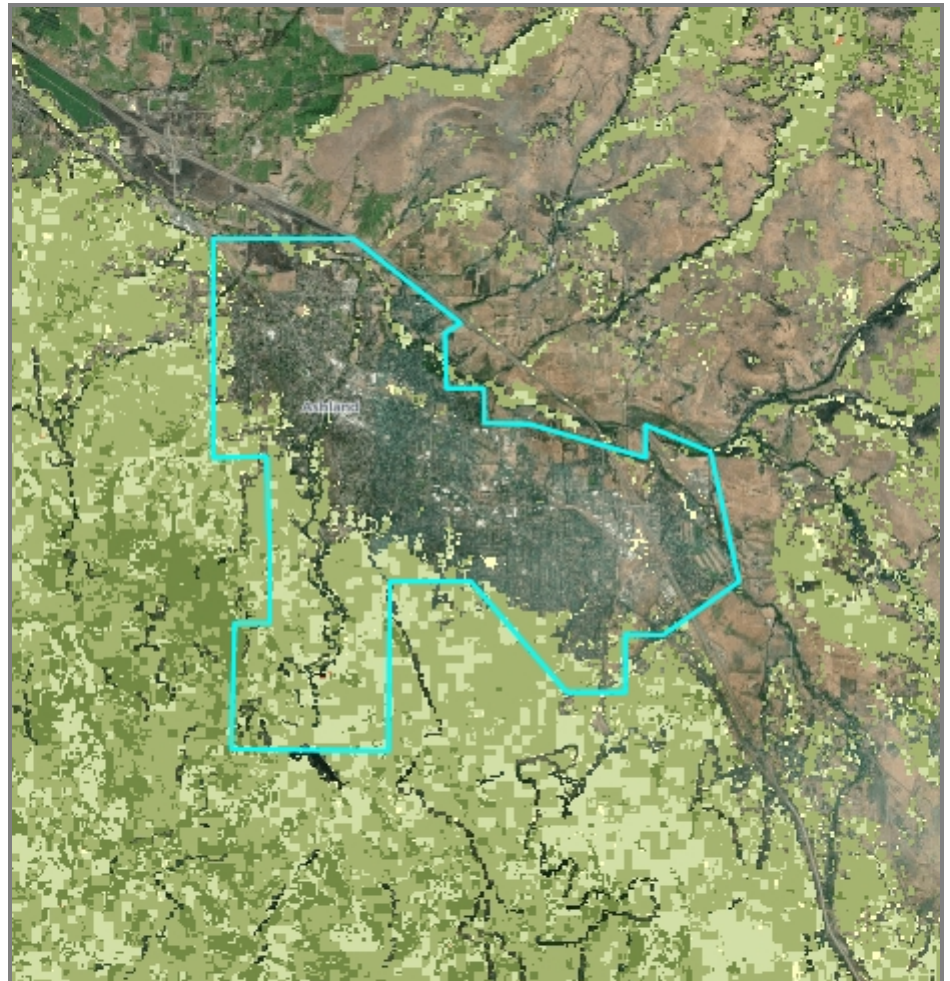
Generated: April 8, 2022

POTENTIAL IMPACT TO FOREST VEGETATION

Potential impact to forest vegetation represents the exposure or consequence of wildfire on mapped forest vegetation. This layer provides information about departure of current vegetation condition relative to historical vegetation and reference conditions, and considers the natural role of fire to specific fire regime groups.

The Potential Impact data layers characterize exposure and susceptibility only, and do not include the likelihood of an area burning. This differentiates the Potential Impact layers from Wildfire Risk layers, which account for the burn probability in the risk rating.

The data values reflect a range of impacts from a very high negative rating, where wildfire will move the landscape further from historical or desired conditions, to positive, where wildfire will bring the landscape closer to historical or desired conditions. Note that wildfire impacts on rangeland and grassland vegetation were not simulated due to a lack of spatial data and adequate characterization of wildfire impacts on vegetation outside of forested communities.





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City of Ashland potential impact to forest vegetation, if a wildfire were to occur.

Category	Description	Acres	%*
Very High	Potential impact is very highly negative (top 3%). Fire has a highly detrimental effect on the landscape, moving the landscape further from historical/desired conditions.	156	2
High	Potential impact is highly negative (87-97th percentile). Fire has a detrimental effect on the landscape, moving the landscape further from historical/desired conditions.	1,257	19
Moderate	Potential impact is moderately negative (52-87th percentile). Fire will move the landscape further from historical/desired conditions.	590	9
Low	Potential impact is slightly negative (19-52th percentile). Fire will move the landscape further from historical/desired conditions.	54	< 1
Low Benefit	Potential impact is slightly beneficial to forest vegetation at low flame lengths, potentially producing a "fuel treatment" effect (0.6-19th percentile).	< 1	< 1
Benefit	Potential impact is beneficial, with a cumulative positive impact on forest vegetation (0-0.6th percentile). There is potential for fire to bring the landscape closer to	2	< 1
No Data	There is no vegetation mapped in the area, or it is considered non-burnable (urban, agriculture, barren, etc).	4,557	69

Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision



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FIRE REGIME GROUPS

A fire regime is a description of the general characteristics of a fire area, including frequency, intensity, size, pattern, season, and severity of effects of wildfire in an ecosystem over an extended period of time, dependent on topography, weather, vegetation, and fire history. How intensely a fire burns determines the effects and severity. Overall impacts of fires will depend on the historical fire regime and the influence of changes to that regime through changes in forest structure, composition, and processes.

Existing vegetation has departed from historical conditions in some areas, which affects the current fire environment. This departure depicts relative degrees of alterations of key ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings. The potential impact to forest vegetation layer (and other potential impact layers) shows the areas where wildfire will move the landscape further from historical conditions, and where there are opportunities to use managed fire, active management, or other fuel treatments to bring the landscape closer to historical conditions.

Historically, higher fire frequency areas have lower fire severities. Vegetation in these areas is considered adaptive or resilient to fire due to this frequency. Examples include Ponderosa pine forests and dry mixed conifer forests. Lower frequency fire regime areas generally have higher severities, with vegetation and ecosystem elements usually considered sensitive due to their lack of exposure to fire. Examples include coastal forests, subalpine forests, alpine meadows, and many stream headwaters and riparian areas (see Existing vegetation).

Fire frequency suggests how often wildfire occurs (see Burn probability and Fire history data layers). Fire severity tells us how much impact wildfires are likely to have on the vegetation and other elements of an ecosystem (see Potential Impact data layers). The living and dead vegetation below forest canopies (shrubs, grasses, leaf litter, dead tree snags, etc.) also influences fire behavior (intensity and spread) and severity (impacts or effects). See Fuel models and Flame length data layers).

The national classification of fire regime groups commonly used includes five groups of fire frequency and severity pairs: I - frequent fire (0-35 years), low severity; II - frequent fire (0-35 years), stand replacement severity; III - 35-100+ years, mixed severity; IV - 35-100+ years, stand replacement severity; and V - 200+ years, stand replacement severity. Oregon has all of these historical fire regimes.

Maps of fire regime groups from LANDFIRE can be found here:
https://www.landfire.gov/geoareasmaps/2012/CONUS_FRG_c12.pdf.

Find more information about fire regime groups here: <https://www.landfire.gov/frg.php>.

Fire Regime table for major vegetation areas (in the Pacific Northwest):
https://www.fs.fed.us/database/feis/fire_regime_table/fire_regime_table.html#PacificNorthwest



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



Generated: April 8, 2022

POTENTIAL IMPACT TO TIMBER RESOURCES

Potential impact to timber resources represents the exposure or consequence of wildfire on mapped highly valued timber on US Forest Service, Tribal, private lands, BLM, and state-managed lands.

The Potential Impact data layers characterize exposure and susceptibility only, and do not include the likelihood of an area burning. This differentiates the potential impact layers from Wildfire Risk layers, which account for the burn probability in the risk rating.

The data values reflect a range of impacts from a very high negative rating, where wildfire is detrimental (for example early seral stage and/or sensitive forests), to positive, where wildfire may produce an overall benefit (for example, understory thinning treatment for fire-adapted species).



City of Ashland potential impact to timber resources, if a wildfire were to occur.

Category	Description	Acres	%*
Very High	Potential impact is very highly negative (top 5%).	0	0
High	Potential impact is highly negative (80-95th percentile).	0	0
Moderate	Potential impact is moderately negative (50-80th percentile).	0	0
Low	Potential impact is slightly negative (19-50th percentile).	0	0
Low Benefit	Potential impact is slightly beneficial to timber resources at low flame lengths (9-19th percentile).	0	0
Benefit	Potential impact is beneficial, with a cumulative positive impact on timber resources (0-9th percentile).	0	0
No Data	There are no timber resources mapped in the area, or it is considered non-burnable (urban, agriculture, barren, etc).	6,617	100

Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)

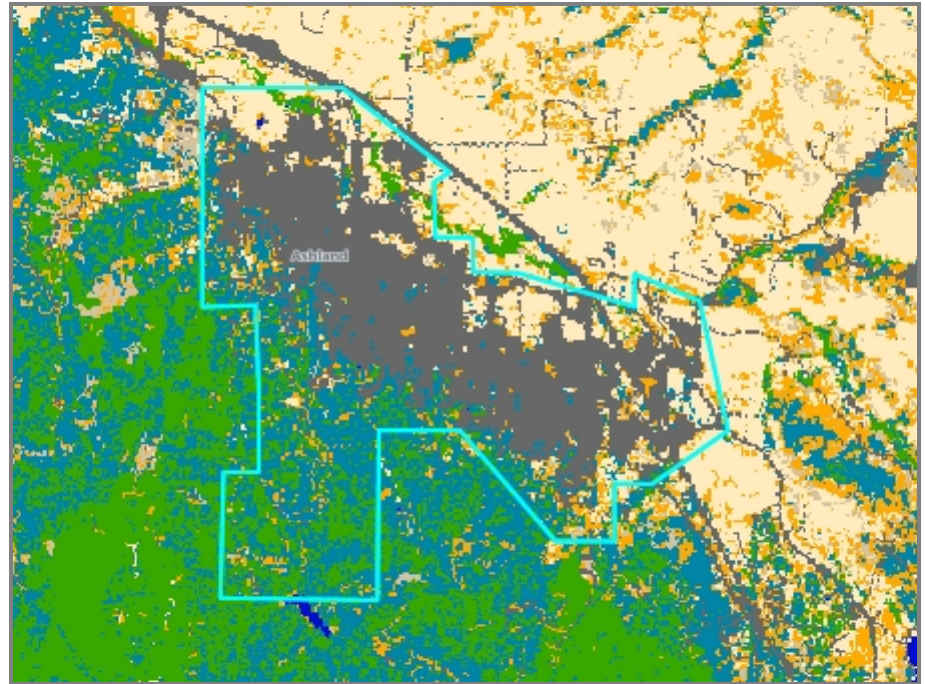


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FUEL MODEL GROUPS

Fuel models describe the fire-carrying materials that make up surface fuels, such as such as grasses, shrubs and litter (see next page). Fuel models are developed from climate characteristics, existing vegetation type, cover, height, and other vegetation characteristics, and help us understand the fuels igniting and carrying fire. These fuel models can be grouped into broad categories of burnable fuels based on descriptions of live and dead vegetation that represent distinct fuel types, size classes, and load distributions (amounts), shown in the map and chart below.

Fuels and other elements of the fuelscape in the risk assessment were extensively reviewed and refined by local expert consultation, and the fuelscape was updated to account for wildfires that occurred through 2017.



City of Ashland fuel model groups (see next page for descriptions of codes)

Category	Description	Acres	%*
Grass	Fuel models 101-104, (GR1; GR2; GR3; GR4)	843	13
Grass/Shrub	Fuel models 121-123, (GS1; GS2; GS3)	466	7
Non-burnable-other	Fuel Models 91-93,99, (NB1; NB2; NB3; NB9)	3,023	46
Non-burnable-water	Fuel Models 98, (NB8)	8	< 1
Slash-blowdown	Fuel Models 202, (SB2)	0	0
Shrub	Fuel Models 141-147, (SH1; SH2; SH3; SH4; SH5; SH6; SH7)	52	< 1
Timber Litter	Fuel Models 181-189, (TL1; TL2; TL3; TL4; TL5; TL6; TL7; TL8; TL9)	1,484	22
Timber-Understory	Fuel Models 161-163, 165, (TU1; TU2; TU3; TU5)	741	11

Source: 2018 Pacific Northwest Quantitative Wildfire Risk Assessment, US Forest Service

* Values may add up to over 100% due to rounding precision



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



Generated: April 8, 2022

Table of Fuel Model Groups

40 Scott and Burgan Fire Behavior Fuel Models Description and Data Dictionary <https://www.landfire.gov/fbfm40.php>
<https://www.landfire.gov/DataDictionary/f40.pdf>

Group	Description
Grass Fuel models 101-104, (GR1; GR2; GR3; GR4)	GR1: Short, sparse dry climate grass is short, naturally or heavy grazing, predicted rate of fire spread and flame length low GR2: Low load, dry climate grass primarily grass with some small amounts of fine, dead fuel, any shrubs do not affect fire behavior GR3: Low load, very coarse, humid climate grass continuous, coarse humid climate grass, any shrubs do not affect fire behavior GR4: Moderate load, dry climate grass, continuous, dry climate grass, fuelbed depth about 2 feet
Grass/Shrub Fuel models 121-123, (GS1; GS2; GS3)	GS1: Low load, dry climate grass-shrub shrub about 1 foot high, grass load low, spread rate moderate and flame length low GS2: Moderate load, dry climate grass-shrub, shrubs are 1-3 feet high, grass load moderate, spread rate high, and flame length is moderate GS3: Moderate load, humid climate grass-shrub, moderate grass/shrub load, grass/shrub depth is less than 2 feet, spread rate is high and flame length is moderate
Non-Burnable-Other	Fuel Models 91-93, 99, (NB1; NB2; NB3; NB9) NB1: Urban NB2: Snow/Ice NB3: Agriculture NB9: Barren
Non-burnable-Water	Fuel Model 98, (NB8): Water
Slash-blowdown	Fuel Model 202, (SB2): Moderate load activity fuel or low load blowdown, 7-12 t/ac, 0-3 inch diameter class, depth about 1 foot, blowdown scattered with many still standing, spread rate and flame low
Shrub Group Fuel Models 141-147, (SH1; SH2; SH3; SH4; SH5; SH6; SH7)	SH1: Low load dry climate shrub, woody shrubs and shrub litter, fuelbed depth about 1 foot, may be some grass, spread rate and flame low SH2: Moderate load dry climate shrub, woody shrubs and shrub litter, fuelbed depth about 1 foot, no grass, spread rate and flame low SH3: Moderate load, humid climate shrub, woody shrubs and shrub litter, possible pine overstory, fuelbed depth 2-3 feet, spread rate and flame low SH4: Low load, humid climate timber shrub, woody shrubs and shrub litter, low to moderate load, possible pine overstory, fuelbed depth about 3 feet, spread rate high and flame moderate SH5: High load, humid climate grass-shrub combined, heavy load with depth greater than 2 feet, spread rate and flame very high SH6: Low load, humid climate shrub, woody shrubs and shrub litter, dense shrubs, little or no herbaceous fuel, depth about 2 feet, spread rate and flame high SH7: Very high load, dry climate shrub, woody shrubs and shrub litter, very heavy shrub load, depth 4-6 feet, spread rate somewhat lower than SH6 and flame very high



Oregon Wildfire Risk Explorer- Advanced Report

City of Ashland
6,616 Acres: (10 Sq. Miles)



Generated: April 8, 2022

Timber Litter Group	TL1: Low load compact conifer litter, compact forest litter, light to moderate load, 1-2 inches deep, may represent a recent burn, spread rate and flame low TL2: Low load broadleaf litter, broadleaf, hardwood litter, spread rate and flame low TL3: Moderate load conifer litter, moderate load conifer litter, light load of coarse fuels, spread rate and flame low TL4: Small downed logs moderate load of fine litter and coarse fuels, small diameter downed logs, spread rate and flame low TL5: High load conifer litter, light slash or dead fuel, spread rate and flame low TL6: Moderate load broadleaf litter, spread rate and flame moderate TL8: Large downed logs, heavy load forest litter, larger diameter downed logs, spread rate and flame low TL8: Long needle litter, moderate load long needle pine litter, may have small amounts of herbaceous fuel, spread rate moderate and flame low TL9: Very high load broadleaf litter, may be heavy needle drape, spread rate and flame moderate
Timber-Understory Group	TU1: Low load dry climate timber grass shrub, low load of grass and/or shrub with litter, spread rate and flame low TU2: Moderate load, humid climate timber-shrub, moderate litter load with some shrub, spread rate moderate and flame low TU3: Moderate load, humid climate timber grass shrub, moderate forest litter with some grass and shrub, spread rate high and flame moderate TU5: Very high load, dry climate shrub, heavy forest litter with shrub or small tree understory, spread rate and flame moderate
Fuel Models 181-189, (TL1; TL2; TL3; TL4; TL5; TL6; TL7; TL8; TL9)	
Fuel Models 161-163, 165, (TU1; TU2; TU3; TU5)	

This report was generated from the Advanced Oregon Wildfire Risk Explorer map viewer: tools.oregonexplorer.info/OE_HtmlViewer/index.html?viewer=wildfireplanning. For more information on wildfire risk in a specific location, you can generate a Homeowner's report from the Oregon Wildfire Risk Explorer map viewer.

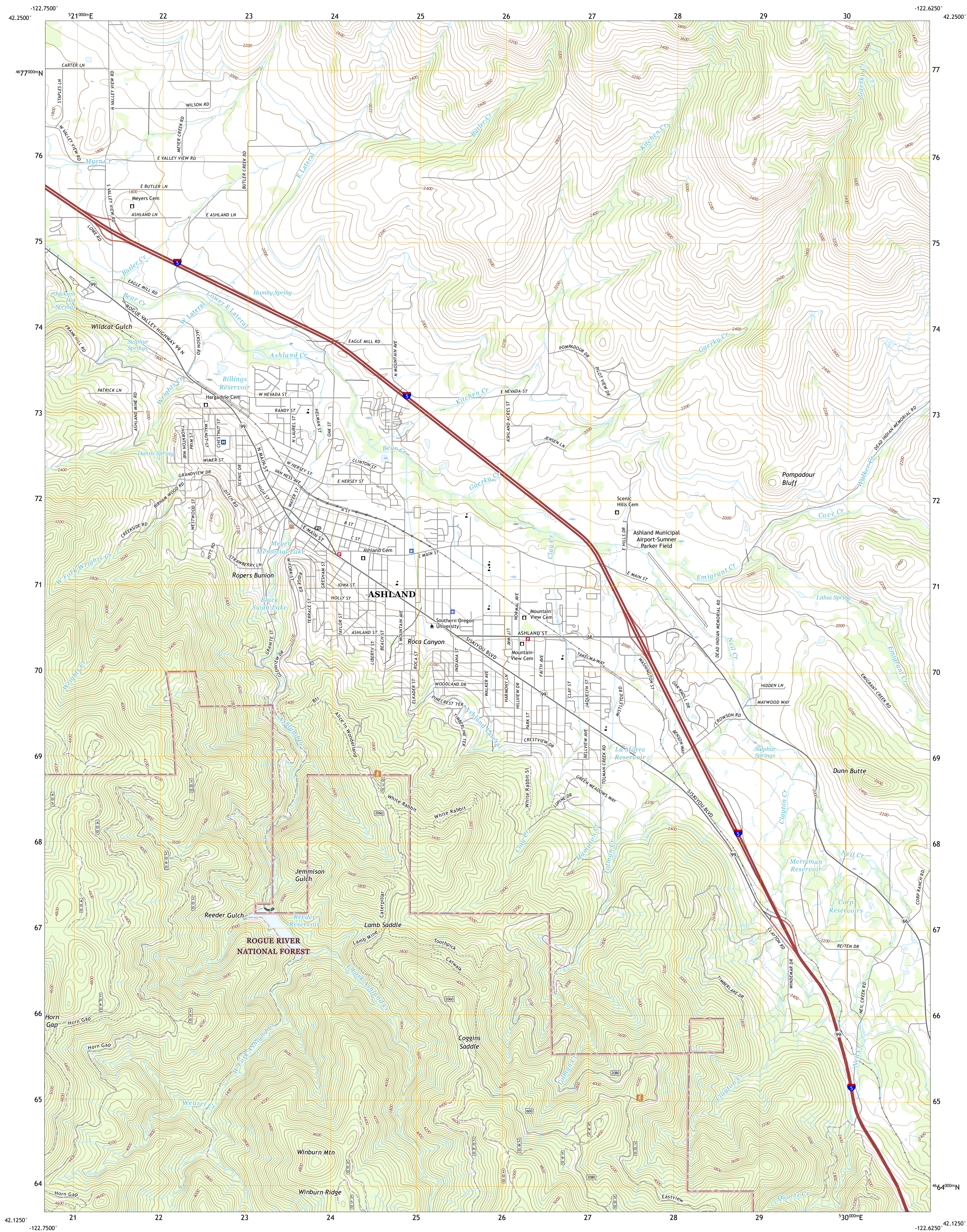
How to Cite:

Accessed from the Oregon Wildfire Risk Explorer on April 08, 2022
URL: https://tools.oregonexplorer.info/OE_HtmlViewer/index.html?viewer=wildfireplanning
Primary data Source: USDA Forest Service Pacific Northwest Quantitative Wildfire Risk Assessment (2018)

The Oregon Wildfire Risk Explorer site, tools and reports are the result of a collaboration among the following organizations and others:



Wildfire risk data is primarily from the USDA Forest Service 2018 Pacific Northwest Quantitative Wildfire Risk Assessment with some components from the 2013 West Wide Wildfire Risk Assessment. The information is being provided as is and without warranty of any kind either express, implied or statutory. The user assumes the entire responsibility and liability related to their use of this information. By accessing this website and/or data contained within, you hereby release the Oregon Department of Forestry, Oregon State University, and all data providers from liability. This institution is an equal opportunity provider. This publication was made possible through grants from the USDA Forest Service.



Produced by the United States Geological Survey North American Datum of 1983 (NAD83) World Geodetic System of 1984 (WGS84)...

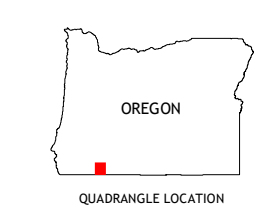
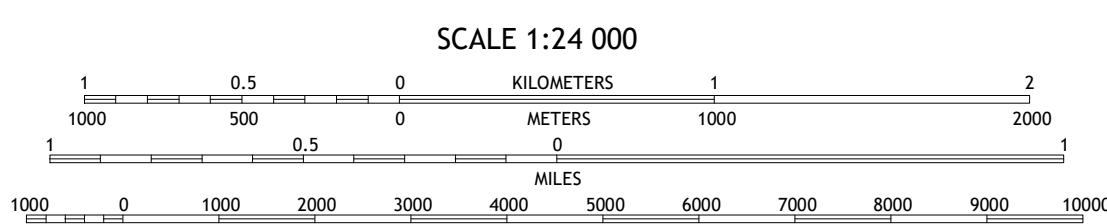
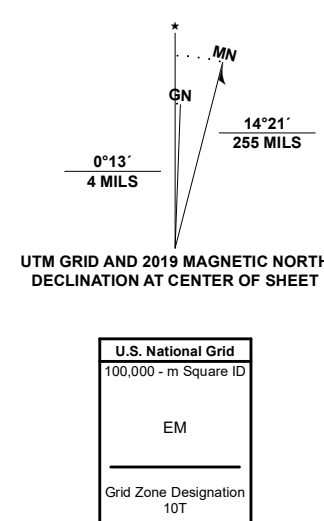


Table with 2 columns: ADJOINING QUADRANGLES (1-8) and corresponding locations (Medford East, Rio Canyon, Grizzly Peak, etc.).

- ROAD CLASSIFICATION: Expressway, Secondary Hwy, Ramp, Interstate Route, FS Primary Route, Local Connector, Local Road, 4WD, US Route, FS Passenger Route, State Route, FS High Clearance Route.

Check with local Forest Service unit for current travel conditions and restrictions.

ASHLAND, OR 2020



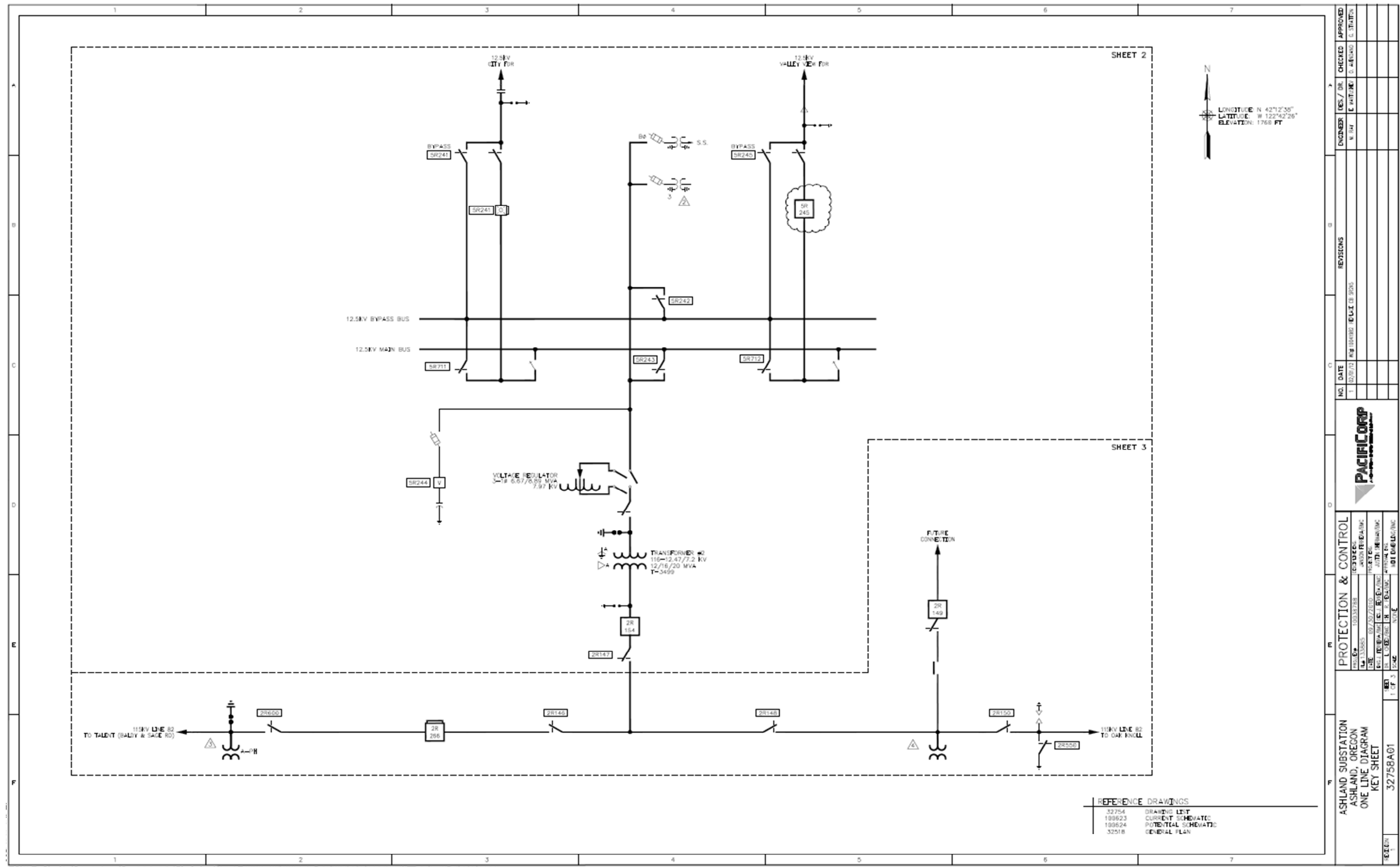


Figure B-3: Ashland Substation one-line diagram.

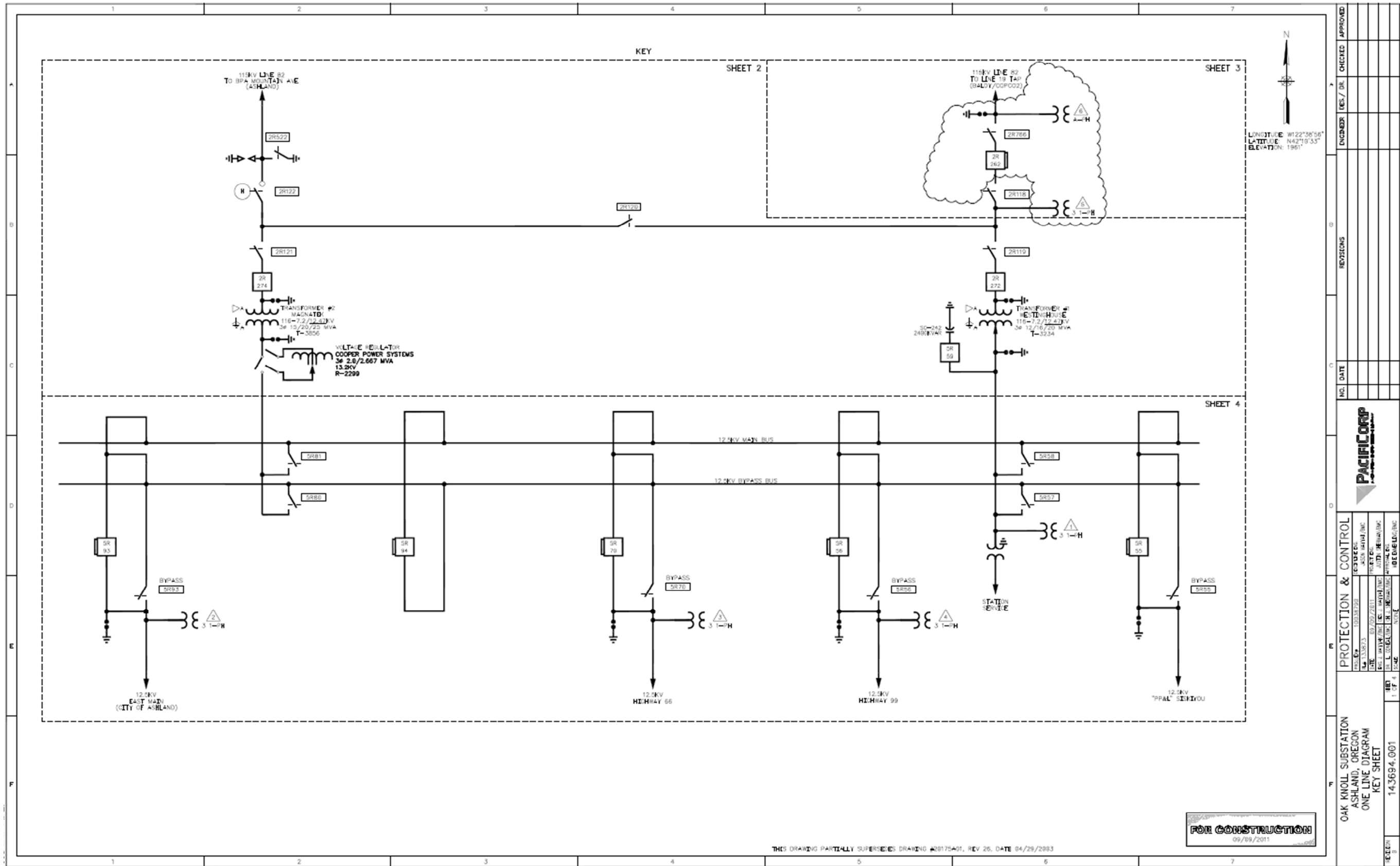
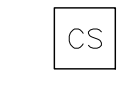
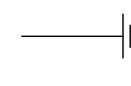




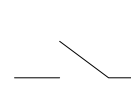











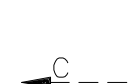


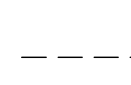


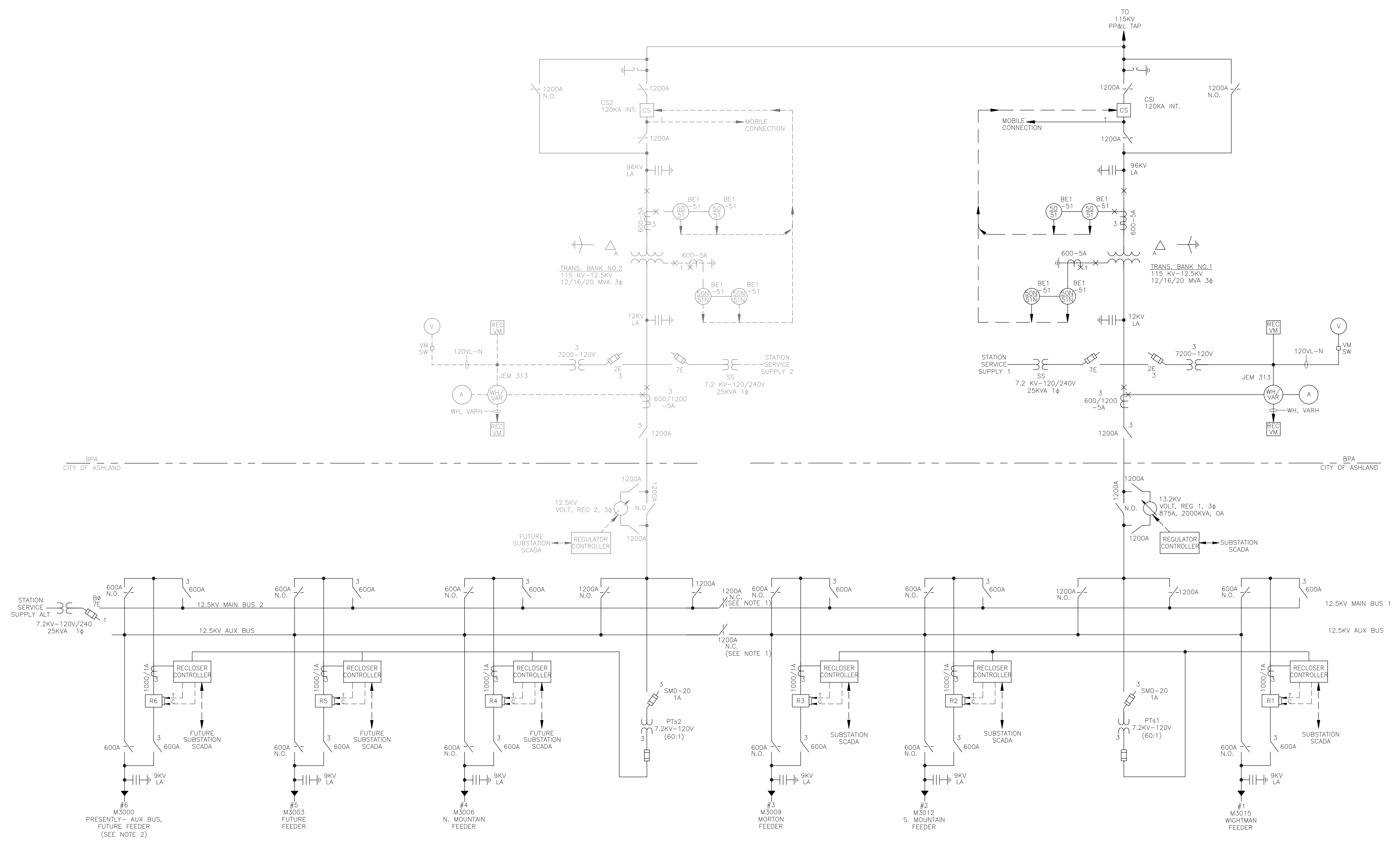
Figure B-4: Oak Knoll Substation one-line diagram.

LEGEND

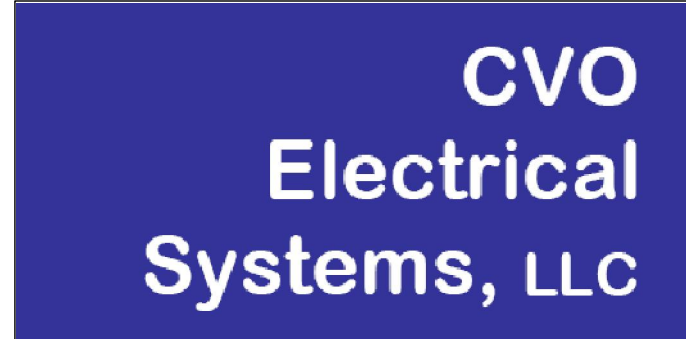
-  GROUP-OPERATED AIR BREAK SWITCH, RATED AS INDICATED
-  CIRCUIT SWITCHER, SF₆
-  GROUND
-  SURGE ARRESTER
-  BUSHING CURRENT TRANSFORMER
-  CURRENT TRANSFORMER
-  POWER TRANSFORMER
-  STATION SERVICE TRANSFORMER
-  POTENTIAL TRANSFORMER
-  HOOK-OPERATED SWITCH, 1 POLE, RATED AS INDICATED
-  POWER FUSE
-  OVERCURRENT RELAY
-  RECLOSER, VACUUM
-  STEP-TYPE VOLTAGE REGULATOR
-  AMMETER
-  VOLTMETER SWITCH
-  VOLTMETER
-  BPA-REVENUE METERING SOLID-STATE ELECTRONIC JOULE METER (SC-JEM-313)
-  RECLOSER CONTROLLER
-  REGULATOR CONTROLLER
-  TRIP SIGNAL
-  CLOSE SIGNAL
-  UNDERGROUND CABLE TERMINATION
-  OVERHEAD CABLE TERMINATION
-  FUTURE SCADA
-  FUTURE EXPANSION
-  N.O. NORMALLY OPEN SWITCH

NOTES:

1. UNTIL SUCH TIME AS THE 2ND TRANSFORMER BANK IS ADDED, BOTH THE MAIN AND AUX BUS TIE SWITCHES SHALL BE NORMALLY CLOSED.
2. UNTIL FEEDER M3000 IS PUT INTO SERVICE THIS RECLOSER POSITION WILL SERVE THE AUX BUS.



SEALED DRAWING ON FILE



VERIFY SCALES
 BAR IS ONE INCH ON ORIGINAL DRAWING
 IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

DRAWN: A IRWIN							
CHECKED:							
PROJ. ENG.: J WITKOWSKI							
DRAWING FILE:							
903209-2							
DATE: JUNE 2010	6/2010	RECORD DRAWING					
	NO.	DATE	REVISION	BY	APP'D		



MOUNTAIN AVENUE SUBSTATION

ONE-LINE DIAGRAM WITH TIE-SWITCHES

REF BPA DRAWING 180764-EPB-A1-1 OF 1, REV 0

SHEET MAS 2

RECORD DRAWING

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SIEMENS

Siemens Surge Arresters with Arc Protection System

The right solution for preserving the environment



Siemens Type 3EK distribution class surge arresters with an Arc Protection System (APS)

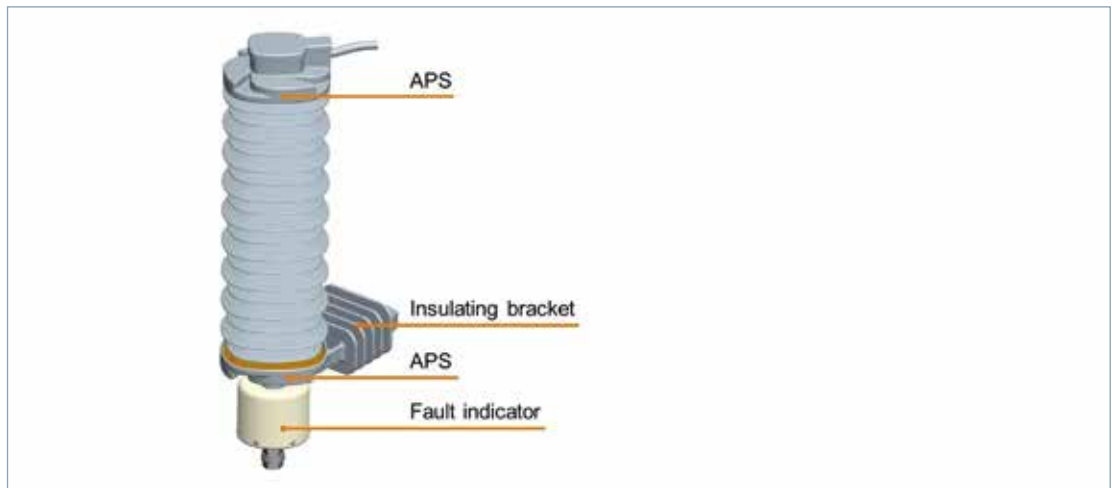
When overvoltage exceeds the energy capacity of an arrester, the varistor blocks become damaged, causing a permanent failure of the arrester. A fault current is developed and arcing begins to occur on the two terminals of the arrester. Molten metal can fall to the ground and ignite ground cover, leading to wildfires that can harm people and wildlife, and damage trees and structures in the area.

Therefore, Siemens Type 3EK distribution class surge arresters can be configured with an Arc Protection System (APS) installed at both ends of the arrester. The APS unit consists of multiple metallic plates forming electrodes which are shaped and aligned in a way that the current flowing through the electrodes and the arc generates a magnetic field. That magnetic force makes the arc rotate around the arrester body, controlling and containing it, mitigating the creation of molten material coming from the end fittings, and thus greatly reducing the risk of wildfires.

The APS is available for Types 3EK4 and 3EK7. Especially in hot and dry regions with high risk of wildfires, such as the western US and South Australia, surge arresters with APS are highly recommended. The surge arrester is also equipped with a visible fault feature. In the event of an arrester failure, a red indicator will appear at the bottom of the arrester.

Siemens distribution arresters with APS fulfill the requirements of Cal Fire's Power Line Fire Prevention Field Guide (2008). They successfully passed all required testing with 100% compliance. As a result, Siemens surge arresters with APS record a substantially lower spark production rate than arresters without APS.

[siemens.com/arresters](https://www.siemens.com/arresters)



Siemens surge arresters with APS mitigate arcs, sparks, and hot materials sufficiently to prevent the ignition of flammable vegetation – particularly advised in regions with high risk of wildfires.

Available for 3EK7 and 3EK4 (with and without fault indicator).

Rated and tested in accordance with IEEE C62.11-2005 Standard for Metal-Oxide Surge Arresters for AC Power Circuits (recognized ANSI standard)

Meets the requirements of the Cal Fire's Power Line Fire Prevention Field Guide (2008) – the standard to evaluate overhead distribution class voltage devices with the intent to prevent wildfires.

Siemens Industry, Inc.
444 Highway 49 South
39218 Richland, MS
USA

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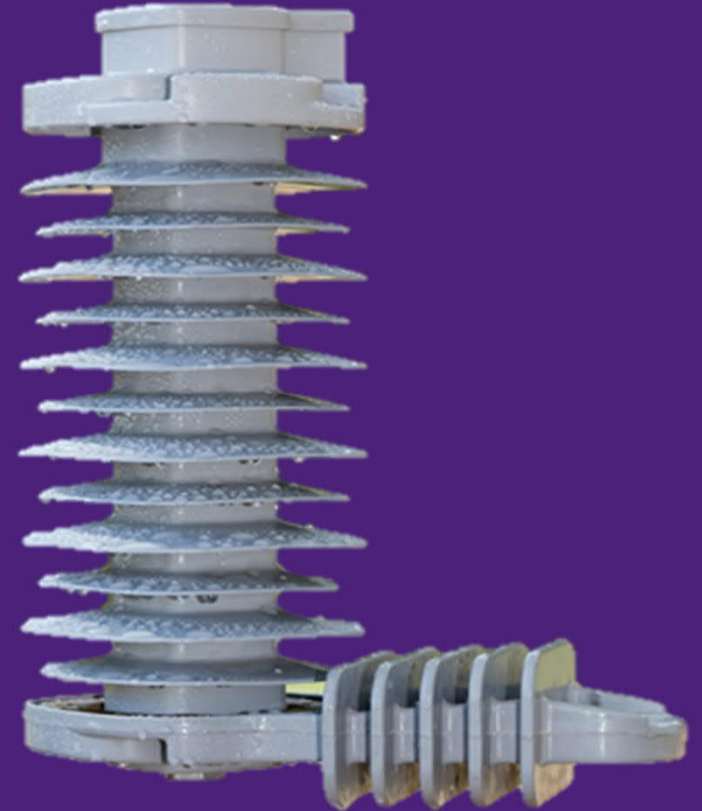
Reference List

3EK4 - CalFire exempt Surge Arresters

Customer	Description (rated/MCOV)	Arrester model
Bear Valley 7000 ft asl	Surge Arrester, 3/2.55 kV	3EK4 030-1AB4-Z Q95 N12
	Surge Arrester, 36/29 kV	3EK4 360-1AR4-Z Q95 N12
City of Redding	Surge Arrester, 9/7.65 kV	3EK4 090-1AC4-Z Q95 N12
Pacificorp * custom birdcap	Surge Arrester, 3/2.55 kV	3EK4 030-1AB4-Z Y96
	Surge Arrester, 3/2.55 kV	3EK4 030-4AB4-Z Y96
	Surge Arrester, 6/5.1 kV	3EK4 060-1AC4-Z Y96
	Surge Arrester, 6/5.1 kV	3EK4 060-4AC4-Z Y96
	Surge Arrester, 10/8.4 kV	3EK4 105-1AC4-Z Y96
	Surge Arrester, 10/8.4 kV	3EK4 105-4AC4-Z Y96
	Surge Arrester, 18/15.3 kV	3EK4 180-1AJ4-Z Y96
	Surge Arrester, 18/15.3 kV	3EK4 180-4AK4-Z Y96
PG&E	Surge Arrester, 15/12.7 kV	3EK4 150-1AF4-Z_Q96_N11
	Surge Arrester, 24/19.5 kV	3EK4 240-1AK4-Z_Q96_N11
SDGE	Surge Arrester, 3/2.55 kV	3EK4_030-1AB4-Z_Q95_N12
	Surge Arrester, 10/8.4 kV	3EK4_105-1AC4-Z_Q95_N12
	Surge Arrester, 12/10.2 kV	3EK4_120-1AF4-Z_Q95_N12
SMUD	Surge Arrester, 3/2.55 kV	3EK4 030-4AB4-Z Q95 N12
	Surge Arrester, 6/5.1	3EK4 060-4AC4-Z Q95 N12
	Surge Arrester, 12/10.2	3EK4 120-4AF4-Z Q95 N12
XCEL	Surge Arrester, 10/8.4 kV	3EK4 105-4AC4-Z Q95 N12
	Surge Arrester, 18/15.3 kV	3EK4 180-4AK4-Z Q95 N12

Distribution Class Arc Protection System

Surge Arrester 3EK4



Overview of the APS Purpose

Arc Protection System

Arrester type 3EK4 with Arc Protection System (APS)

- Specially designed arc plates.
- Forces arc to rotate externally to MOVs.
- Mitigates fire hazards from hot parts falling on combustible ground cover.
- Have performed witness testing and received approval from Cal Fire.



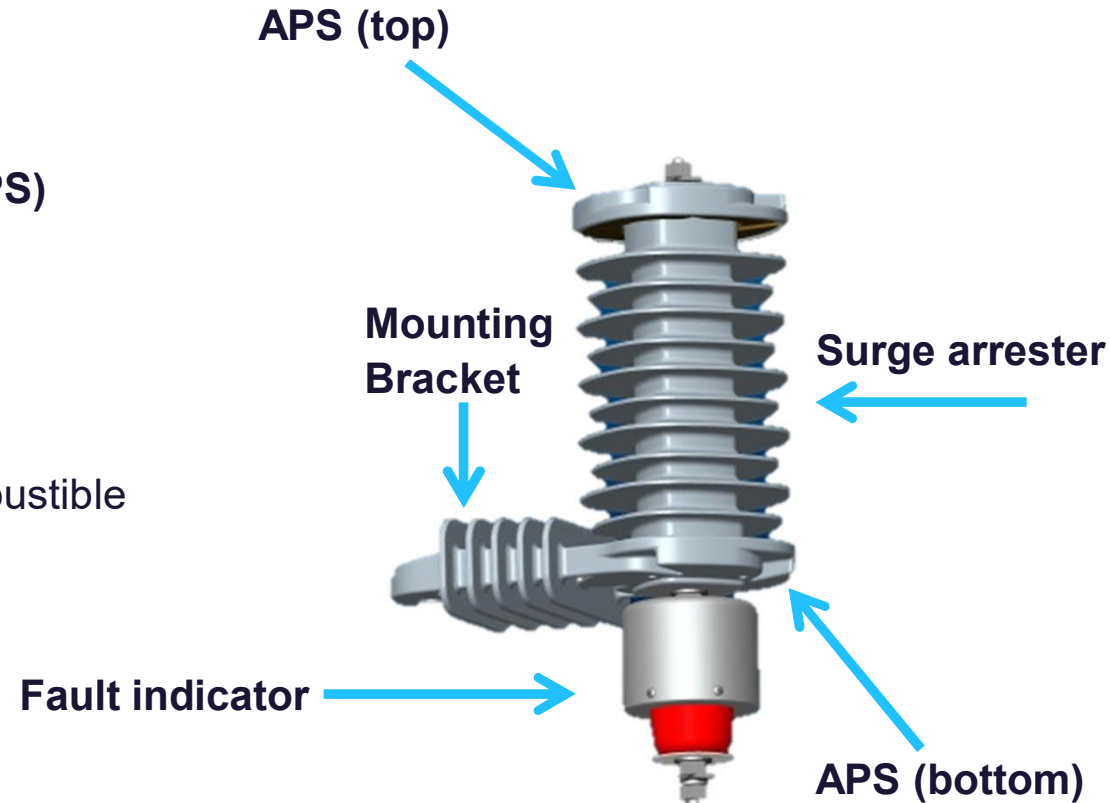
Overview of the APS Purpose

Arc Protection System

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Only arrester
with
Cal Fire's
permanent
exemption



Overview of the APS Purpose

Arc Protection System

Arrester type 3EK4 with Arc Protection System (APS)

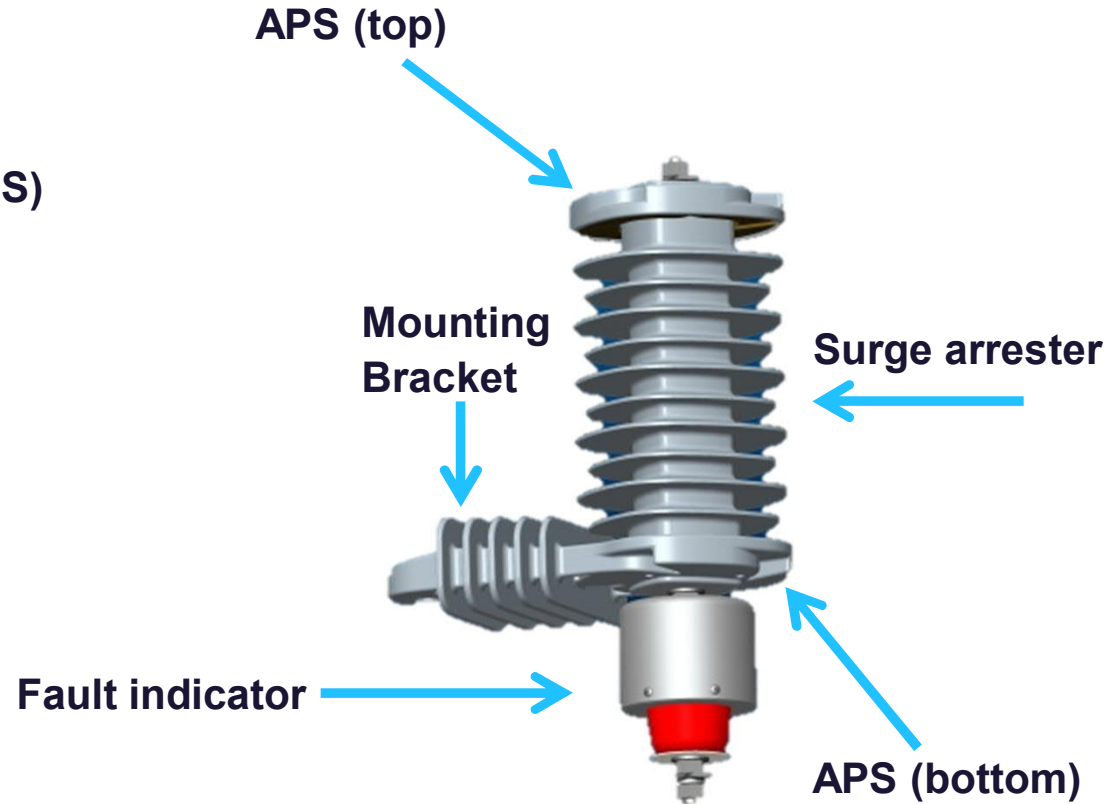


- Without APS

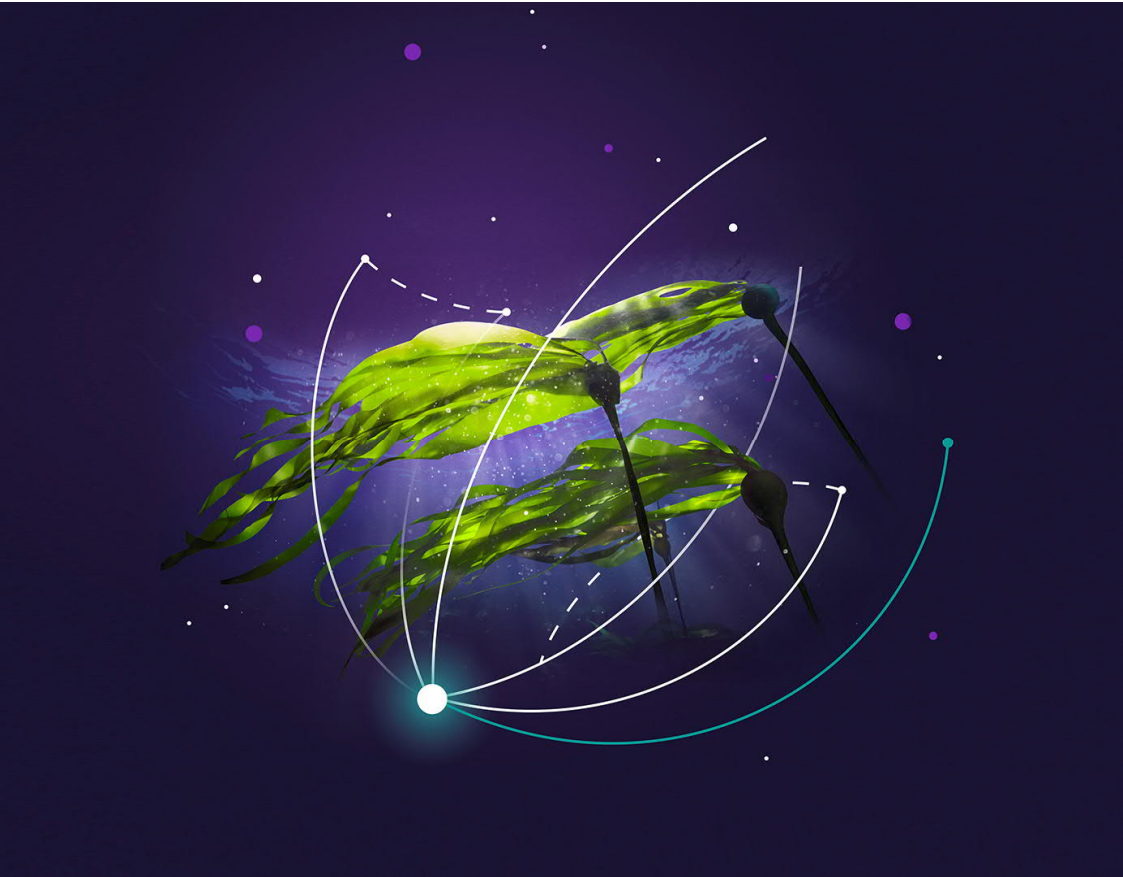


- With APS

Only arrester with Cal Fire's permanent exemption



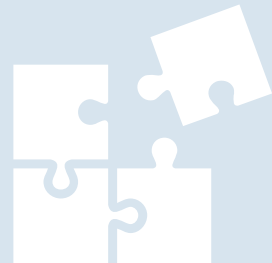
Siemens Surge Arresters **is** simply the best procurement choice



Adolfo Villanueva
Surge Arresters & Line Insulators

Siemens Industry, Inc.
adolfo.villanueva@siemens.com

www.siemens-energy.com



CMU medium voltage power fuses



General

Eaton's Cooper Power™ series CMU power fuse is a boric acid, expulsion-style fuse. Suitable for both indoor and outdoor applications, the CMU power fuse provides an economical alternative to refillable fuses. CMU expulsion power fuses are available in three maximum voltage classes: 17 kV, 27 kV, and 38 kV. The fuse unit comes in three speed variations: Standard "E", Slow "SE", and Fast "K". Amperage sizes range from 3 A through 200 A.

The CMU power fuse interrupting rating greatly exceeds that of conventional distribution cutouts that use a fuse tube and link design, and considerably reduces the hazards and noise of the violent exhaust common to cutouts under fault interrupting conditions. The CMU power fuse, employing the use of a calibrated silver element, boric acid for its interrupting media and rod mechanism for arc extension, creates low arcing voltage and mild exhaust during fault interruption.



Powering Business Worldwide

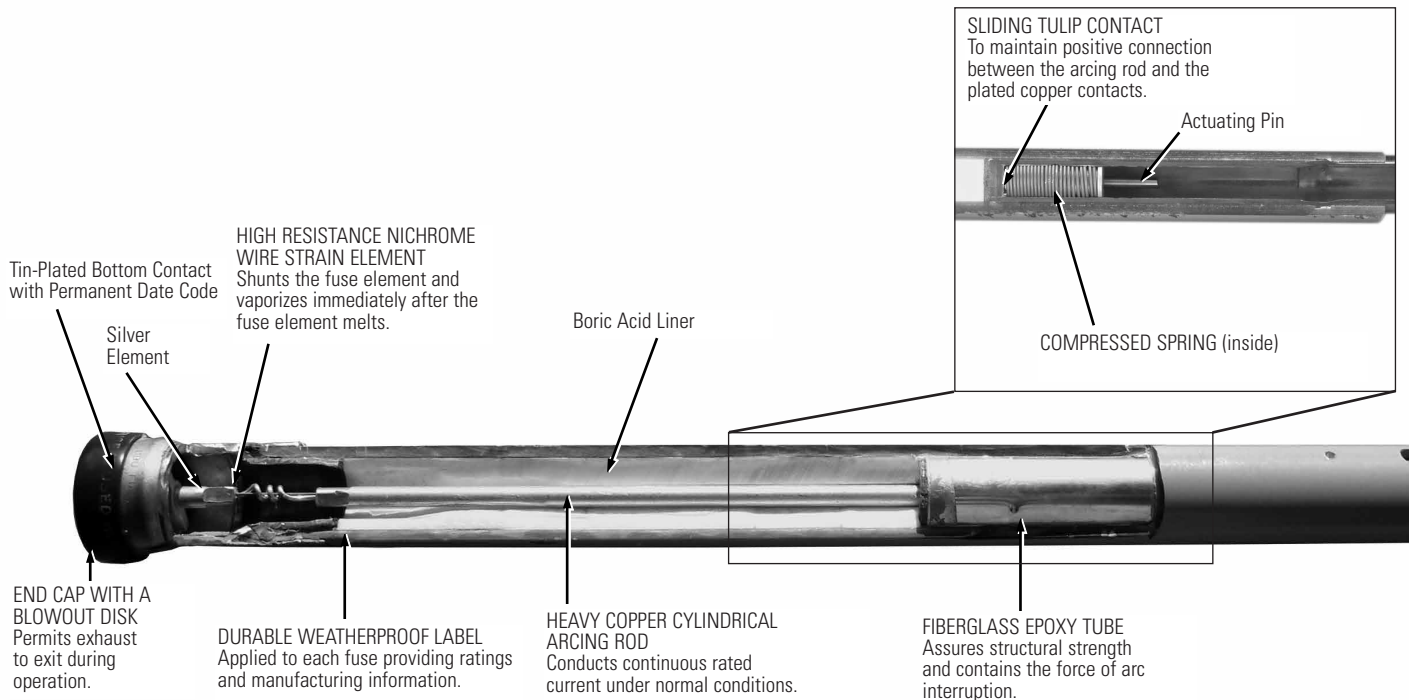


Figure 1. Fuse unit.

Application

The CMU power fuses provide effective protection for circuits and equipment which operate on system voltages up to 34,500 V. They can be used on both electric utility and industrial distribution systems. Typical applications include:

- Power Transformers
- Feeder Circuits
- Distribution Transformers
- Potential Transformers
- Station Service Transformers
- Metal-enclosed Switchgear
- Pad-Mounted Switches
- Overhead Capacitor Racks

CMU power fuses can be used in outdoor or indoor applications, and can be used to directly replace competitive equivalent units.

When used in upstream system protection, the CMU power fuse operates promptly to limit the stress on electrical systems due to short circuits. It provides isolation for the faulted circuit, limiting the size of interrupted service area.

Full protection is provided for downstream equipment, even down to minimum melt current, regardless of the nature of the fault. The CMU power fuse acts rapidly to take transformer and feeder circuits off-line before damage can become widespread. It also provides excellent isolation for capacitors in the event of a fault condition. When installed on the primary side of substation power transformers, CMU power fuses provide protection against small, medium or large faults.

Production tests

Tests are conducted in accordance with Eaton quality assurance requirements.

- Physical Inspection
- Micro-Ohm Resistance Testing
- Construction Integrity Testing

Installation

No special tools are required to install the CMU power fuse. The CMU power fuse and end fittings are designed to fit into industry standard mountings. Refer to Installation Instructions Sheet MN132032EN for details.

Electrical characteristics

- The CMU power fuse interrupts at a natural current zero in the current wave and allows a minimum of a half cycle of fault current to flow before the fault is cleared. The time-current characteristics associated with a CMU power fuse have a gradual slope, making it easier to coordinate with downstream equipment.
- The CMU power fuse is ideal for higher voltage (up to 38 kV) and high current applications (through 200 A). Proper coordination can be achieved through use of the appropriate time-current curves.
- The CMU power fuse provides effective protection for circuits and equipment which operates on voltages from 2,400 V to 34,500 V.
- The CMU power fuse has interrupting capabilities from 10,000 to 14,000 A symmetrical.
- The CMU power fuse is offered in three configuration for use with high currents: "E" (standard), "K" (fast), and "SE" (slow). The curves for the "SE" are less inverse and allow for more of a time delay at high currents.
- CMU power fuses, when used on the transformer-primary side, should be selected based on the anticipated normal transformer loading schedule, including daily or repetitive peak loads, and

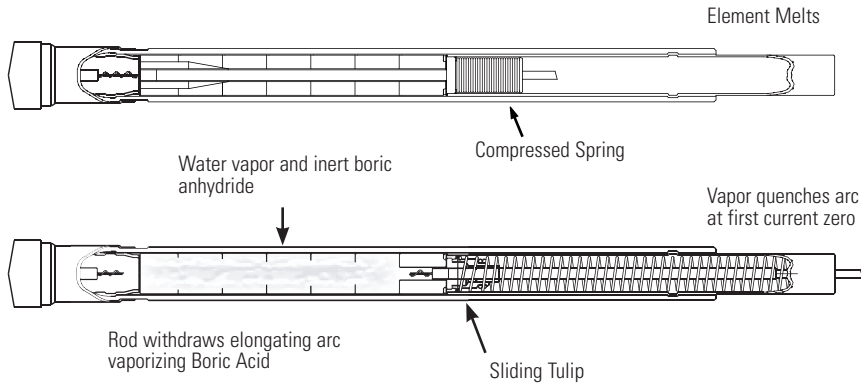


Figure 2. CMU power fuse cross section view.

must be sized with the inrush currents in mind.

The CMU power fuses have been designed and tested according to the following standards:

- IEEE Std C37.40™ standard—Service Conditions and Definitions for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
- IEEE Std C37.41™ standard—Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
- IEEE Std C37.42™ standard—Specifications for High-Voltage Expulsion Type Distribution Class Fuses, Cutouts, Fuse Disconnecting Switches and Fuse links
- IEEE Std C37.46™ standard—Specifications for High-Voltage Expulsion and Current-Limiting Type Power Class Fuses and Fuse Disconnecting Switches
- IEEE Std C37.48.1™ standard—Guide for the Operation, Classification, Application, and Coordination of Current-Limiting Fuses with Rated Voltages 1–38 kV

Operation

The CMU power fuse utilizes the proven performance of boric acid to create the de-ionizing action needed to interrupt the current. A spring-loaded arcing rod carries the normal continuous current through the unit when the circuit is operational.

Under normal conditions, the fusible element’s temperature is well below its melting temperature and does not melt. When a fault occurs that is large enough to melt the fuse element, an arc is initiated and elongated by the units spring, pulling the arcing rod up into the boric acid interrupting media. The heat produced decomposes the boric acid liner inside producing water vapor and boric anhydride which helps to de-ionize the arc. The by-products extinguish the arc at a natural current zero and exit out the bottom of the fuse.

The arcing rod is prevented from falling back into its original position by residual force in the compression spring, whose free length is greater than the available space within the fuse unit. When the fuse operates, the upward motion of the spring forces the top of the arcing rod to penetrate the upper seal, striking the latch mechanism. On indoor applications, this action causes the blown fuse indicator to actuate. On outdoor installations, the latch releases the fuse unit allowing the ejector spring to move the assembly outward and swing through a 180 degree arc into a dropout position. This dropout action provides immediate visual indication that the fuse has operated. When the fuse is blown and the dropout action completed, the entire unit is removed with a hotstick.

When replacing the blown fuse, the end fittings should be removed

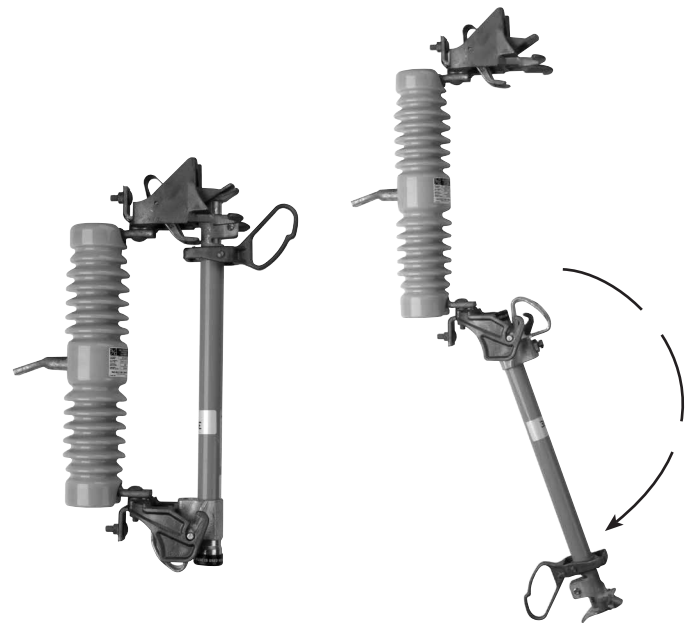


Figure 3. Outdoor application (left) and dropout action (right).

from the operated fuse unit, and if undamaged, clamped onto the new fuse unit.

When installed indoors, the exhaust and noise produced during the interruption process are limited by the muffler attached to the lower end fitting. The CMU power fuse unit is then discarded, and replaced with a new unit, re-using the end fittings if undamaged.

During the interrupting process, current continues to flow in the circuit and in the fuse until a current zero is reached. When the arc is stopped at current zero, the voltage will attempt to re-ignite the arc. The voltage across the fuse terminals builds rapidly and is referred to as the Transient Recovery Voltage (TRV). The TRV is the most severe waveform the fuse will have to withstand. This voltage build-up puts a great deal of potentially destructive force on the fuse units and the system in total. Whether or not extinguishing of the arc is successful depends, in general, on the dielectric strength between the fuse terminals. In short, the dielectric strength between the fuse terminals must be greater than the voltage trying to re-ignite the arc for a successful interruption to occur.

When properly applied, the CMU power fuse has a dielectric withstand that is greater than the TRV, regardless of the fault current.

Table 1. CMU Catalog Numbers and Information

Voltage Rating Speed	Rating A	Catalog Numbers	Min. Melt Curve Reference R240-91-	Max. Clear Curve Reference R240-91-	Max Int. kA Sym	Approx. Shipping Wt.	Indoor End Fittings Catalog Number	Outdoor End Fittings Catalog Number
17 kV, K	3	CMU702003	153	156	14	2.1	CMU3097	CMU3095
	6	CMU702006						
	8	CMU702008						
	10	CMU702010						
	12	CMU702012						
	15	CMU702015						
	20	CMU702020						
	25	CMU702025						
	30	CMU702030						
	40	CMU702040						
	50	CMU702050						
	65	CMU702065						
	80	CMU702080						
	100	CMU702100						
	140	CMU702140						
200	CMU702200							
17 kV, E std	5	CMU612005	152	155	14	2.1	CMU3097	CMU3095
	7	CMU612007						
	10	CMU612010						
	13	CMU612013						
	15	CMU612015						
	20	CMU612020						
	25	CMU612025						
	30	CMU612030						
	40	CMU612040						
	50	CMU612050						
	65	CMU612065						
	80	CMU612080						
	100	CMU612100						
	125	CMU612125						
	150	CMU612150						
175	CMU612175							
200	CMU612200							
17 kV, SE slow	15	CMU712015	151	154	14	2.1	CMU3097	CMU3095
	20	CMU712020						
	25	CMU712025						
	30	CMU712030						
	40	CMU712040						
	50	CMU712050						
	65	CMU712065						
	80	CMU712080						
	100	CMU712100						
	125	CMU712125						
150	CMU712150							
175	CMU712175							
200	CMU712200							

Note: Muffler can be ordered separately. Order catalog number CMUFDA1103.

Table 1. CMU Catalog Numbers and Information (continued)

Voltage Rating Speed	Rating A	Catalog Numbers	Min. Melt Curve Reference R240-91-	Max Clear Curve Reference R240-91-	Max Int. kA Sym	Approx. Shipping Wt.	Indoor End Fittings Catalog Number	Outdoor End Fittings Catalog Number
27 kV, K	3	CMU703003	153	159	12.5	2.1	CMU3097	CMU3095
	6	CMU703006						
	8	CMU703008						
	10	CMU703010						
	12	CMU703012						
	15	CMU703015						
	20	CMU703020						
	25	CMU703025						
	30	CMU703030						
	40	CMU703040						
	50	CMU703050						
	65	CMU703065						
	80	CMU703080						
	100	CMU703100						
140	CMU703140							
200	CMU703200							
27 kV, std	5	CMU613005	152	158	12.5	2.1	CMU3097	CMU3095
	7	CMU613007						
	10	CMU613010						
	13	CMU613013						
	15	CMU613015						
	20	CMU613020						
	25	CMU613025						
	30	CMU613030						
	40	CMU613040						
	50	CMU613050						
	65	CMU613065						
	80	CMU613080						
	100	CMU613100						
	125	CMU613125						
150	CMU613150							
175	CMU613175							
200	CMU613200							
27 kV, SE slow	15	CMU713015	151	157	12.5	2.1	CMU3097	CMU3095
	20	CMU713020						
	25	CMU713025						
	30	CMU713030						
	40	CMU713040						
	50	CMU713050						
	65	CMU713065						
	80	CMU713080						
	100	CMU713100						
	125	CMU713125						
150	CMU713150							
175	CMU713175							
200	CMU713200							

Note: Muffler can be ordered separately. Order catalog number CMUFDA1103.

Table 1. CMU Catalog Numbers and Information (continued)

Voltage Rating Speed	Rating A	Catalog Numbers	Min. Melt Curve Reference R240-91-	Max Clear Curve Reference R240-91-	Max Int. kA Sym	Approx. Shipping Wt.	Indoor End Fittings Catalog Number	Outdoor End Fittings Catalog Number
38 kV, K	3	CMU704003	153	159	10	2.8	CMU3097	CMU3095
	6	CMU704006						
	8	CMU704008						
	10	CMU704010						
	12	CMU704012						
	15	CMU704015						
	20	CMU704020						
	25	CMU704025						
	30	CMU704030						
	40	CMU704040						
	50	CMU704050						
	65	CMU704065						
	80	CMU704080						
	100	CMU704100						
140	CMU704140							
200	CMU704200							
38 kV, E std	5	CMU614005	152	158	10	2.8	CMU3097	CMU3095
	7	CMU614007						
	10	CMU614010						
	13	CMU614013						
	15	CMU614015						
	20	CMU614020						
	25	CMU614025						
	30	CMU614030						
	40	CMU614040						
	50	CMU614050						
	65	CMU614065						
	80	CMU614080						
	100	CMU614100						
	125	CMU614125						
150	CMU614150							
175	CMU614175							
200	CMU614200							
38 kV, SE slow	15	CMU714015	151	157	10	2.8	CMU3097	CMU3095
	20	CMU714020						
	25	CMU714025						
	30	CMU714030						
	40	CMU714040						
	50	CMU714050						
	65	CMU714065						
	80	CMU714080						
	100	CMU714100						
	125	CMU714125						
150	CMU714150							
175	CMU714175							
200	CMU714200							

Note: Muffler can be ordered separately. Order catalog number CMUFDA1103.

Construction

The complete fuse consists of the fuse unit, end fittings, and a mounting.

CMU end fittings

End fittings are required to complete the electrical connection between the fuse unit and the mounting. End fittings are positioned on the top and bottom of the fuse unit. They can be used over again if they remain undamaged.

End fittings are available in two versions: indoor and outdoor.

Indoor fittings

The indoor end fittings are composed of high-impact plastic and high conducting copper alloy. The blown fuse indicator, located on the top end fitting, provides visual indication of an operated fuse unit. The silver-plated contact rod ensures positive conductivity between the fuse and the mounting.

The spring-loaded plastic mounting handle actuates the latch mechanism when engaged into the mounting. It readily accepts a hotstick to install or remove the assembled fuse.

A locating pin in the upper fitting assures proper alignment and engagement with the fuse. The cast bottom indoor fitting has a locating slot on the inside bore, which aligns with a locating pin on the lower section of the fuse for proper alignment. Two pivotal slots are formed into the fitting for insertion into the mount.

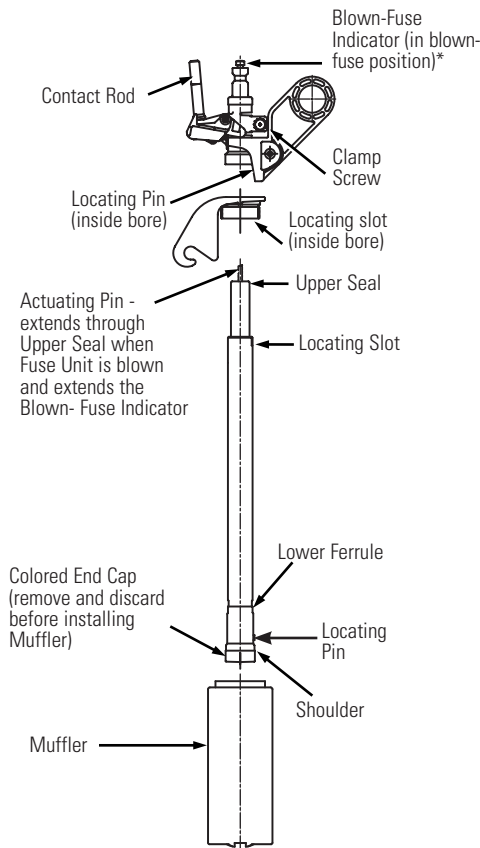


Figure 4. Indoor CMU power fuse fuse fittings.

The bottom indoor fitting is threaded to accept a muffler attachment for limiting noise and contamination to indoor equipment. The muffler is constructed of a plated steel housing containing copper mesh screening. This copper mesh absorbs and contains the noise and exhaust materials of the fuse during a fault condition. The muffler helps prevent contamination of components and mechanisms within the switchgear. This containment action also avoids accidental flash-over from phase-to-phase or phase-to-ground by limiting airborne particles and gases.

Outdoor fittings

Outdoor end fittings are made of a cast-copper plated alloy. A large hookey on the upper fitting allows for easy installation into pole-top mountings with a hotstick. The pivotal design of this hookey provides for proper engagement of the upper mounting. In the event of a fault, the arcing rod will penetrate through the upper end of the fuse and cause the latch to release. Once released, the fuse will rotate down to the drop-out position to indicate a blown-fuse.

The positive locking action of the latch mechanism prevents detachment from the mounting due to shock or vibration. The lower end fitting has two cylindrical posts that insert into the lower mounting, serving as the axis to rotate the fuse into the engaged position, and to suspend the fuse during a blown, drop-out condition.

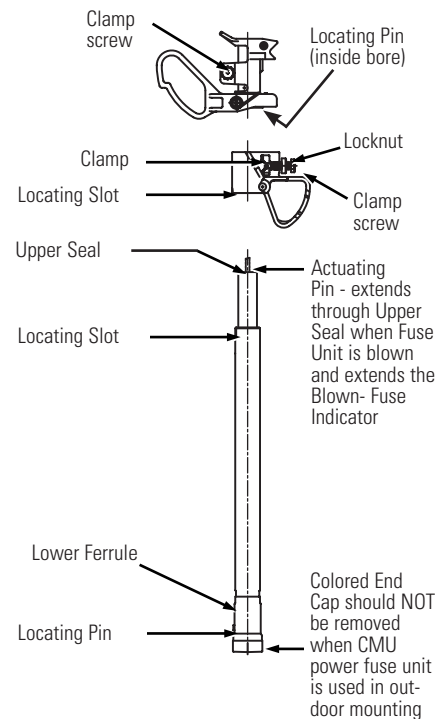
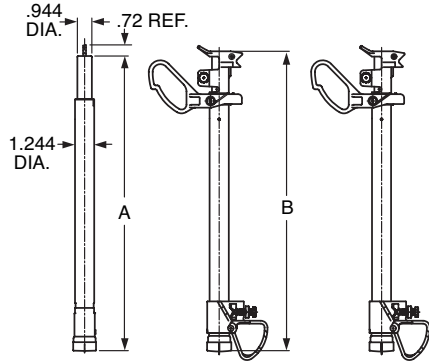
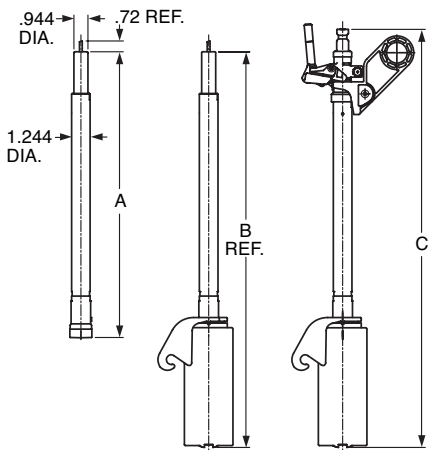


Figure 5. Outdoor CMU power fuse fittings.



Dimensions in Inches

Rating	A	B
17.1 kV	19.08	19.41
27.0 kV	22.58	22.91
38.0 kV	28.76	29.09



Dimensions in Inches

Rating	A	B	C
17.1 kV	19.08	27.19	28.82
27.0 kV	22.58	30.69	32.32
38.0 kV	28.76	36.87	38.50

Table 2. TRV Characteristics

Fuse Rating kV Normal	Primary Faults			Secondary Faults		
	Test Circuit - Normal Frequency Recovery Voltage, kV rms	TRV Natural Frequency, Kc	TRV Amplitude Factor	Test Circuit - Normal Frequency Recovery Voltage, kV rms	TRV Natural Frequency, Kc	TRV Amplitude Factor
14.4	17.1	5.5	1.6	14.4	17	1.7
25	27	5.5	1.6	27	13	1.7
34.5	38	3.9	1.6	38	6.5	1.7

Table 3. CMU Power Fuse Short-Circuit Interrupting Ratings

kV, Nominal	Amperes, Interrupting		MVA, Interrupting (Three-Phase Symmetrical)
	CMU System	Symmetrical based on X/R = 15	Asymmetrical Where X/R = 15
17	7.2	14000	22400
	4.8 / 8.32Y		175
	7.2 / 12.47Y		200
	7.62 / 13.2Y		300
	13.8		320
	14.4		335
	16.5		350
27	7.2 / 12.47Y	12500	20000
	7.62 / 13.2Y		175
	13.8		200
	14.4		270
	16.5		285
	23.0		300
	14.4 / 24.9Y		310
	20 / 34.5Y ¹		365
38	23.0	10000	16000
	14.4 / 24.9Y		475
	27.6		600
	20 / 34.5Y		600

1 Applies to 23 kV single-insulator style only, for protection of single-phase-to-neutral circuits (line or transformers) and three-phase transformers or banks with solidly grounded neutral connections.

Figure 6. Outdoor (top) and indoor (bottom) dimensions.

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For Eaton's Cooper Power series product information call 1-877-277-4636 or visit: www.eaton.com/cooperpowerseries.

ELF™ current-limiting dropout fuse



General

Eaton's Cooper Power™ series ELF™ current-limiting dropout fuse is a full range current-limiting fuse designed for mounting in an industry standard interchangeable cutout that is presently used for expulsion fuses. The ELF fuse is designed to be used to protect pole-type transformers, single-phase and three-phase laterals and underground taps.

The full-range current-limiting rating ensures reliable operation of all over-loads and fault currents. The element construction consists of two separate sections (low-current section and high-current section) which are self-contained in one housing. The low-current section provides consistent, reliable clearing of all currents high enough to melt the element. The high-current section is a punched-hole ribbon design which controls peak arc voltage levels and limits both current and energy (I^2t) let-through levels during high-current fault clearing operation.

The ELF dropout fuse operates silently, unlike expulsion fuses. In addition, the expulsive shower that exists with an expulsive fuse operation is eliminated. This offers increased safety to line personnel during circuit energization operations. In addition, the reliable drop open design makes locating the fault easy.

Production tests

Tests are conducted on 100% of production in accordance with Eaton requirements.

- Physical Inspection
- I^2t Testing
- Resistance Testing
- Helium Mass Spectrometer Leak Testing

Installation

The ELF fuse is designed to be mounted in 15 kV and 27 kV, (110 kV, 125 kV or 150 kV BIL) rated interchangeable open distribution cutouts including Eaton's Type L, S&C Type XS, Hubble Type C™ and ABB Type ICX™ cutouts. Designs for use in 35 kV (170 kV BIL) rated ABB Series V™ cutouts are also available.

It is easy to install using a clampstick due to its small size. Refer to *Service Information MN132028EN ELF Current-Limiting Dropout Fuse Installation Instructions* for installation instructions.

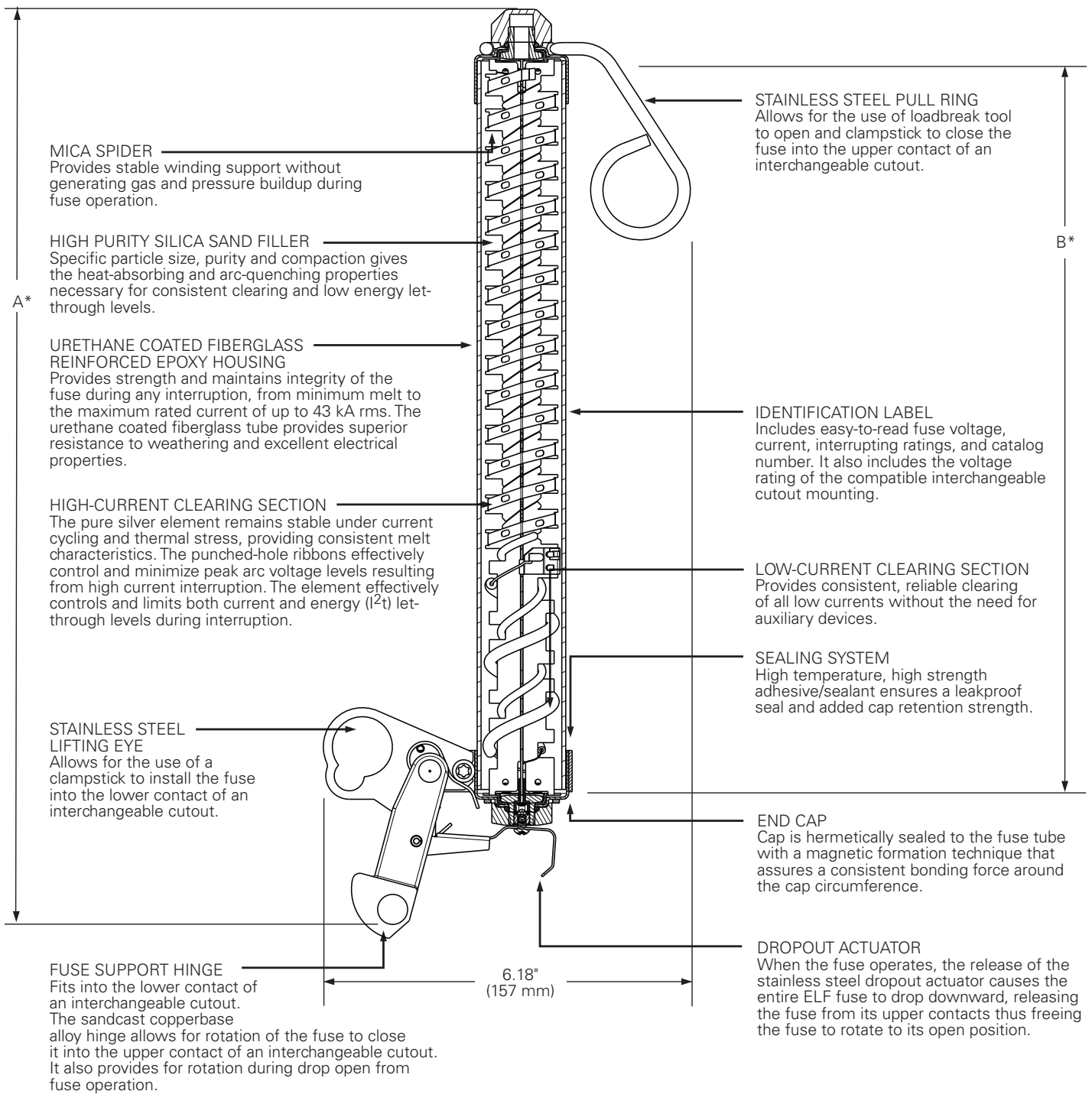


Figure 1. Line illustration of single-barrel ELF fuse cutaway with dimensions.

* See Table 5, 6, or 7 for dimensions A and B.

Table 1. ELF Fuse Electrical Ratings and Characteristics

Fuse Ratings		Cutout Rating		Continuous Current Ratings (A) ^a			Minimum Melt I ² t (A ² • s)	Maximum Clear I ² t (A ² • s)	Maximum Interrupting Current (A rms symmetrical)
Voltage (kV)	Current (A)	Voltage (kV)	BIL (kV)	25°C	40°C	55°C			
8.3	6	15	110	8	7	6	520	4550	31000
	8			12	11	11	1150	6500	
	12			18	17	16	1150	7000	
	18			25	24	23	1350	8600	
	20			27	26	25	2000	11700	
	25			34	33	31	2900	17000	
	30			43	41	39	4000	20000	
	40			50	48	46	8000	39000	
	50*			68	65	62	16000	65000	
	65*			78	75	71	20000	100000	
	80*			95	91	87	32000	150000	
100*	120	114	109	46000	215000				
15.0	6	15	110	8	7	6	520	4550	20000
	8			12	11	11	1150	6500	
	12			18	17	16	1150	7000	
	18			25	24	23	1350	8600	
	20			27	26	25	2000	11700	
8.3	6	27	150	8	7	6	520	4550	31000
	8			12	11	11	1150	6500	
	12			18	17	16	1150	7000	
	18			25	24	23	1350	8600	
	20			27	26	25	2000	11700	
	25			34	33	31	2900	17000	
	30			43	41	39	4000	20000	
	40			50	48	46	8000	39000	
	50*			68	65	62	16000	65000	
	65*			78	75	71	20000	100000	
	80*			95	91	87	32000	150000	
100*	120	114	109	46000	215000				
15.0**	6	27	150	8	7	6	520	4550	43000
15.0**	8			12	11	11	1150	6500	43000
15.0**	12			18	17	16	1150	7000	43000
15.0**	18			25	24	23	1350	8600	43000
15.0**	20			27	26	25	2000	11700	43000
15.0**	25			34	33	31	2900	17000	43000
15.0	30			43	41	39	5100	25000	20000
15.0**	30*			43	41	39	5100	25000	43000
15.0**	40*			50	48	46	8000	39000	43000
15.0**	50*			68	65	62	16000	65000	43000
23.0	6			27	150	8	7	6	520
	8	12	11			11	1150	7000	
	12	18	17			16	1150	8000	
	18	25	24			23	1350	10000	
	20	27	26			25	2000	14000	
	25*	34	33			31	2900	20000	
30*	43	41	39	5100	30000				
24.0	6	36	170	8	7	6	520	5200	13000
	8			12	11	11	1150	7000	
	12			18	17	16	1150	8000	
	18			25	24	23	1350	10000	
	20			27	26	25	2000	14000	

Notes: a. For temperatures other than listed, a deration factor of 0.26% per °C can be applied.
 * Multi-barrel design
 ** 15 kV, 125 kV BIL, 6 through 25 A (single barrel part numbers FAK44W6 through FAK44W25) and 30 through 50 A (double barrel part numbers FAK44W30P, FAK44W40, and FAK44W50) have been tested and approved for 17.2 kV application.

Table 2. Recommended ELF Current-Limiting Dropout Fuse Voltage Ratings

System Voltage (kV)		Recommended Fuse Ratings (kV)			
		Four-Wire Multi-Grounded Neutral		Three-Wire Wye or Delta	
Nominal	Maximum	Single-Phase	Three-Phase	Single-Phase (Line-to-Line)	Three-Phase
2.4	2.54	–	–	8.3	8.3
4.16/2.4	4.4/2.54	8.3	8.3	–	–
4.16	4.4	–	–	8.3	8.3
4.8	5.08	–	–	8.3	8.3
6.9	7.26	–	–	8.3	8.3
7.2	7.62	–	–	8.3	8.3
7.97	8.4	–	–	8.3	8.3
8.32/4.8	8.8/5.08	8.3	8.3	–	–
11.0	12.0	–	–	15	15
12.0/6.93	12.7/7.33	8.3	15 or 8.3 ^a	–	–
12.47/7.2	13.2/7.62	8.3	15 or 8.3 ^a	–	–
12.47	13.2	–	–	15	15
13.2/7.62	13.97/8.07	8.3	15 or 8.3 ^a	–	–
13.2	13.97	–	–	15	15
13.8/7.97	14.52/8.38	8.3	15 or 8.3 ^a	–	–
13.8	14.52	–	–	15	15
14.4	15.24	–	–	15	15
16.3	17.1	–	–	15 ^c	15 ^c
20.78/12.0	22.0/12.7	15	23 or 15 ^a	–	–
22.0	24.0	–	–	23 ^b	23 ^b
22.86/13.2	24.2/13.97	15	23 or 15 ^a	–	–
23.0	24.34	–	–	23 ^b	23 ^b
24.9/14.4	26.4/15.24	15	23 or 15 ^{a,c}	–	–
34.5/19.92	36.51/21.08	23	–	–	–

- Notes:**
- a. This lower voltage fuse rating may be used if either of the following conditions are met:
 - 1) If the probability and a line-to-line and a three-phase ungrounded fault is very low.
 - or-
 - 2) If all of the below conditions are met:
 - If the probability of a three-phase ungrounded primary fault is very low.
 - If a secondary breaker or other series connected device is used to interrupt secondary faults.
 - If no more than 50% of the secondary load is delta connected.
 - If the line-to-line primary fault current is high enough to assure simultaneous operation of two fuses by melting at a maximum of 0.2 seconds.
 - b. A 23 kV rated fuse is recommended where 125 kV BIL interchangeable cutout mountings are used and a 24 kV rated fuse is recommended where 170 kV BIL interchangeable cutout mountings are used.
 - c. 15 kV, 125 kV BIL, 6 through 25 A (single barrel part numbers FAK44W6 through FAK44W25) and 30 through 50 A (double barrel part numbers FAK44W30P, FAK44W40, and FAK44W50) are recommended for this application.

Table 3. Recommendations for Distribution Transformers in Single-Phase Applications (Refer to Figure 3 for primary voltage connections, Figures A and D.) †

Fuse Voltage	8.3 kV		8.3 kV		8.3 kV		15.0 kV	
System Voltage	2400 Δ		4160 Y/2400		4800 Δ		8320 Y/4800	
Single-Phase Transformer Size (kVA)	Figure A		Figure D		Figure A		Figure D	
	Rated Amps	Fuse Rating	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings
10	4.17	6	4.17	6	2.08	6 ^a	2.08	6 ^a
15	6.25	12 ^a	6.25	12 ^a	3.13	6	3.13	6
25	10.42	18	10.42	18	5.21	8	5.21	8
37.5	15.63	20	15.63	20	7.81	12	7.84	12
50	20.83	30	20.83	30	10.42	18	10.42	18
75	31.25	40	31.25	40	15.63	20	15.63	20
100	41.67	50	41.67	50	20.83	30	20.83	30
167	69.58	80	69.58	80	34.79	50	34.79	50
250	104.17	100 ^d	104.17	100 ^d	52.08	65	52.08	65
333	138.75	—	138.75	—	69.38	80	69.38	80

Fuse Voltage	8.3 kV		8.3 kV		8.3 kV		15.0 kV	
System Voltage	7200 Δ		12470 Y/7200		13200 Y/7620		12000 Δ	
Single-Phase Transformer Size (kVA)	Figure A		Figure D		Figure D		Figure A	
	Rated Amps	Fuse Rating	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings
10	1.39	6 ^a	1.39	6 ^a	1.31	6 ^a	.83	6 ^a
15	2.08	6 ^a	2.08	6 ^a	1.97	6 ^a	1.25	6 ^a
25	3.47	6	3.47	6	3.28	6	2.08	6 ^a
37.5	5.21	8	5.21	8	4.92	8	3.13	6
50	6.94	12 ^a	6.94	12 ^a	6.56	12 ^a	4.17	6
75	10.42	18	10.42	18	9.84	18 ^a	6.25	12 ^a
100	13.89	20	13.89	20	13.12	18	8.33	12
167	23.19	30	23.19	30	21.92	30	13.92	20
250	34.72	50	34.72	50	32.81	40 ^b	20.83	30
333	46.25	65	46.25	65 ^c	43.70	50	27.75	40
500	69.44	80	69.44	80 ^c	65.62	80 ^c	41.67	50

Fuse Voltage	15.0 kV		15.0 kV		15.0 kV		23.0 kV	
System Voltage	13200 Δ		14400 Δ		24940 Y/14400		34500 Y/19920	
Single-Phase Transformer Size (kVA)	Figure A		Figure A		Figure D		Figure D	
	Rated Amps	Fuse Rating	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings
10	.76	6 ^a	.69	6 ^a	.69	6 ^a	.50	6 ^a
15	1.14	6 ^a	1.04	6 ^a	1.04	6 ^a	.75	6 ^a
25	1.89	6 ^a	1.74	6 ^a	1.74	6 ^a	1.25	6 ^a
37.5	2.84	6 ^a	2.60	6 ^a	2.60	6 ^a	1.88	6 ^a
50	3.79	6	3.47	6	3.47	6	2.51	6 ^a
75	5.68	8	5.21	8	5.21	8	3.77	6
100	7.58	12	6.94	12 ^a	6.94	12 ^a	5.02	8
167	12.65	18	11.60	18	11.60	18	8.38	12
250	18.94	25	17.36	25	17.36	25	12.55	18
333	25.23	30	23.13	30	23.13	30	16.72	25
500	37.88	50	34.72	50	34.72	50	25.10	30

† See notes on page 7.

Effective November 2020

Table 4. Recommendations for Distribution Transformers in Three-Phase Applications (Refer to Figure 3 for primary voltage connections, Figures B, C, E, and F) †

Fuse Voltage	8.3 kV				8.3 kV		8.3 kV		8.3 kV			
System Voltage	2400 Δ		Figure C		4160 Y/2400		4800 Δ		Figure C		8320 Y/4800	
Single-Phase kVA	Rated Amps	Fuse Rating	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings
10	4.17	6	7.22	12 ^a	4.17	6	2.08	6 ^a	3.61	6	2.08	6 ^a
15	6.25	12 ^a	10.83	18	6.25	12 ^a	3.13	6	5.41	8	3.13	6
25	10.42	18	18.04	25	10.42	18	5.21	8	9.02	12	5.21	8
37.5	15.63	20	27.06	40	15.63	20	7.81	12	13.53	18	7.84	12
50	20.83	30	36.09	50	20.83	30	10.42	18	18.04	25	10.42	18
75	31.25	40	54.13	80	31.25	40	15.63	20	27.06	40	15.63	20
100	41.67	50	72.17	100	41.67	50	20.83	30	36.08	50	20.83	30
167	69.58	80	120.28	—	69.58	80	34.79	50	60.14	80	34.79	50
250	104.17	100 ^d	180.42	—	104.17	100 ^d	52.08	65	90.21	—	52.08	65
333	138.75	—	240.56	—	138.75	—	69.38	80	120.28	—	69.38	80

Fuse Voltage	8.3 kV				15.0 kV or 8.3 kV ^d		15.0 kV or 8.3 kV ^d		15.0 kV			
System Voltage	7200 Δ		Figure C		12470 Y/7200		13200 Y/7620		Figure B		12000 Δ	
Single-Phase kVA	Rated Amps	Fuse Rating	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings
15	2.08	6 ^a	3.61	6	2.08	6 ^a	1.97	6 ^a	1.25	6 ^a	2.17	6 ^a
25	3.47	6	6.01	8	3.47	6	3.28	6	2.08	6 ^a	3.61	6
37.5	5.21	8	9.02	12	5.21	8	4.92	8	3.13	6	5.41	8
50	6.94	12 ^a	12.03	18	6.94	12 ^a	6.56	12 ^a	4.17	6	7.22	12 ^a
75	10.42	18	18.04	25	10.42	18	9.84	18 ^a	6.25	12 ^a	10.83	18
100	13.89	20	24.06	30	13.89	20	13.12	18	8.33	12	14.43	20
167	23.19	30	40.10	50	23.19	30	21.92	30	13.92	20	24.06	30
250	34.72	50	60.14	80	34.72	50	32.81	40 ^b	20.83	30	36.08	50
333	46.25	65	80.19	100	46.25	65 ^c	43.70	50	27.75	40	48.11	50
500	69.44	80	120.28	—	69.44	80 ^c	65.62	80 ^c	41.67	50	72.17	—

Fuse Voltage	15.0 kV				15.0 kV		15 kV ^{d, e}			
System Voltage	13200		Figure C		14400		Figure C		24940 Y/14400	
Single-Phase kVA	Rated Amps	Fuse Rating	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings	Rated Amps	Fuse Ratings
10	.76	6 ^a	1.31	6 ^a	.69	6 ^a	1.20	6 ^a	.69	6 ^a
15	1.14	6 ^a	1.97	6 ^a	1.04	6 ^a	1.80	6 ^a	1.04	6 ^a
25	1.89	6 ^a	3.28	6	1.74	6 ^a	3.01	6	1.74	6 ^a
37.5	2.84	6	4.92	8	2.60	6 ^a	4.51	8 ^a	2.60	6 ^a
50	3.79	6	6.56	12 ^a	3.47	6	6.01	8	3.47	6
75	5.68	8	9.84	18 ^a	5.21	8	9.02	12	5.21	8
100	7.58	12	13.12	25	6.94	12 ^a	12.03	18	6.94	12 ^a
167	12.65	18	21.87	30	11.60	18	20.05	25	11.60	18
250	18.94	25	32.80	50	17.36	25	30.07	40	17.36	25
333	25.23	30	43.74	—	23.13	30	40.09	50	23.13	30
500	37.88	50	65.61	—	34.72	50	60.14	—	34.72	50

* The recommended fuse sizes for this connection are based on equal size transformers in the bank. If a larger transformer is used in the bank for supplying single-phase loads, the fuse selections should be based on the larger transformer kVA.

† See notes on page 7.

Notes: (Table 4): Recommended fuse ratings are based on the use of ELF fuse time-current characteristics in R240-91-42, R240-91-43 and R240-91-44. Recommendations provide overload protection (fusing ratio) between 200-300% rated load.

$$\text{Fusing Ratio} = \frac{\text{Fuse Min. Melt Current at 300 sec.}}{\text{Transformer Full Load Current}} \times 100$$

- a. Fuse allows more than 300% load for 300 seconds.
- b. 8.3 kV rated fuse is a single-barrel fuse, 15 kV rated fuse is a double-barrel fuse.
- c. Available only at 8.3 kV.
- d. This lower voltage fuse rating may be used if either of the following conditions are met:
 - 1) If the probability of a line-to-line or a three-phase ungrounded fault is very low.

-OR-

- 2) If all of the below conditions are met:
 - If the probability of a three-phase ungrounded primary fault is very low.
 - If a secondary breaker or other series connected device is used to interrupt secondary faults.
 - If no more than 50% of the secondary load is delta connected.
 - If the line-to-line primary fault current is high enough to assure simultaneous operation of two fuses by melting at a maximum of 0.2

seconds.

- e. 15 kV, 125 kV BIL 6 through 25 A (single-barrel part numbers FAK44W6 through FAK44W25) and 30 through 50 A (double-barrel part numbers KAF44W30P, FAK44W40, and FAK44W50) are recommended for this application.

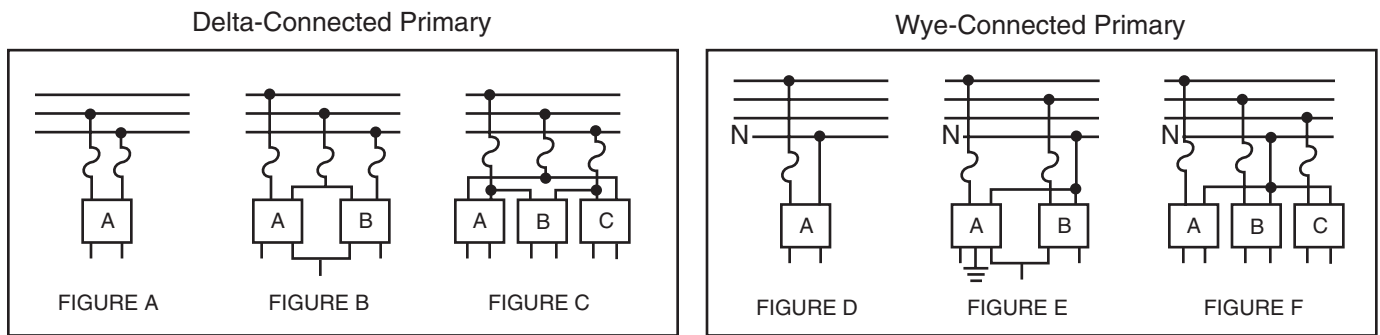


Figure 2. Schematic of primary voltage system connections.

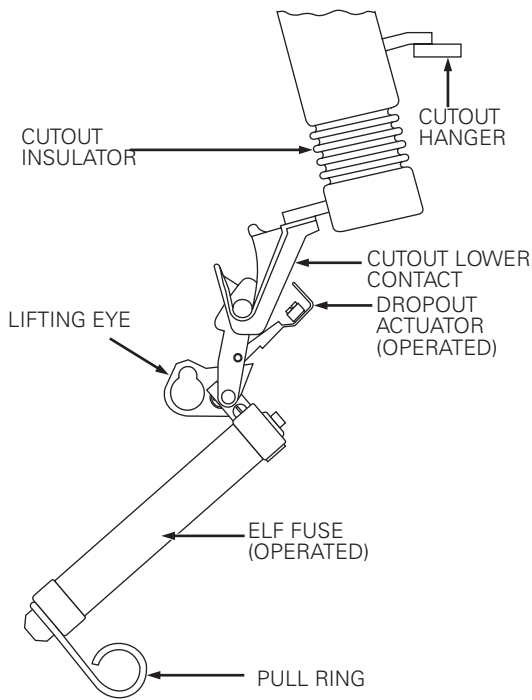


Figure 3. ELF fuse in interchangeable cutout after dropping open due to operation of dropout actuator.

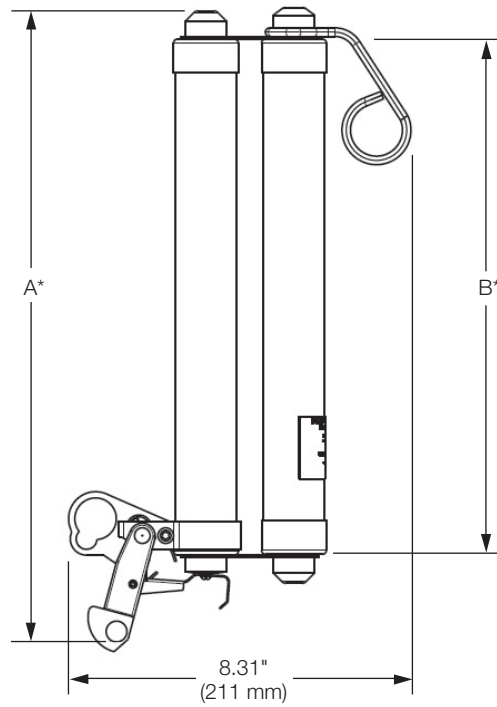


Figure 4. Double-barrel ELF fuse dimensions.

* See Table 5, 6, or 7 for dimensions A and B.

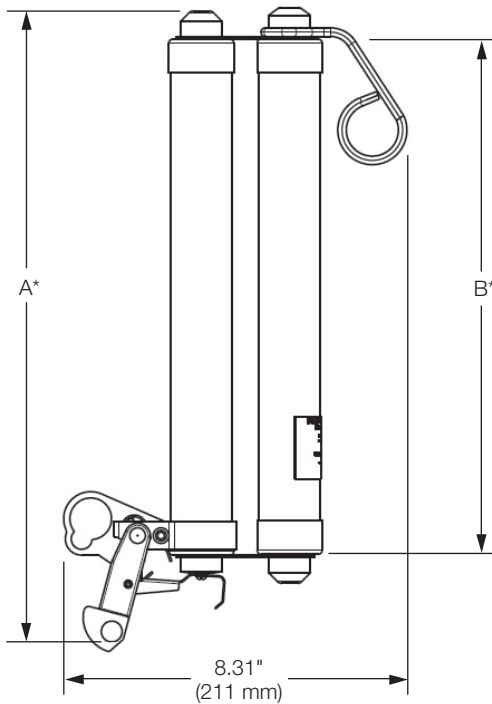
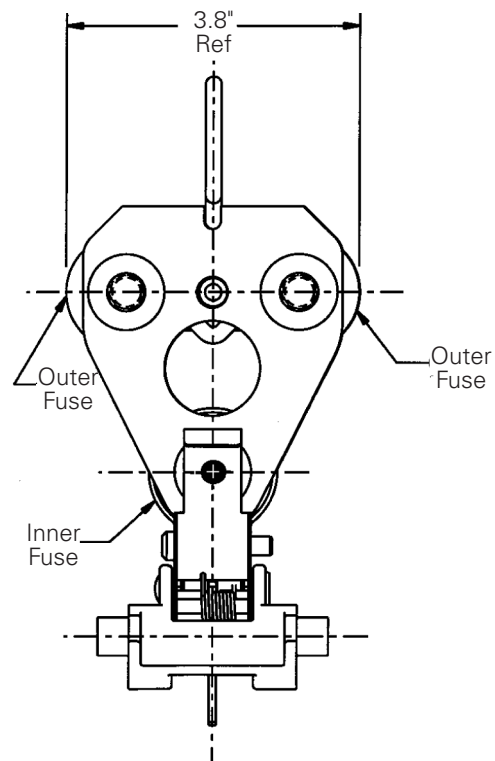


Figure 5. Triple-barrel ELF fuse dimensions.



* See Table 5 or 6 for dimensions A and B.

Operation

When the ELF fuse clears a fault, the dropout actuator operates and allows the fuse to drop open in the cutout. (Refer to Figure 3.)

Ordering information

To order an ELF current-limiting dropout fuse, determine the amperage rating and the voltage ratings of the application, specify required fuse from Tables 5, 6, or 7.

Table 5. ELF Current-Limiting Dropout Fuse Catalog Numbers for 15 kV, 110 kV BIL Interchangeable Cutouts

Fuse Rating			Dimensions		
Voltage (kV)	Current Rating (A)	ELF Fuse Catalog Number	Figure	A	B
8.3	6	FAK23W6	1	11.37" (289 mm)	8.83" (224 mm)
	8	FAK23W8	1		
	12	FAK23W12	1		
	18	FAK23W18	1		
	20	FAK23W20	1		
	25	FAK23W25	1		
	30	FAK23W30	1		
	40	FAK23W40	1		
	50	FAK23W50*	4		
	65	FAK23W65*	4		
	80	FAK23W80*	4		
100	FAK23W100**	5			
15.0	6	FAK24W6	1	11.37" (289 mm)	8.83" (224 mm)
	8	FAK24W8			
	12	FAK24W12			
	18	FAK24W18			
	20	FAK24W20			

* Double-barrel design

** Triple-barrel design

Table 6. ELF Current-Limiting Dropout Fuse Catalog Numbers for 15 kV, 125 kV or 150 kV BIL and 27 kV, 125 kV BIL Interchangeable Cutouts

Fuse Rating		ELF Fuse Catalog Number	Figure	Dimensions	
Voltage (kV)	Current Rating (A)			A	B
8.3	6	FAK43W6	1	15.16" (385 mm)	12.34" (313 mm)
	8	FAK43W8	1		
	12	FAK43W12	1		
	18	FAK43W18	1		
	20	FAK43W20	1		
	25	FAK43W25	1		
	30	FAK43W30	1		
	40	FAK43W40	1		
	50	FAK43W50*	4		
	65	FAK43W65*	4		
80	FAK43W80*	4			
100	FAK43W100**	5			
15.0***	6	FAK44W6	1	15.16" (385 mm)	12.34" (313 mm)
15.0***	8	FAK44W8	1		
15.0***	12	FAK44W12	1		
15.0***	18	FAK44W18	1		
15.0***	20	FAK44W20	1		
15.0***	25	FAK44W25	1		
15.0	30	FAK44W30	1		
15.0***	30	FAK44W30P*	4		
15.0***	40	FAK44W40*	4		
15.0***	50	FAK44W50*	4		
23.0	6	FAK45W6	1	15.16" (385 mm)	12.34" (313 mm)
	8	FAK45W8	1		
	12	FAK45W12	1		
	18	FAK45W18	1		
	20	FAK45W20	1		
	25	FAK45W25*	4		
	30	FAK45W30*	4		

* Double-barrel design

** Triple-barrel design

***15 kV, 125 kV BIL, 6 through 25 A (single barrel part numbers FAK44W6 through FAK44W25) and 30 through 50 A (double barrel part numbers FAK44W30P, FAK44W40, and FAK44W50) have been tested and approved for 17.2 kV application.

Table 7. ELF Current-Limiting Dropout Fuse Catalog Numbers for 36 kV, 170 kV BIL ABB Cutouts*

Fuse Rating		ELF Fuse Catalog Number	Figure	Dimensions	
Voltage (kV)	Current Rating (A)			A	B
24.0	6	FAK46W6	1	18.55" (471 mm)	15.7" (399 mm)
	8	FAK46W8			
	12	FAK46W12			
	18	FAK46W18			
	20	FAK46W20			

* 36 kV ABB Non-Loadbreak Cutout Series V

Additional information

Refer to the following reference literature for application recommendations:

- B240-12060 CAL Fire Exempt Full-Range, Current-Limiting Dropout Fuse Reduces Fire Risk on Distribution Lines
 - PA132007EN Protect Your Upstream Personnel and Investment While Increasing Distribution Reliability with the ELF Fuse
 - R240-66-1 ELF Fuse Coordination Tables with Protecting Fuse Links
 - R240-66-2 ELF Fuse Coordination Tables with Protected Fuse Links
 - R240-91-42 8.3 kV ELF Fuse Time-Current Characteristic Curves
 - R240-91-43 15.0 kV ELF Fuse Time-Current Characteristic Curves
 - R240-91-44 23.0 kV ELF Fuse Time-Current Characteristic Curves
 - MN132028EN ELF Current-Limiting Dropout Fuse Installation Instructions
 - 93033 Application Solutions Provided with ELF Fuse
 - CP-9415 ELF Certified Test Report
- Contact your Eaton representative for more information.

Table 8. ELF Fuse Ratings for 15 kV UltraSIL Polymer-Insulated and Porcelain Type L Fuse Cutouts

ELF Fuse Rating Code*		ELF Fuse Ratings	
Digit 8	Digit 9	Voltage kV	Current A
3	A	8.3	6
3	B	8.3	8
3	C	8.3	12
3	D	8.3	18
3	E	8.3	20
3	F	8.3	25
3	G	8.3	30
3	H	8.3	40
3	J	8.3	50**
3	K	8.3	65**
3	L	8.3	80**
4	A	15.0	6
4	B	15.0	8
4	C	15.0	12
4	D	15.0	18
4	E	15.0	20

a For temperatures other than listed, a deration factor of 0.26% per °C can be applied.

* Replace digits 8 and 9 of the catalog number with the correct ELF fuse rating codes.

** Double-barrel design

Note: For more information regarding the ELF fuse, refer to Catalog section CA132027EN.

Table 9. ELF Fuse Ratings for 27 kV UltraSIL Polymer-Insulated and Porcelain Type L Fuse Cutouts

ELF Fuse Rating Code*		ELF Fuse Ratings	
Digit 8	Digit 9	Voltage kV	Current A
3	A	8.3	6
3	B	8.3	8
3	C	8.3	12
3	D	8.3	18
3	E	8.3	20
3	F	8.3	25
3	G	8.3	30
3	H	8.3	40
3	J	8.3	50**
3	K	8.3	65**
3	L	8.3	80**
4	A	15.0***	6
4	B	15.0***	8
4	C	15.0***	12
4	D	15.0***	18
4	E	15.0***	20
4	F	15.0***	25
4	G	15.0***	30**
4	H	15.0***	40**
4	J	15.0***	50**
5	A	23.0	6
5	B	23.0	8
5	C	23.0	12
5	D	23.0	18
5	E	23.0	20
5	F	23.0	25**
5	G	23.0	30**

a For temperatures other than listed, a deration factor of 0.26% per °C can be applied.

* Replace digits 8 and 9 of the catalog number with the correct ELF fuse rating codes.

** Double-barrel design

*** These ELF fuses have been tested and approved for a 17.2 kV application.

Note: For more information regarding the ELF fuse, refer to Catalog section CA132027EN.

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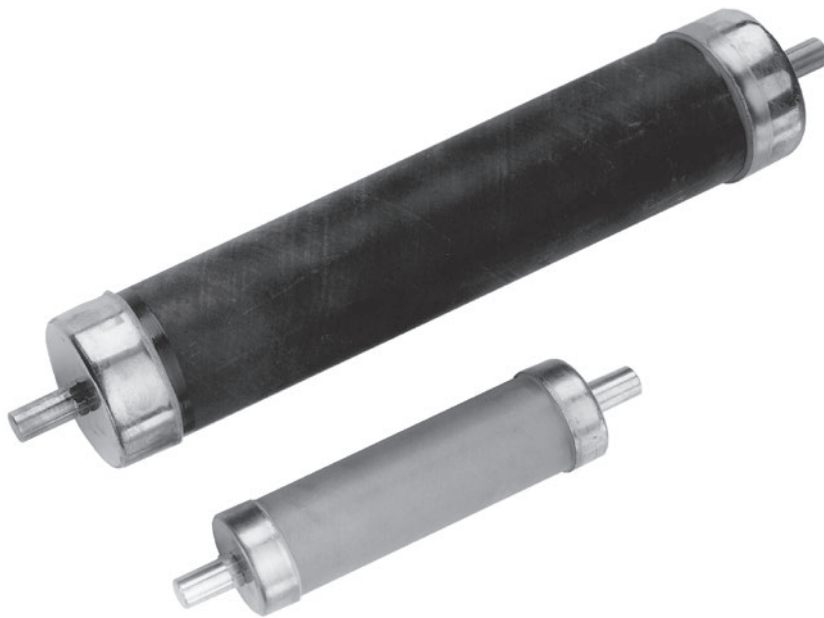
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product information call 1-877-277-4636 or
visit: www.eaton.com/cooperpowerseries.

X-Limiter™ full-range current-limiting fuse



General

Eaton's Cooper Power™ series X-Limiter™ full-range current-limiting fuses are used for transformer protection, capacitor protection and sectionalizing. Their non-gas evolving element design allows for maximum energy limitation and minimum peak arc voltages without corrosive by-products. Thus, they can significantly limit the electrical and mechanical stresses on the protected equipment and the whole system supplying the fault.

The X-Limiter fuse is tested to meet ANSI® and IEEE® standard design requirements for power fuses as well as distribution-class fuses. The standard X-Limiter fuse is designed for clip-mounting in enclosures (refer to catalog section CA132046EN) or for a drywell canister mounting.

X-Limiter clip style fuses

The X-Limiter fuse's patented element design allows a "tailored" time-current curve and superior full-range clearing characteristics. This ensures easy coordination with upstream and downstream protective equipment. The X-Limiter current-limiting fuses have the ability to interrupt any current which will melt its element, from its minimum melt rating through its maximum interrupting rating. In most applications it does not require derating in elevated temperature environments. For applications requiring higher load capacity, X-Limiter fuses can be used in parallel to double current ratings.

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Production tests

Tests are conducted in accordance with Eaton requirements.

- Physical Inspection
- I²t Testing
- Resistance Testing

Table 1. Electrical Characteristics

Fuse Type	Full Range
Maximum Interrupting Current	50,000 A rms symmetrical

Table 2. X-Limiter Time Current Characteristic Curves

Voltage Rating (kV)	TCC Curves	Fuse Design
4.3	R240-91-105	Single Fuse
4.3, 5.5	R240-91-106	Parallel-Mounted Fuse
5.5	R240-91-107	Single Fuse
8.3, 15.5, 23.0	R240-91-109	Single Fuse
8.3, 15.5, 23.0	R240-91-110	Parallel-Mounted Fuse
8.3, 15.5, 23.0	R240-91-111	50A "DW" Fuse

Installation

The X-Limiter fuse is designed to fit industry standard mountings. Each fuse is marked with its mounting code number (either 1, 2, 4, 5, 6 or 9). The mounting code number defines the mounting's insulation level, contact spacing, and contact type. Refer to Catalog Section CA132046EN for specific mountings.

X-Limiter clip-style fuses fit 5/8" standard clip-style mountings in pad-mounted transformers, switchgear, sectionalizing enclosures, industrial vaults and metal clad switchgear. They also fit drywell canisters, both deadbreak and loadbreak. In single drywell canister applications the X-Limiter fuse can provide continuous load current capability through 50 A.

Review *Service Information MN132026EN X-Limiter Full-Range Current-Limiting Fuse Installation Instructions* included with every shipment of fuses, for more detailed information.

Table 3. Electrical Ratings

Continuous Current Rating (A)	Maximum Design Voltage									
	4.3 kV		5.5 kV		8.3 kV		15.5 kV		23 kV	
	Minimum Melt I ² t (A ² S)	Maximum Clear I ² t (A ² S)	Minimum Melt I ² t (A ² S)	Maximum Clear I ² t (A ² S)	Minimum Melt I ² t (A ² S)	Maximum Clear I ² t (A ² S)	Minimum Melt I ² t (A ² S)	Maximum Clear I ² t (A ² S)	Minimum Melt I ² t (A ² S)	Maximum Clear I ² t (A ² S)
10	900	5,300	900	5,300	750	8,400	750	8,400	750	10,000
12	900	5,300	900	5,300	750	8,400	750	8,400	750	10,000
18	1,700	7,900	1,700	10,000	1,658	11,000	1,658	12,000	1,658	13,200
20	–	–	1,700	10,000	1,658	11,000	1,658	12,000	1,658	13,200
25	2,100	12,500	3,000	38,000	2,035	25,000	2,035	23,000	2,035	30,000
30	–	–	3,000	38,000	4,000	31,000	4,000	31,000	4,000	38,000
35	2,950	24,500	–	–	–	–	–	–	–	–
40	–	–	6,600	66,000	8,140	50,000	8,140	50,000	8,140	90,000
45	6,300	64,000	–	–	–	–	–	–	–	–
50DW	–	–	–	–	8,140	50,000	8,140	50,000	8,140	90,000
50	9,000	72,000	9,000	98,000	11,720	80,000	11,720	90,000	11,720	95,000
65	18,000	99,000	18,000	165,000	26,460	180,000	26,460	181,000	26,460	181,000
75	26,000	150,000	36,000	240,000	–	–	–	–	–	–
80	–	–	–	–	46,900	270,000	46,900	270,000	46,900	300,000
100	47,000	240,000	–	–	100,000	580,000	100,000	600,000	100,000	704,000
125	–	–	–	–	100,000	580,000	100,000	600,000	–	–
130	–	–	–	–	–	–	–	–	–	–
140	–	–	–	–	100,000	580,000	–	–	–	–

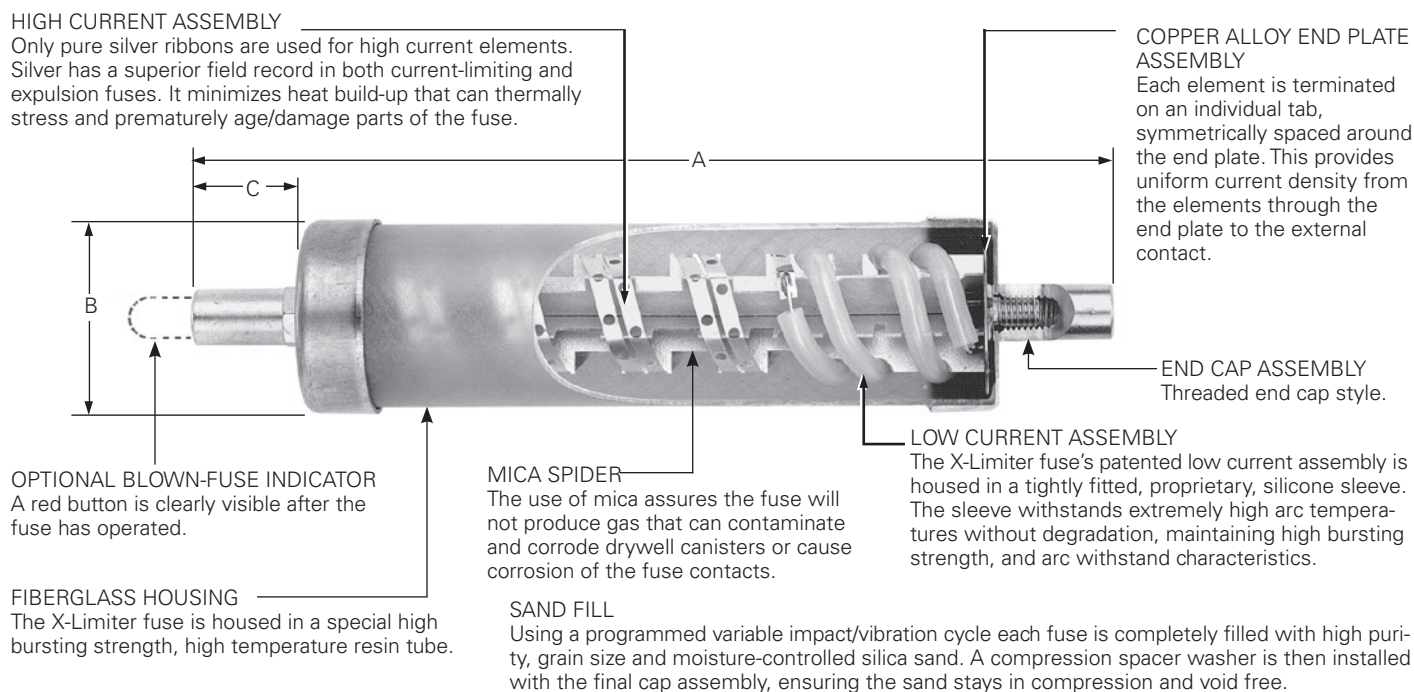


Figure 1. X-Limiter full-range current-limiting clip-style fuse cutaway shows details and dimensions. (See Table 4 for dimensions.)

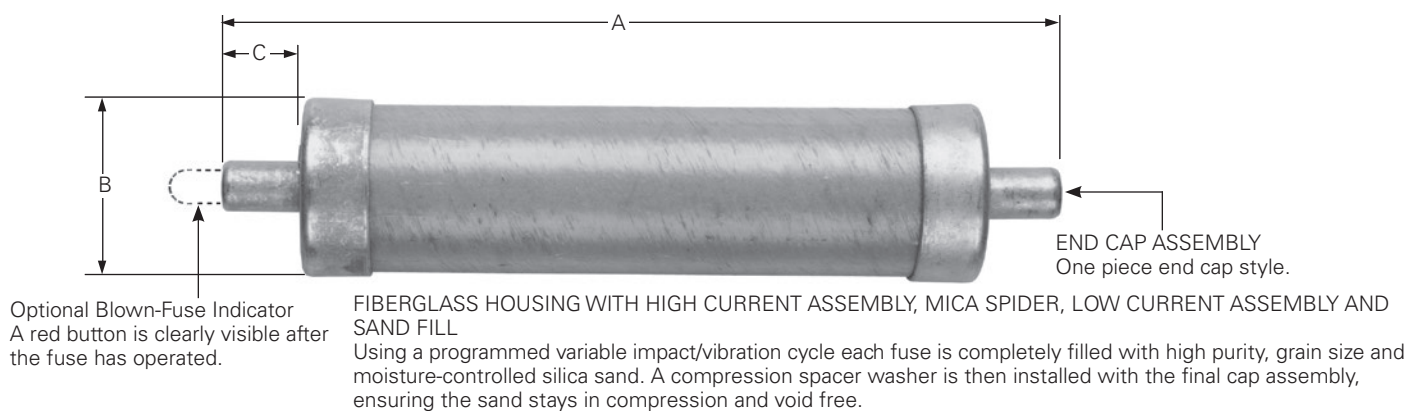


Figure 2. X-Limiter full-range current-limiting clip-style fuse shows details and dimensions. (See Table 4 for dimensions.)

Table 4. X-Limiter Clip-style Fuse Dimensional Information (See Figures 1 and 2 for dimensional drawings.)

Fuse Rating	Voltage (kV)	Current (A)	Dimensions – Inches (mm)			Weight lbs (kg)	Mounting Code
			A	B	C		
4.3 *	10-100		10.0 (254)	2.13 (54)	1.0 (25)	2.0 (0.9)	4
5.5 *	10-75		10.0 (254)	2.13 (54)	1.0 (25)	2.0 (0.9)	4
8.3 **	10-40		10.11 (257)	2.15 (55)	1.0 (25)	2.0 (0.9)	4
8.3 *	50 DW		10.0 (254)	2.13 (54)	1.0 (25)	2.0 (0.9)	4
8.3 *	50-140		14.69 (373)	3.16 (80)	1.19 (30)	5.5 (2.5)	5
15.5 **	10-40		14.37 (365)	2.15 (55)	1.0 (25)	3.0 (1.4)	5
15.5 *	50 DW		14.31 (363)	2.13 (54)	1.0 (25)	3.0 (1.4)	5
15.5 *	50-125		17.5 (444)	3.16 (80)	1.19 (30)	8.0 (3.6)	6
23 **	10-40		17.21 (437)	2.15 (55)	1.0 (25)	4.0 (1.8)	6
23 *	50 DW		17.13 (435)	2.13 (54)	1.0 (25)	4.0 (1.8)	6
23 *	50-100		27.37 (695)	3.16 (80)	1.19 (30)	12.0 (5.4)	9

* All dimensions from Figure 1.

** All dimensions from Figure 2.

Application peak let-through current

Maximum peak let-thru curves provide the opportunity of comparing an unprotected system or one protected with an expulsion fuse, boric acid fuse, or recloser to a system protected with X-Limiter current-limiting fuses. For example, as shown in Figure 4, an unprotected circuit with 20,000 A available fault current can deliver a maximum peak current to a fault of about 50,000 A (find the intersection of the 20,000 A available current line with the peak current line, and read the result on the left maximum let-thru axis). This would be the current delivered, regardless of the size of any expulsion fuse that could be applied.

Protecting this apparatus with a 15.5 kV, 40 A, X-Limiter fuse however, would limit the peak let-thru current to the apparatus to about 8500 A. This is the same peak let-thru delivered to a fault by a system having only 3800 A available current.

Peak arc voltage

The peak arc voltage of an X-Limiter fuse is controlled by fuse design to be less than 2.1 times the peak applied voltage. As an example, an 8.3 kV fuse can be used to protect apparatus on a 2400 V system. During operation the peak arc voltage will be less than one-half of the system basic insulation level (BIL).

Example: $E_{qEpeak} = 2.4 \text{ kV} \times 1.414 \times 2.1 = 7.2 \text{ kV}$ Distribution-Class BIL of 2.4 kV system is 45 kV.

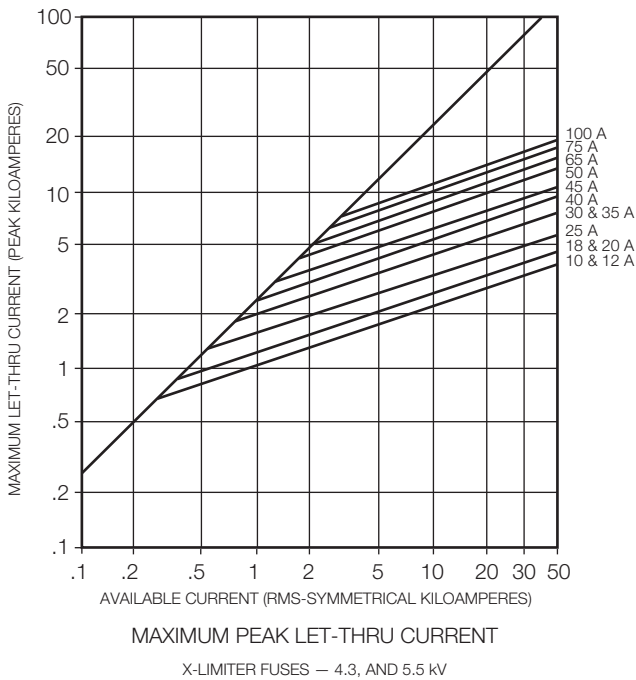


Figure 3. Maximum peak let-thru current 4.3 and 5.5 kV X-Limiter fuses.

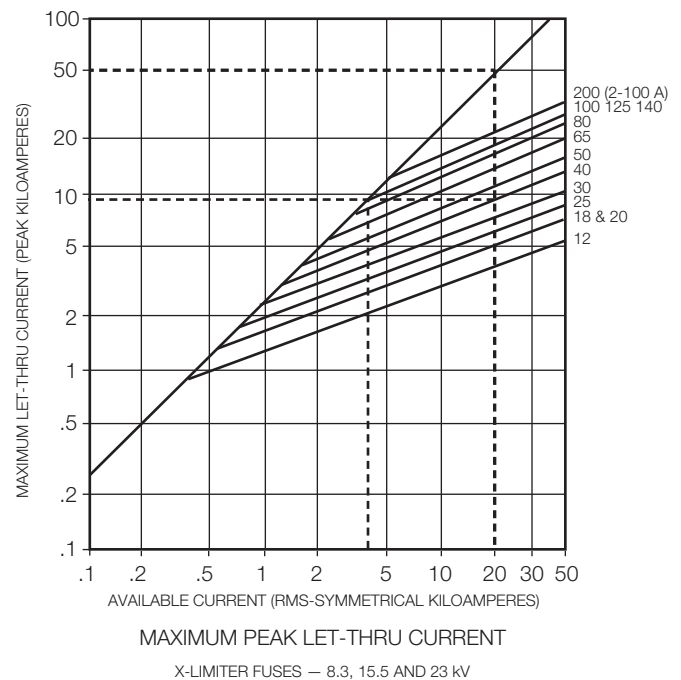


Figure 4. Maximum peak let-thru current 8.3, 15.5 and 23 kV X-Limiter fuses.

Table 5. Recommended X-Limiter Fuse Current Ratings (Amperes)

Single-Phase Transformer kVA	Fuse Voltage													
	4.3 kV		8.3 kV				15.5				15.5 ⁷ /23 kV		23 kV	
	Single-phase Transformer Voltage Rating (kV)													
	2.4		7.2		7.62\7.96		12.0		14.4		16.0		19.4	
A	B	A	B	A	B	A	B	A	B	A	B	A	B	
10	–	12	–	–	–	–	–	–	–	–	–	–	–	
15	10	18	–	–	–	–	–	–	–	–	–	–	–	
25	18	25	–	–	–	12	–	–	–	–	–	–	–	
37.5	25	40	–	12	10	12	–	–	–	–	–	–	–	
50	30	50	10	18	10	18	–	12	–	10	–	–	–	
75	50	80	18	25	18	25	10	18	–	12	–	12	–	10
100	65	125	20	40	20	30	18	25	10	18	10	18	–	12
167	100 ^B	200 ^P	40	65	25	65	20	40	18	30	18	30	10	25
250	160 ^P	280 ^{P2}	50	80	50	80	30	50	25	50	25	40	20	30
333	200 ^P	280 ^{P2}	80	125	65	125	50	80	40	65	30	50	25	50
500	–	–	100	140	125	200 ^P	65	125	50	100	50	80	40	65
833	–	–	160 ^P	280 ^P	160 ^P	280 ^P	100	200 ^P	80	125	80	125	65	100
1000	–	–	–	–	200 ^P	280 ^P	125	250 ^P	100	200 ^P	100	160 ^P	80	130 ^P

Three-Phase Transformer kVA	Fuse Voltage																			
	4.3 kV		5.5 kV				8.3 kV				8.3 ³ /15.5 kV ⁷				15.5 ³ /23 ³ kV ⁷				23 ³ kV	
	Three-Phase Transformer Voltage Rating (kV)																			
	2.4		4.16		4.8		7.2\7.96		8.32		12.47		13.2\14.4		20.8		22.9\24.9		34.5	
A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
15	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
30	12	20	–	12	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	
45	18	30	10	18	–	18 ⁵	–	10	–	–	–	–	–	–	–	–	–	–	–	
75	30	50	18	30	18	25	10	18	10	12	–	10	–	10	–	–	–	–	–	
112.5	40	75	25	40	20	30	18	25	12	20	–	12	–	12	–	–	–	–	–	
150	65	100	30	50	30	50	20	30	20	30	12	20	12	20	–	12	–	10	–	
225	80	140	50	80	40	80 ^{P2}	30	50	25	40	18	25	18	25	12	18	10	18	–	10
300	125	200 ^P	65	125	65	100 ^{P2}	40	50	30	50	20	30	20	40	12	20	12	18	10	12
500	200 ^P	280 ^{P2}	100 ^B	200 ^P	100 ^{P2}	140 ²	60	100	50	80	40	65	30	50	25	40	18	30	12	25
750	280 ^{P2}	–	160 ^P	280 ^{P2}	140 ²	250 ^{P2}	100	140	80	140	65	100	50	80	30	50	30	50	20	30
1000	–	–	200 ^P	280 ^{P2}	200 ^{P2}	280 ^{P2}	125	200 ^P	125	200 ^P	80	125	35	125	40	65	40	65	25	40
1500	–	–	–	–	280 ^{P2}	–	200 ^P	250 ^P	140	250 ^P	125	200	100	160 ^P	65	125	65	100	40	65
2000	–	–	–	–	–	–	250 ^P	–	250 ^P	280 ^P	140	250 ^P	125	200 ^P	80	160 ^P	80	160 ^P	50	80
2500	–	–	–	–	–	–	–	–	280 ^P	–	200 ^P	280 ^P	200 ^P	250 ^P	100	200 ^P	100	160 ^P	65	130 ^P
3000	–	–	–	–	–	–	–	–	–	–	280 ^P	–	250 ^P	–	125	200 ^P	125	200 ^P	80	130 ^P

Notes:

Column A = 140% - 200% Transformer Rating
 Column B = 200% - 300% Transformer Rating

- Not all current ratings are available in all voltage ratings. Check fuse size listing.
- 8.3 kV fuse can be used on 2.4, 4.16 and 4.8 kV applications. Mounting requirements however, should be checked.
- Phase-to-ground voltage rated fuses are frequently recommended for YY connected transformers.
 Application of this voltage rating limited to ground wye/ground wye transformers with no more than 50% delta connected secondary load.
- Fuse selected to meet inrush criteria and cold lead pickup criteria of:
 25 times transformer full load current for .01 seconds.
 12 times transformer full load current for .1 seconds.
 3 times transformer full load current for 10 seconds.
- Fuse application allows in excess of 300% load.
- Drywell application limited to 50 A single barrel and 100 A parallel.
- 8.3 kV fuses 6 through 50 A (paralleled to 100 A) have been tested to 9.8 kV.
 15.5 kV fuses 6 through 50 A (paralleled to 100 A) have been tested to 17.1 kV.
- 4.3 kV 100 A fuse derated to 90 A in drywell applications.
- Recommendation consists of 2 fuses of equal current rating connected in parallel.

Ordering information

To order an X-Limiter fuse, first determine the amperage and voltage ratings of the fuse(s) desired, and then select the appropriate catalog number from Table 6. For parallel fusing, order two fuses.

DW at the end of a catalog number denotes a 50 A fuse that will fit a 2" drywell mounting.

Specific fuse amperage and voltage ratings can be determined using Table 5 and/or the time current curves listed in Table 2.

Fuse extenders are available as follows:

- Catalog No. FEXT45, adapts Code 4 fuses to Code 5 mountings.
- Catalog No. FEXT56, adapts Code 5 fuses to Code 6 mountings.

Test shorting bars are available as follows:

- Catalog No. SB1019A01, Mounting Code 4.
- Catalog No. SB1019A02, Mounting Code 5.
- Catalog No. SB1019A03, Mounting Code 6.

Additional information

Refer to the following reference literature for more information:
S240-56-1, X-Limiter Full-Range Current-Limiting Fuse Installation Instructions

CA132046EN, Current-Limiting Fuse Mounts

R240-91-105, 4.3 kV X-Limiter Fuse TCC

R240-91-106, 4.3, 5.5 kV (130-200) Parallel Mounted X-Limiter Fuse TCC

R240-91-107, 5.5 kV X-Limiter Fuse TCC

R240-91-109, 8.3, 15.5, 23.0 kV X-Limiter Fuse TCC

R240-91-110, 8.3, 15.5, 23.0 kV (130-280) Parallel X-Limiter Fuse TCC

R240-91-111, 8.3, 15.5, 23.0 kV DW X-Limiter Fuse TCC

CA132054EN, X-Limiter™ hinge-mounted current-limiting fuse

Table 6. X-Limiter Full-range Current-limiting Fuse (Refer to Figures 1 and 2)

Continuous Current Rating (A)	Catalog Number				
	4.3 kV	5.5 kV	8.3 kV	15.5 kV	23 kV
10	43F010-I	55F010-I	83F010-I	155F010-I	23F010-I
12	43F012-I	55F012-I	83F012-I	155F012-I	23F012-I
18	43F018-I	55F018-I	83F018-I	155F018-I	23F018-I
20	–	55F020-I	83F020-I	155F020-I	23F020-I
25	43F025-I	55F025-I	83F025-I	155F025-I	23F025-I
30	–	55F030-I	83F030-I	155F030-I	23F030-I
35	43F035-I	–	–	–	–
40	–	55F040-I	83F040-I	155F040-I	23F040-I
45	43F045-I	–	–	–	–
50DW	–	–	83F050-DW	155F050-DW	23F050-DW
50	43F050-I	55F050-I	83F050-I	155F050-I	23F050-I
65	43F065-I	55F065-I	83F065-I	155F065-I	23F065-I
75	43F075-I	55F075-I	–	–	–
80	–	–	83F080-I	155F080-I	23F080-I
100	43F100-I	–	83F100-I	155F100-I	23F100-I
125	–	–	83F125-I	155F125-I	–
140	–	–	83F140-I	–	–

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FIRE*Bird*

Rapid Wildfire Detection System



LINDSEY
FireSense

Facts to Know About Fires Along Boundaries

90%

90% of all wildfires in the United States occur within 1/2 mile of a road.¹

10x

Power line fires average ten times larger than other fires.²

12.6 Million

U.S. new home construction from 1990 - 2010 resulted in 12.6 million more homes being placed in wildfire vulnerable wildland urban interfaces.³

¹Peterson, Peter H., "Roads and Wildfires," Pacific Biodiversity Institute, Winthrop, WA, 2007, page 4

²Mitchell, Joseph W., "Power line failures and catastrophic wildfires under extreme weather conditions," Engineering Failure Analysis, Volume 35, 2013, Pages 726-735

³"New analyses reveal WUI growth in the U.S.," Northern Research Station, USDA Forest Service, downloaded on 1/15/2021 from <https://www.nrs.fs.fed.us/data/WUI/>

FIREBird Rapid Wildfire Detection System

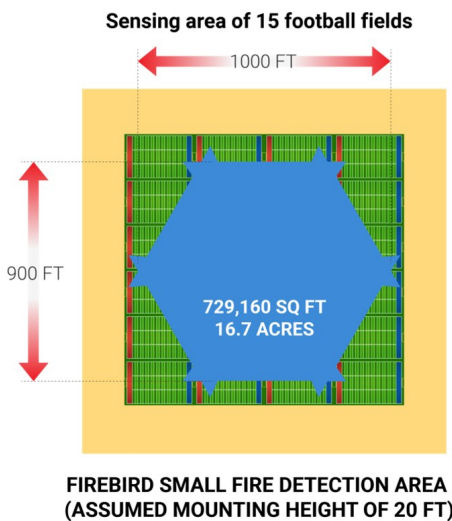
Respond to Fires While Small and Easy to Contain

The FIREBird system by Lindsey FireSense is designed specifically to detect and report very small wildfires along boundaries. Quick detection results in faster fire response and smaller fires to contain.

Boundary fires can include wildfires that start along rights-of-way or easements like those associated with electric utility lines and roadways, or wildfires that start near wildland-urban interfaces where neighborhoods adjoin fuel-rich wildlands.

The unique risks associated with rights-of-way and wildland–urban interfaces call for defensive fire detection methods that can sense fires almost immediately after ignition. Such detection maximizes the available response time and ensures firefighting resources arrive to the smallest possible fire helping to prevent massive devastation.

Many systems and programs have been introduced with the intent of watching for wildfires at a distance. Only the FIREBird system is specifically designed to detect very small fires as well as larger fires at a distance, providing a scalable solution.



Optimized to Quickly Detect Small Wildfires

The FIREBird system is specifically designed to detect very small (3'x3') fires across a discrete area. When regularly placed along critical boundaries, the system provides continuous fire detection along that path. The FIREBird system is ideal for any arbitrary property border.

Small fire detection is provided over the contiguous 17-acre area surrounding a FIREBird device. Larger fires can be detected out to 1/2 mile or more, depending upon terrain. Uniform protection across larger land areas is as simple as deploying additional FIREBird devices.

FIREBird devices are also capable of detecting and reporting on multiple, simultaneous fires within their zone of coverage.

FIREBird System

A FIREBird system consists of one or more FIREBird wildfire detection devices and the FireSense web portal.

The FIREBird Wildfire Detection Device

Rather than looking for fire from a distance, FIREBird devices provides a highly local, “in situ” approach to wildfire detection. Conveniently mounted on any structure, FIREBird devices continuously monitor and protect the surrounding area, and are ideal for boundaries such as rights-of-way, facility perimeters, or wildland urban interfaces.

Autonomous Fire Detection

Unmanned, autonomous operation ensures fast wildfire detection and notification without the need for additional staff.

Fast Fire Detection

Each FIREBird device provides continuous, 360-degree, monitoring provided by 14 wildfire-specific thermal detectors and optical cameras. No scanning is involved, reducing delays in fire detection.

Multiple advanced neural-network algorithms running on the FIREBird device provide local determination of abnormal heat and fire events. These algorithms also minimize the likelihood of false or missed detections.

All the computing power needed for simultaneous sensor sampling and processing of the advanced neural networks is contained within each FIREBird. There is no need to transmit data for further processing. This results in the fastest fire detection possible.

Fire Weather Reporting

Knowledge of local weather conditions is crucial during a fire event. Each FIREBird device can provide continuous, high accuracy measurements of fire-critical weather data including windspeed, wind direction, ambient temperature and humidity.

Weather data is available during normal conditions, as well as after a fire is detected.

Communications

FIREBird devices support both cellular and satellite radios to ensure communication continuity regardless of the availability or status of nearby cell towers.

While cellular is required for transmission of images, Iridium satellite radio ensures communications are not lost during events.

Flexible Power Options

FIREBird devices are normally powered via an included solar panel or external AC power.

A built-in battery, specially encased to prevent thermal runaway, provides days of power in the event of a power outage or dark or smoky skies.

FIREBird Features

Communications

Both cellular and satellite communications can be included in FireBird. Backup satellite communications ensures transmission of critical alarms and data when cellular communications is turned off or not available.

Weather Station

Provides fire fighting personnel with accurate wind speed, wind direction, ambient temperature, and humidity. When no fire is present, this information can quickly identify local red flag conditions.

Lateral View Cameras

When installed along a right-of-way, these cameras can provide useful before and after imagery to help assess the condition of assets such as power lines.

Thermal Sensors

Advanced sensor arrays detect the unique thermal signature of wildfires, providing for rapid heat event detection. Sophisticated neural network algorithms minimize false indications.

Continuous 360° Detection

The combination of thermal sensor arrays and visible light cameras have overlapping fields of view, providing continuous fire detection around the device without the need for scanning or panning.

Cameras

Six visible light cameras provide visual confirmation of fire events. The images are processed in the FIREBird along with the thermal sensor output on-board to confirm the presence of fire.



The FireSense Web Portal

A Convenient, Powerful Web Interface for FIREBird Devices

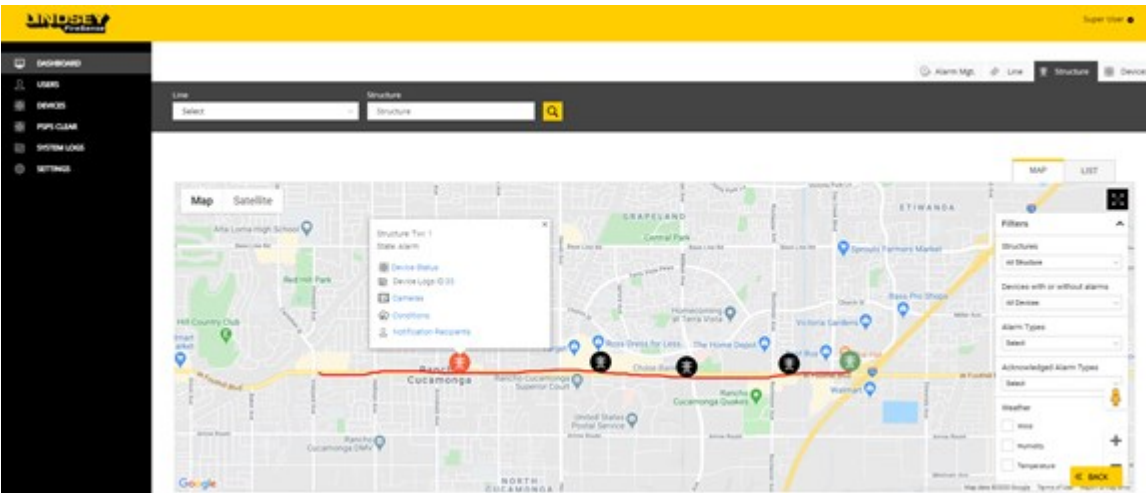
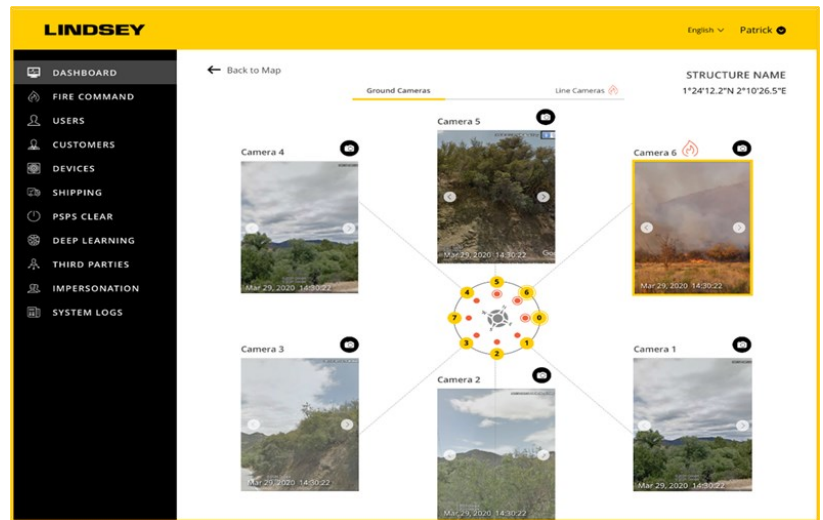
As part of the FIREBird System, the FireSense web portal is a secure, password protected, cloud-based interface for collection and viewing of data from the FIREBird device, alarm notification management, and graphical presentation.

Get a Quick Overview:

The Dashboard view provides a status summary of all devices including all key indicators.

Organize Your FIREBird Devices:

Create FIREBird device groups organized by right-of-way, boundary name, location perimeter, land area, or any other method to enhance your ability to manage alarms. For utilities, organizing FIREBird devices by feeder or electrical circuit simplifies use of the PSPS CLEAR function.



Enhance Your View

While in map view, toggle on or off various layers to add weather information, red flag warnings, and locations of existing, named, fires.

See Where the Problems Are

Auto-zooming maps quickly isolate the area to focus on. Color-coded status indicators allow for rapid fire identification. Images, alarm status, device history, and notification history are all a click away.

The screenshot displays the LINDSEY FireSense web interface. At the top left is the LINDSEY FireSense logo, and at the top right is the user name 'Aswathy VIJAY'. A dark sidebar on the left contains a menu with options: DASHBOARD, CUSTOMERS, USERS, DEVICES, PSPS CLEAR, BATCH DOWNLOADS, SHIPPING, SYSTEM LOGS, IMPERSONATION, and OS/FIRMWARE UPLOAD. The main content area shows a 'Ground Camera 4' view. It includes a 'Refresh Images' button, the location name 'Location Name' with coordinates '1°24'12.2"N 2°10'26.5"E', and a 'Direction:' label. The central image shows a fire in a field with smoke rising. Below the image is a timestamp '2021-01-01 01:06:05' and weather/environmental data: 'Weather: 74°F, Mostly cloudy | Environ: Forest'. A circular diagram below the image shows eight numbered camera views (0-7) around a central point, with 'Previous Structure' and 'Next Structure' labels. A yellow button at the bottom says '<< Back to Ground Cameras'.

Fire Imagery and Documentation

After a heat event or fire is detected, the FIREBird captures six overlapping images, providing a 360 degree view of the surrounding area . This allows for quick visual confirmation by the user and valuable visual information to fire fighting staff. Clicking on any image allows for full screen inspection of the image.

Users can view images from any camera on the FIREBird device. Due to the fast fire detection provided by these devices, images retrieved can potentially provide important documentation regarding the cause of the event.

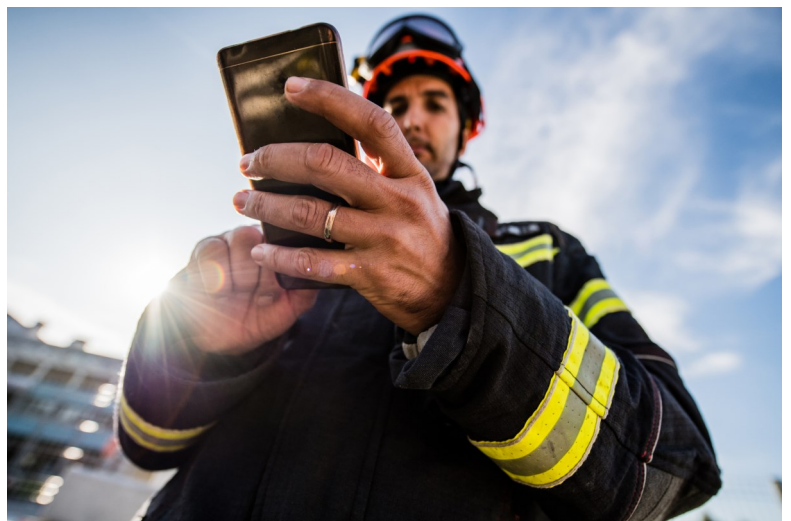
Desktop and Mobile Friendly

Equally at home in any browser, the FireSense portal is also mobile friendly; eliminating the need to download a separate application.

For traveling professionals depending primarily on mobile access, the FOLLOW ME feature ensures you are notified of fire events within a user-specified area. The OFF DUTY feature puts all notifications to sleep.

Control Who Gets Notified

Identify which person or persons get notified of alarms, and whether by SMS and/or email. Notification can be segmented by combinations of alarm types, FIREBird groups, or even by individual FIREBird devices.



The FireSense Web Portal (continued)

Right-of-Way Condition Monitoring

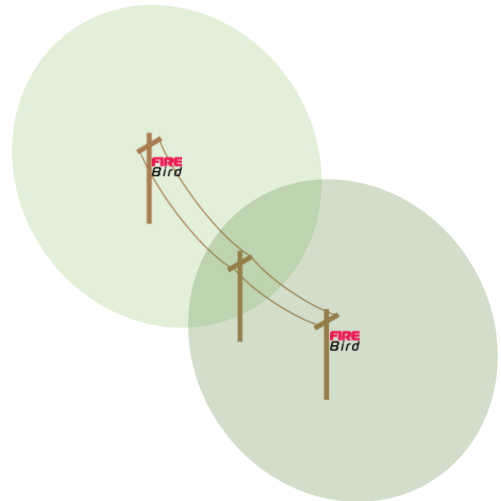
Each FIREBird device is equipped with two additional cameras that look along the monitored boundary. Rather than looking at the ground and environment for the purpose of fire detection, these two lateral view camera's primary role is in documenting the condition of the monitored boundary line.



Dedicated lateral view cameras provide images along the protected right-of-way or boundary line.

Advantage of Regular Placement

Regular placement of FIREBird devices along a boundary line, right-of-way, or easement provides a continuous fire detection zone extending hundreds of feet on either side. The lateral view cameras add a practical means of protecting assets, monitoring their condition, and documenting any changes.



The PSPS CLEAR Function

Designed specifically for utilities, images are captured at select times every day to document the condition of a power line's right-of-way. In the event a line must be de-energized for the purpose of a Public Service Power Shutoff (PSPS) or for any other reason, additional images can be captured before the line is re-energized. The unique "PSPS CLEAR" function provides visual comparison tools to help utility personnel assess whether any damage occurred to the line during the outage.

This feature can also be used for comparison of image sets along roadways, pipelines, railroad lines, or for any other asset that follows a path.

Hardware Configurations

The base FIREBird wildfire detection device includes:

- Six ground view cameras for imaging and fire detection
- Eight wildfire specific thermal sensors for heat and fire detection
- Advanced neural net processor
- Cellular radio (4G LTE Cat-1) with Lindsey FireSense provided service
- Built-in 120VAC power supply



Ordering Options

- Weather station providing high accuracy wind speed, direction, and temperature
- Satellite radio (Iridium SBD) with Lindsey FireSense provided service
- 22.4 A-Hour thermal runaway protected battery
- Solar-panel and mounting bracket (in place of AC power supply)
- Two lateral view cameras providing for and aft view of the protected boundary path
- Mounting arm and hardware for connection to a wood or steel pole

Dimensions: 240 W x 290 D x 309 H mm (9.41" W x 11.37" D x 12.15" H)

Weight: 7.5 kg (16.5 lbs) FIREBird device only



About Lindsey FireSense

Lindsey FireSense LLC focuses on products designed to detect and mitigate damage associated with wildfires.

For more information, visit www.Lindsey-FireSense.com.

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Specifications subject to change without notice.

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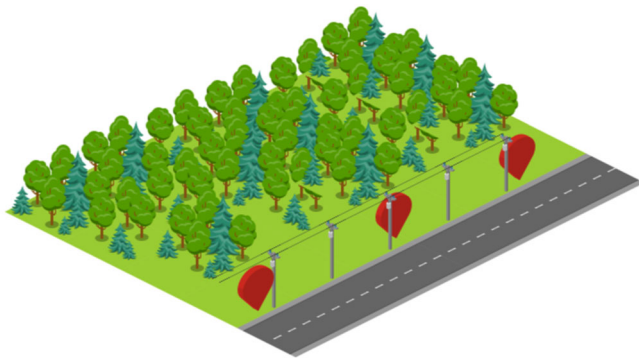
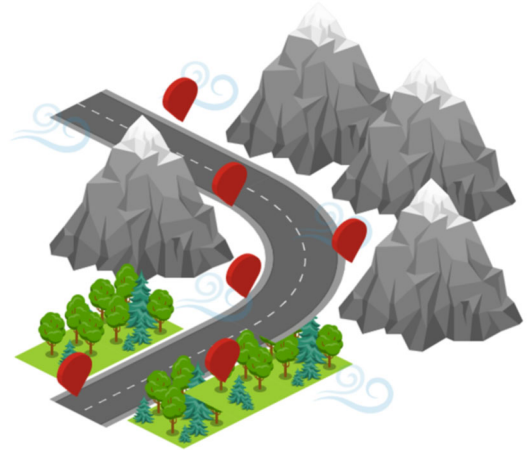
Why Deploy FIREBird Rapid Wildfire Detection Devices in Your Community?

Boundary fires that start along rights-of-way, easements, or near wildland-urban interfaces, threaten homes, commercial buildings, and property, potentially resulting in millions of dollars of damage.

Numbers to Know:

90%

90% of all wildfires in the U.S. occur within 1/2 mile of a road.¹

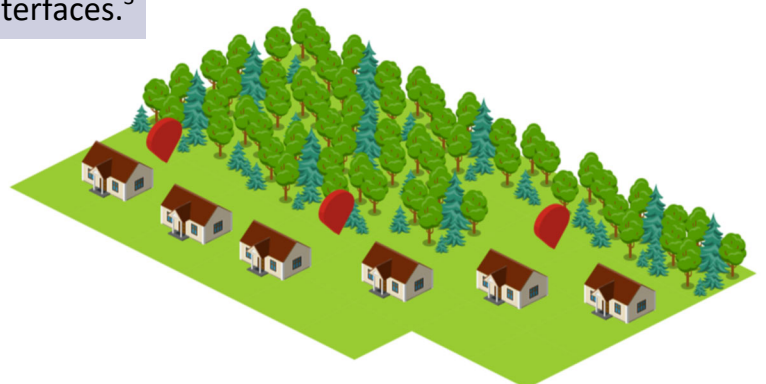


10X

Power line fires are, on average, 10x larger than other wildfires.²

12.6 million

Home construction from 1990 - 2010 placed 12.6 million new homes in vulnerable wildland-urban interfaces.³



 Indicates potential placement of FIREBird device.

FIREBird Rapid Wildfire Detection System

Protect the Boundaries in Your Community

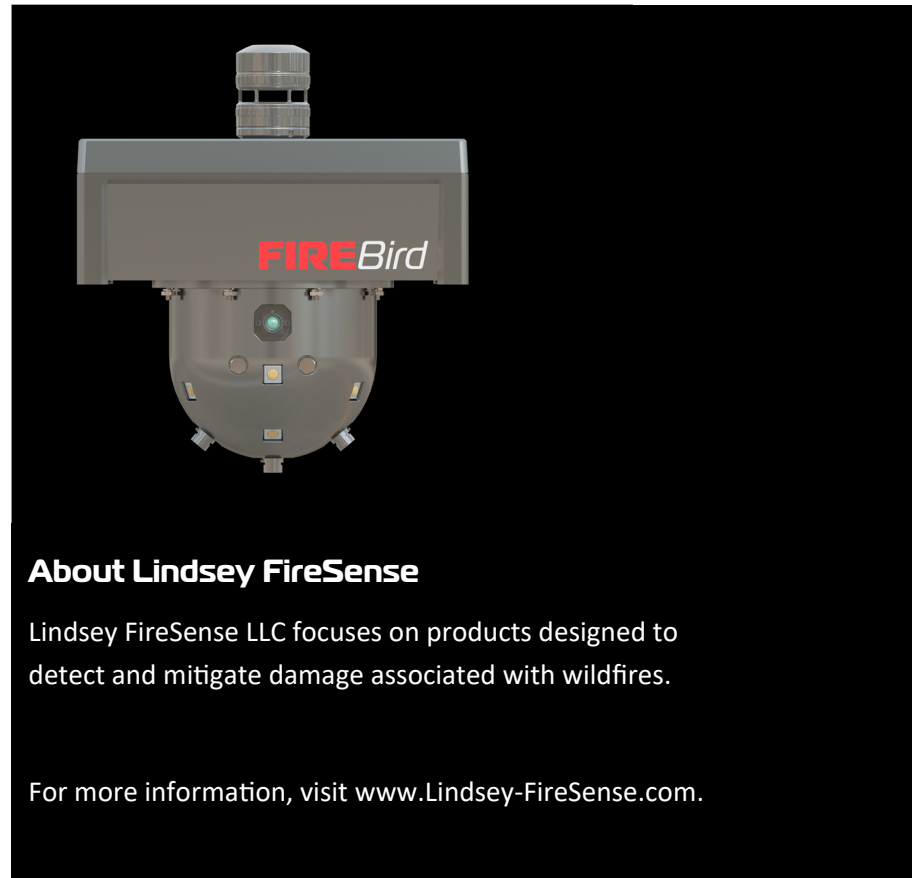
Key Features of the FIREBird System

- Detect very small fires (as small as 3'x3')
- Detect fires quickly
- Report fires quickly
- Unmanned, autonomous operation
- Comprehensive, mobile friendly web-interface providing notifications, imaging, and more

Placement of FIREBird in Your Community

Easily installed, FIREBird devices can be placed in any vulnerable area in your community:

- Wildland-urban interfaces
- Neighborhoods
- Shopping centers
- School campuses
- Industrial parks
- Along roadways or powerlines
- Large estates



About Lindsey FireSense

Lindsey FireSense LLC focuses on products designed to detect and mitigate damage associated with wildfires.

For more information, visit www.Lindsey-FireSense.com.

¹Peterson, Peter H., "Roads and Wildfires," Pacific Biodiversity Institute, Winthrop, WA, 2007, page 4

²Mitchell, Joseph W., "Power line failures and catastrophic wildfires under extreme weather conditions," Engineering Failure Analysis, Volume 35, 2013, Pages 726-735

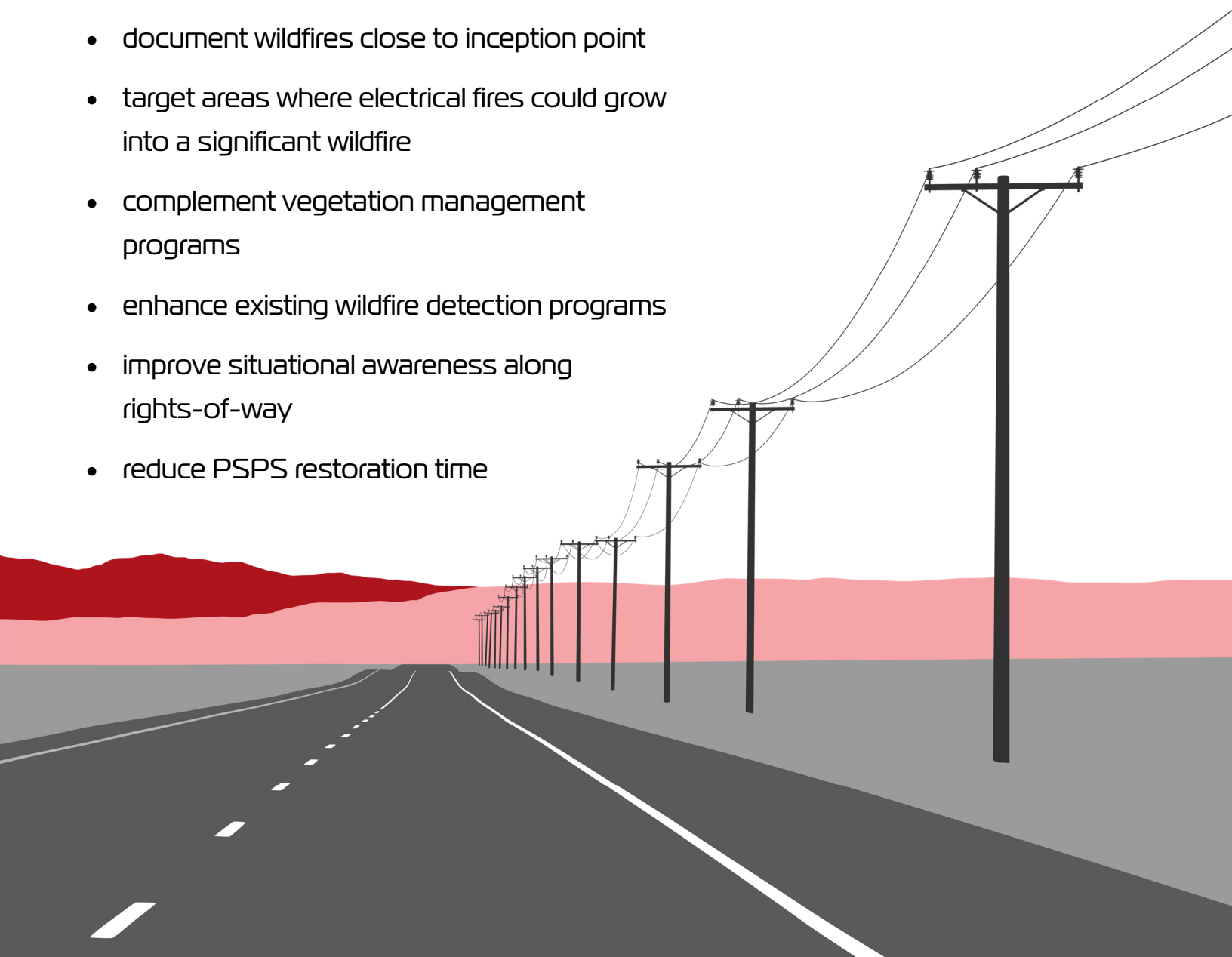
³"New analyses reveal WUI growth in the U.S.," Northern Research Station, USDA Forest Service, downloaded on 1/15/2021 from <https://www.nrs.fs.fed.us/data/WUI/>

Why Should Electric Utilities Deploy the FIREBird Rapid Wildfire Detection System?

Power line fires are, on average, 10x larger than other wildfires¹. The FIREBird System is a defensive wildfire monitoring system that quickly detects and reports wildfires along power line rights-of-way.

FIREBird offers the ability to:

- enhance public and employee safety
- detect wildfires near power lines quickly
- document wildfires close to inception point
- target areas where electrical fires could grow into a significant wildfire
- complement vegetation management programs
- enhance existing wildfire detection programs
- improve situational awareness along rights-of-way
- reduce PSPS restoration time



FIREBird Rapid Wildfire Detection System

Protect Critical Areas of the Electrical Grid

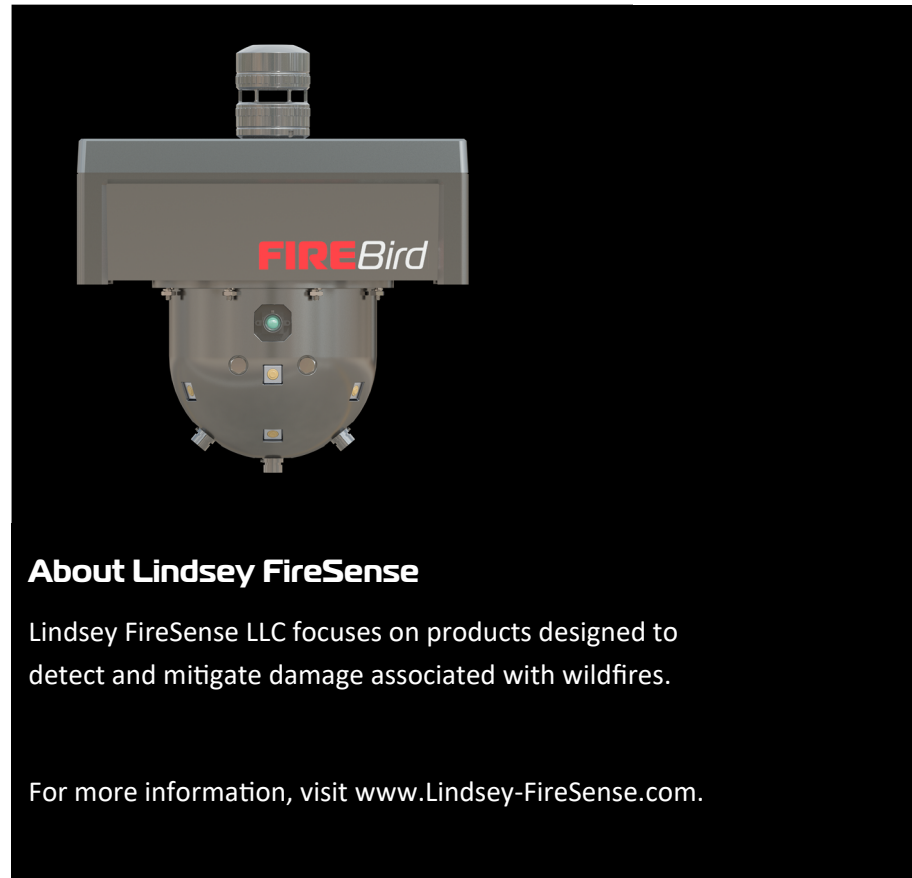
Key Features of the FIREBird System

- detects very small fires (as small as 3'x3')
- detects and reports fires quickly
- obtains images of detected fires quickly
- reports on weather conditions before, during, and after wildfire events
- collects right-of-way images to enhance PSPS recovery
- operates autonomously without the need to interpret results
- uses a mobile friendly web-interface

Placement of FIREBird on Your Electric System

Easily installed, FIREBird devices can be placed in any vulnerable area in your system:

- distribution lines
- transmission lines
- substations
- control centers



¹Peterson, Peter H., "Roads and Wildfires," Pacific Biodiversity Institute, Winthrop, WA, 2007, page 4

Genics Fire Mesh - Fire Protection for Wood Utility Poles

- Genics Fire Mesh is an expandable graphite intumescent coating on a flexible and durable galvanized wire construction cloth.
- Fire Mesh can be easily attached by nailing or stapling it to a wood pole.
- It can be cut and molded around existing hardware to ensure complete coverage of wood pole. Likewise, new hardware can easily be installed over Fire Mesh.
- The Genics Fire Mesh design of ¼" grid spacings allows for constant airflow and visibility of the underlying wood.
- The flexible mesh design allows for future pole maintenance, inspection and climbing.
- When the heat of a fire reaches 302°F (150°C) the coating instantly expands to about 200X to create an insulative blanket (mechanical barrier and thermal barrier) between the fire and the wood pole.
- After a fire event, cut out and replace the activated section or simply place new mesh over the activated area. Extremely durable product - current testing is showing 6+ years fully effective.

- Specified by major US and Canadian utilities and railroads.
- Tested by *FP Innovations*, *Western Fire Center* and is an *Intertek* certified product.

Available in rolls of various sizes

6" x 7'

18" x 50'

36" x 12.5'

36" x 25'

36" x 50'

Frequently Asked Questions

Q. Will it work for a second burn?

A. We suggest that after a burn you replace the mesh or wrap a new layer overtop of it.

Q. Can you gaff it? And if so, will it still work?

A. Our testing has shown that Fire Mesh is easily gaffable and that it will still perform.

Q. Will it interfere with a groundline inspection program?

A. No. The Genics Fire Mesh can be easily moved out of the way and then returned to position.

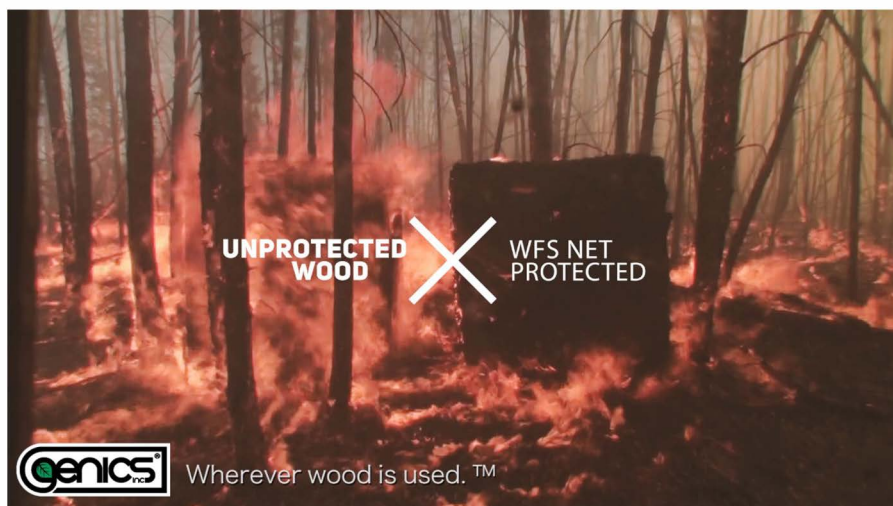
Q. How many poles can I protect per roll and how much does it cost per pole?

A. Based on a 40" circumference pole Genics Fire Mesh will cover seven poles up to about six feet. This works out to about \$75-80 per pole.

YOU CAN'T STOP A FIRE BUT YOU CAN PROTECT YOUR ASSETS

FIRE MESH

- INNOVATIVE NET DESIGNED TO PROTECT WOOD PRODUCTS FROM FIRE.
- FORMS A PROTECTIVE BARRIER THAT STOPS THE SPREAD OF FLAMES.
- ALLOWS FOR AIRFLOW AND BREATHABILITY UNTIL ACTIVATED BY FIRE.



SEE FIRE MESH IN ACTION:
[HTTPS://WWW.YOUTUBE.COM/
WATCH?V=G8IW3UDWPXU](https://www.youtube.com/watch?v=G8IW3uDWPXU)

 **GEN
PAC**
General Pacific, Inc.

503-907-2900

SALES@GENPAC.COM

GENICS INC.

Cobra[™] SHIELD



- Genics *Cobra*[™] SHIELD II is the most versatile and effective wood pole fire retardant product on the market
- Highly effective intumescent coating which reacts to the fire or heat by expanding to many times the original dry thickness
- Limits heat and oxygen to wood pole



Application

Genics *Cobra*™ SHIELD can be applied by brush, roller or with a power sprayer (Genics recommends Graco 450 or larger airless sprayer) to a thickness of approximately 1/32" TO 1/64". Remove vegetation from around pole and apply to at least six feet. Product will be fully dry in 24 hours and equipment can be cleaned up with soap and water. Ensure pole is dry and that ambient air temperature is and remains at a minimum of 50F for at least 48 hours.



Features

Genics *Cobra*™ SHIELD is a highly effective intumescent coating that reacts to fire or heat by expanding to many times its original dry film thickness. The expanded material forms a char which insulates against the heat of fire and reduces available oxygen to the surface. This limits flame spread and the amount of smoke developed.

Genics *Cobra*™ SHIELD is non-toxic. It contains no asbestos, harmful ingredients, halogens or solvents. It will not burn in liquid or solid state. Under fire conditions, it forms a char, preventing the spread of flames, and slowing the penetration of heat through the substrate (Fire Endurance).

When top-coated with Genics Pro Coat sealer, Genics *Cobra*™ SHIELD will remain effective for two to five years (depending on the local environment). Genics Pro coat is a quick drying spray on product which takes

very little extra time to apply.

With the quick curing time of *Cobra*™ SHIELD, it can be applied in front of fires. It is also effective as a long term fire damage prevention program when covered with a coat of Genics Pro Coat sealer. *Cobra*™ SHIELD is not only ideal for wild fire protection but also as a precautionary measure before controlled burns.

For temporary protection of outbuildings and other combustible materials, Genics also offers FR41. It is a clear fire retardant spray-on product which safely washes away with first rain. FR41 is applied at a rate of approximately 1 pint per pound of fully penetrable material (i.e. grass) or 80 square feet per gallon for flat surfaces.

Proven Effective

Genics *Cobra*™ SHIELD has been field tested for efficacy and durability and is a proven product in the protection of wood poles against the hazards of ground fires.

Field Testing



Pre Test Setup

During Burn

Approximately 1 Hour After Fire

Lab Testing

	Test Thickness (mils)	Flame Spread	Smoke Detected
Osmose FireGuard	125	25	60
	30	35	45
Genics Cobra Shield II	30	0	15

Independent lab tested to Fire Test ASTM E84

MILS are thickness measure of 1/1000th of an inch

Flame Spread and Smoke Detected numeric test results are a scale whereby lower numbers are more effective.

Available Products

<i>Cobra</i>™ SHIELD	Genics FR41	Genics Pro Coat sealer
#53020	#53150	#53090
5 Gallon Pail	5 Gallon Pail	5 Gallon pail
Approximate coverage 80 sq ft per gallon	Approximate coverage 80 sq ft per gallon	Approximate coverage 320 sq ft per gallon

Guarantee/Warranty: Recommendations of the use of our products are based on tests carried out at government approved labs. Manufacturer and seller are not responsible for results where the product is used under conditions beyond our control. Under no circumstances will Genics Inc. be liable for consequential damages to anyone in excess of the purchase price of the product or services.

Hendrix Flame Retardant Insulators

Introduction

A fire retardant rated polymer will ignite if the temperature exceeds its ignition point. However, a FR material will self-extinguish after the heat source is removed.

Although no specific flammability standard exists for insulators, the most commonly referenced industry standards for FR rated materials are all equivalent: UL-94, ASTM D3801 and IEC60695.

UL 94

Hendrix flame retardant (FR) insulators are tested according to UL 94. The material passes vertical burning V-0, which is the most stringent rating for UL 94. Below is a summary of the test:

- UL 94 evaluates the flammability behavior of a polymeric material under an open flame or radiant heat source
- V-0 rating:
 - Flame self-extinguishes in ≤ 10 seconds after the ignition source is removed
 - Cotton balls located 300 mm (~11.8") below the burning samples should not ignite by the flaming particles or drops

Conventional test

In addition to the UL 94 test, a "field" burning test was conducted using a Hendrix FR insulator. A utility torch (Bernzomatic MAP/PRO) flame was directly applied to the insulator's fin, the thinnest section (~1/8"), for 30 continuous seconds.

- Flame self-extinguished less than 5 seconds after the torch was removed
- The insulator burning drops self-extinguished and didn't ignite the cotton balls placed 2ft below the insulator.

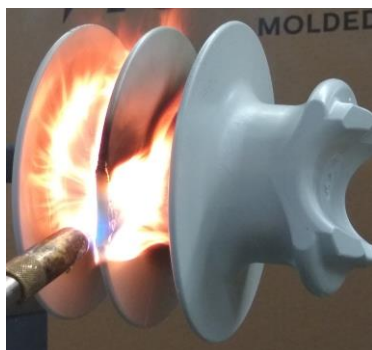


Image 1: Heat source applied for 30 seconds.



Image 2: Flame self-extinguished after heat source is removed.

HEXION ARMORBUILT™ WILDFIRE SHIELD

Guard the Grid

Ensure grid stability in the face of wildfires with the Hexion ArmorBuilt Wildfire Shield — a durable, burn-prevention safeguard for wood utility poles.

Durable, Affordable and Sustainable

For more than a century, Hexion has delivered sustainable product innovations and technologies that enhance everyday life. Merging fire science and smart materials, Hexion's ArmorBuilt covering instantly swells and seals around the pole to create a protective and effective heat insulation barrier. This helps you extend the lifespan of wood utility poles, reduce repair costs and protect more people.



In 2020, 17,700 structures¹ were lost to wildfires, costing up to \$13B² in damages.



The cost to repair damage from a fire can be as high as \$40,000 per pole.³

 **HEXION™**
Responsible Chemistry



Test picture



Pole without ArmorBuilt



Pole after it was wrapped with ArmorBuilt

Heat-Triggered Protection

ArmorBuilt leverages Hexion's smart materials so that it swiftly responds to heat to form a protective barrier, dramatically reducing the risk of damage.

- Activates within 20 seconds when in contact with wildfire
- Swells around and insulates the pole
- Prevents burning, strength loss and pole failure
- Withstands 12-foot flames with temperatures of up to 2,100°F⁴

A Durable Barrier

Designed with superior durability and self-healing properties, ArmorBuilt can withstand weather elements as well as routine utility inspections like boring tests without compromising its protective performance.

- Designed with superior durability
- Self-heals and seals cuts and holes during a fire
- UV resistance backed by Quantitative Ultra-Violet (QUV) testing⁵

Designed for Line Workers

Safe and easy to apply, climb, cut and repair, ArmorBuilt accommodates regular utility pole maintenance tasks and does not require special handling or installation practices — saving time in the field.

- Easy to secure to new or existing poles
- Can be climbed and cut without compromise
- Holds up to 490 pounds when double-wrapped⁶
- Has the same electrical insulating properties as a wood pole without protective coverings
- Passed wooden power-pole-handling testing

Sustainable Security

Designed to extend the lifespan of wood utility poles by protecting them from the effects of wildfire and rot, ArmorBuilt promotes a long-lasting and sustainably sourced power infrastructure.

- Extends the lifespan of wood utility poles
- Promotes a renewably sourced infrastructure
- Does not release harmful VOCs or chemicals
- Poles can be re-secured with new material post-fire to ensure future fire protection

Puts People First

By protecting poles so they stay upright, ArmorBuilt helps reduce the risk of fire spreading — helping prevent loss of life.

- Helps reduce risk of fires encroaching on towns and cities
- Helps maintain open ingress and egress routes for first responders and evacuees

A Cost-Effective Safeguard

Helping to drastically minimize pole replacements and associated infrastructure repair costs, ArmorBuilt is a cost-effective wildfire protection solution.

- Helps prevent millions in damages
- Minimizes pole replacement and repair
- Has a built-in sustainable U.S. supply and scalability
- Produced on an ISO 9001:2015-certified site

2021 ENERGY STAR® Partner of the Year

For Comprehensive Energy
Management Program

Start Building Your Wildfire Defense

Put the power of ArmorBuilt protection to work for you.
Contact an ArmorBuilt representative today at [Hexion.com](https://www.hexion.com).

¹National Interagency Fire Center's Incident Year-to-Date Report as of November 9, 2020.

²The costs of insured losses from fires through November 2020 in California, Oregon, Washington and Colorado as reported by Risk Management Solutions (RMS).

³Exacter and Cigre 2019 Pole Fire Survey and Research report.

⁴Third-party-certified Wildfire Simulation Testing (SWI/EDM) of wood poles secured with one and two layers of protective wrap revealed no char or strength loss when engulfed in 12-foot swirling, open flame at temperatures of 2,100°F for a duration of 3 minutes.

⁵Over 2.5 years of continuous Quantitative Ultra-Violet (QUV) testing, correlating to 30+ years of North American UV exposure, have demonstrated ArmorBuilt's ability to withstand the damaging effects of long-term UV light exposure. QUV refers to Q-Lab's line of weathering test machines. The method used is ASTM G 154, Cycle 7, which continuously repeats a cycle consisting of 8-hour UV exposure at 60°C (140°F), 15 minutes of water spray and 3.75 hours of condensation (humidity) at 50°C (122°F). This test is widely used in the coatings and plastics industries.

⁶PG&E climbing tests revealed that ArmorBuilt can hold up to 490 pounds when double-wrapped around wood utility poles.

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E-LAM® Engineered Laminated Wood Structures - Fire Resistance



E-LAM® laminated wood structure after a grass fire shows minimal char and less than 1% reduction in strength.

Heavy wood construction develops a char at the rate of 1/40 in (0.65 mm) per minute under an ASTM E-119 fire exposure test.



Glulam laminated wood sample during (top photo) & after (above photo) ASTM E-119 fire exposure test.

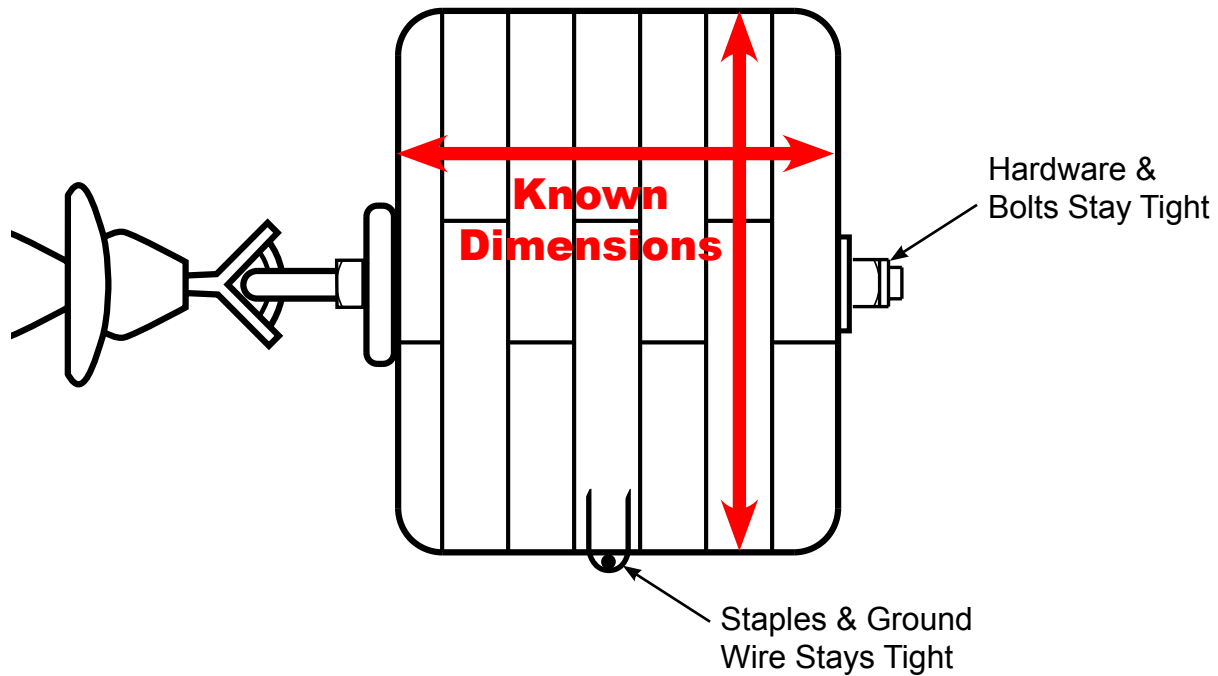
ASTM E-119 Time & Temperature Table

5 min - 1,000° F	Engineered wood beams as small as 6-3/4" x 13-1/2" can be assigned a one-hour fire rating.
10 min - 1,300° F	
30 min - 1,550° F	
1 hr - 1,700° F	

Fire Type	Fire Exposure	Char Thickness	% of Strength Reduction W= 12.25 in. D= 36 in.
Grass Fire @ 1,500° F	1 Minute	0.025 in	1%
Brush Fire @ 1,500° F	5 Minutes	0.125 in	4%
Tall Brush Fire @ 1,500° F	7 Minutes	0.175 in	5%
Crown Forest Fire @ 2,000° F	10 Minutes	0.25 in	7%

Eliminate Pole Fires Due to Loose Ground Wire & Hardware. Engineered E-LAM® Structure Members are Fabricated per ANSI 05.2 with Kiln Dried Lumber.

- No Shrinkage in the Field -

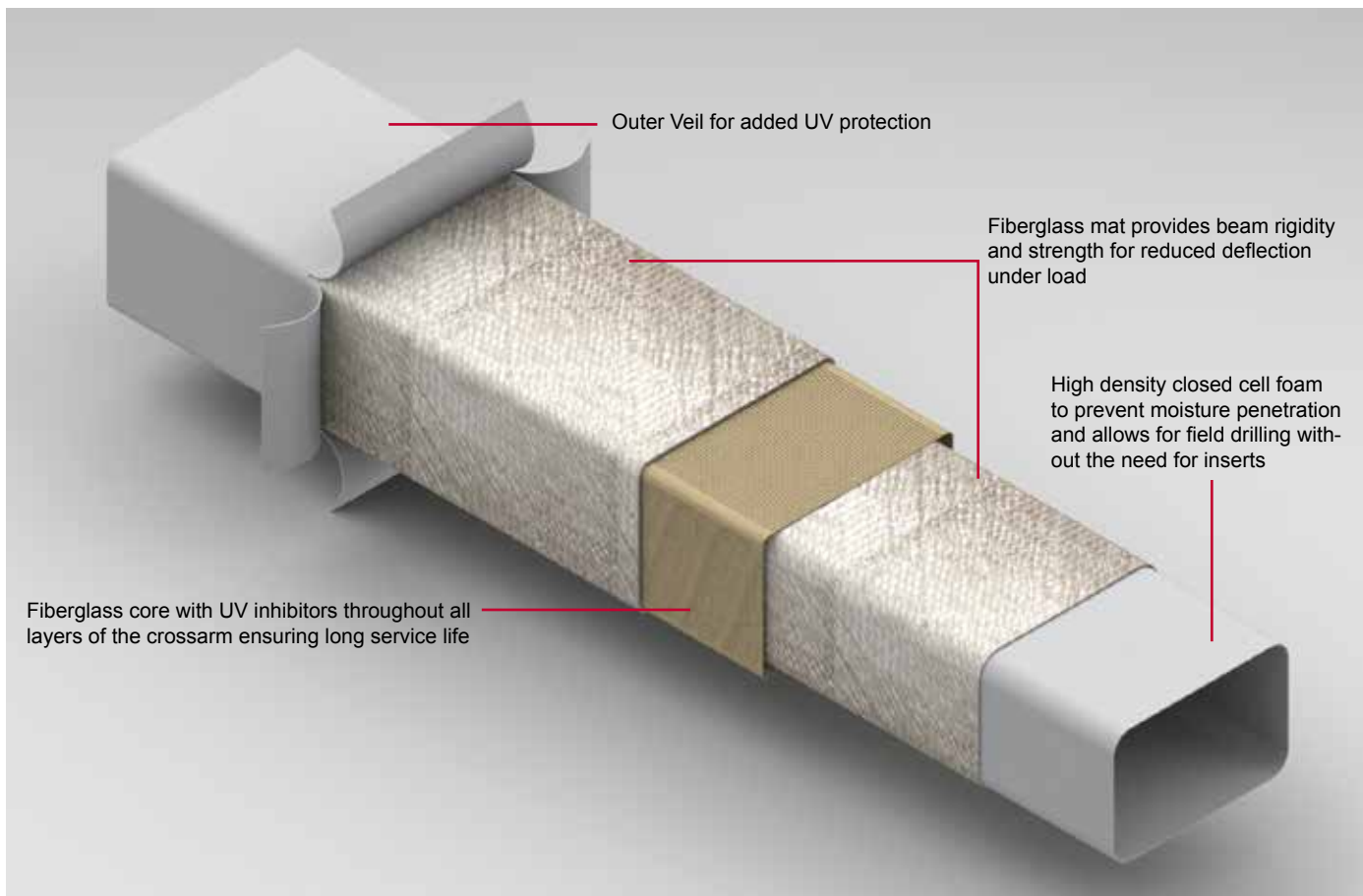




Utility Crossarms and Braces

macleanpower.com





Features and Benefits

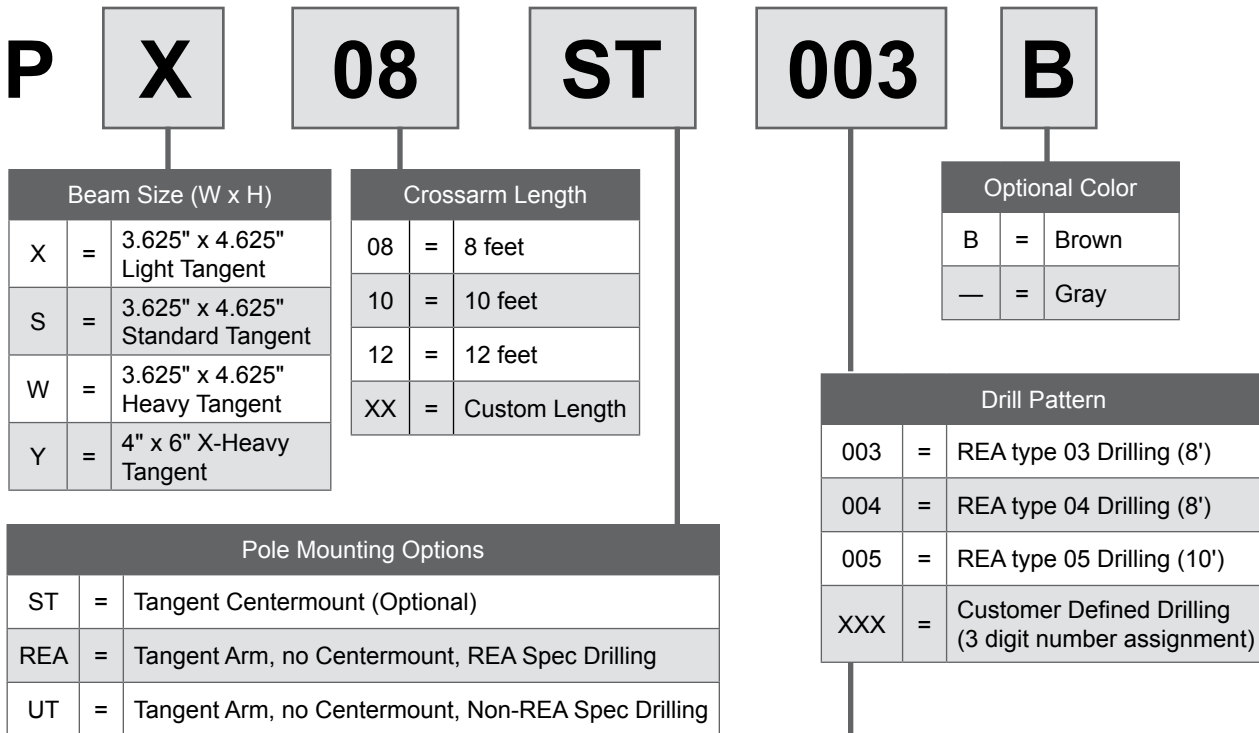
- UV stabilized pultruded fiberglass beam
- Extensive use of woven and straight fibers for increased strength and reduced deflection
- High density, closed cell, expandable foam core
- Environmentally friendly - no chemicals or preservatives
- Deadends use an MPS exclusive curved washer to reduce arm stress
- Compatible installation with saddle pins on tangent crossarms
- Alternative and superior product to wooden crossarms without the additional costs of chemical treatments and disposal health concerns
- Field drillable design - available in std. REA or custom drill
- Lighter than wood with consistent material properties
- Improves overall system insulation and integrity
- Shipped ready to be installed with no assembly required
- RUS listed
- Assembled in the U.S.A.

MPS Advantages

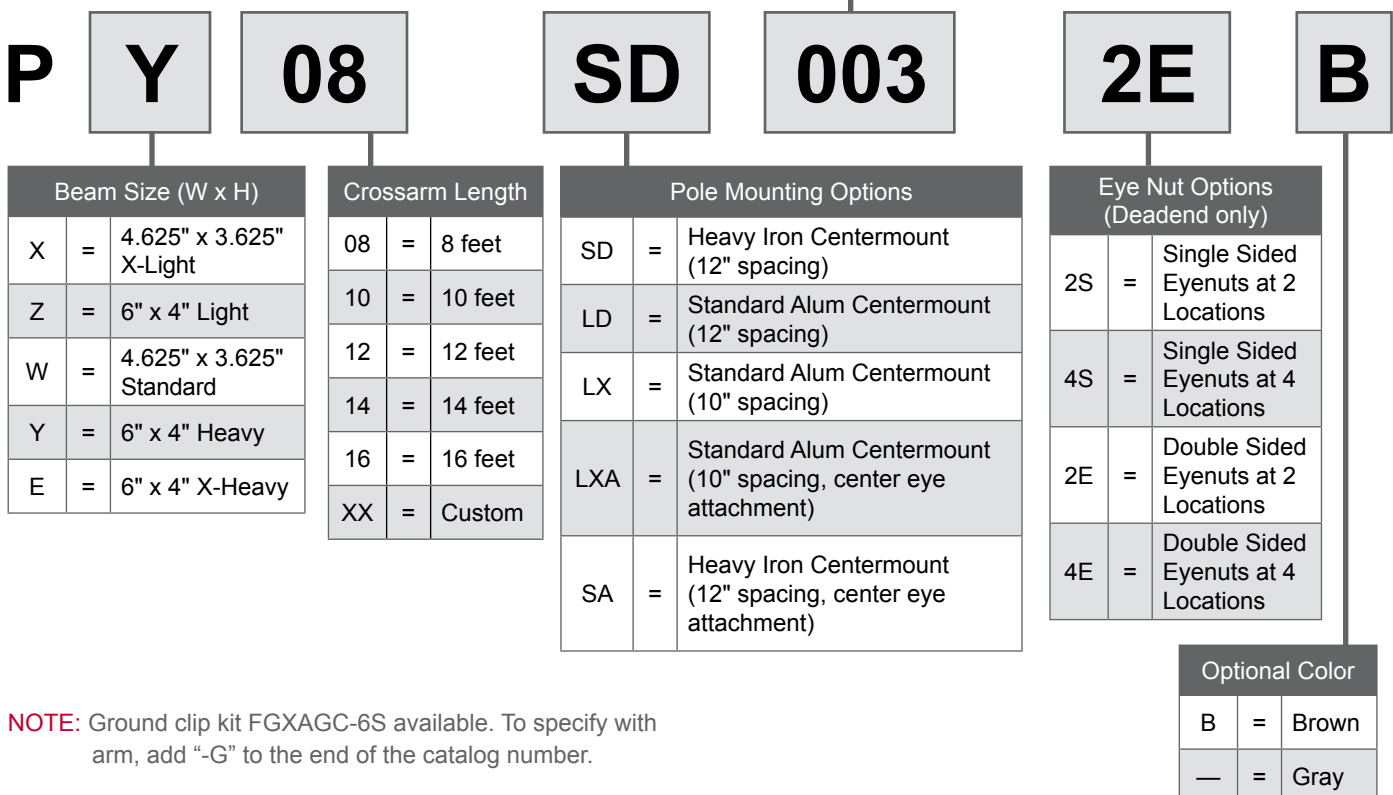
- Over 30 years of fiberglass pultrusion experience
- High quality products that meet or beat industry standards
- 10 US manufacturing plants
- Dedicated technical and customer service experts
- Customized application support
- Vertically integrated for quick response to storm and customer emergencies
- Locations throughout the world
- MPS offers a wide variety of products
 - Aluminum Mounts
 - Fiberglass Products
 - Anchoring Systems
 - Formed Wire
 - Conductor Hardware
 - Grounding and Tools
 - Connectors
 - Insulator Systems
 - Cutouts
 - Pole Line Hardware
 - Enclosures and Pads
 - Surge Arresters
 - Telecommunications Hardware



Tangent Catalog Numbering System



Deadend Catalog Numbering System



Tangent Crossarms

Light and Standard Duty



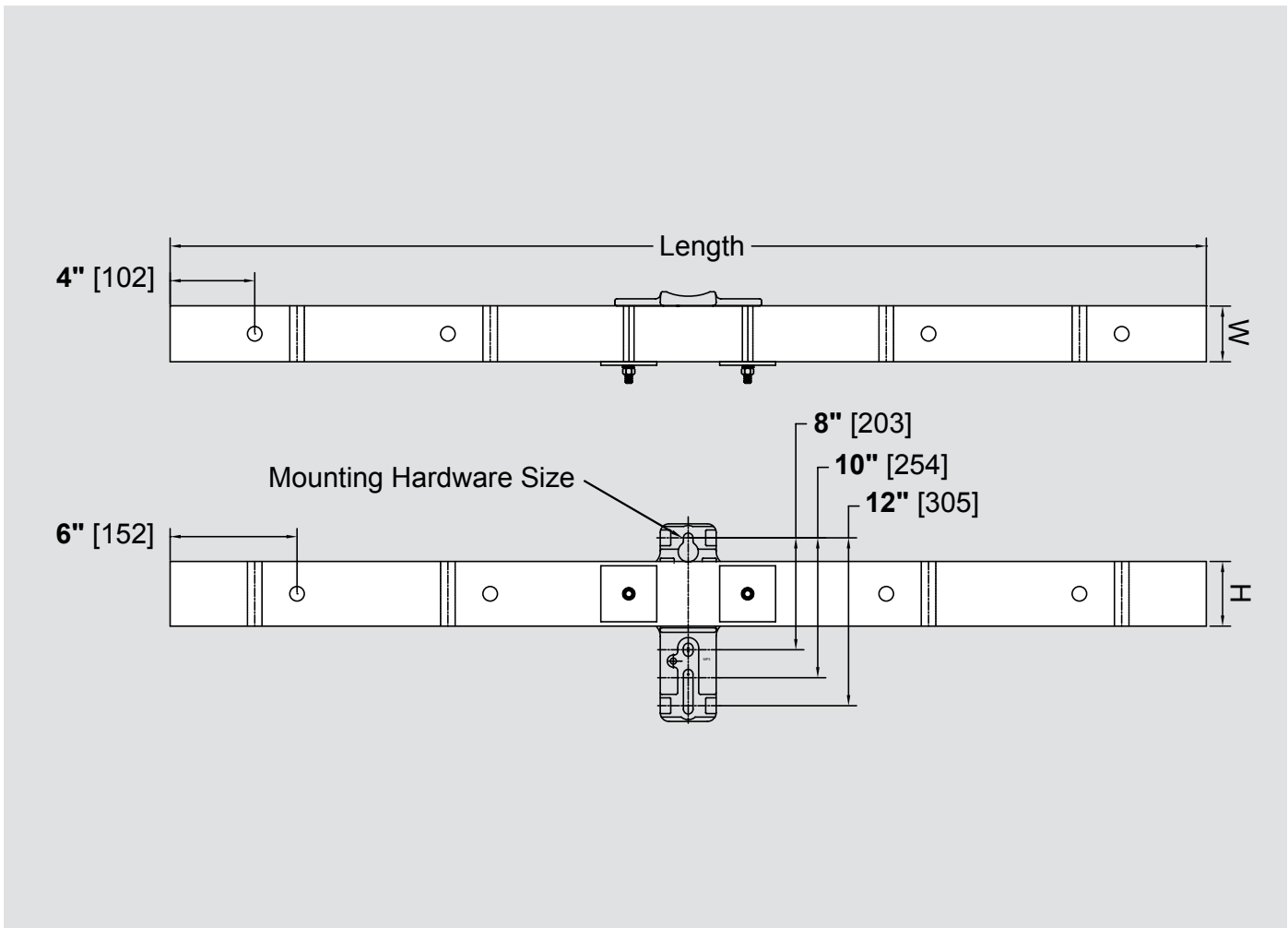
Specifications

- UV Stabilized Fiberglass Beam with UV Protective Veil
- Bandable
- Keyhole Slot
- 8"-12" Pole Mounting
- Cast Aluminum Base
- Available in Gray or Brown
- RUS listed

General Specifications

Series	Mounting Spacing	Mounting Hardware Size	Beam Size (W x H)	Base Material
PX	8" - 12"	5/8"	3.625" x 4.625"	Aluminum
PS	8" - 12"	3/4"	3.625" x 4.625"	Aluminum

Dimensions





Light Duty Tangent Crossarms Series PX

Braced Tangent Crossarms

Catalog Number	Length in Feet**	Ultimate Load Per Side in Pounds	Deflection in Inches Per 1000 Pounds	Load Per Position	Weight in Pounds	Beam Size W x H
PX08REA003*	8	2000	1.52	—	26	3-5/8" x 4-5/8"
PX08REA004*	8	2000	1.52	—	26	3-5/8" x 4-5/8"
PX10REA005*	10	1500	2.20	—	33	3-5/8" x 4-5/8"

Braces not provided

Catalog Number	Length in Feet**	Ultimate Load Per Side in Pounds	Deflection in Inches Per 1000 Pounds	Load Per Position	Weight in Pounds	Beam Size W x H
PX08ST003*	8	3200	0.68	2350	34	3-5/8" x 4-5/8"
PX08ST004*	8	3200	0.68	1600	34	3-5/8" x 4-5/8"
PX10ST005*	10	2500	1.28	1250	41	3-5/8" x 4-5/8"

Standard Duty Tangent Crossarms Series PS

Braceless Tangent Crossarms

Catalog Number	Length in Feet**	Ultimate Load Per Side in Pounds	Deflection in Inches Per 1000 Pounds	Load Per Position	Weight in Pounds	Beam Size W x H
PS7.5ST388	7.5	4300	0.53	2950	35	3-5/8" x 4-5/8"
PS08ST003	8	4100	0.60	3050	36	3-5/8" x 4-5/8"
PS08ST004	8	4100	0.60	2000	36	3-5/8" x 4-5/8"
PS9.5ST171	9.5	3300	0.83	2300	41	3-5/8" x 4-5/8"
PS10ST005	10	3200	0.90	1600	42	3-5/8" x 4-5/8"

* RUS Listed

** Standard length shown. For other lengths, consult your MPS representative or customer service.

All numbers published to 95% confidence interval

Tangent Crossarms

Heavy and Extra Heavy Duty



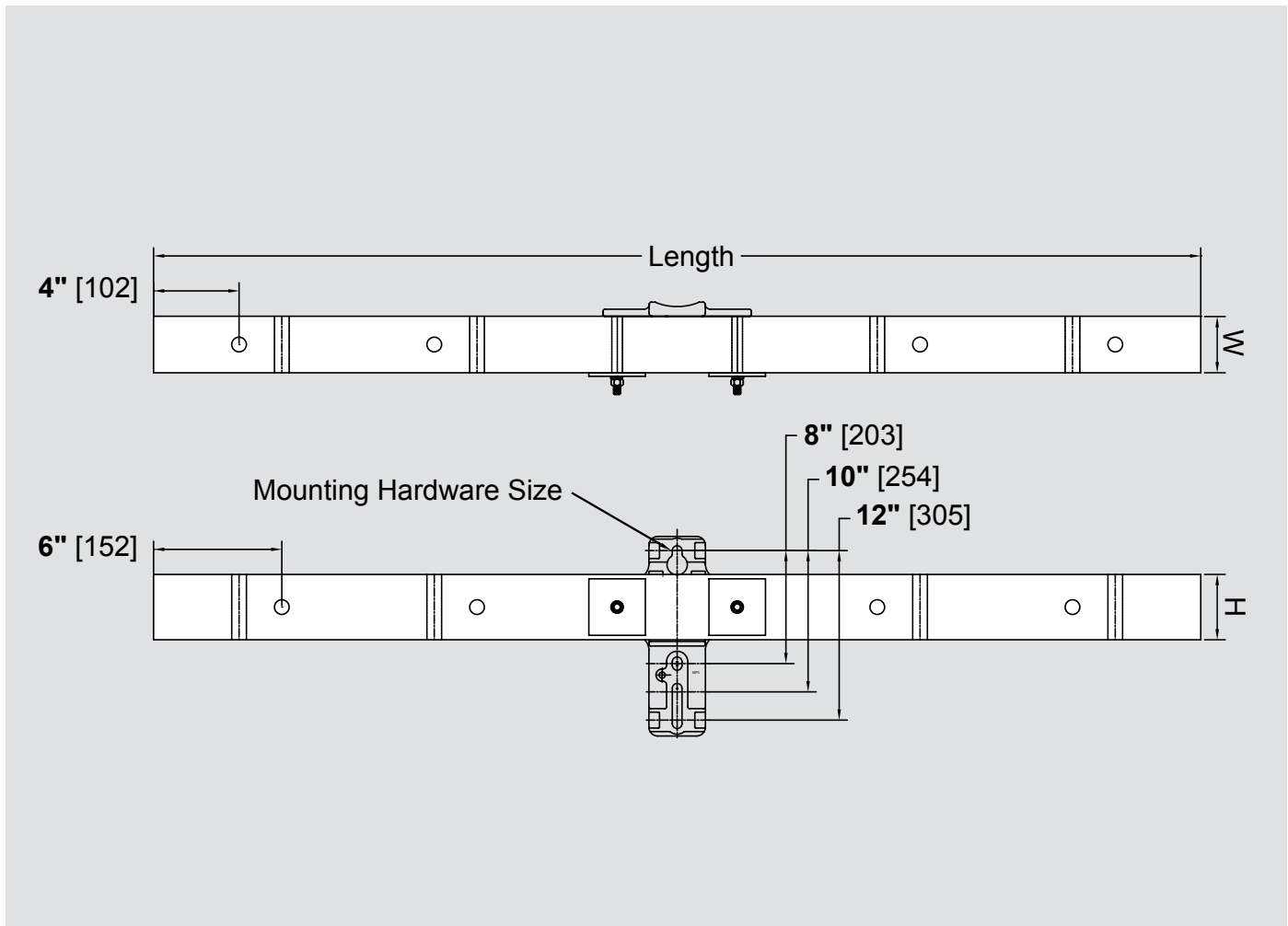
Specifications

- UV Stabilized Fiberglass Beam with UV Protective Veil
- Bandable
- Keyhole Slot
- 8"-12" Pole Mounting
- Cast Aluminum Base
- Available in Gray or Brown
- RUS listed

General Specifications

Series	Mounting Spacing	Mounting Hardware Size	Beam Size (W x H)	Base Material
PW	8" - 12"	3/4"	3.625" x 4.625"	Aluminum
PY	10" - 12"	3/4"	4" x 6"	Aluminum

Dimensions





Heavy Duty Tangent Crossarms Series PW

Braced Tangent Crossarms

Catalog Number	Length in Feet**	Ultimate Load Per Side in Pounds	Deflection in Inches Per 1000 Pounds	Load Per Position	Weight in Pounds	Beam Size W x H
PW08REA003*	8	4000	0.75	—	35	3-5/8" x 4-5/8"
PW08REA004*	8	4000	0.75	—	35	3-5/8" x 4-5/8"
PW10REA005*	10	3100	1.20	—	43	3-5/8" x 4-5/8"

Braces not provided

Braceless Tangent Crossarms

Catalog Number	Length in Feet**	Ultimate Load Per Side in Pounds	Deflection in Inches Per 1000 Pounds	Load Per Position	Weight in Pounds	Beam Size W x H
PW7.5ST388	7.5	7200	0.53	5200	43	3-5/8" x 4-5/8"
PW08ST003*	8	7200	0.60	5400	45	3-5/8" x 4-5/8"
PW08ST004*	8	7200	0.60	3600	45	3-5/8" x 4-5/8"
PW9.5ST171	9.5	5900	0.83	4100	51	3-5/8" x 4-5/8"
PW10ST005*	10	5700	0.90	2800	53	3-5/8" x 4-5/8"
PW12ST349	12	4700	1.21	3300	61	3-5/8" x 4-5/8"

Extra Heavy Duty Tangent Crossarms Series PY

Braceless Tangent Crossarms

Catalog Number	Length in Feet**	Ultimate Load Per Side in Pounds	Deflection in Inches Per 1000 Pounds	Load Per Position	Weight in Pounds	Beam Size W x H
PY7.5ST388	7.5	8800	0.17	6050	56	4" x 6"
PY08ST003	8	8400	0.22	6250	59	4" x 6"
PY08ST004	8	8400	0.22	4200	59	4" x 6"
PY9.5ST171	9.5	6850	0.37	4750	68	4" x 6"
PY10ST005	10	6600	0.42	3300	71	4" x 6"
PY12ST349	12	5450	0.58	3800	83	4" x 6"

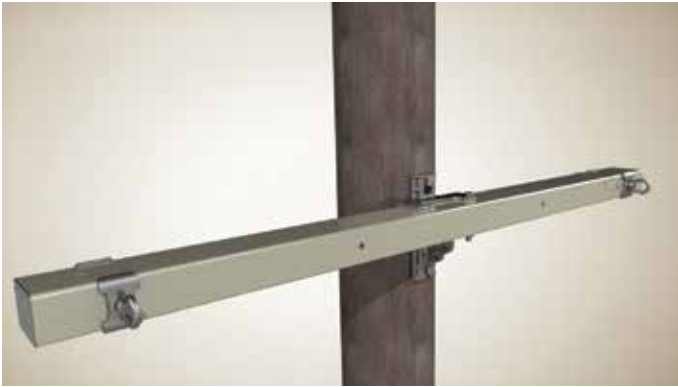
* RUS Listed

** Standard length shown. For other lengths, consult your MPS representative or customer service.

All numbers published to 95% confidence interval

Deadend Crossarms

Extra Light, Light and Standard Duty



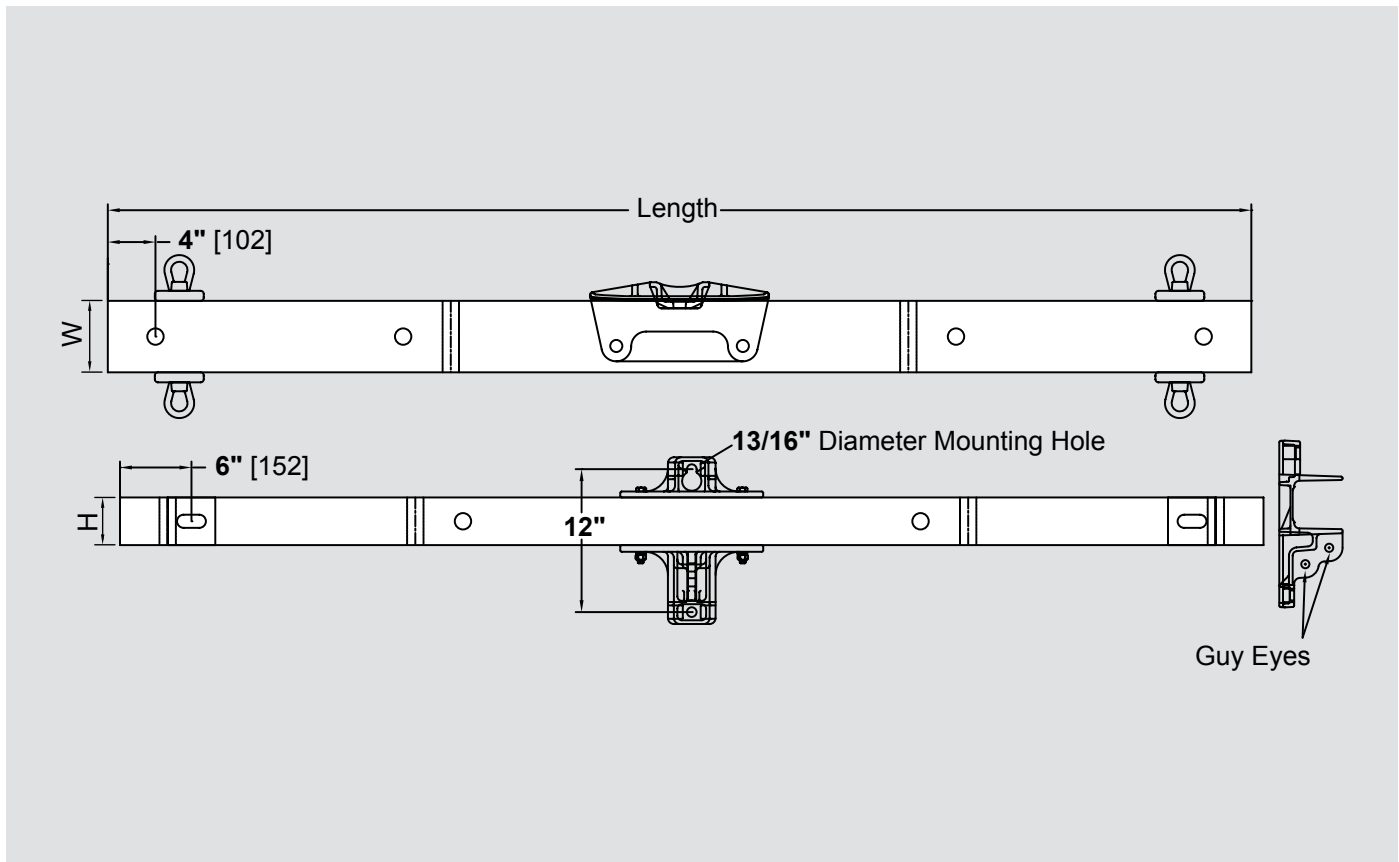
Specifications

- UV Stabilized Fiberglass Beam with UV Protective Veil
- Bandable
- Keyhole Slot
- "Double Nutting" Feature
- Available in Gray or Brown
- Centermount with Cast-in Guy Attachments
- MPS exclusive curved washers
- RUS listed

General Specifications

Series	Mounting Spacing	Mounting Hardware Size	Beam Size (W x H)	Base Material	Extra Eye Kit
PX	10" or 12"	3/4"	4.625" x 3.625"	Aluminum or Iron	SP58-2EYEKIT
PW	10" or 12"	3/4"	4.625" x 3.625"	Aluminum or Iron	SP58-2EYEKIT
PZ	10" or 12"	3/4"	6" x 4"	Aluminum or Iron	LP58-2EYEKIT

Dimensions





Extra Light Duty Deadend Series PX

Beam Size = 4.625" x 3.625"

Catalog Number	Length in Feet**	Ultimate Load Per Side in Pounds***	Ultimate Load Per Position	Deflection in Inches per 1000 Pounds	Guy Hole Rating**** (Dual / Single)	Guy Hole Size	Weight in Pounds
PX05LD573-2E	5	8650	8650	< 0.15	24,000 / 21,000	11/16"	34
PX7.5LX388-2E	7.5	5150	5150	0.53	NA / 21,000	15/16"	42
PX08LD003-2E	8	4950	4950	0.68	24,000 / 21,000	11/16"	44
PX08LD003-4E	8	4950	3500	0.68	24,000 / 21,000	11/16"	53
PX9.5LX171-2E	9.5	3950	3950	1.13	NA / 21,000	15/16"	49
PX10LD005-2E	10	3850	3850	1.28	24,000 / 21,000	11/16"	50
PX10LD005-4E	10	3850	2900	1.28	24,000 / 21,000	11/16"	59

Light Duty Deadend Series PZ

Beam Size = 6" x 4"

Catalog Number	Length in Feet**	Ultimate Load Per Side in Pounds***	Ultimate Load Per Position	Deflection in Inches per 1000 Pounds	Guy Hole Rating**** (Dual / Single)	Guy Hole Size	Weight in Pounds
PZ05LD573-2E	5	9400	9400	< 0.15	24,000 / 21,000	11/16"	44
PZ08LD003-2E*	8	9400	9400	0.24	24,000 / 21,000	11/16"	59
PZ08LD003-4E*	8	9400	6750	0.24	24,000 / 21,000	11/16"	68
PZ10LD005-2E*	10	7350	7350	0.47	24,000 / 21,000	11/16"	69
PZ10LD005-4E*	10	7350	5600	0.47	24,000 / 21,000	11/16"	78

Beam Size = 4.625" x 3.625"

Catalog Number	Length in Feet**	Ultimate Load Per Side in Pounds***	Ultimate Load Per Position	Deflection in Inches per 1000 Pounds	Guy Hole Rating**** (Dual / Single)	Guy Hole Size	Weight in Pounds
PW05LD573-2E	5	10,200	10,200	< 0.15	24,000 / 21,000	11/16"	39
PW7.5LX388-2E	7.5	10,200	10,200	0.27	NA / 21,000	15/16"	50
PW08LD003-2E*	8	10,200	10,200	0.35	24,000 / 21,000	11/16"	52
PW08LD003-4E*	8	10,200	7050	0.35	24,000 / 21,000	11/16"	61
PW9.5LX171-2E	9.5	8300	8300	0.62	NA / 21,000	15/16"	58
PW10LD005-2E*	10	7950	7950	0.70	24,000 / 21,000	11/16"	60
PW10LD005-4E*	10	7950	6050	0.70	24,000 / 21,000	11/16"	69
PW12LD349-2E	12	6500	6500	1.05	24,000 / 21,000	11/16"	68
PW12LD349-4E	12	6500	4600	1.05	24,000 / 21,000	11/16"	77

* RUS Listed

** Standard length shown in feet. For other lengths, consult your MPS representative or customer service

*** Ultimate longitudinal load per side in pounds. Crossarm with "SA", "LXA" or "LA" (Center Phase) attachment used as a single-sided application are limited to an 84% ultimate load

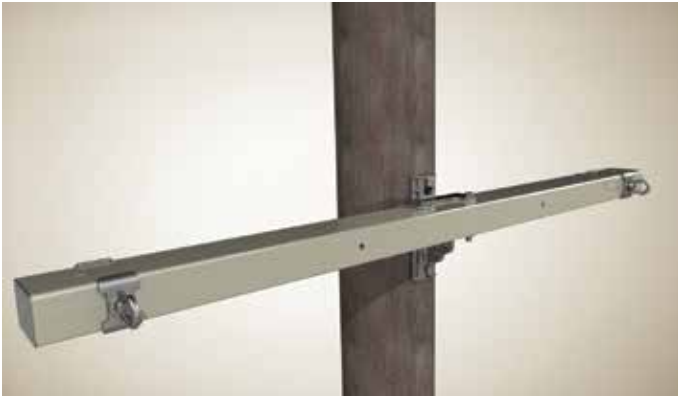
****Guy hole load values stated at 30 degree guy angle in pounds

All numbers published to 95% confidence interval

Note: SM = SD designation per catalog matrix

Deadend Crossarms

Heavy Duty



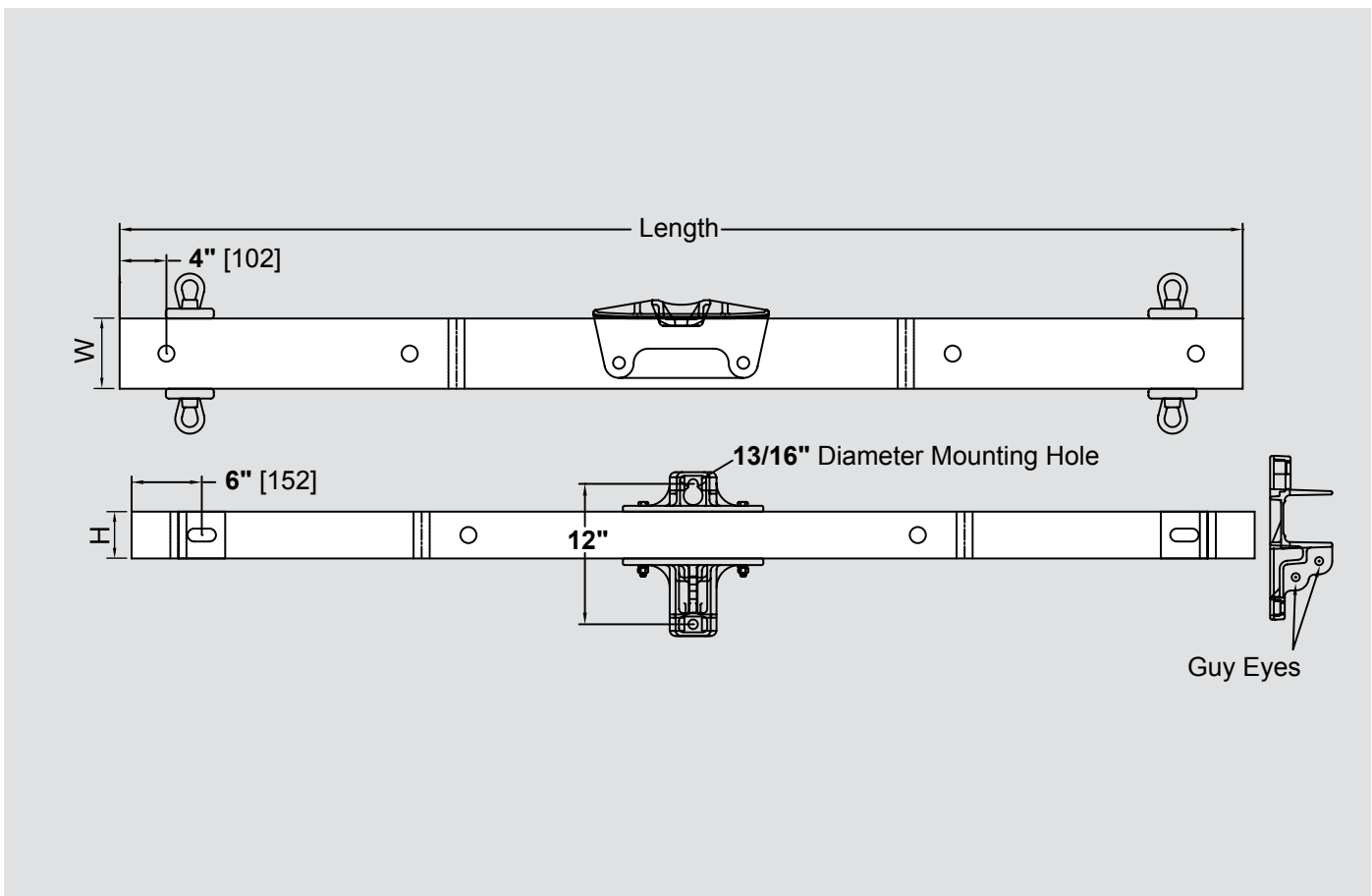
Specifications

- UV Stabilized Fiberglass Beam with UV Protective Veil
- Bandable
- Keyhole Slot
- "Double Nutting" Feature
- Available in Gray or Brown
- Centermount with Cast in Guy Attachment
- MPS exclusive curved washers
- RUS listed

General Specifications

Series	Mounting Spacing	Mounting Hardware Size	Beam Size (W x H)	Base Material	Extra Eye Kit
PY	10" or 12"	3/4"	6" x 4"	Aluminum or Iron	LP58-2EYEKIT
PE	12"	3/4"	6" x 4"	Iron	LPH34-2EYEKIT

Dimensions





Heavy Duty Deadend Series PY

Beam Size = 6" x 4"

Catalog Number	Length in Feet**	Ultimate Load Per Side in Pounds***	Ultimate Load Per Position	Deflection in Inches per 1000 Pounds	Guy Hole Rating**** (Dual / Single)	Guy Hole Size	Weight in Pounds
PY05SD573-2E	5	12,500	12,500	< 0.15	40,000 / 30,000	13/16"	60
PY7.5LX388-2E	7.5	12,500	12,500	0.17	NA / 21,000	15/16"	64
PY08SD003-2E*	8	12,500	12,500	0.22	40,000 / 30,000	13/16"	78
PY08SD003-4E*	8	12,500	10,050	0.22	40,000 / 30,000	13/16"	87
PY10SD005-2E*	10	11,000	11,000	0.42	40,000 / 30,000	13/16"	90
PY10SD005-4E*	10	11,000	8350	0.42	40,000 / 30,000	13/16"	99
PY12SD349-2E	12	9000	9000	0.58	40,000 / 30,000	13/16"	102
PY12SD349-4E	12	9000	6350	0.58	40,000 / 30,000	13/16"	111

All numbers published to 90% confidence interval

Heavy Duty Deadend Series PE

Beam Size = 6" x 4"

Catalog Number	Length in Feet**	Ultimate Load Per Side in Pounds***	Ultimate Load Per Position	Deflection in Inches per 1000 Pounds	Guy Hole Rating**** (Dual / Single)	Guy Hole Size	Weight in Pounds
PE08SD003-2E	8	16,000	16,000	< 0.15	40,000 / 30,000	13/16"	82
PE08SD003-4E	8	16,000	11,400	< 0.15	40,000 / 30,000	13/16"	94
PE10SD005-2E	10	12,500	12,500	0.43	40,000 / 30,000	13/16"	94
PE10SD005-4E	10	12,500	9500	0.43	40,000 / 30,000	13/16"	106
PE12SD349-2E	12	10,200	10,200	0.66	40,000 / 30,000	13/16"	105
PE12SD349-4E	12	10,200	7250	0.66	40,000 / 30,000	13/16"	118
PE14SD484-2E	14	8650	8650	1.14	40,000 / 30,000	13/16"	117
PE14SD484-4E	14	8650	5400	1.14	40,000 / 30,000	13/16"	130

* RUS Listed

** Standard length shown in feet. For other lengths, consult your MPS representative or customer service

*** Ultimate longitudinal load per side in pounds. Crossarm with "SA", "LXA" or "LA" (Center Phase) attachment used as a single-sided application are limited to an 84% ultimate load

****Guy hole load values stated at 30 degree guy angle in pounds

All numbers published to 95% confidence interval

Double Stack Deadend Crossarms

Heavy Duty



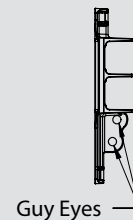
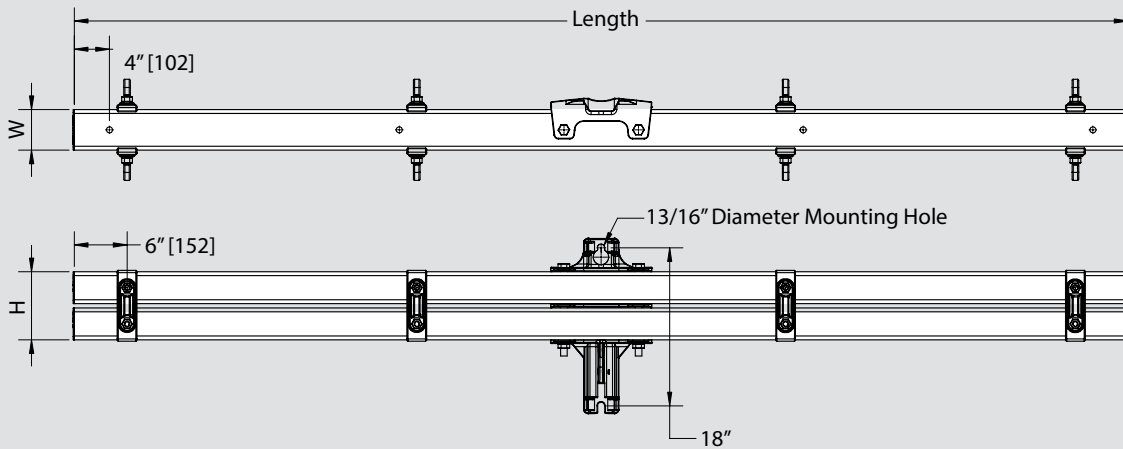
Specifications

- UV Stabilized Fiberglass Beam with UV Protective Veil
- Bandable
- Keyhole Slot
- "Double Nutting" Feature
- Available in Gray or Brown
- Centermount with Cast in Guy Attachment
- MPS exclusive curved washers
- RUS listed

General Specifications

Series	Mounting Spacing	Mounting Hardware Size	Beam Size (W x H)	Base Material	Extra Eye Kit
PW-DS	18"	3/4"	2 x 4.625" x 3.625"	Aluminum	SPDS58-2EYEKIT

Dimensions



Double Stack Deadend Series PW-DS

Beam Size = 2 x 4.625" x 3.625"

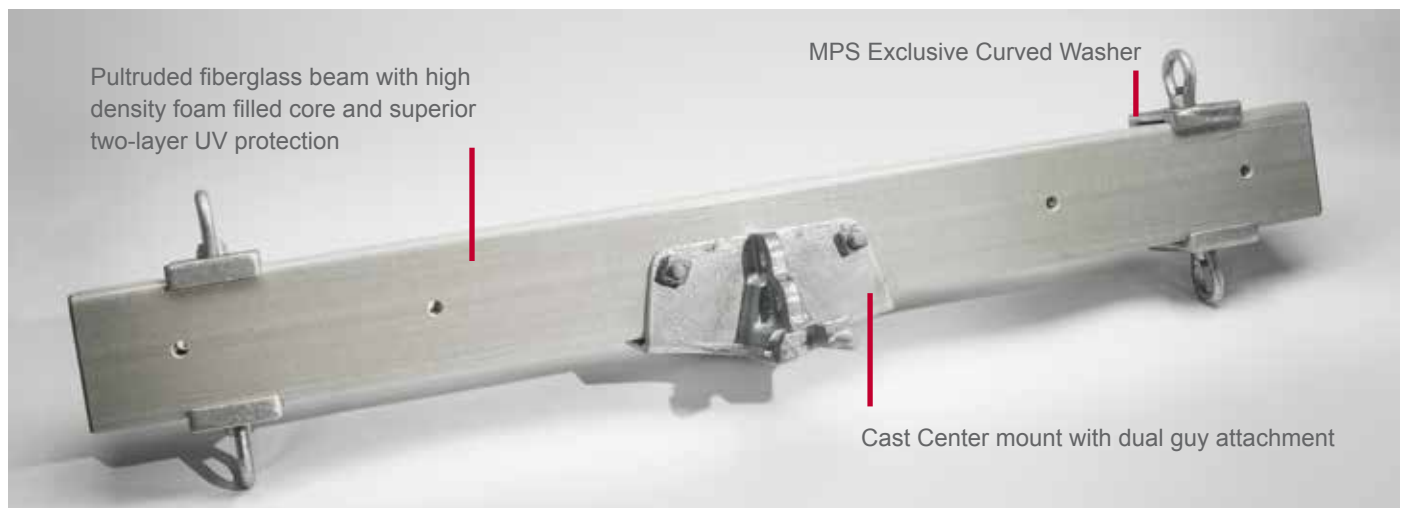
Catalog Number	Length in Feet**	Ultimate Load Per Side Pounds	Ultimate Load Per Position	Deflection in Inches per 1000 Pounds	Guy Hole Rating**** (Dual / Single)	Guy Hole Size	Weight in Pounds
PW08DS003-2E	8	20,400	20,400	0.35	40,000 / 30,000	15/16"	88
PW08DS003-4E	8	20,400	14,100	0.35	40,000 / 30,000	15/16"	95
PW10DS005-2E	10	15,900	15,900	0.70	40,000 / 30,000	15/16"	105
PW10DS005-4E	10	15,900	12,100	0.70	40,000 / 30,000	15/16"	111
PW12DS349-2E	12	13,000	13,000	1.05	40,000 / 30,000	15/16"	122
PW12DS349-4E	12	13,000	9200	1.05	40,000 / 30,000	15/16"	128
PW14DS484-2E	14	11,000	11,000	1.75	40,000 / 30,000	15/16"	138
PW14DS484-4E	14	11,000	6900	1.75	40,000 / 30,000	15/16"	145
PW16DS481-2E	16	9500	9500	2.80	40,000 / 30,000	15/16"	155
PW16DS481-4E	16	9500	5700	2.80	40,000 / 30,000	15/16"	162

** Standard length shown in feet. For other lengths, consult your MPS representative or customer service

****Guy hole load values stated at 30 degree guy angle in pounds

All numbers published to 95% confidence interval

The Fiberglass Advantage



Consider fiberglass crossarms over wood for your next project. Compared to wood, fiberglass crossarms:

- Don't contain potentially harmful chemicals or preservatives
- Don't require special disposal at the end of life
- Won't decay, rot, absorb moisture or splinter
- Are woodpecker and insect repellent
- Are up to 50% lighter and 6X stronger
- Help increase system BIL level
- Install up to 35% faster and have a lower total cost of ownership
- Are a manufactured product with consistent material properties and strength for the life of the product

Steel Crossarms

Steel Arms

Steel crossarms are produced from structural steel angle or tubing for high strength deadend and tangent applications.

Features

- Multiple bolt holes for a variety of conductor attachment points permit assembly of jumper pins and arrester/equipment mounting brackets
- Provided with a center mounting plate for attachment to pole

Material

Steel hot dip galvanized

Steel Crossarm (3" x 5" x 3/8" Angle)				
Catalog Number	L	A	Ult Strength Rating Per Phase (lbs)	Weight Ea (lbs)
D-21140-GA	60	27	5000	59

Notes:

- 1) All holes are 11/16" diameter unless otherwise noted
- 2) Strength ratings based on balanced load applications

Steel Crossarm (3" x 5" x 3/8" Angle)					
Catalog Number	L	A	B	Ult Strength Rating Per Phase (lbs)	Weight Ea (lbs)
D-21143-GA	78	20	32	4000	70

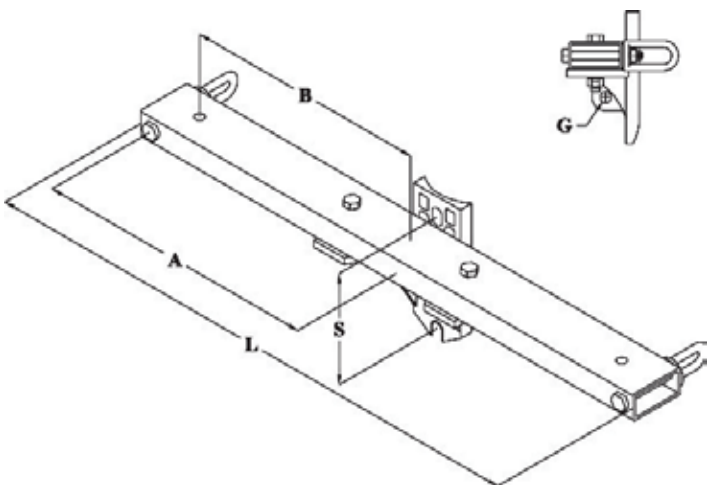
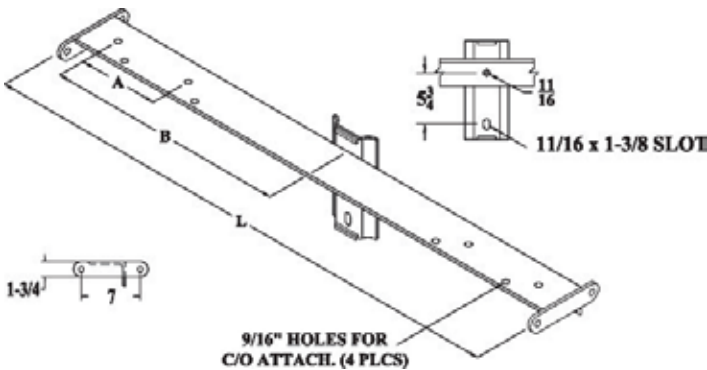
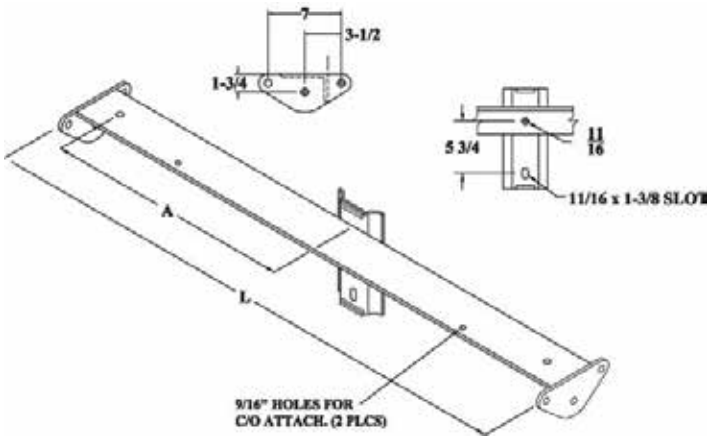
Notes:

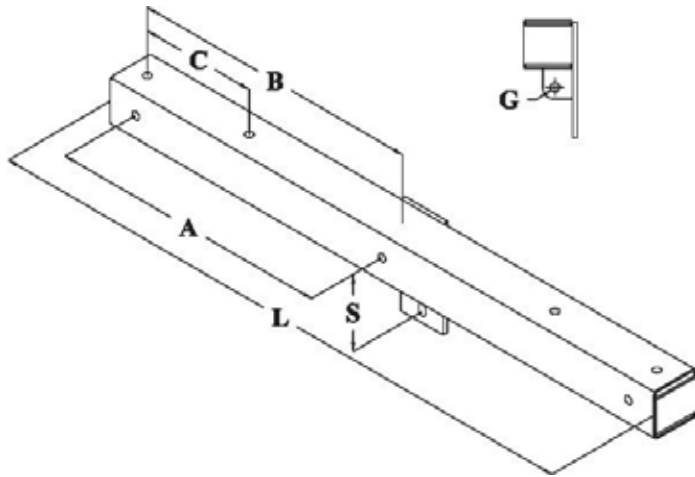
- 1) All holes are 11/16" diameter unless otherwise noted
- 2) Strength ratings based on balanced load applications

Steel Crossarm (2" x 4" Rectangular Tubing)							
Catalog Number	L	A	B	G	S	Ult Strength Rating Per Phase (lbs)	Weight Ea (lbs)
DEA86H40BE6	42	20	18	13/16	8	10000	37
DEA86H46BE6D	48	23	21	13/16	8	9500	43
DEA86H58.5BE6	60	29	27.25	13/16	8	9000	50
DEA86H58.5BE6D	60	29	27.25	13/16	8	9000	52

Notes:

- 1) All holes are 13/16" diameter unless otherwise noted
- 2) Suffix "D" indicates double deadend hardware (eyelets on both sides of arm)
- 3) Strength ratings based on balanced load applications





Steel Arms

Steel crossarms are produced from structural steel angle or tubing for high strength deadend and tangent applications.

Features

- Multiple bolt holes for a variety of conductor attachment points permit assembly of jumper pins and arrester/equipment mounting brackets
- Provided with a center mounting plate for attachment to pole

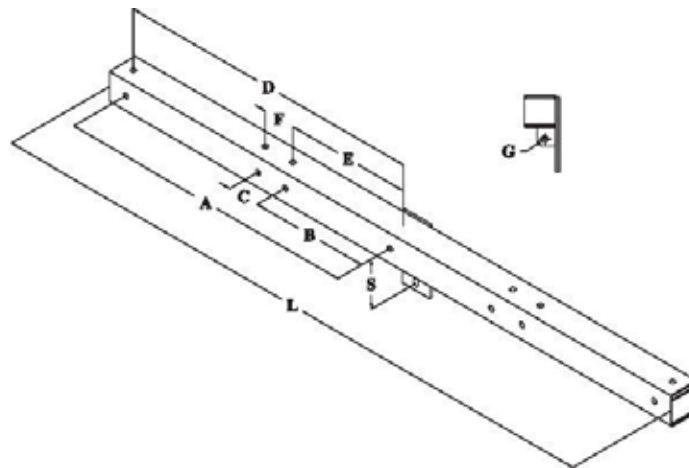
Material

Steel hot dip galvanized

Steel Crossarm (5" x 5" Square Tubing)							
Catalog Number	L	A	B	C	S	Ult Strength Rating Per Phase (lbs)	Weight Ea (lbs)
SF-TA-68-64	64	29	20	12	8	8000	80

Notes:

- 1) All holes are 13/16" diameter unless otherwise noted
- 2) Strength ratings based on balanced load applications



Steel Crossarm (5" x 5" Square Tubing)										
Catalog Number	L	A	B	C	D	E	F	G	S	Weight Ea (lbs)
SF-TA-102-FPL	102	48	19	5	49	20	5	15/16	8	118

Notes:

- 1) All holes are 13/16" diameter unless otherwise noted
- 2) Strength ratings based on balanced load applications

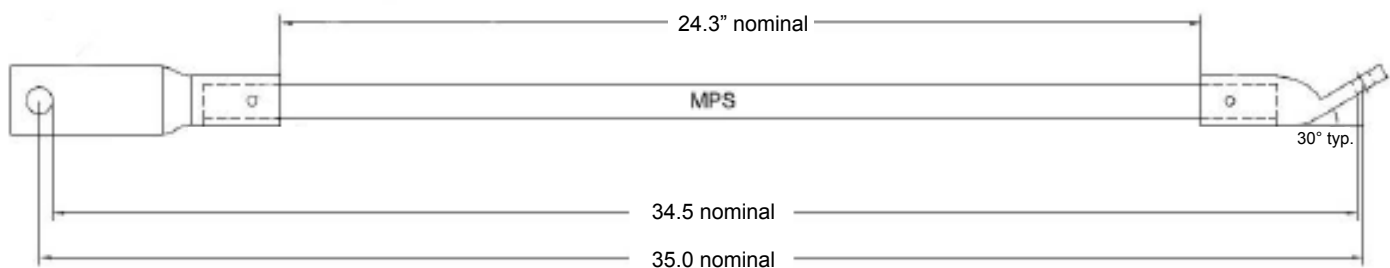
Hole Spacings	19	24	48	Load / Connection
6 wire (3/Phase)	x	x	x	2500 lbs.
4 wire (2/Phase)	x		x	3500 lbs.
4 wire (2/Phase)		x	x	3000 lbs.
2 wire (1/Phase)			x	5000 lbs.

60" / 18" Crossarm Brace

MacLean Power Systems' Fiberglass Underarm Crossarm Brace is designed to provide durable, long lasting, and economical support to crossarms. The MPS Fiberglass Crossarm Brace is a better alternative to traditional wooden crossarm braces due to its durability and longevity.

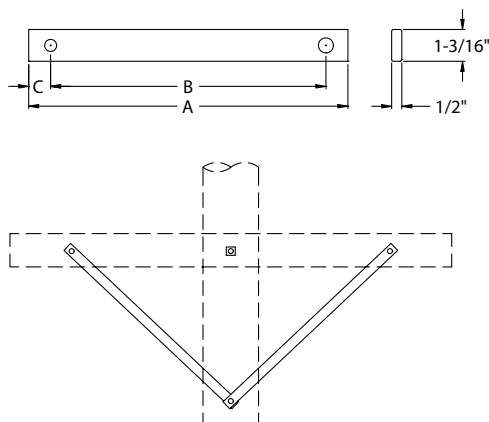
Features

- Crimped Aluminum Alloy End Fittings
- High Strength 1500 lbs. capacity
- RUS Listed



Catalog Number	Span(in.)	Drop(in.)	Crossarm Fitting Hole Diameter (in.)	Pole Fitting Hole Diameter	Weight(lbs)
CRBR-35	60	18	9/16"	11/16"	1.875

Crossarm Braces



Crossarm Braces

Material

Rod: Fiberglass gray ultraviolet (UV) protective coating

Catalog Number	Dimensions (In)			Weight (Lbs)
	A	B	C	
CRB29	29	26	1.5	1.2

Notes:

1) Lengths shown are considered standard; for other lengths, consult factory

Standard Apitong Brace

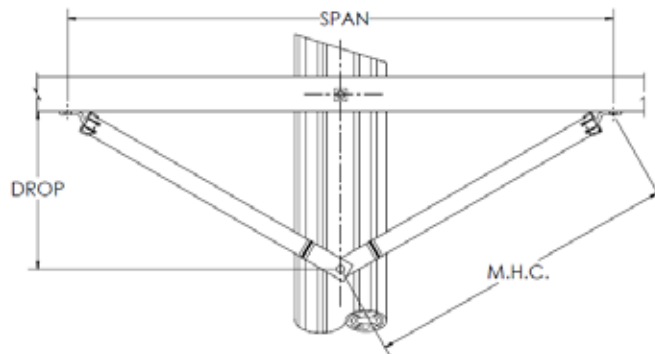
MPS wood crossarm braces are design engineered to support wood crossarms to provide durability, strength, and extended service life. MPS wood crossarm braces have better insulation properties than conductive metal braces.

Features

- Apitong wood cross section 1 3/4" square
- Mounting hole diameters are 9/16" for mounting to crossarm and 11/16" for mounting to pole
- Designed for heavy duty application
- Lightweight alternative to steel crossarm braces
- Corrosion resistant aluminum end fittings
- Tongue and groove configuration permanently pins end fitting to wood
- Preservative treated, extra strong apitong wood resists insect, fungus, and environmental attack
- Sold in pairs

Material

Aluminum Alloy end fittings
Preservative treated Apitong wood



CATALOG NO.	SPAN (in)	DROP (in)	M.H.C. (in)	WEIGHT/PAIR (lbs)
JA4712R	42	12	24.19	3.6
JA4716R	42	16	26.40	4
JA4714R	48	14	27.78	4.2
JA4788R	48	18	30.00	5.6
JA4748R	48	24	33.94	5.8
JA4760R	60	18	34.99	6.6
JA4761R	60	26	39.70	7.5
JA4730R	60	30	42.43	8
JA4766R	66	20	38.59	7.2
JA4772R	72	22	42.19	7.9
JA1370RS.2	72	36	50.91	8

SHIPPING VIEW:
10/PACK

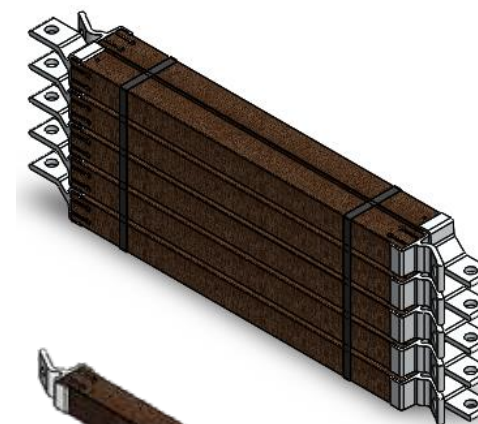


MODEL JA
REVERSIBLE



CATALOG NO.	SPAN (in)	DROP (in)	M.H.C. (in)	WEIGHT/PAIR (lbs)
MA4212	42	12	24.19	3.8
MA4216	42	16	26.40	4.2
MA4814	48	14	27.78	4.6
MA4818	48	18	30.00	4.9
MA4824	48	24	33.94	5.5
MA6018	60	18	34.99	5.6
MA6026	60	26	39.70	6.8
MA6030	60	30	42.43	6.7
MA6620	66	20	38.59	8
MA7222	72	22	42.19	4.1
MA7236	72	36	50.91	4.4

SHIPPING VIEW:
10/PACK



MODEL MA



Slimline Apitong Brace

MPS wood crossarm braces are design engineered to support wood crossarms to provide durability, strength, and extended service life. MPS wood crossarm braces have better insulation properties than conductive metal braces.

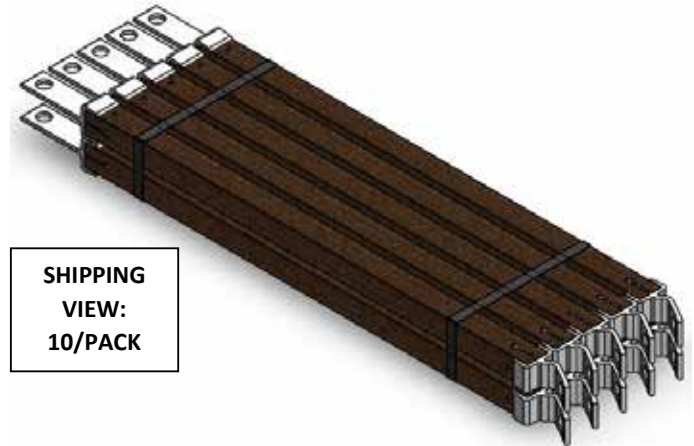
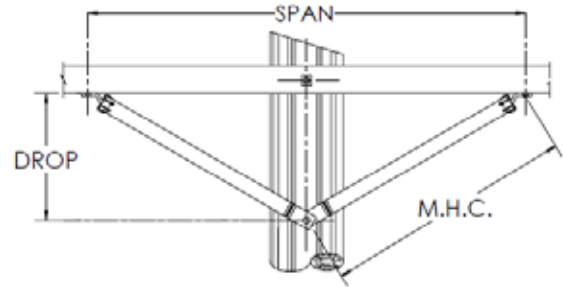
Features

- Apitong wood cross section 1 1/4" square
- Mounting hole diameters are 9/16" for mounting to crossarm and 11/16" for mounting to pole
- Lightweight alternative to steel crossarm braces
- Corrosion resistant aluminum end fittings
- Tongue and groove configuration permanently pins end fitting to wood
- Preservative treated, extra strong apitong wood resists insect, fungus, and environmental attack
- Sold in pairs

Material

Aluminum Alloy end fittings
Preservative treated Apitong wood

CATALOG NO.	SPAN (in)	DROP (in)	M.H.C. (in)	WEIGHT/PAIR (lbs)
MAF-4814	48	14	27.78	2.3
MAF-4818	48	18	30.00	2.5
MAF-4824	48	24	33.94	2.8
MAF-6018	60	18	34.99	2.9
MAF-6030	60	30	42.43	3.4
MAF-7222	72	22	42.19	3.4



Alley Arm Brace

MPS wood crossarm braces are design engineered to support wood crossarms to provide durability, strength, and extended service life. MPS wood crossarm braces have better insulation properties than conductive metal braces.

Features

- Apitong wood cross section 2 11/16" square
- Mounting hole diameters are 9/16" for mounting to crossarm and 11/16" for mounting to pole
- Lineman's step provided as standard, add "-L/S" to catalog number when step is not needed
- Corrosion resistant aluminum end fittings
- Tongue and groove configuration permanently pins end fitting to wood
- Preservative treated, extra strong apitong wood resists insect, fungus, and environmental attack
- Sold in pairs

Material

Aluminum Alloy end fittings

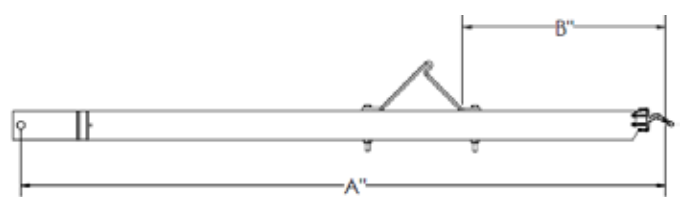
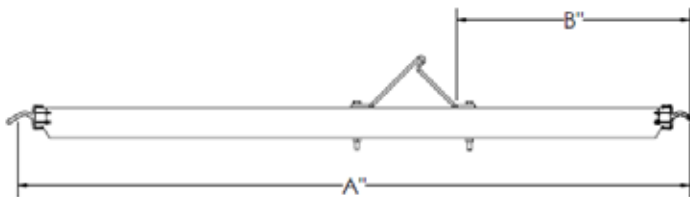
Preservative treated Apitong wood



**MODEL MAAB
TRADITIONAL**



**MODEL MRAAB
REVERSIBLE**



**SHIPPING
VIEWS**



CATALOG NO.		A (in)	B (in)	WEIGHT (lbs)	SHIPPING CONFIG.
MRAAB-60	MAAB-60	60	20 3/4	12.06	4
MRAAB-76	MAAB-76	76	20 3/4	14.95	2
MRAAB-84	MAAB-84	84	20 3/4	16.39	2
MRAAB-60-L/S	MAAB-60-L/S	60	20 3/4	10.47	4
MRAAB-76-L/S	MAAB-76-L/S	76	20 3/4	13.34	2
MRAAB-84-L/S	MAAB-84-L/S	84	20 3/4	14.78	2

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Fort Mill, SC 29715 USA
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maclepower.com

Customer Service 1.855.MPS.SHIP
info@maclepower.com



MEYER

UTILITY STRUCTURES

Meyer Light Duty
and Distribution Class
Steel Poles

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Why Use Steel?

Steel: The Better Choice

A Meyer Standard Class Steel Pole Series pole is a better choice than a wood pole in most cases. Typically used for voltages from 12.5kV to 230kV, a steel pole is up to 50% lighter than a wood “equivalent”.

More Environmentally Responsible

Steel is actually a more environmentally responsible material. Many people think of wood as being 100% recyclable. Wood is renewable, but not 100% recyclable. Wood poles require extensive chemical preservatives to prolong their life. Many groups are concerned about those chemicals leaching into water sources, agricultural and playground dirt, leading many governments to classify wood poles as a hazardous waste which restrict the recycling and landfill choices a pole owner has when the time comes to retire the pole. And, as the wood pole eventually decays, those chemicals are fully released and the carbon that was bound into the pole’s wood is released back into the environment, giving wood a carbon footprint.

Stronger in All Ways

Stronger than wood, stiffer than composite; steel is unmatched in its universal applicability. Precisely engineered capacities, rather than approximated ones, give you performance you can rely on.

Fewer Poles: Lower Installed Costs; Lower Maintenance Costs: Fewer Headaches

Steel poles support longer spans. Longer spans require fewer poles, less labor, less hardware and less time which result in lower installed costs.

Superior Aesthetics

The predictability and consistency of steel poles’ geometry and straightness provide an advantage in appearance that wood poles cannot offer. And, because not all installation sites are the same, steel’s versatility wins again... round or sided; galvanized or weathering; the options are multiple and the choice is yours!

Ease of Handling and Maintenance

The pole handling equipment used to handle wood poles may be used to handle the lighter class-for-class steel pole. Unlike steel poles, wood poles expand and contract over time, requiring periodic maintenance and adjustments to their hardware.

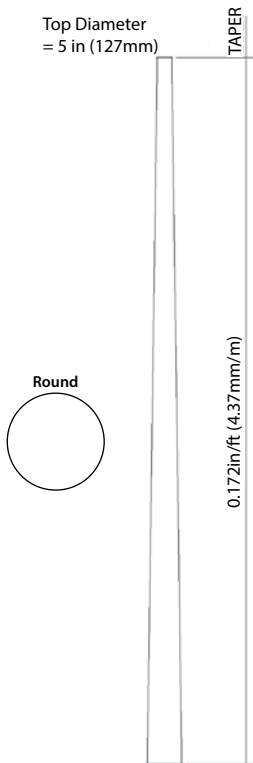
Overall, and for many reasons, steel is simply the better choice.

General Notes

- A. Materials: ASTM A1011, Grade 65 or A572, Grade 65 modified (galvanized poles), with silicon limit of 0.06% max, ASTM A871, Grade 65 modified (self-weathering poles) with a Charpy V-Notch Impact Value of 15 foot-pounds (20.3 joules) at - 20°F/- 29°C (Heat Lot Tested). Bolts are supplied per ASTM F3125.
- B. Pole section properties and moment capacities are calculated in accordance with ASCE/SEI 48 (latest version) and RUS Bulletin 1724E-214.
- C. Resultant moments were calculated using loading specified in RUS Bulletin 1724E-214.
- D. Any correlation of pre-engineered steel pole size to wood pole class is based on Class B construction. Pre-engineered steel pole sizes shall be selected per ASCE 48 (latest version).
- E. The ultimate capacities listed herein are based on the materials' minimum yield strength. Thus, loads used to calculate pole moments should include appropriate overload factors.
- F. Embedment depths are assumed to be 10% of total pole length +2 ft. (.6m). Actual embedment depths should be based on existing soil conditions and backfill material. Example: Pole Length = 80 ft. (24.4m): Assumed embedment depth = 10 ft. (3m).
- G. Bearing Plates are welded to the bottom of the poles and extend approximately 3/4" (19.05 mm) past the outside of the tower wall. Bearing plate thicknesses are 3/16" (4.76 mm) for pole diameters $\leq 30"$ (762 mm), they are 1/4" (6.35 mm) for pole diameters $> 30"$ (762 mm) $\leq 45"$ (1143 mm) and 5/16" (7.94 mm) for pole diameters $> 45"$ (1143 mm). Poles with a galvanized finish have a sizable opening in the bearing plate to allow for ventilation during galvanizing. Poles with weathering finishes have bearing plates that also have an opening. A pole cap is included with each pole.
- H. Welds:
 - Long Seam Weld = 80% minimum penetration
 - Long Seam-Female Section of Slip Joint +6" = 100% penetration
- I. Below grade corrosion protection is recommended. Shop applied protective coating and/or ground sleeves are available upon request.
- J. Poles shall be marked with the Meyer job number and the DC class and length in feet, e.g. DC5 - 45 . Additional marking is available upon request.
- K. Slipjoints have a 1.65 slipjoint factor for a minimum of 2'-0".
- L. Climbing for poles available upon request.

Distribution Class – Meyer DC Series

ROUND STEEL POLES

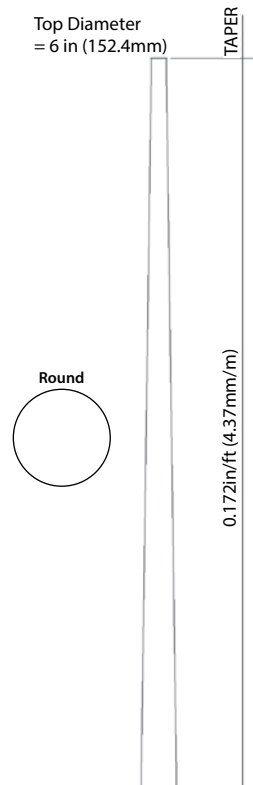


STEEL POLE CLASSIFICATION CLASS 5 | MEYER (ROUND) DC5

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm)	Groundline Moment (ft-kips/kN-m)	Estimated Pole Weight (Black) (lbs./kg)
30/9.14	0.12/3.05	10.16/258.06	28.40/38.51	297/135
35/10.67	0.12/3.05	11.02/279.91	33.90/45.96	365/166
40/12.19	0.12/3.05	11.88/301.75	39.40/53.42	438/199
45/13.72	0.12/3.05	12.74/323.60	44.90/60.87	578/262
50/15.24	0.12/3.05	13.60/345.44	50.40/68.33	518/235

STEEL POLE CLASSIFICATION CLASS 4 | MEYER (ROUND) DC4

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm)	Groundline Moment (ft-kips/kN-m)	Estimated Pole Weight (Black) (lbs./kg)
30/9.14	0.12/3.05	10.16/258.06	35.80/48.54	297/135
35/10.67	0.12/3.05	11.02/279.91	42.80/58.03	365/166
40/12.19	0.12/3.05	11.88/301.75	49.70/67.38	438/199
45/13.72	0.12/3.05	12.74/323.60	56.70/76.87	578/262
50/15.24	0.12/3.05	13.60/345.44	63.60/86.23	518/235

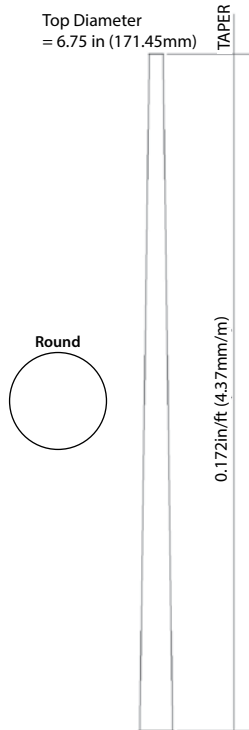


STEEL POLE CLASSIFICATION CLASS 3; RUS S-02.0 | MEYER (ROUND) DC3

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm)	Groundline Moment (ft-kips/kN-m)	Estimated Pole Weight (Black) (lbs./kg)
30/9.14	0.12/3.05	11.16/283.46	44.80/60.74	337/153
35/10.67	0.12/3.05	12.02/305.31	53.50/72.54	412/187
40/12.19	0.12/3.05	12.88/327.15	62.20/84.33	492/223
45/13.72	0.12/3.05	13.74/349.00	70.90/96.13	578/262
50/15.24	0.12/3.05	14.60/370.84	79.60/107.92	669/303
55/16.76	0.12/3.05	15.10/383.54	88.20/119.58	786/357
60/18.29	0.12/3.05	15.96/405.38	96.80/131.24	884/401
65/19.81	0.12/3.05	16.82/427.23	105.50/143.04	1000/454
70/21.34	0.12/3.05	17.67/448.82	114.10/154.70	1112/504
75/22.86	0.12/3.05	18.53/470.66	122.70/166.36	1229/557
80/24.38	0.12/3.05	19.40/492.76	131.30/178.02	1351/613
85/25.91	0.12/3.05	20.26/514.60	139.90/189.68	1479/671
90/27.43	0.12/3.05	21.12/536.45	148.50/201.34	1614/732
95/28.96	0.12/3.05	21.98/558.29	157.10/213.00	1757/797

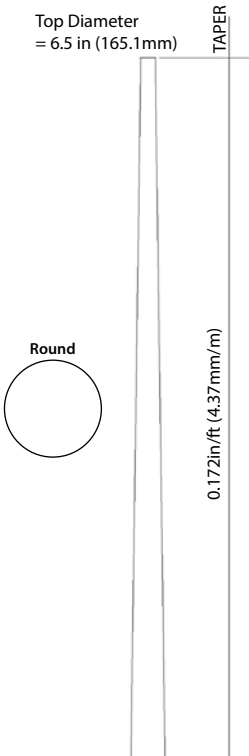
Distribution Class – Meyer DC Series

ROUND STEEL POLES



STEEL POLE CLASSIFICATION CLASS 2; RUS S-02.4 | MEYER (ROUND) DC2

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm)	Groundline Moment (ft-kips/kN-m)	Estimated Pole Weight (Black) (lbs./kg)
30/9.14	0.133/3.38	11.92/302.77	55.20/74.98	404/183
35/10.67	0.133/3.38	12.77/324.36	66.00/89.48	493/224
40/12.19	0.133/3.38	13.63/346.20	76.80/104.13	587/266
45/13.72	0.133/3.38	14.49/368.05	87.50/118.63	687/312
50/15.24	0.133/3.38	15.35/389.89	98.20/133.14	794/360
55/16.76	0.133/3.38	18.82/478.03	108.90/147.65	928/421
60/18.29	0.133/3.38	16.68/423.67	119.60/162.16	1045/474
65/19.81	0.133/3.38	17.54/445.52	130.20/176.53	1178/534
70/21.34	0.133/3.38	18.40/467.36	140.90/191.04	1306/592
75/22.86	0.133/3.38	19.26/489.20	151.50/205.41	1441/654
80/24.38	0.133/3.38	20.12/511.05	162.10/219.78	1581/717
85/25.91	0.133/3.38	20.98/532.89	172.80/234.29	1728/784
90/27.43	0.133/3.38	21.84/554.74	183.40/248.66	1881/853
95/28.96	0.133/3.38	22.70/576.58	194.00/263.03	2049/929

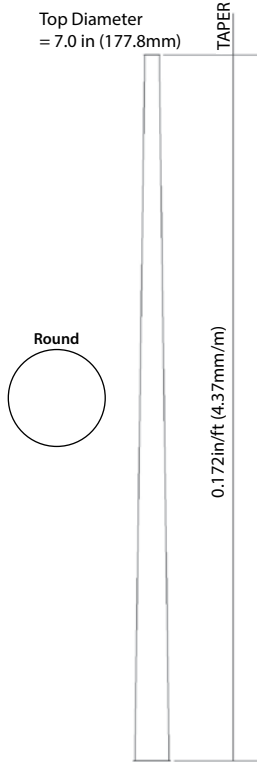


STEEL POLE CLASSIFICATION CLASS 1; RUS S-02.9 | MEYER (ROUND) DC1

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm)	Groundline Moment (ft-kips/kN-m)	Estimated Pole Weight (Black) (lbs./kg)
30/9.14	0.162/4.11	11.66/296.16	67.20/91.11	475/215
35/10.67	0.162/4.11	12.52/318.01	80.30/108.87	579/263
40/12.19	0.162/4.11	13.38/339.85	93.30/126.50	692/314
45/13.72	0.162/4.11	14.24/361.70	106.40/144.26	812/368
50/15.24	0.162/4.11	15.10/383.54	119.40/161.89	939/426
55/16.76	0.162/4.11	15.51/393.95	132.30/179.38	1097/498
60/18.29	0.162/4.11	16.37/415.80	145.30/197.00	1235/560
65/19.81	0.162/4.11	17.23/437.64	158.30/214.63	1395/633
70/21.34	0.162/4.11	18.09/459.49	171.20/232.12	1548/702
75/22.86	0.162/4.11	18.95/481.33	184.10/249.61	1707/774
80/24.38	0.162/4.11	19.81/503.17	197.00/267.10	1875/850
85/25.91	0.162/4.11	20.67/525.02	209.90/284.59	2052/931
90/27.43	0.162/4.11	21.53/546.86	222.70/301.94	2235/1014
95/28.96	0.162/4.11	22.39/568.71	235.60/319.43	2434/1104

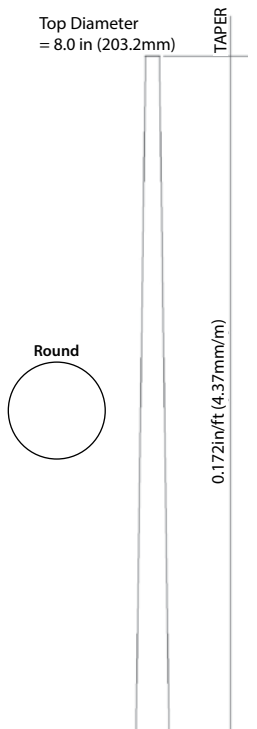
Distribution Class – Meyer DC Series

ROUND STEEL POLES



STEEL POLE CLASSIFICATION H1; RUS S-03.5 | MEYER (ROUND) DCH1

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm)	Groundline Moment (ft-kips/kN-m)	Estimated Pole Weight (Black) (lbs./kg)
30/9.14	0.1875/4.76	12.16/308.86	80.60/109.28	578/262
35/10.67	0.1875/4.76	13.02/330.71	96.40/130.70	704/319
40/12.19	0.1875/4.76	13.88/352.55	112.10/151.99	837/380
45/13.72	0.1875/4.76	14.74/374.40	127.70/173.14	980/445
50/15.24	0.1875/4.76	15.60/396.24	143.40/194.42	1131/513
55/16.76	0.1875/4.76	15.96/405.38	158.90/215.44	1319/598
60/18.29	0.1875/4.76	16.82/427.23	174.50/236.59	1484/673
65/19.81	0.1875/4.76	17.68/449.07	190.10/257.74	1675/760
70/21.34	0.1875/4.76	18.54/470.92	205.60/278.76	1856/842
75/22.86	0.1875/4.76	19.40/492.76	221.10/299.77	2046/928
80/24.38	0.1875/4.76	20.26/514.60	236.60/320.79	2245/1018
85/25.91	0.1875/4.76	21.12/536.45	252.10/341.80	2453/1113
90/27.43	0.1875/4.76	21.98/558.29	267.60/362.82	2667/1210
95/28.96	0.1875/4.76	22.84/580.14	283.10/383.83	2903/1317



STEEL POLE CLASSIFICATION H2; RUS S-04.2 | MEYER (ROUND) DCH2

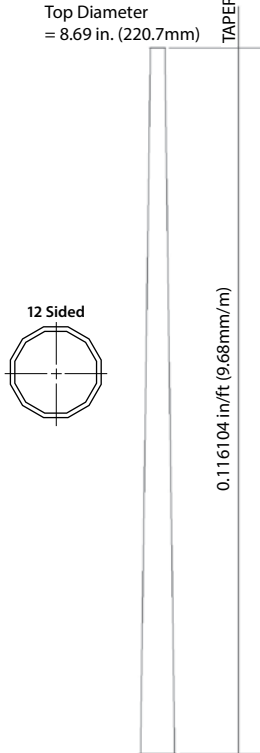
Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm)	Groundline Moment (ft-kips/kN-m)	Estimated Pole Weight (Black) (lbs./kg)
30/9.14	0.1875/4.76	13.16/334.26	95.70/129.75	641/291
35/10.67	0.1875/4.76	14.02/356.11	114.20/154.83	776/352
40/12.19	0.1875/4.76	14.88/377.95	132.90/180.19	919/417
45/13.72	0.1875/4.76	15.74/399.80	151.50/205.41	1072/486
50/15.24	0.1875/4.76	16.60/421.64	170.00/230.49	1235/560
55/16.76	0.1875/4.76	16.96/430.78	188.50/255.57	1436/651
60/18.29	0.1875/4.76	17.82/452.63	206.90/280.52	1610/730
65/19.81	0.1875/4.76	18.68/474.47	225.50/305.74	1814/823
70/21.34	0.1875/4.76	19.54/496.32	243.90/330.68	2006/910
75/22.86	0.1875/4.76	20.40/518.16	262.30/355.63	2206/1001
80/24.38	0.1875/4.76	21.26/540.00	280.70/380.58	2415/1095
85/25.91	0.1875/4.76	22.12/561.85	299.00/405.39	2633/1194
90/27.43	0.1875/4.76	22.98/583.69	317.40/430.34	2857/1296
95/28.96	0.1875/4.76	23.84/605.54	335.80/455.28	3105/1408

General Notes

- A. Material - ASTM A871 Modified (Self Weathering) or ASTM A572 modified (galvanized). A588, A871, A572, minimum grade 50 (flange plate). F_y — 65 ksi (448 MPa) with a Charpy V-Notch Impact Value of 15 foot-pounds (20.3 joules) at -20°F/-29°C (Heat Lot Tested).
- B. Pole section properties and moment capacities are calculated in accordance with ASCE/SEI 48 (latest version) and RUS Bulletin 1724E-214.
1. LD Poles are regular dodecagon (12-Sided Polygon).
 2. Pole diameters are measured across the flats
- C. Embedment depths are assumed to be 10% of total pole length +2 ft. (.6m). Actual embedment depths should be based on existing soil conditions and backfill material.
Example: Pole Length = 80 ft. (24.4m): Assumed embedment depth =10 ft. (3m).
- D. For standard steel pole classifications MeyerLD1–MeyerLD12, standard slip-jointed designs are single piece to a total pole length (HT) of 50ft. Standard flange joint pole designs are single piece for HT=50ft, 2-piece for HT=55ft to HT=100ft, and 3-piece for HT=105ft to HT=120ft.
For standard steel pole classifications MeyerLD1–MeyerLD6 are 2-piece for HT=55ft to HT=90ft and 3-piece for HT=105ft to HT=120ft. Standard flange joint pole designs for 55ft and 60ft pole lengths top sections are 35ft and for HT=70ft the top section is 45ft.
For standard steel pole classifications, MeyerLD7–MeyerLD12 are 2-piece for HT=55ft to HT=95ft and 3-piece for HT=100ft to HT=120ft. Standard flange joint pole designs for 55ft and 60ft pole lengths top sections are 35ft and for HT=70ft the top section is 50ft. All top sections within a pole class have the same top diameter, thickness and taper.
- E. Bearing Plates are welded to the bottom of the poles and extend approximately $\frac{3}{4}$ " (19.05 mm) past the outside of the tower wall. Bearing plate thicknesses are $\frac{3}{16}$ " (4.76 mm) for pole diameters ≤ 30 " (762 mm), $\frac{1}{4}$ " (6.35 mm) for pole diameters > 30 " (762 mm) ≤ 45 " (1143 mm) and $\frac{5}{16}$ " (7.94 mm) for pole diameters > 45 " (1143 mm). Poles with a galvanized finish have a sizable opening in the bearing plate to allow for ventilation during galvanizing. Poles with weathering finishes have bearing plates that are closed. A pole cap is included with each pole. A sealer plate is included in the base section of weathering steel poles.
- F. Weld Penetration:
Circumference Weld = 100%
Long Seam Weld = 80%
Long Seam-Female Slip Joint +6" = 100%
Sealer Plates & Bearing Plates = $\frac{3}{16}$ in. (4.8mm) Fillet Weld
- G. Pole Grounding is available upon request.
- H. Below grade corrosion protection is recommended. Shop applied protective coating and/or ground sleeves are available upon request.
- I. Poles shall be marked with the Meyer job number and the LD class and length in feet, e.g. LD2 – 100. Additional marking is available upon request.
- J. Resultant moments were calculated using loading specified in RUS Bulletin 1724E-214.
- K. Any correlation of pre-engineered steel pole size to wood pole class is based on Class B construction. Pre-engineered steel pole sizes shall be selected per ASCE 48 (latest version).
- L. The ultimate capacities listed herein are based on the materials' minimum yield strength. Thus, loads used to calculate pole moments should include appropriate overload factors.

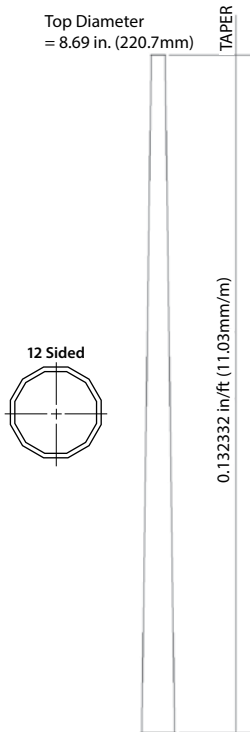
MeyerLD STEEL POLES

STEEL POLE CLASSIFICATION CLASS 1; RUS S-02.9 | Meyer (12 SIDED) LD1



Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.1875/4.763	13.34/339	93/126	959/435
45/13.72	.1875/4.763	13.92/354	106/144	1101/499
50/15.24	.1875/4.763	14.50/368	119/162	1248/566
55/16.76	.1875/4.763	14.59/371	132/179	1436/651
60/18.29	.1875/4.763	15.17/385	145/197	1589/721
65/19.81	.1875/4.763	15.74/400	158/215	1765/801
70/21.34	.1875/4.763	16.32/415	171/233	1931/876
75/22.86	.1875/4.763	16.90/429	184/250	2104/954
80/24.38	.1875/4.763	17.48/444	197/268	2283/1036
85/25.91	.1875/4.763	18.06/459	210/285	2466/1119
90/27.43	.1875/4.763	18.64/473	223/303	2657/1205
95/28.96	.1875/4.763	18.73/457	236/320	2931/1329
100/30.48	.1875/4.763	19.31/490	248/337	3130/1420
105/32.00	.1875/4.763	19.89/505	261/355	3332/1511
110/33.53	.1875/4.763	20.48/520	274/372	3543/1607
115/35.05	.1875/4.763	21.06/535	287/389	3757/1704
120/36.58	.1875/4.763	21.64/550	299/406	3979/1805

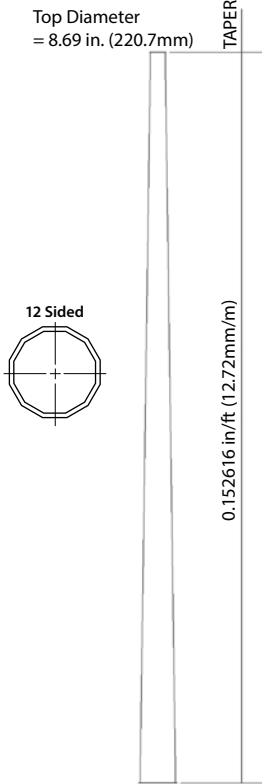
STEEL POLE CLASSIFICATION H-1; RUS S-03.5 | Meyer (12 SIDED) LD2



Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.1875/4.763	13.99/355	112/152	990/449
45/13.72	.1875/4.763	14.64/372	127/173	1139/517
50/15.24	.1875/4.763	15.31/389	143/194	1293/586
55/16.76	.1875/4.763	15.47/393	159/215	1494/678
60/18.29	.1875/4.763	16.14/410	174/236	1658/752
65/19.81	.1875/4.763	16.80/427	190/258	1851/840
70/21.34	.1875/4.763	17.46/443	205/279	2029/920
75/22.86	.1875/4.763	18.12/460	221/300	2213/1004
80/24.38	.1875/4.763	18.79/477	236/321	2405/1091
85/25.91	.1875/4.763	19.44/494	252/342	2604/1181
90/27.43	.1875/4.763	20.11/511	267/363	2809/1274
95/28.96	.1875/4.763	20.27/515	283/384	3115/1413
100/30.48	.1875/4.763	20.93/532	298/405	3328/1510
105/32.00	.1875/4.763	21.60/549	313/426	3549/1610
110/33.53	.1875/4.763	22.25/565	329/446	3778/1714
115/35.05	.1875/4.763	22.92/582	344/467	4011/1819
120/36.58	.1875/4.763	23.58/599	359/488	4253/1929

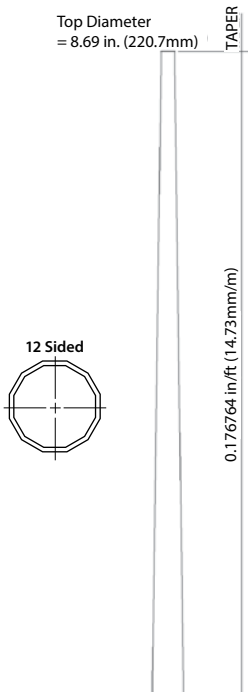
MeyerLD STEEL POLES

STEEL POLE CLASSIFICATION H-2; RUS S-04.2 | Meyer (12 SIDED) LD3



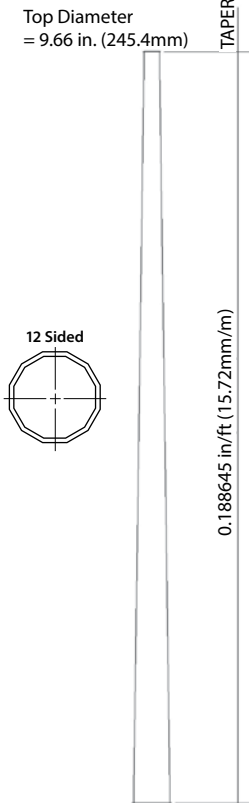
Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.1875/4.763	14.80/376	132/180	1027/466
45/13.72	.1875/4.763	15.56/395	151/205	1185/538
50/15.24	.1875/4.763	16.32/415	170/230	1351/613
55/16.76	.1875/4.763	16.59/421	188/255	1566/710
60/18.29	.1875/4.763	17.36/441	207/280	1742/790
65/19.81	.1875/4.763	18.12/460	225/305	1952/885
70/21.34	.1875/4.763	18.88/480	244/330	2145/973
75/22.86	.1875/4.763	19.65/499	262/355	2346/1064
80/24.38	.1875/4.763	20.41/518	280/380	2556/1159
85/25.91	.1875/4.763	21.17/538	299/405	2771/1257
90/27.43	.1875/4.763	21.94/557	317/430	2995/1359
95/28.96	.1875/4.763	22.20/564	335/455	3341/1515
100/30.48	.1875/4.763	22.96/583	354/480	3575/1622
105/32.00	.1875/4.763	23.72/602	372/504	3818/1732
110/33.53	.1875/4.763	24.49/622	390/529	4071/1847
115/35.05	.1875/4.763	25.25/641	408/554	4330/1964
120/36.58	.1875/4.763	26.01/661	426/579	4595/2084

STEEL POLE CLASSIFICATION H-3; RUS S-04.9 | Meyer (12 SIDED) LD4



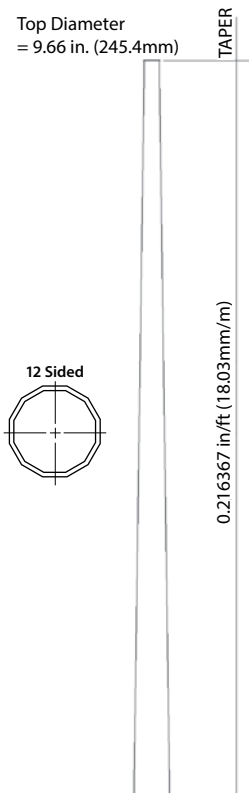
Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.1875/4.763	15.76/400	155/211	1072/486
45/13.72	.1875/4.763	16.65/423	177/240	1242/563
50/15.24	.1875/4.763	17.53/445	199/270	1421/645
55/16.76	.1875/4.763	17.92/455	221/299	1657/752
60/18.29	.1875/4.763	18.81/478	242/329	1849/839
65/19.81	.1875/4.763	19.69/500	264/358	2079/943
70/21.34	.1875/4.763	20.57/522	286/387	2290/1039
75/22.86	.1875/4.763	21.45/545	307/417	2509/1138
80/24.38	.1875/4.763	22.34/567	329/446	2738/1242
85/25.91	.1875/4.763	23.22/590	350/475	2976/1350
90/27.43	.1875/4.763	24.11/612	372/504	3221/1461
95/28.96	.1875/4.763	24.50/600	393/534	3616/1640
100/30.48	.1875/4.763	25.37/644	415/563	3876/1758
105/32.00	.1875/4.763	26.26/667	436/592	4146/1881
110/33.53	.1875/4.763	27.14/689	458/621	4424/2007
115/35.05	.1875/4.763	28.03/712	479/651	4713/2138
120/36.58	.1875/4.763	28.91/734	501/680	5008/2272

MeyerLD STEEL POLES



STEEL POLE CLASSIFICATION H-4; RUS S-05.7 | Meyer (12 SIDED) LD5

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.1875/4.763	17.20/437	180/245	1180/535
45/13.72	.1875/4.763	18.15/461	206/279	1364/619
50/15.24	.1875/4.763	19.09/485	231/313	1559/707
55/16.76	.1875/4.763	19.54/496	256/347	1827/829
60/18.29	.1875/4.763	20.48/520	281/382	2037/924
65/19.81	.1875/4.763	21.42/544	307/416	2290/1039
70/21.34	.1875/4.763	22.37/568	332/450	2518/1142
75/22.86	.1875/4.763	23.31/592	357/484	2757/1251
80/24.38	.1875/4.763	24.25/616	382/518	3006/1363
85/25.91	.1875/4.763	25.20/640	407/552	3265/1481
90/27.43	.1875/4.763	26.14/664	432/586	3533/1603
95/28.96	.1875/4.763	26.59/ 675	457/620	3973/1802
100/30.48	.1875/4.763	27.53/699	482/654	4256/1930
105/32.00	.1875/4.763	28.48/723	507/688	4549/2063
110/33.53	.1875/4.763	29.42/747	532/722	4865/2207
115/35.05	.1875/4.763	30.36/771	557/756	5178/2349
120/36.58	.1875/4.763	31.31/795	582/790	5501/2495



STEEL POLE CLASSIFICATION H-5; RUS S-06.5 | Meyer (12 SIDED) LD6

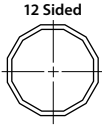
Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.1875/4.763	18.31/465	207/281	1231/558
45/13.72	.1875/4.763	19.40/493	236/321	1430/649
50/15.24	.1875/4.763	20.48/520	265/360	1640/744
55/16.76	.1875/4.763	21.07/535	294/399	1932/876
60/18.29	.1875/4.763	22.15/563	323/439	2158/979
65/19.81	.1875/4.763	23.23/590	353/478	2435/1104
70/21.34	.1875/4.763	24.31/617	382/517	2685/1218
75/22.86	.1875/4.763	25.39/645	410/557	2945/1336
80/24.38	.1875/4.763	26.48/673	439/596	3216/1459
85/25.91	.1875/4.763	27.56/700	468/635	3498/1587
90/27.43	.1875/4.763	28.64/727	497/674	3793/1720
95/28.96	.1875/4.763	29.22/742	526/714	4321/1960
100/30.48	.1875/4.763	30.30/770	555/753	4633/2101
105/32.00	.1875/4.763	31.38/797	584/792	4957/2248
110/33.53	.1875/4.763*	32.46/824	613/831	5997/2720
115/35.05	.1875/4.763*	33.55/852	642/871	6454/2927
120/36.58	.1875/4.763*	34.63/880	671/910	6927/3142

*Bottom section pl thickness = .25/6.350

MeyerLD STEEL POLES

Top Diameter
= 9.85 in. (250.2mm)

TAPER



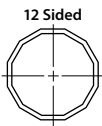
0.180628 in./ft. (15.05mm/m)

STEEL POLE CLASSIFICATION H-6; RUS S-07.4 | Meyer (12 SIDED) LD7

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft.-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.25/6.350	17.08/434	236/321	1539/698
45/13.72	.25/6.350	17.98/457	270/366	1781/808
50/15.24	.25/6.350	18.88/480	303/411	2035/923
55/16.76	.25/6.350	19.16/487	336/455	2365/1073
60/18.29	.25/6.350	20.07/510	369/500	2636/1196
65/19.81	.25/6.350	20.97/533	402/545	2985/1354
70/21.34	.25/6.350	21.88/556	435/590	3281/1488
75/22.86	.25/6.350	22.78/579	468/634	3589/1628
80/24.38	.25/6.350	23.68/601	501/679	3910/1774
85/25.91	.25/6.350	24.58/624	533/723	4244/1925
90/27.43	.25/6.350	25.49/647	566/768	4589/2082
95/28.96	.25/6.350	26.39/670	599/812	4947/2244
100/30.48	.25/6.350	26.67/677	632/857	5504/2497
105/32.00	.25/6.350	27.58/701	664/901	5879/2667
110/33.53	.25/6.350	28.48/723	697/945	6267/2843
115/35.05	.25/6.350	29.38/746	730/990	6681/3030
120/36.58	.25/6.350	30.28/769	762/1034	7094/3218

Top Diameter
= 9.85 in. (250.2mm)

TAPER

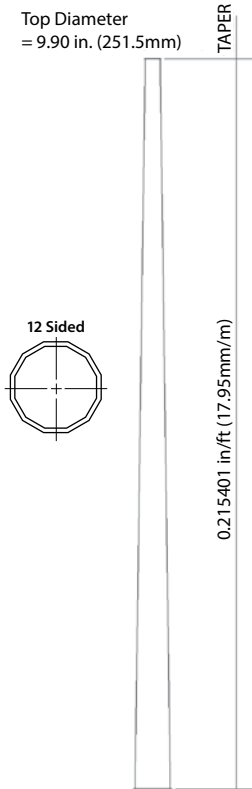


0.194151 in./ft. (16.18mm/m)

STEEL POLE CLASSIFICATION RUS S-08.0 | Meyer (12 SIDED) LD8

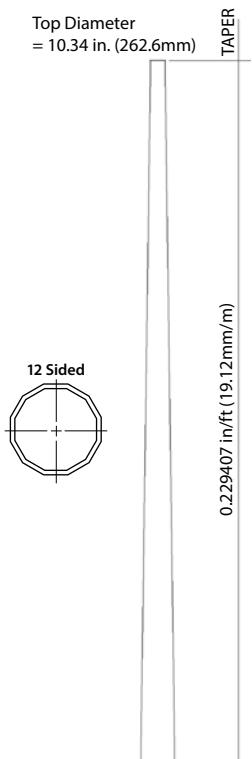
Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft.-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.25/6.350	17.62/448	255/346	1572/713
45/13.72	.25/6.350	18.58/472	291/395	1822/826
50/15.24	.25/6.350	19.56/497	327/443	2085/946
55/16.76	.25/6.350	19.91/506	359/486	2432/1103
60/18.29	.25/6.350	20.88/530	398/540	2715/1232
65/19.81	.25/6.350	21.85/555	434/588	3078/1396
70/21.34	.25/6.350	22.82/580	470/637	3387/1536
75/22.86	.25/6.350	23.79/604	505/685	3709/1682
80/24.38	.25/6.350	24.77/629	541/733	4045/1835
85/25.91	.25/6.350	25.73/654	576/781	4394/1993
90/27.43	.25/6.350	26.71/678	612/829	4756/2157
95/28.96	.25/6.350	27.67/703	647/877	5131/2327
100/30.48	.25/6.350	28.02/712	682/925	5741/2604
105/32.00	.25/6.350	29.00/737	718/973	6150/2790
110/33.53	.25/6.350	29.96/761	753/1021	6558/2975
115/35.05	.25/6.350	30.94/786	789/1069	6980/3166
120/36.58	.25/6.350	31.90/810	824/1117	7416/3364

MeyerLD STEEL POLES



STEEL CLASSIFICATION RUS S-09.0 | Meyer (12 SIDED) LD9

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.25/6.350	18.52/470	287/389	1629/739
45/13.72	.25/6.350	19.59/498	327/444	1892/858
50/15.24	.25/6.350	20.67/525	368/499	2171/985
55/16.76	.25/6.350	21.12/536	408/553	2544/1154
60/18.29	.25/6.350	22.21/564	448/608	2846/1291
65/19.81	.25/6.350	23.28/591	488/662	3237/1468
70/21.34	.25/6.350	24.36/619	528/717	3567/1618
75/22.86	.25/6.350	25.43/646	568/771	3912/1774
80/24.38	.25/6.350	26.51/673	608/825	4271/1937
85/25.91	.25/6.350	27.59/701	649/879	4644/2106
90/27.43	.25/6.350	28.67/728	688/934	5034/2283
95/28.96	.25/6.350	29.74/755	728/988	5452/2473
100/30.48	.25/6.350	30.19/767	768/1042	6123/2777
105/32.00	.25/6.350	31.28/795	808/1096	6539/2966
110/33.53	.25/6.350	32.35/822	848/1150	6991/3171
115/35.05	.25/6.350	33.43/849	888/1204	7447/3378
120/36.58	.25/6.350	34.50/876	928/1258	7918/3592



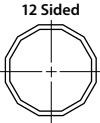
STEEL CLASSIFICATION RUS S-10.0 | Meyer (12 SIDED) LD10

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.25/6.350	19.51/496	319/433	1713/777
45/13.72	.25/6.350	20.66/525	364/494	1992/904
50/15.24	.25/6.350	21.81/554	409/554	2286/1037
55/16.76	.25/6.350	22.33/567	453/615	2692/1221
60/18.29	.25/6.350	23.48/596	498/675	3009/1365
65/19.81	.25/6.350	24.62/625	543/736	3424/1553
70/21.34	.25/6.350	25.77/655	587/797	3772/1711
75/22.86	.25/6.350	26.92/684	632/857	4137/1877
80/24.38	.25/6.350	28.07/713	677/917	4511/2046
85/25.91	.25/6.350	29.21/742	721/978	4931/2237
90/27.43	.25/6.350	30.36/771	766/1038	5344/2424
95/28.96	.25/6.350	31.51/800	810/1098	5773/2619
100/30.48	.25/6.350	32.03/814	854/1159	6508/2952
105/32.00	.25/6.350	33.18/843	899/1219	6960/3157
110/33.53	.25/6.350	34.33/872	943/1279	7428/3369
115/35.05	.25/6.350	35.48/901	988/1339	7912/3589
120/36.58	.25/6.350	36.62/930	1032/1399	8413/3816

MeyerLD STEEL POLES

Top Diameter
= 11.50 in. (292.1mm)

TAPER



0.226993 in/ft (18.92mm/m)

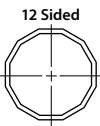
STEEL CLASSIFICATION RUS S-11.0 | Meyer (12 SIDED) LD11

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.25/6.350	20.57/522	352/477	1843/836
45/13.72	.25/6.350	21.70/551	401/543	2136/969
50/15.24	.25/6.350	22.84/580	450/610	2444/1109
55/16.76	.25/6.350	23.36/593	499/677	2881/1307
60/18.29	.25/6.350	24.50/622	548/743	3213/1457
65/19.81	.25/6.350	25.63/651	597/810	3639/1651
70/21.34	.25/6.350	26.77/680	647/877	4002/1815
75/22.86	.25/6.350	27.90/709	696/943	4381/1987
80/24.38	.25/6.350	29.04/738	745/1010	4791/2173
85/25.91	.25/6.350	30.17/766	794/1076	5201/2359
90/27.43	.25/6.350	31.31/795	843/1143	5627/2552
95/28.96	.25/6.350	32.44/824	892/1209	6070/2753
100/30.48	.25/6.350	32.95/837	940/1275	6843/3104
105/32.00	.25/6.350	34.09/866	989/1341	7307/3314
110/33.53	.25/6.350	35.22/895	1038/1408	7788/3533
115/35.05	.25/6.350	36.36/924	1087/1474	8285/3758
120/36.58	.25/6.350	37.49/952	1136/1540	8796/3990

STEEL CLASSIFICATION RUS S-12.0 | Meyer (12 SIDED) LD12

Top Diameter
= 11.93 in. (303.0mm)

TAPER



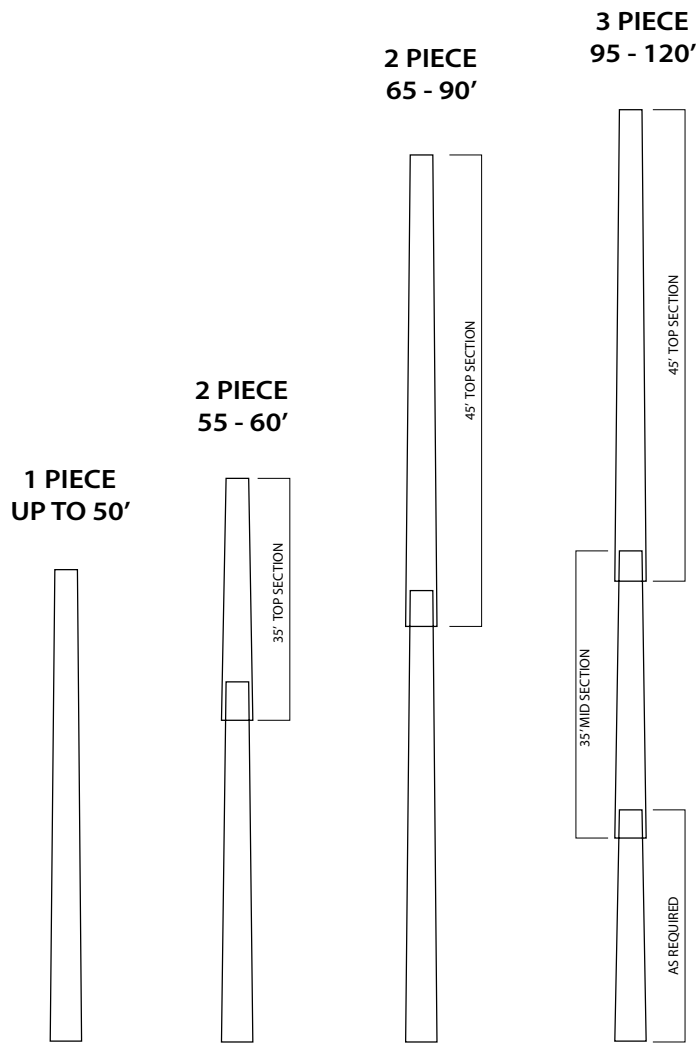
0.237618 in/ft (19.80mm/m)

Total Pole Length (ft./m)	Plate Thickness (in./mm)	Base Dia. at Bearing Plate (in./mm) F-F	Groundline Moment (ft-kips/kN-m) F-F	Estimated Pole Weight (Black) (lbs./kg)
40/12.19	.25/6.350	21.43/544	384/520	1920/871
45/13.72	.25/6.350	22.62/575	437/593	2225/1009
50/15.24	.25/6.350	23.81/605	491/666	2546/1155
55/16.76	.25/6.350	24.38/619	544/738	3010/1365
60/18.29	.25/6.350	25.57/649	598/811	3355/1522
65/19.81	.25/6.350	26.76/680	652/884	3805/1726
70/21.34	.25/6.350	27.94/710	705/957	4185/1898
75/22.86	.25/6.350	29.13/740	759/1029	4596/2085
80/24.38	.25/6.350	30.32/770	813/1102	5009/2272
85/25.91	.25/6.350	31.51/800	866/1174	5437/2466
90/27.43	.25/6.350	32.70/831	920/1247	5883/2668
95/28.96	.25/6.350	33.88/861	973/1319	6348/2879
100/30.48	.25/6.350	34.44/875	1026/1392	7168/3251
105/32.00	.25/6.350	35.63/905	1080/1464	7655/3472
110/33.53	.25/6.350	36.82/935	1133/1536	8162/3702
115/35.05	.25/6.350	38.01/965	1186/1609	8681/3938
120/36.58	.25/6.350*	39.20/996	1241/1682	10228/4639

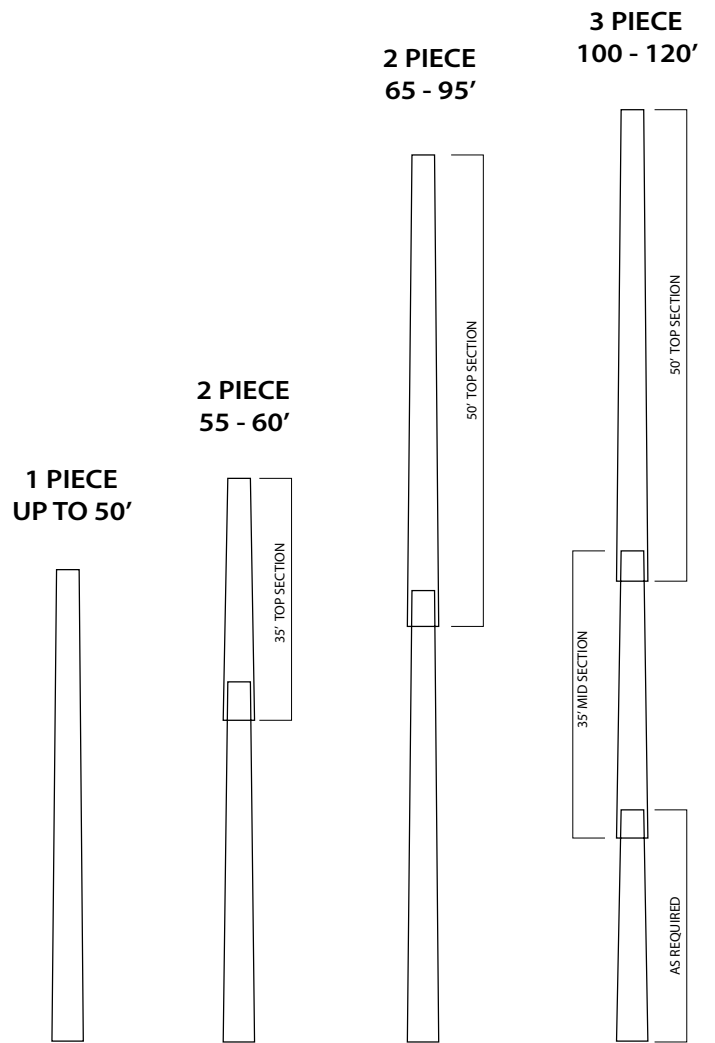
*Bottom section pl thickness = .3125/7.938

SLIP JOINT CONFIGURATION

Slip Joint Configuration (LD1 – LD6)



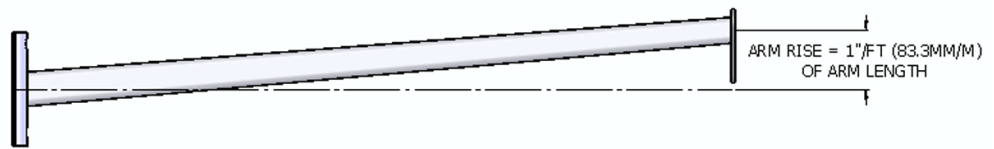
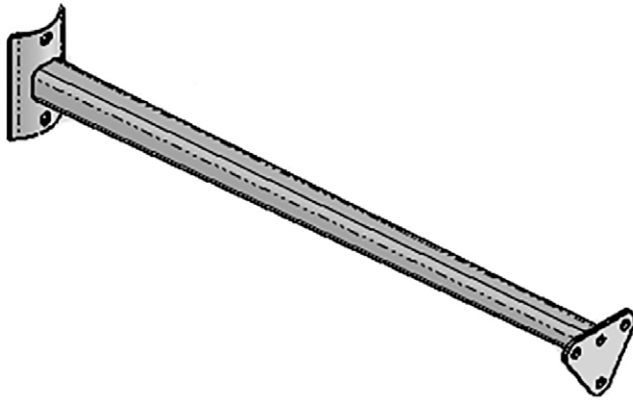
Slip Joint Configuration (LD7 – LD12)



In-service axial loads shall not exceed the maximum applied jacking force

STANDARD DAVIT ARMS

CURVED ARMS AVAILABLE UPON REQUEST ONLY



GENERAL NOTES

1. Material - ASTM A871 modified (self-weathering) painted or ASTM A572 modified (galvanized) $F_y=65$ ksi (448 MPa) with a Charpy V-Notch Impact Value of 15 foot-pounds (20.3 Joules) at $-20^\circ\text{F}/-29^\circ\text{C}$ (Heat Lot Tested).
2. Welds:
 - Long Seam - 50% Pentr
 - Bracket to Shaft - .375"/9.5mm Fillet
 - End Plate to Shaft - .1875"/4.76mm Fillet
3. All bolts - A325 Type III - 92 ksi (634 MPa).
4. All slots - 1.125"/28.6mm x 1.5"/38.1mm.
5. Arm and vang ratings represent hardware capacities only. It is the customer's responsibility to determine the capacity of pole to resist applied loads.
6. Arms should not be used for deadend or unbalanced conditions.
7. Steel davit arms shall not be left unloaded.
8. Catalog no. and description.

*Maximum loads shown in chart applied non-simultaneously.

For simultaneous load application:

$$M_L = L \times \text{Arm Length}$$

$$M_V = V \times \text{Arm Length} + (T \times W) + \frac{\text{Arm Weight} \times \text{Arm Length}}{2}$$

$$SR = \frac{M_L + M_V}{\text{Yield Strength}}$$

Check $SR \leq \text{Actual Section Modulus}$

NOTATION:

M_L = Longitudinal moment

M_V = Vertical moment

L = Longitudinal load

V = Vertical load

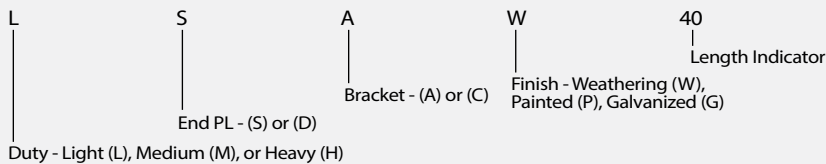
T = Transverse load

W = Rise (see tabulation)

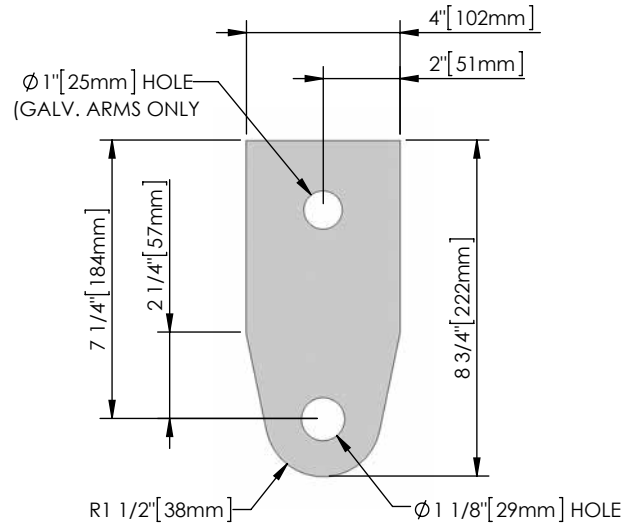
Arm Length units

SR = Required section modulus

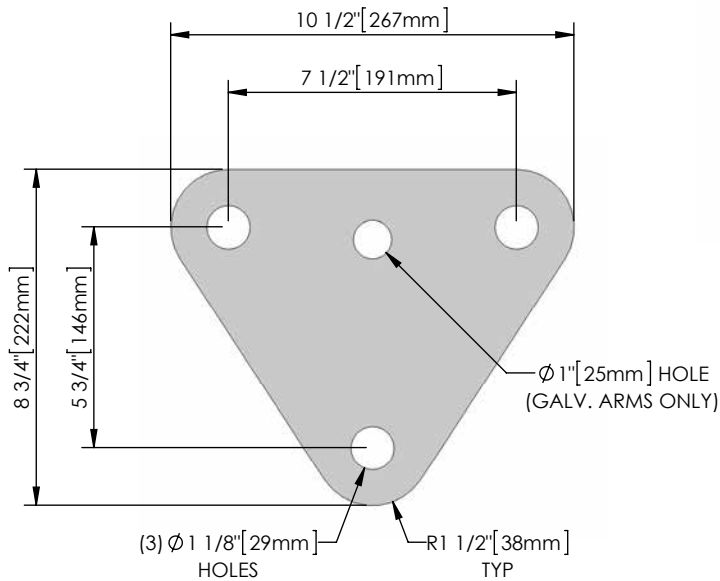
Actual section modulus listed in tabulation



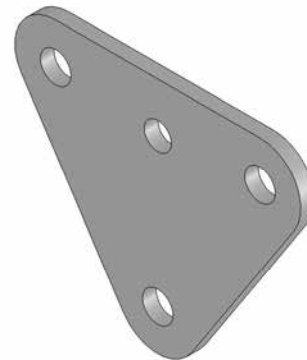
DAVIT ARM DETAILS



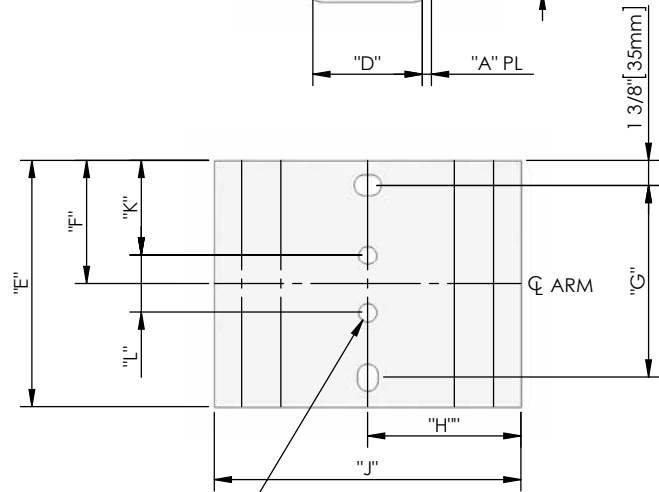
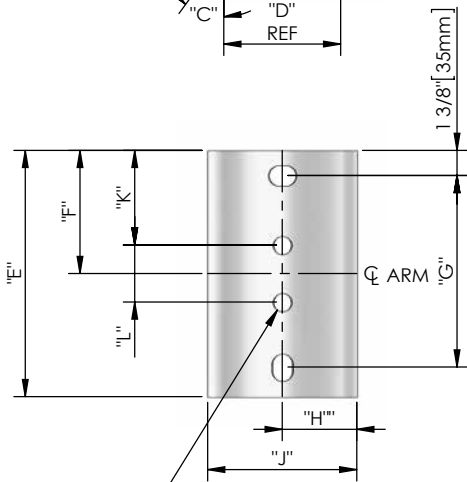
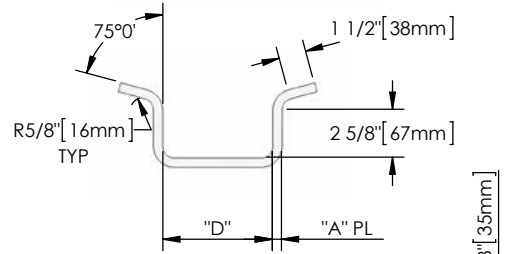
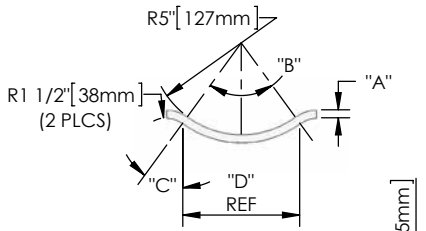
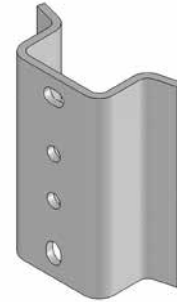
END PLATE 'S'



END PLATE 'D'



LD BRACKET DETAILS

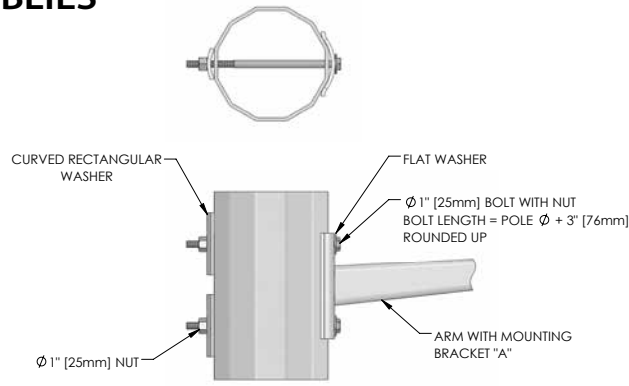


**BRACKET 'A'
STANDARD**

**BRACKET 'C'
ALLOWS INDEPENDENT MOUNTING
OF TWO ARMS BACK TO BACK AT
ONE ELEVATION.**

PAINTED OR WEATHERING		GALVANIZED		DUTY	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"J"	"K"	"L"
BRKT "A"	BRKT "C"	BRKT "A"	BRKT "C"												
69067	-----	69076	-----	LIGHT	7/16"	72.2°	36.1°	6 7/16"	13 1/2"	6 3/4"	10 1/2"	4 3/8"	8 3/4"	5 3/4"	2 1/8"
69068	-----	69077	-----	MEDIUM	7/16"	103.5°	51.7°	8 9/16"	19"	9 1/2"	16"	6 9/32"	12 9/16"	7 15/16"	3 1/8"
69069	-----	69078	-----	HEAVY	1/2"	103.5°	51.7°	8 5/8"	24"	9 1/2"	16"	6 11/32"	12 11/16"	7 7/16"	4 1/8"
	69073		69082	LIGHT	1/2"	-----	-----	4"	13 1/2"	6 3/4"	10 1/2"	7 13/32"	14 13/16"	5 11/16"	2 1/8"
	69074		69083	MEDIUM	1/2"	-----	-----	5"	19"	9 1/2"	16"	7 29/32"	15 13/16"	7 15/16"	3 1/8"
	69075		69084	HEAVY	1/2"	-----	-----	6"	24"	9 1/2"	16"	8 13/32"	16 13/16"	7 7/16"	4 1/8"

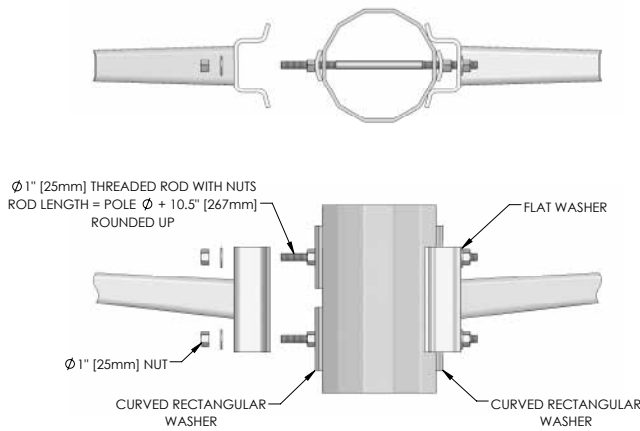
TYPICAL ARM ASSEMBLIES



TYPE A
SINGLE ARM MOUNTING WITH STANDARD BRACKET
"A" SHOWN. FOR DOUBLE ARM MOUNTING,
THE CURVED WASHERS WOULD BE OMITTED.

Arm Bracket "A" Hardware

Pole Diameter (flat x flat)	Weathering				Galvanized				
	1"[25mm] Dia. Bolt with (1) 1"[25mm] Dia. Nut	1"[25mm] Dia. Flat Washer	Curved Rectangular Washer	Hardware Kit Number	1"[25mm] Dia. Bolt with (1) 1"[25mm] Dia. Nut	1"[25mm] Dia. Flat Washer	Curved Rectangular Washer	Hardware Kit Number	
> 6.3in[159.5mm] ≤ 9.2in [233.1mm]	2 x 65413	2 x 74269	2 x 69066	HWK-AW095	2 x 78310	2 x 74115	2 x 69066	HWK-AG095	
> 9.2in[233.1mm] ≤ 11.1in [282.1mm]	2 x 65415	2 x 74269	2 x 69066	HWK-AW115	2 x 78311	2 x 74115	2 x 69066	HWK-AG115	
> 11.1in[282.1mm] ≤ 13.0in [331.2mm]	2 x 65417	2 x 74269	2 x 69066	HWK-AW135	2 x 78312	2 x 74115	2 x 69066	HWK-AG135	
> 13.0in[331.2mm] ≤ 14.5in [368.0mm]	2 x 65419	2 x 74269	2 x 69066	HWK-AW150	2 x 78313	2 x 74115	2 x 69066	HWK-AG150	
> 14.5in[368.0mm] ≤ 16.4in [417.1mm]	2 x 65421	2 x 74269	2 x 69066	HWK-AW170	2 x 78314	2 x 74115	2 x 69066	HWK-AG170	
> 16.4in[417.1mm] ≤ 18.4in [466.1mm]	2 x 65423	2 x 74269	2 x 69066	HWK-AW190	2 x 78315	2 x 74115	2 x 69066	HWK-AG190	
> 18.4in[466.1mm] ≤ 20.3in [515.2mm]	2 x 65425	2 x 74269	2 x 69066	HWK-AW210	2 x 78316	2 x 74115	2 x 69066	HWK-AG210	
> 20.3in[515.2mm] ≤ 22.2in [564.3mm]	2 x 65427	2 x 74269	2 x 69066	HWK-AW230	2 x 78317	2 x 74115	2 x 69066	HWK-AG230	
> 22.2in[564.3mm] ≤ 24.1in [613.3mm]	2 x 65429	2 x 74269	2 x 69066	HWK-AW250	2 x 78318	2 x 74115	2 x 69066	HWK-AG250	



TYPE C
ARMS MAY BE INDEPENDENTLY MOUNTED.
DOUBLE ARM MOUNTING WITH OPTIONAL
BRACKET "C" SHOWN.
CURVED WASHERS REQUIRED.

Arm Bracket "C" Hardware

Pole Diameter (flat x flat)	Weathering					Galvanized				
	1"[25mm] Dia. Bolt with (2) 1"[25mm] Dia. Nuts	1"[25mm] Dia. Nuts (additional)	1"[25mm] Dia. Flat Washer	Curved Rectangular Washer	Hardware Kit Number	1"[25mm] Dia. Bolt with (2) 1"[25mm] Dia. Nuts	1"[25mm] Dia. Nuts (additional)	1"[25mm] Dia. Flat Washer	Curved Rectangular Washer	Hardware Kit Number
> 6.3in[159.5mm] ≤ 9.2in [233.1mm]	2 x 66419	4 x 72940	4 x 74269	4 x 69066	HWK-CW095	2 x 78330	2 x 73442	4 x 74115	2 x 69066	HWK-CG095
> 9.2in[233.1mm] ≤ 11.1in [282.1mm]	2 x 66421	4 x 72940	4 x 74269	4 x 69066	HWK-CW115	2 x 78331	2 x 73442	4 x 74115	2 x 69066	HWK-CG115
> 11.1in[282.1mm] ≤ 13.0in [331.2mm]	2 x 66423	4 x 72940	4 x 74269	4 x 69066	HWK-CW135	2 x 78332	2 x 73442	4 x 74115	2 x 69066	HWK-CG135
> 13.0in[331.2mm] ≤ 14.5in [368.0mm]	2 x 66425	4 x 72940	4 x 74269	4 x 69066	HWK-CW150	2 x 78333	2 x 73442	4 x 74115	2 x 69066	HWK-CG150
> 14.5in[368.0mm] ≤ 16.4in [417.1mm]	2 x 66427	4 x 72940	4 x 74269	4 x 69066	HWK-CW170	2 x 78334	2 x 73442	4 x 74115	2 x 69066	HWK-CG170
> 16.4in[417.1mm] ≤ 18.4in [466.1mm]	2 x 66429	4 x 72940	4 x 74269	4 x 69066	HWK-CW190	2 x 78335	2 x 73442	4 x 74115	2 x 69066	HWK-CG190
> 18.4in[466.1mm] ≤ 19.8in [502.9mm]	2 x 66431	4 x 72940	4 x 74269	4 x 69066	HWK-CW205	2 x 78336	2 x 73442	4 x 74115	2 x 69066	HWK-CG210
> 19.8in[502.9mm] ≤ 21.7in [552.0mm]	2 x 66433	4 x 72940	4 x 74269	4 x 69066	HWK-CW225	2 x 78337	2 x 73442	4 x 74115	2 x 69066	HWK-CG230
> 21.7in[552.0mm] ≤ 23.7in [601.1mm]	2 x 66435	4 x 72940	4 x 74269	4 x 69066	HWK-CW245	2 x 78338	2 x 73442	4 x 74115	2 x 69066	HWK-CG250

STANDARD DAVIT ARMS

LIGHT DUTY ARMS

PLATE THICKNESS = .1875"/4.76mm - 65 KSI (448 MPa) SMALL END SQUARE = 3"/76.2mm, LARGE END SQUARE = 4"/101.6mm, SECTION MODULUS = 2.803in³/45.94cm³

CATALOG NO.	ARM LENGTH	ARM WEIGHT	ARM RISE	*V Lbs/V Kg	*T Lbs/T Kg	* L Lbs/L Kg
L_40	4 ft/1.22m	68 Lbs/31 Kg	4 in/102mm	3,745/1,698	2,500/1,134	1,250/567
L_45	4.5 ft/1.37m	72 Lbs/33 Kg	4.5 in/114mm	3,323/1,507	2,500/1,134	1,111/504
L_50	5 ft/1.52m	76 Lbs/35 Kg	5 in/127mm	2,986/1,354	2,500/1,134	1,000/454
L_55	5.5 ft/1.68m	80 Lbs/37 Kg	5.5 in/140mm	2,710/1,229	2,500/1,134	909/412
L_60	6 ft/1.83m	84 Lbs/39 Kg	6 in/152mm	2,480/1,125	2,500/1,134	833/378
L_65	6.5 ft/1.98m	88 Lbs/40 Kg	6.5 in/165mm	2,285/1,036	2,500/1,134	769/349
L_70	7 ft/2.13m	92 Lbs/42 Kg	7 in/178mm	2,118/961	2,500/1,134	714/324
L_75	7.5 ft/2.29m	96 Lbs/44 Kg	7.5 in/191mm	1,974/895	2,500/1,134	667/303
L_80	8 ft/2.44m	99 Lbs/45 Kg	8 in/203mm	1,847/838	2,500/1,134	625/283
L_85	8.5 ft/2.59m	103 Lbs/47 Kg	8.5 in/216mm	1,736/787	2,500/1,134	588/267
L_90	9 ft/2.74m	107 Lbs/49 Kg	9 in/229mm	1,636/742	2,500/1,134	556/252
L_95	9.5 ft/2.90m	111 Lbs/51 Kg	9.5 in/241mm	1,548/702	2,500/1,134	526/239
L_10	10 ft/3.05m	115 Lbs/53 Kg	10 in/254mm	1,468/666	2,500/1,134	500/227

MEDIUM DUTY ARMS

PLATE THICKNESS = .1875"/4.76mm - 65 KSI (448 MPa) SMALL END SQUARE = 3"/76.2mm, LARGE END SQUARE = 5"/127mm, SECTION MODULUS = 4.783in³/78.39cm³

CATALOG NO.	ARM LENGTH	ARM WEIGHT	ARM RISE	*V Lbs/V Kg	*T Lbs/T Kg	* L Lbs/L Kg
M_40	4 ft/1.22m	88 Lbs/40 Kg	4 in/102mm	6,421/2,913	4,000/1,814	1,250/567
M_45	4.5 ft/1.37m	93 Lbs/42 Kg	4.5 in/114mm	5,702/2,586	4,000/1,814	1,111/504
M_50	5 ft/1.52m	97 Lbs/44 Kg	5 in/127mm	5,126/2,325	4,000/1,814	1,000/454
M_55	5.5 ft/1.68m	102 Lbs/46 Kg	5.5 in/140mm	4,655/2,112	4,000/1,814	909/412
M_60	6 ft/1.83m	106 Lbs/48 Kg	6 in/152mm	4,262/1,932	4,000/1,814	833/378
M_65	6.5 ft/1.98m	111 Lbs/50 Kg	6.5 in/165mm	3,930/1,783	4,000/1,814	769/349
M_70	7 ft/2.13m	115 Lbs/52 Kg	7 in/178mm	3,646/1,654	4,000/1,814	714/324
M_75	7.5 ft/2.29m	120 Lbs/54 Kg	7.5 in/191mm	3,399/1,542	4,000/1,814	667/303
M_80	8 ft/2.44m	124 Lbs/56 Kg	8 in/203mm	3,183/1,444	4,000/1,814	625/283
M_85	8.5 ft/2.59m	129 Lbs/59 Kg	8.5 in/216mm	2,992/1,357	4,000/1,814	588/267
M_90	9 ft/2.74m	133 Lbs/61 Kg	9 in/229mm	2,823/1,281	4,000/1,814	556/252
M_95	9.5 ft/2.90m	138 Lbs/63 Kg	9.5 in/241mm	2,672/1,212	4,000/1,814	526/239
M_10	10 ft/3.05m	142 Lbs/65 Kg	10 in/254mm	2,535/1,150	4,000/1,814	500/227

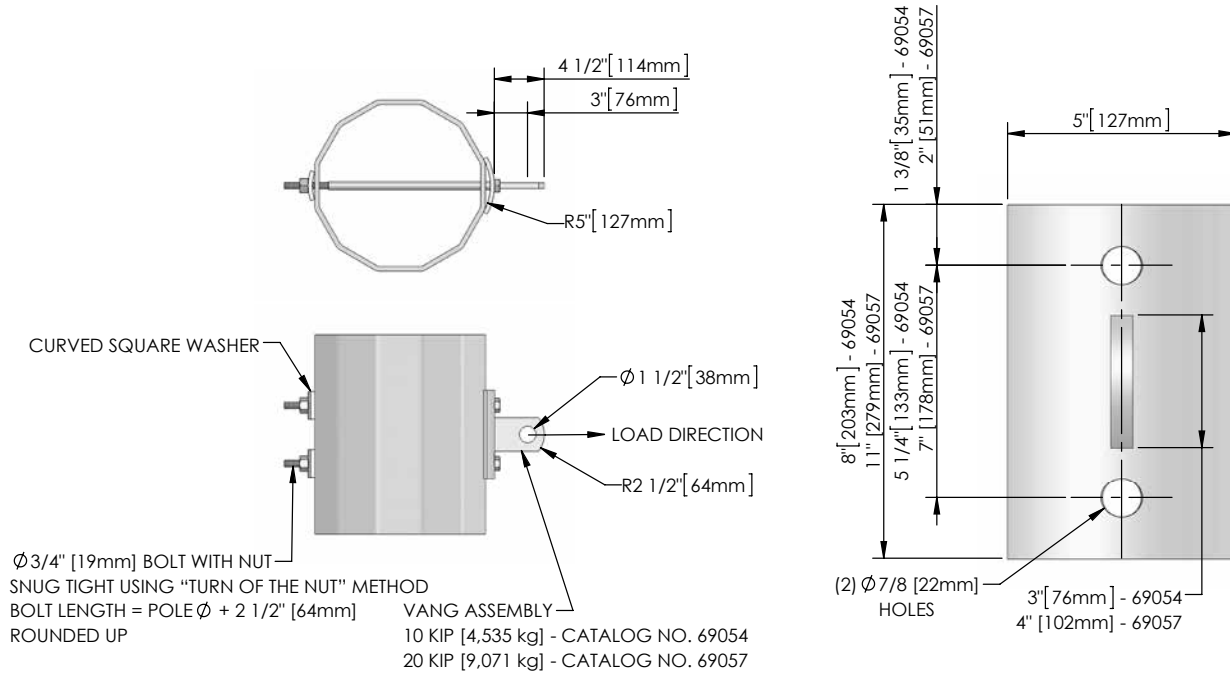
HEAVY DUTY ARMS

PLATE THICKNESS = .1875"/4.76mm - 65 KSI (448 MPa) SMALL END SQUARE = 3.5"/88.9mm, LARGE END SQUARE = 6"/152mm, SECTION MODULUS = 7.267in³/119.11cm³

CATALOG NO.	ARM LENGTH	ARM WEIGHT	ARM RISE	*V Lbs/V Kg	*T Lbs/T Kg	* L Lbs/L Kg
H_40	4 ft/1.22m	111 Lbs/50 Kg	4 in/102mm	9,780/4,436	4,000/1,814	1,250/567
H_45	4.5 ft/1.37m	116 Lbs/53 Kg	4.5 in/114mm	8,687/3,940	4,000/1,814	1,111/504
H_50	5 ft/1.52m	122 Lbs/55 Kg	5 in/127mm	7,812/3,544	4,000/1,814	1,000/454
H_55	5.5 ft/1.68m	127 Lbs/58 Kg	5.5 in/140mm	7,096/3,219	4,000/1,814	909/412
H_60	6 ft/1.83m	133 Lbs/60 Kg	6 in/152mm	6,560/2,976	4,000/1,814	833/378
H_65	6.5 ft/1.98m	138 Lbs/63 Kg	6.5 in/165mm	5,995/2,719	4,000/1,814	769/349
H_70	7 ft/2.13m	143 Lbs/65 Kg	7 in/178mm	5,563/2,523	4,000/1,814	714/324
H_75	7.5 ft/2.29m	149 Lbs/68 Kg	7.5 in/191mm	5,188/2,353	4,000/1,814	667/303
H_80	8 ft/2.44m	155 Lbs/70 Kg	8 in/203mm	4,860/2,205	4,000/1,814	625/283
H_85	8.5 ft/2.59m	160 Lbs/73 Kg	8.5 in/216mm	4,570/2,073	4,000/1,814	588/267
H_90	9 ft/2.74m	165 Lbs/75 Kg	9 in/229mm	4,313/1,956	4,000/1,814	556/252
H_95	9.5 ft/2.90m	172 Lbs/78 Kg	9.5 in/241mm	4,083/1,852	4,000/1,814	526/239
H_10	10 ft/3.05m	177 Lbs/81 Kg	10 in/254mm	3,876/1,758	4,000/1,814	500/227

**Note: Listed load capacities are for arm shafts, brackets, through bolts and endplates only.
Pole strength and localized effects on the pole are not included.**

STANDARD BOLT ON HARDWARE – 10 KIP AND 20 KIP

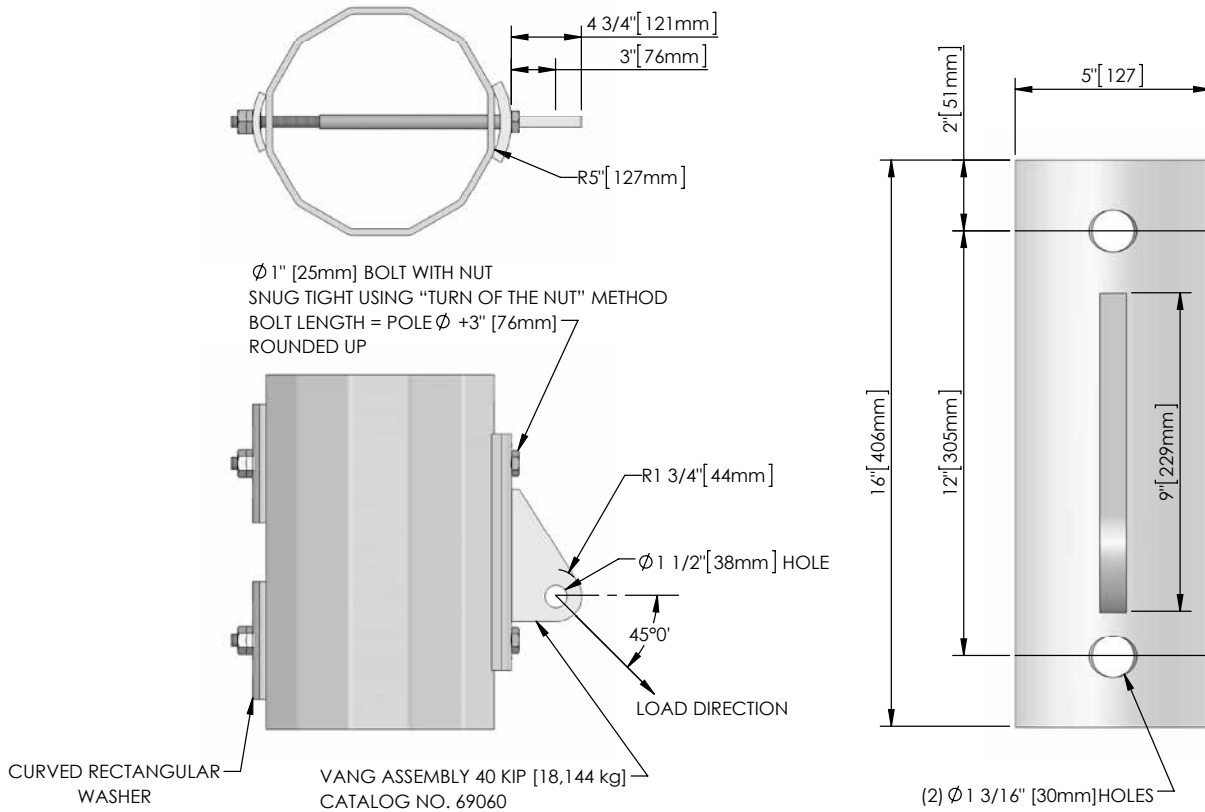


10 KIP and 20 KIP Vang Assembly Hardware

Pole Diameter (flat x flat)	Weathering			Galvanized				
	3/4"[19mm] Dia. Bolt and Nut	3/4"[19mm] Dia. Curved Square Washer	Assembly Number	3/4"[44mm] Dia. Bolt and Nut	3/4"[19mm] Dia. Curved Square Washer	Lock Washer	Assembly Number	
> 8.2in[208.5mm] ≤ 10.1in [257.6mm]	2 x 65313	2 x 69064	HWK-W10K105	2 x 69343	2 x 69139	2 x 74125	HWK-G10K105	
> 10.1in[257.6mm] ≤ 12.1in [306.7mm]	2 x 65315	2 x 69064	HWK-W10K125	2 x 69345	2 x 69139	2 x 74125	HWK-G10K125	
> 12.1in[306.7mm] ≤ 14.0in [355.7mm]	2 x 65317	2 x 69064	HWK-W10K145	2 x 69347	2 x 69139	2 x 74125	HWK-G10K145	
> 14.0in[355.7mm] ≤ 15.9in [404.8mm]	2 x 65319	2 x 69064	HWK-W10K165	2 x 69349	2 x 69139	2 x 74125	HWK-G10K165	
> 15.9in[404.8mm] ≤ 17.9in [453.9mm]	2 x 65321	2 x 69064	HWK-W10K185	2 x 69351	2 x 69139	2 x 74125	HWK-G10K185	
> 17.9in[453.9mm] ≤ 19.8in [502.9mm]	2 x 65323	2 x 69064	HWK-W10K205	2 x 69353	2 x 69139	2 x 74125	HWK-G10K205	
> 19.8in[502.9mm] ≤ 21.7in [552.0mm]	2 x 65325	2 x 69064	HWK-W10K225	2 x 69355	2 x 69139	2 x 74125	HWK-G10K225	
> 21.7in[552.0mm] ≤ 23.7in [601.1mm]	2 x 65327	2 x 69064	HWK-W10K245	2 x 69357	2 x 69139	2 x 74125	HWK-G10K245	
> 23.7in[601.1mm] ≤ 25.6in [650.1mm]	2 x 65329	2 x 69064	HWK-W10K265	2 x 69359	2 x 69139	2 x 74125	HWK-G10K265	

NOTE: 10 KIP/ 20 KIP Capacity represents the ultimate capacity of the vang assembly, which includes the vang, through bolts, and curved washers. Pole strength and localized effects are not included.

STANDARD BOLT ON HARDWARE – 40 KIP



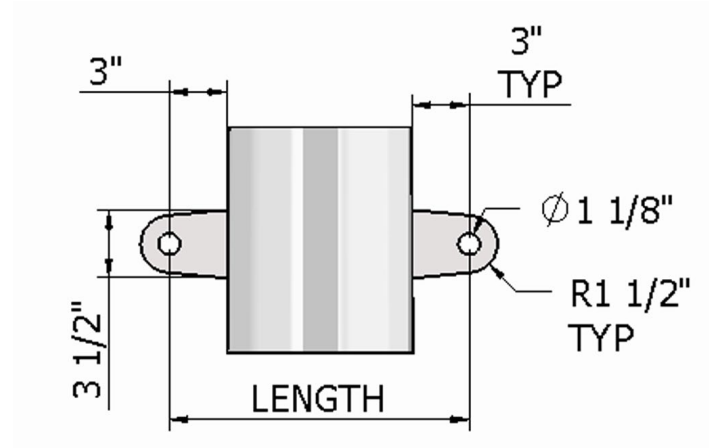
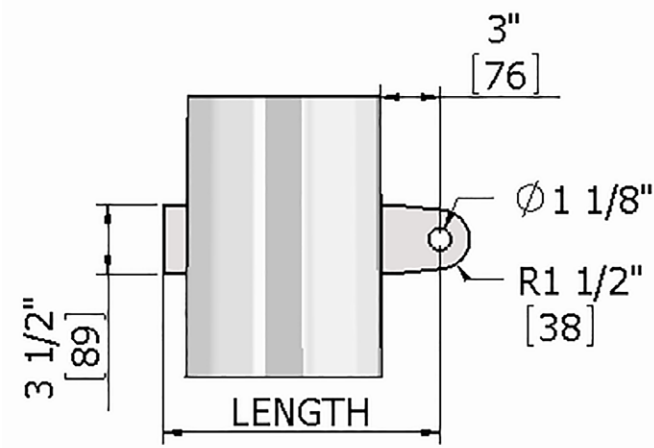
40 KIP Vang Assembly Hardware

Pole Diameter (flat x flat)	Weathering			Galvanized			
	1" [25mm] Dia. Bolt and Nut	1" [25mm] Dia. Curved Square Washer	Assembly Number	1" [25mm] Dia. Bolt and Nut	1" [25mm] Dia. Curved Rectangular Washer	Lock Washer	Assembly Number
> 7.7in[196.3mm] ≤ 9.7in[245.3mm]	2 x 65413	2 x 69066	HWK-W40K010	2 x 78310	2 x 69126	2 x 74120	HWK-G40K010
> 9.7in[245.3mm] ≤ 11.6in[294.4mm]	2 x 65415	2 x 69066	HWK-W40K012	2 x 78311	2 x 69126	2 x 74120	HWK-G40K012
> 11.6in[294.4mm] ≤ 13.5in[343.5mm]	2 x 65417	2 x 69066	HWK-W40K014	2 x 78312	2 x 69126	2 x 74120	HWK-G40K014
> 13.5in[343.5mm] ≤ 15.5in[392.5mm]	2 x 65419	2 x 69066	HWK-W40K016	2 x 78313	2 x 69126	2 x 74120	HWK-G40K016
> 15.5in[392.5mm] ≤ 17.4in[441.6mm]	2 x 65421	2 x 69066	HWK-W40K018	2 x 78314	2 x 69126	2 x 74120	HWK-G40K018
> 17.4in[441.6mm] ≤ 19.3in[490.7mm]	2 x 65423	2 x 69066	HWK-W40K020	2 x 78315	2 x 69126	2 x 74120	HWK-G40K020
> 19.3in[490.7mm] ≤ 21.2in[539.7mm]	2 x 65425	2 x 69066	HWK-W40K022	2 x 78316	2 x 69126	2 x 74120	HWK-G40K022
> 21.2in[539.7mm] ≤ 23.2in[588.8mm]	2 x 65427	2 x 69066	HWK-W40K024	2 x 78317	2 x 69126	2 x 74120	HWK-G40K024
> 23.2in[588.8mm] ≤ 25.1in[637.9mm]	2 x 65429	2 x 69066	HWK-W40K026	2 x 78318	2 x 69126	2 x 74120	HWK-G40K026

NOTE: 40 KIP Capacity represents the ultimate capacity of the vang assembly, which includes the vang, through bolts, and curved washers. Pole strength and localized effects are not included.

STANDARD THROUGH VANG

OVERSIZED 6" HEIGHT VANG AVAILABLE UPON REQUEST ONLY



One-Sided Through Vang

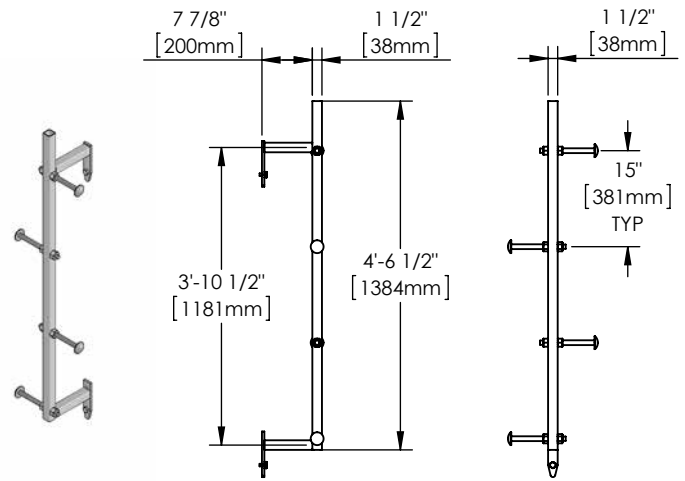
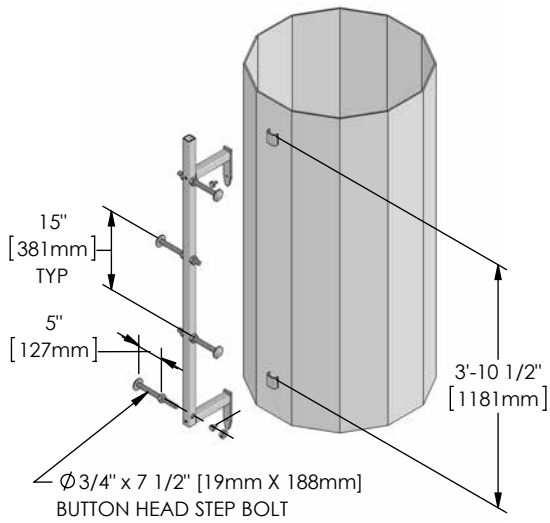
Length	Thickness	Galvanized Part No.	Weathering Part No.
13.5"	0.75"	80323	80324
15.5"	0.75"	80326	80327
17.5"	0.75"	80328	80329
19.5"	0.75"	80330	80331
21.5"	0.75"	80332	80335
23.5"	0.75"	80336	80337
25.5"	0.75"	80342	80343
27.5"	0.75"	80344	80345
29.5"	0.75"	80346	80347
31.5"	0.75"	80348	80350
33.5"	0.75"	80351	80352

Two-Sided Through Vang

Length	Thickness	Galvanized Part No.	Weathering Part No.
15.5"	0.75"	80353	80354
17.5"	0.75"	80355	80356
19.5"	0.75"	80357	80358
21.5"	0.75"	80380	80381
23.5"	0.75"	80382	80383
25.5"	0.75"	80384	80385
27.5"	0.75"	80386	80387
29.5"	0.75"	80388	80389
31.5"	0.75"	80390	80391
33.5"	0.75"	80392	80393
35.5"	0.75"	80394	80395

Length assumes distance from hole to hole with diameters starting at 9.5", increasing 2" with each additional vang length.

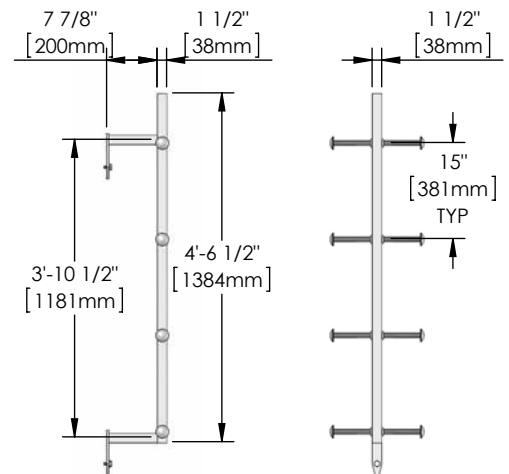
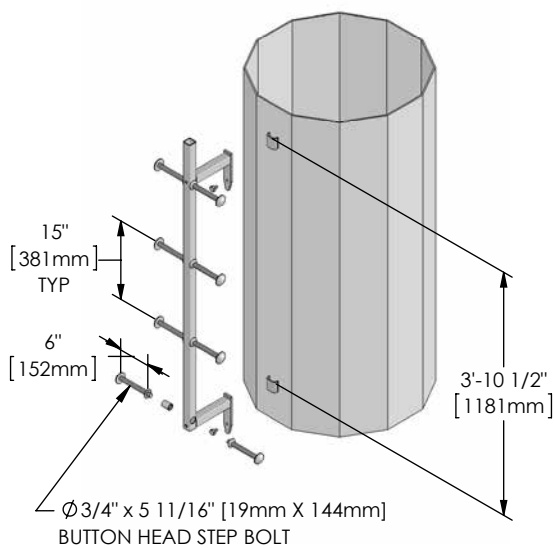
STANDARD LADDERS



STANDARD CLIMBING LADDER

CATALOG NO. 69342 - WEATHERING

CATALOG NO. 50921 - GALVANIZED

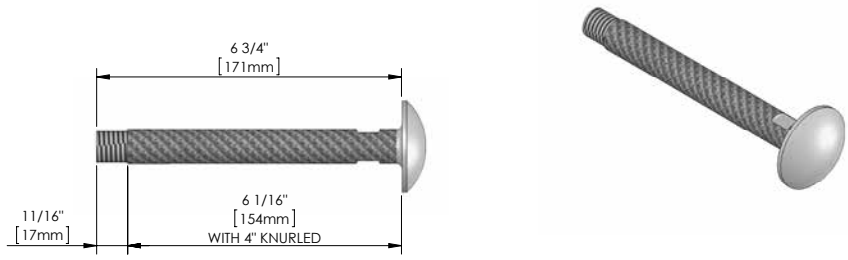


STANDARD WORKING LADDER

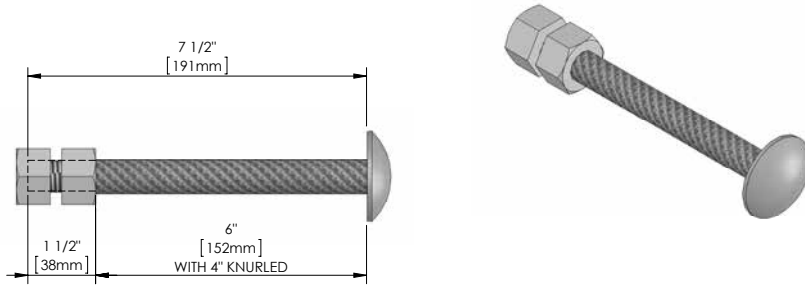
CATALOG NO. 69344 - WEATHERING

CATALOG NO. 52540 - GALVANIZED

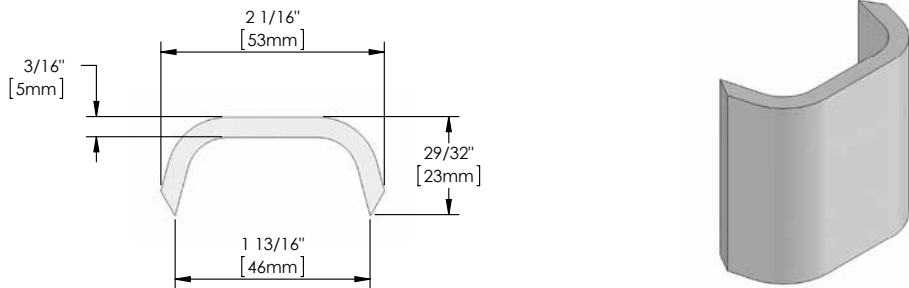
CLIMBING HARDWARE



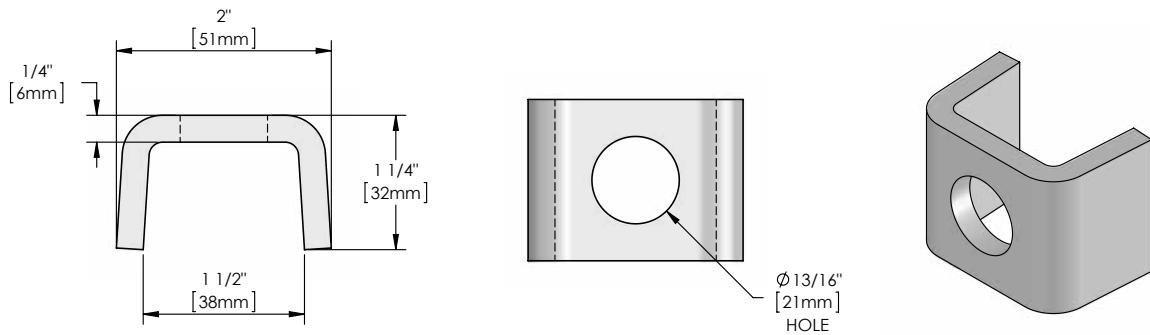
STANDARD STEP BOLT
 CATALOG NO. 70860 - WEATHERING
 CATALOG NO. 70859 - GALVANIZED



STANDARD STEP BOLT - 3/4" DIA
 CATALOG NO. 79087 - WEATHERING
 CATALOG NO. 79097 - GALVANIZED

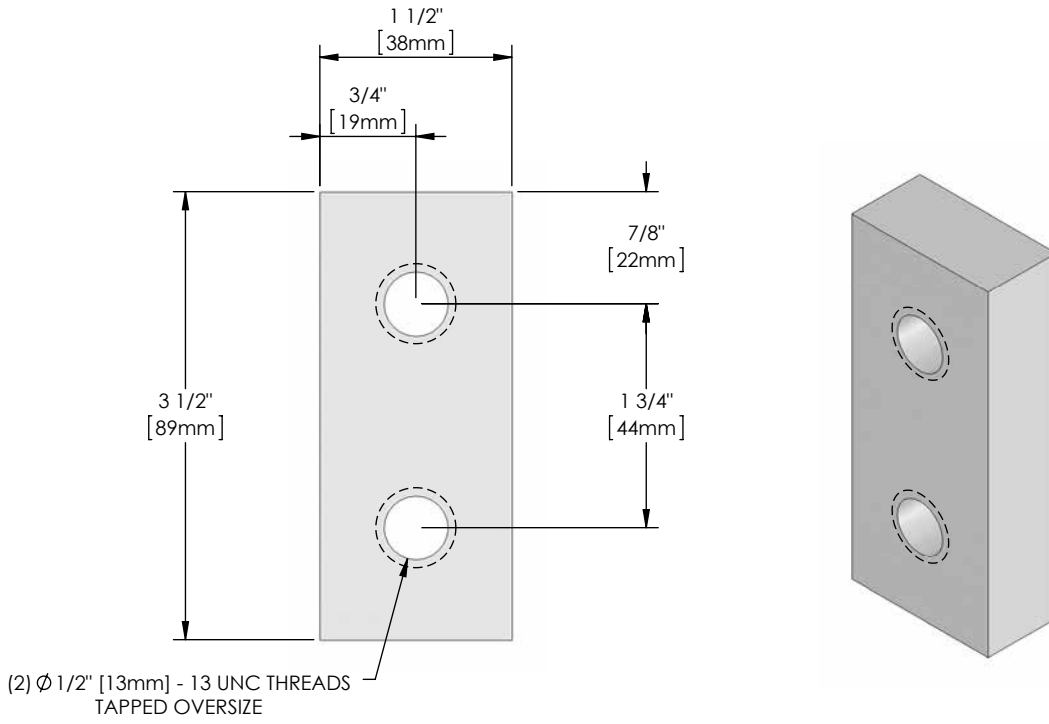


STANDARD LADDER CLIP
 (ALL FINISHES)
 CATALOG NO. 76266

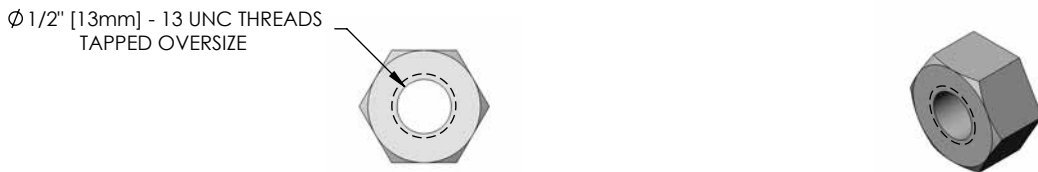


STANDARD STEP LUG
 FOR 3/4" [19mm] STEP BOLT
 (ALL FINISHES)
 CATALOG NO. 78086

GROUNDING OPTIONS



S.S. GROUND PAD - 2 HOLE
CATALOG NO. 78131



ϕ 1/2" [13mm] S.S. GROUND NUT
CATALOG NO. 73515

TERMS AND CONDITIONS OF SALE

MEYER UTILITY STRUCTURES

Terms and Conditions of Sale - Effective 10-15-2018

These Terms and Conditions shall govern all transactions between Meyer Utility Structures, LLC ("MEYER") and any buyer or potential buyer (the "Buyer") placing orders for or otherwise purchasing products (the "Products") from MEYER. Any terms or conditions proposed or referenced in any purchase order or other document presented by Buyer that add to, vary from, or conflict with the terms herein are hereby rejected. Notwithstanding any contrary language in Buyer's purchase order or any other document purporting to set forth any additional or different terms or conditions governing the purchase and sale of the Products, these Terms and Conditions set forth the full and final expression of the complete agreement and contract of sale of Products by MEYER to Buyer. No modification of these Terms and Conditions shall be binding on MEYER unless specifically approved in writing in a written agreement signed by an authorized representative of MEYER. To the extent that the submission of any bid or quotation, or the furnishing of any Products by MEYER could be considered to operate as an acceptance of any prior terms or conditions published by Buyer, such bid, quotation or furnishing of such Products is expressly made on the condition that Buyer assents to these Terms and Conditions. Buyer specifically acknowledges that the pricing of the Products has been set based on the agreed allocation of risks contained in these Terms and Conditions. If, notwithstanding the provisions of these Terms and Conditions, a court of competent jurisdiction determines that different or additional terms and conditions apply to an order, then MEYER shall have the right to retroactively modify the prices to reflect the additional level of risk and responsibility that MEYER assumes under such additional or different terms.

1) Delivery, Title, Risk of Loss

Unless otherwise stated in MEYER's proposal or specifically agreed by MEYER in writing, all Products are sold FOB Shipping Point, freight prepaid and allowed, using carriers selected by MEYER and with shipping and handling charges included in the price of the Products. Title to and risk of loss in the Products will pass to Buyer at the FOB point.

2) Payment Terms

Payment terms for partial and complete shipments are net 30 days from date of invoice. Except as provided in paragraph 9 below, Products are invoiced upon shipment. Buyer agrees to pay a finance charge of one and one-half percent per month (or at the highest rate allowed by law, whichever is less) on all past due balances.

3) Delivery Schedules/Delays

All delivery commitments by MEYER are good faith estimates based upon current information available from our suppliers at the time the dates for delivery are established. Delivery of the Products is conditioned upon prompt receipt of Buyer's order. Quoted delivery times are subject to prior sales and raw material availability. MEYER shall not be liable for any delay or failure to perform or deliver, in whole or in part, due to: (i) conditions, circumstances, or events beyond MEYER's reasonable control, including but not limited to legal orders, acts of war, acts of terrorism, embargoes, boycotts, blockades, acts of God, unusual weather conditions, fire, accident, explosion, mill shutdowns, unavailability of transportation, unavailability of raw materials, fuel shortages, default by suppliers, and the enactment or implementation of any law, regulation, order, or decree that is not in effect at the time the order is placed; or (ii) any act or failure to act by Buyer or Buyer's agents, contractors, or representatives.

4) Taxes

Product prices do not include any taxes. Buyer shall be solely responsible for the payment of any and all sales taxes, ad valorem taxes, value added taxes, goods and services taxes, use taxes, excise taxes, tariffs, import duties, export duties, and other taxes, fees and charges imposed by any governmental authority, whether foreign or domestic, upon any Product purchased and sold hereunder or upon the manufacture, sale, transfer, transportation, use or delivery thereof. The amount of any such present, future or retroactive taxes, fees, and charges required to be collected by MEYER will be invoiced by MEYER, and Buyer agrees to pay the same, except to the extent that Buyer has furnished MEYER with an exemption certificate acceptable to the appropriate taxing authorities.

5) Inspection and Acceptance

Buyer may inspect the Products during business hours at MEYER's facility on reasonable notice to MEYER, provided such inspection does not unreasonably interfere with MEYER's operations. Buyer agrees to inspect the Products promptly following receipt, and will report to MEYER any shortage, damage or visually detectable discrepancy within 30 days following receipt of delivery. All claims for shortages, damage and visually detectable discrepancies not reported to MEYER in writing within such 30 day period are waived by Buyer.

6) Compliance with Laws

In connection with the transactions governed by these Terms and Conditions, Buyer and MEYER agree and covenant that they will each comply with all applicable laws and regulations of the United States and all other foreign state and local jurisdictions regarding the manufacture, marketing, sale, resale, use, export and distribution of the Products, including, but not limited to, the U.S. export control laws and the U.S. Foreign Corrupt Practices Act.

7) Warranty

MEYER warrants that Products are being sold to Buyer free and clear of any encumbrances arising through MEYER. In addition, MEYER warrants that all Products will conform to any mutually agreed specifications for the Products and will otherwise be free from defects in materials and workmanship for a period ending on the earlier of 12 months from the date of installation or 18 months from the date of shipment. MEYER will, at its option, repair or replace any Product that is not in conformance with the foregoing warranties. MEYER will arrange transportation for the return of warranted Products and any replacement Products, and will be responsible for payment for such transportation arranged by MEYER. MEYER will have no liability for any costs, losses, expenses or damages beyond the cost of repair or replacement, and transportation arranged by MEYER. Any repair or replacement by MEYER shall not extend the original warranty period. MEYER's obligations under all warranties shall be waived if Buyer fails to (i) provide MEYER written notice of Buyer's specific warranty claim and the Product(s) affected within the warranty period, and (ii) provide MEYER with reasonable opportunity to inspect the Product(s) that are the subject of Buyer's warranty claim. If any technical advice is furnished by MEYER with respect to Buyer's specifications or use of the Products, MEYER assumes no obligation or liability for the advice given, or results obtained, with all such advice being given and accepted at Buyer's risk.

Other than the warranty of title, the warranties herein do not apply under any circumstances to: (i) any type of corrosion, irrespective of the cause; (ii) damage due to normal wear and tear, misuse, mishandling, or accident; (iii) any Product that has been modified or repaired by a party other than MEYER without MEYER's specific prior approval; (iv) any Product that has not been installed or maintained in accordance with MEYER's erection drawings or prudent industry practices; or (v) any Product that has experienced loading in excess of the maximum factored design loads or fatigue damage due to dynamic or cyclic loading.

THE WARRANTIES AND REMEDIES STATED HEREIN ARE MEYER'S SOLE WARRANTIES GIVEN WITH RESPECT TO THE PRODUCTS AND BUYER'S SOLE REMEDIES FOR ANY FAILURE OF THE PRODUCTS TO CONFORM TO SUCH WARRANTIES. THESE WARRANTIES ARE IN LIEU OF AND EXCLUDE ALL OTHER WARRANTIES, GUARANTEES AND REMEDIES, WHETHER EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY SPECIFICALLY DISCLAIMED.

8) Indemnification

MEYER and Buyer will defend and indemnify one another and their respective directors, officers and employees against any and all claims, losses, liability, damages, or expenses incurred on the account of any injury or death to persons and damage to property, to the extent such injury, death or damage is caused by or attributable to a party's negligence or willful misconduct in connection with the Products or the transactions to which these Terms and Conditions apply. Neither MEYER nor Buyer shall be obligated to indemnify one another in any manner whatsoever for the other party's own negligence or willful misconduct, or for the negligence or willful misconduct of others.

MEYER will defend any suit or proceeding brought against Buyer to the extent that such suit or proceeding is based on a claim that any Product purchased by Buyer or any part thereof constitutes an infringement of any United States patent issued as of the date of MEYER's quotation or proposal. MEYER shall have no obligation of defense or indemnity to the extent that any alleged infringement is attributable to any design or other special requirement specified by Buyer.

TERMS AND CONDITIONS OF SALE

In the event that a Product for which MEYER has an obligation to indemnify Buyer hereunder, or part thereof, is held to infringe a patent and the use thereof is enjoined, MEYER shall, at its expense and option, either (a) obtain for Buyer the right to continue using such Product or part, (b) replace the Product or part with a Product or part that is non-infringing, (c) modify the Product or part so that it becomes non-infringing, or (d) accept the return of the Product and refund the purchase price, less applicable depreciation.

9) Modification; Cancellation; Delay by Buyer

No order accepted by MEYER may be modified or cancelled by Buyer except upon MEYER's prior written approval. In the case of any request for changes to an order, including, but not limited to changes in delivery dates, increases in quantities, and modifications to Products, MEYER's approval shall be conditioned upon Buyer's agreement to MEYER's revised pricing and dates of delivery for the Products affected thereby, including charges for any work or materials rendered unnecessary by such changes, and anticipated inventory carrying costs to be incurred by MEYER as a result of such changes. In the case of any request for cancellation of all or any portion of an order by Buyer, MEYER shall be adequately compensated by Buyer for all work, materials and overhead expended in connection with the cancelled Products, which amount shall be based upon the degree of completion of the cancelled Products at the time of cancellation; provided, however, that the minimum cancellation charge, regardless of degree of completion, shall be 15% of the price of the cancelled Products.

If MEYER is delayed in or prevented from performing any of its obligations due to the acts or omissions of Buyer or its agents or contractors (including but not limited to failure to provide prompt drawing approvals and/or such other information as MEYER reasonably requires to proceed expeditiously with its obligations under the order), delivery dates and Product prices may be adjusted by MEYER to reflect then current delivery schedules and raw material costs.

If, having been notified when the Products will be ready for shipment, Buyer fails to provide adequate delivery instructions, fails to take delivery, or requests that MEYER delay the delivery of the Products, MEYER shall be entitled to complete the fabrication of the Products and to place the Products into storage at Buyer's expense. Buyer agrees to compensate MEYER in the amount of 1.5% of the Product purchase price for each 15 day period that Products remain in storage at MEYER's facility beyond the originally scheduled delivery date. MEYER further reserves the right to deliver to Buyer at Buyer's principal place of business any Products that have remained in storage at MEYER's facility for more than 60 days.

10) Limitation of Liability

THE REMEDIES OF BUYER SET FORTH IN THESE TERMS AND CONDITIONS ARE EXCLUSIVE AND ARE BUYER'S SOLE REMEDIES FOR ANY FAILURE OF MEYER TO COMPLY WITH ITS OBLIGATIONS HEREUNDER OR UNDER THE TRANSACTIONS TO WHICH THESE TERMS AND CONDITIONS APPLY. NOTWITHSTANDING ANY PROVISION IN THESE TERMS AND CONDITIONS TO THE CONTRARY, IN NO EVENT SHALL MEYER BE LIABLE TO BUYER IN CONTRACT, WARRANTY, TORT (INCLUDING STRICT LIABILITY) OR OTHERWISE FOR LOSS OF PROFITS OR REVENUE, BUSINESS INTERRUPTION, LOSS OF USE OF PRODUCTS OR ANY ASSOCIATED EQUIPMENT, COST OF CAPITAL, DOWNTIME, COST OF SUBSTITUTE EQUIPMENT, COST OF PURCHASED POWER, OR ANY OTHER INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES WHATSOEVER. THE TOTAL CUMULATIVE LIABILITY OF MEYER IN CONNECTION WITH ANY TRANSACTION GOVERNED BY THESE TERMS AND CONDITIONS, WHETHER THE CLAIMS ARE BASED IN CONTRACT, WARRANTY, TORT (INCLUDING STRICT LIABILITY) OR OTHERWISE, SHALL NOT EXCEED THE PRICE PAID BY BUYER FOR THE PRODUCT(S) UPON WHICH SUCH CLAIM OR LIABILITY IS BASED. The forgoing exclusions and limitations of damages will apply even if any warranty stated herein fails of its essential purpose.

11) Default and Termination for Cause

Each of MEYER and Buyer shall be entitled, without prejudice to any other rights they may have hereunder, to terminate and cancel any order or transaction governed by these Terms and Conditions upon notice in writing to the other party, if the other party is in default of any of its obligations under the transaction and has failed to remedy or cure such default within 30 days following the date it receives notification in writing of the existence of the default.

Further, MEYER may terminate or cancel any transaction governed by these Terms and Conditions immediately upon notice to Buyer if Buyer becomes insolvent, ceases to pay its debts as they come due, makes a general assignment for the benefit of creditors, suffers or permits the appointment of a receiver for its business or assets, or avails itself of or becomes subject to any proceeding under the Federal Bankruptcy Act or any other applicable law relating to insolvency or the protection of rights of creditors. In the event that MEYER terminates an order or transaction as provided in this paragraph 11, MEYER shall be entitled to recover from Buyer or Buyer's representative the amounts that MEYER would be entitled to collect from Buyer upon a cancellation by Buyer under paragraph 9 above.

12) Backcharges and Setoffs

Buyer shall not withhold any backcharges, setoffs, deductions or credits against amounts otherwise due MEYER unless such charges are authorized by MEYER in writing in advance.

13) Use of Intellectual Property

The ownership of all copyrights and other intellectual property rights in all designs, drawings, technical reports and technical calculations developed or provided by MEYER will remain with MEYER. MEYER grants to Buyer a royalty-free, non-exclusive license to use and reproduce any designs, drawings, technical reports and technical calculations developed by MEYER in connection with the Products. This license is limited to the right to use and reproduce such designs, drawings, reports and calculations for Buyer's or Buyer's contractors' own use in the erection, installation, operation and maintenance of the specific Product for which the applicable design, drawing, report or calculation was developed.

14) Insurance

MEYER agrees to maintain the following insurance:

- (i) Commercial General Liability with policy limits of \$5 million per occurrence.
- (ii) Workers' Compensation in accordance with statutory requirements of the state where Meyer's manufacturing facility is located and Employers' Liability with policy limits of \$1 million.
- (iii) Automobile Liability Insurance with policy limits of \$5 million per occurrence covering owned, non-owned and hired vehicles.

A certificate of insurance evidencing the above coverage will be furnished upon request.

15) Miscellaneous

All typographical or clerical errors made by MEYER in any quotation, acknowledgment or publication are subject to correction. The validity, construction and interpretation of these Terms and Conditions, all orders and transactions to which these Terms and Conditions apply, the sale of the goods or materials by MEYER to Buyer, the rights and duties of the parties with respect to such sale, the relationship between MEYER and Buyer, and any disputes arising out of the foregoing shall be governed by and construed under the laws of the State of Tennessee, U.S.A. without regard to its conflicts of law rules and without regard to the United Nations Convention on Contracts for the International Sale of Goods. Any dispute between MEYER and Buyer shall be heard exclusively in the state or federal courts located in Shelby County, Tennessee, and Buyer specifically consents to the jurisdiction and venue of such courts. MEYER AND BUYER HEREBY IRREVOCABLY WAIVE THEIR RIGHT TO TRIAL BY JURY IN ANY ACTION OR PROCEEDING RELATING TO THE PRODUCTS OR THE TRANSACTIONS GOVERNED BY THESE TERMS AND CONDITIONS.

These terms and conditions supersede all other communications, negotiations and prior oral or written statements regarding the subject matter of these terms and conditions. No conditions, usage of trade, course of dealing or performance, understanding or agreement purporting to modify, vary, explain, or supplement these terms and conditions shall be binding unless hereafter made in writing and signed by the party to be bound. Any failure or delay on the part of either MEYER or Buyer to exercise any right, power, privilege or remedy herein shall not constitute a waiver thereof. If any provision or portion of these terms shall be adjudged invalid or unenforceable for any reason by a court of competent jurisdiction or by operation of any applicable law, that invalidity or unenforceability shall not affect the other provisions of these terms, all of which shall remain in full force and effect. Buyer shall not assign its rights or delegate its duties hereunder or any interest herein without the prior written consent of MEYER, and any such assignment, without such consent, shall be void.

MEYER

UTILITY STRUCTURES

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800.501.0962
ISO 9001:2015
meyerutilitystructures.com



Okoguard® Aerial Jumper Cable

15kV - 90°C Rating



- A Coated, Stranded Copper Conductor
- B Strand Screen
- C Insulation/Jacket-Okoguard

Insulation/Jacket

Okoguard is Okonite's registered trade name for its exclusive ethylene-propylene base, thermosetting compound, whose optimum balance of electrical and physical properties is unequaled in other solid dielectrics.

This durable Okoguard insulation serves as a jacket as well. It is permanently embossed with a legend and has a natural, highly visible, red color.

Applications

Okoguard Portable Jumper cables are designed as flexible power leads for use with tap-off or jumper clamps which permit temporary connections or "by-pass" of energized aerial lines operating at voltages up to and including 15000V (phase to phase).

Specifications

Power Conductors: Extra-flexible rope tin coated copper per ASTM B-33, flexible rope stranded.

Conductor Screen: A taped conductive screen, whose purpose is to improve service life, dielectric strength and eliminate internal corona, meets and exceeds ICEA Standard S-96-639.

Insulation: Okoguard meets and exceeds ICEA Standard S-93-639.

Product Features

- Extra-flexible conductors for ease of handling under adverse conditions.
- Conductor screen for improved voltage stress control.
- Heat, moisture and ozone resistant 90°C Okoguard Insulation/Jacket.
- Okoguard is red for visual attention and it has good color stability even when exposed to strong sunlight.
- Excellent low temperature properties.

Okoguard Aerial Jumper Cable

15kV - 90°C Rating

Product Data

Section 6: Sheet 4

Catalog Number	Conductor Size AWG	Min. No. Strands	Nominal Cdr. Diameter - Inches	Approx. O.D. - Inches	Approx. O.D. - mm	Approx. Net Weight (lbs./1000')	Approx. Ship Weight (lbs./1000')	Amps Per Cdr.
15kV - Okoguard Insulation: #2 AWG Through #4/0 AWG, 210 mils								
▲ 303-21-1934	2	259	0.319	0.780	19.8	425	480	192
▲ 303-21-1938	1/0	259	0.408	0.863	22.0	583	638	258
▲ 303-21-1940	2/0	259	0.450	0.910	23.3	687	752	298
▲ 303-21-1944	4/0	437	0.592	1.052	27.2	997	1092	400

▲ **Authorized Stock Item.** Available from our Customer Service Centers

Minimum Order Quantity is 150 ft.

Standard Package —1000' N.R. Reel. Standard package will be furnished where orders do not specify otherwise.

Ampacities

Ampacity based on 90°C conductor temperature, 40°C ambient temperature.
For ampacity correction factors covering various ambient temperatures:

Ambient Temperature Degrees		Correction Factor
C	F	
10	50	1.26
20	68	1.18
30	86	1.10
40	104	1.00
50	122	0.90



Shakespeare

A valmont COMPANY

FIRE-RESISTANT COMPOSITE PRODUCTS

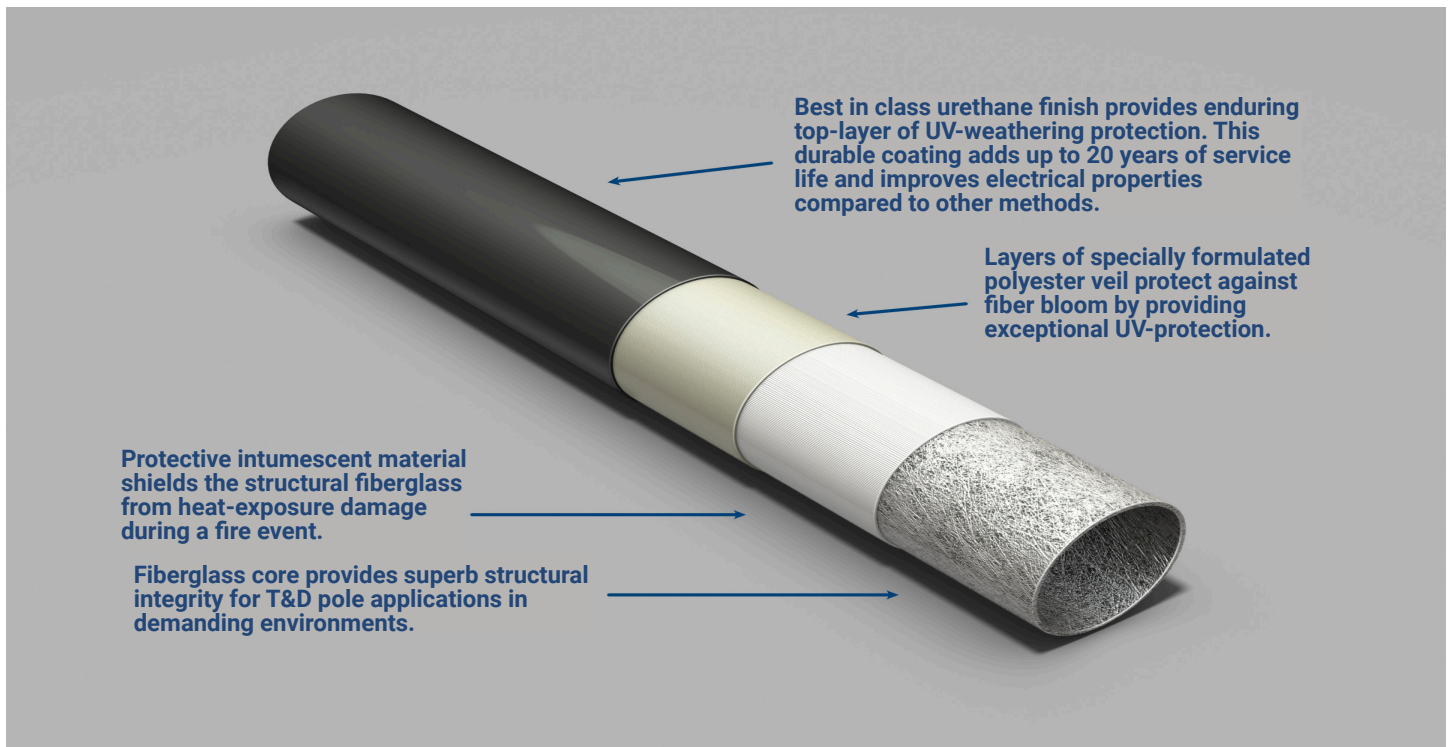
NEW FIREBREAK™ INTUMESCENT VEIL

Shakespeare T&D utility poles, crossarms, and SafeFence™ substation perimeter barrier systems may now be specified with a specially engineered internal FireBreak™ intumescent veil.

The patent-pending FireBreak veil serves as an integrated thermal barrier to fortify the structural integrity of these Shakespeare composite products and is designed for installations in areas prone to wildfires.

FIREBREAK VEIL HIGHLIGHTS

- Shakespeare composite T&D poles, crossarms, and fencing crafted with an integrated FireBreak veil provide a beneficial safeguard for maintaining a robust grid during fire season.
- The internal FireBreak veil remains dormant and is protected from UV rays, wind, rain, and freeze-thaw cycles until the intumescent material is activated by the extreme heat of a wildfire.
- In an active fire, the internal thermal veil swells and increases in volume, providing a thermal barrier that protects the composite product's structural integrity by producing an exterior char, which is nonflammable and a poor conductor of heat.
- Internal intumescent veil is oriented between an external UV-protective polyester veil and the first layer of continuous structural fiberglass strand mat (see technical illustrations).
- On Shakespeare utility poles the intumescent veil protects the entire pole length above grade and two-feet below grade.
- Available on one-piece Shakespeare utility poles ranging from 35-feet to 65-feet in length (Class 4 to H6) and on two-piece poles from 65-feet to 105-feet in length (Class 1 to H6).





In fire-testing at the Southwest Research Institute, the entire length of Shakespeare poles were protected and little-to-no charring was observed on interior structural glass. After a fire, remediation procedures are available for charred products.

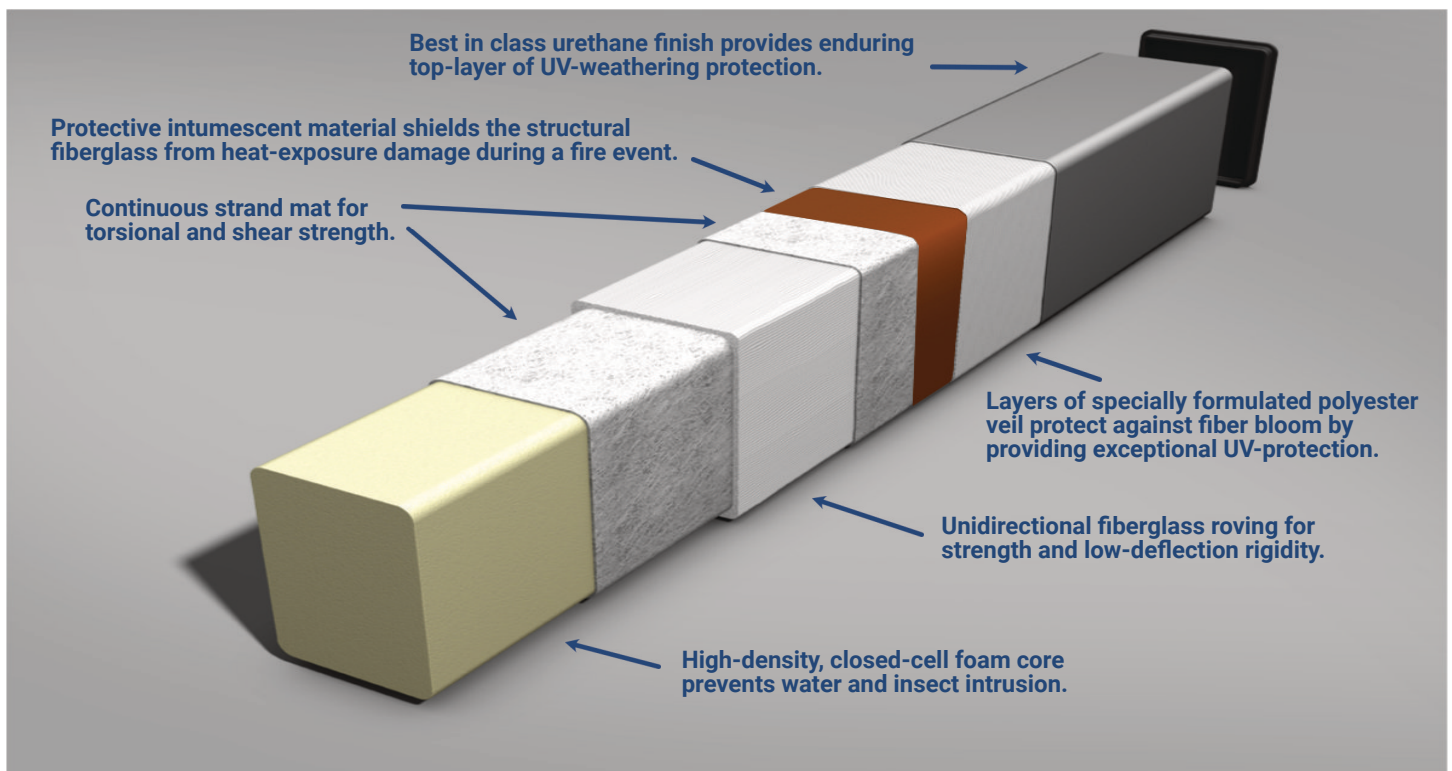
THE COMPOSITE ADVANTAGE

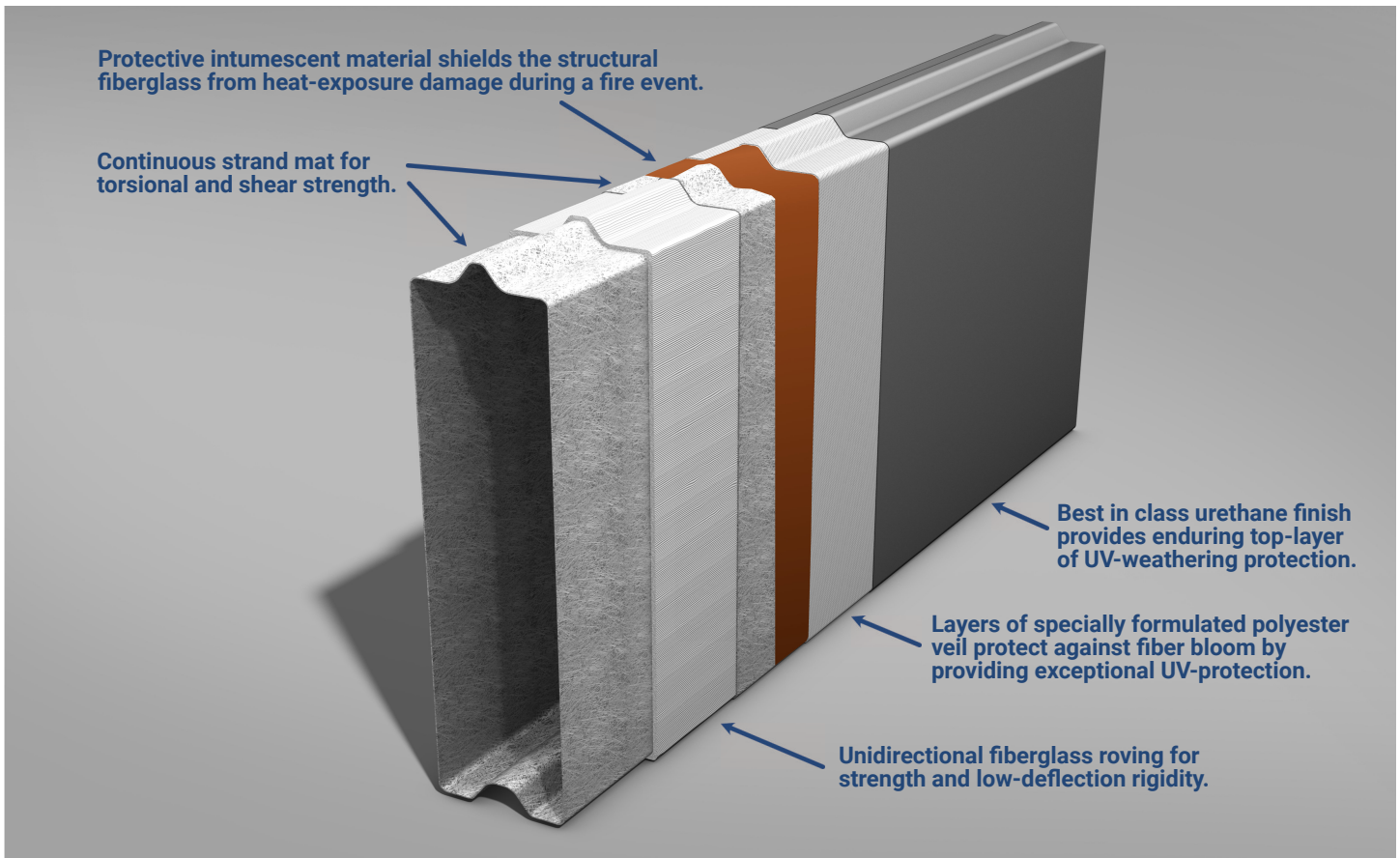
- Shakespeare composite products are a smart alternative to many other materials. Composites are rust proof, impervious to insects, and will never rot like wood.
- Composite products are lightweight and easy to install, saving time, manpower, equipment, and money during installation.
- With low conductivity levels, composite products are well suited for power transmission and distribution applications.
- Composites are built for tough environments. The products perform well in high winds and extreme cold.
- Shakespeare composites poles and crossarms provide long-lasting good looks with triple-layer UV protection.
- To enhance your grid reliability in the most demanding of environments, specify the FireBreak intumescent veil on your next Shakespeare composite pole or crossarm order.

As fire season increases in duration and drought conditions spread to a wider range of environments, ordering Shakespeare products with an integrated FireBreak™ veil is a smart investment that protects your utility assets.

Initially designed for use by utilities in the American West, the Shakespeare FireBreak intumescent veil is now available to all utilities globally.

The internal FireBreak intumescent veil is only available upon request and must be specified at the time of quotation and product ordering.





For superb fire protection, the integrated FireBreak™ intumescent veil is now available within the Shakespeare SafeFence™ substation perimeter barrier.

SafeFence non-conductive perimeter barrier fencing provides safety and security around substations, transformer yards, and other utility properties with installed power-delivery assets. The fiberglass wall deters would-be vandals, excludes wildlife, and hides unsightly equipment from growing neighborhoods.

SafeFence is extremely durable and with ballistic-grade composite panels can be ordered upon request to protect your most essential utility assets.

SAFEFENCE PRODUCT BENEFITS

- Now available with internal FireBreak intumescent veil.
- Safe, non-conductive fiberglass posts and planks.
- Attractive, available in a range of UV-resistant colors.
- Simple, fast, inexpensive installation with little or no heavy lifting equipment.
- Can be modified and cut in the field.
- Spans up to 18 feet, heights up to 24 feet.
- Low maintenance product with supports and panels that will not rust.
- Effective noise barrier capabilities available upon request.



Shakespeare composite T&D poles, crossarms, and SafeFence™ substation perimeter fencing systems are now available with an integrated FireBreak™ intumescent veil. The FireBreak™ veil is an internal thermal barrier that fortifies the structural integrity of these Shakespeare products and is specially designed for use in areas prone to wildfires.



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SIEMENS

Ingenuity for life

Compact Modular Recloser (CMR)

usa.siemens.com/cmrrrecloser

Intelligent. Compact. Self-powered by voltage. A new class of single-phase recloser.

By eliminating regular maintenance and utilizing line voltage for the power supply, the new modular auto-recloser addresses common problems of hydraulic reclosers. The CMR is rated for voltage systems up to 38 kV and features an insulated housing that covers all live parts. The lightweight device permits easy installation and fast commissioning, plus the ability for wireless firmware and configuration updates.

Key features

Fully integrated self-powered system:

- Power supply using line voltage
- Rechargeable battery for backup power
- Magnetic-actuated vacuum interrupter
- Integrated protection relay and controller
- Flexible mounting options.

Intelligent:

- Wireless connectivity
- GPS time reference
- SCADA capability (future)
- Voltage and current measurement
- Fault-passage indication (FPI)
- Comprehensive event log
- Full range of TCC curves.

Compact:

- Lightweight 48.5 lbs (22 kg) excluding mounting bracket
- Simple and quick to install.

Reliable and reduced maintenance

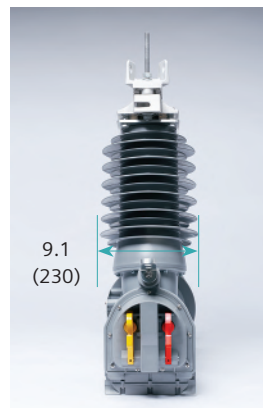
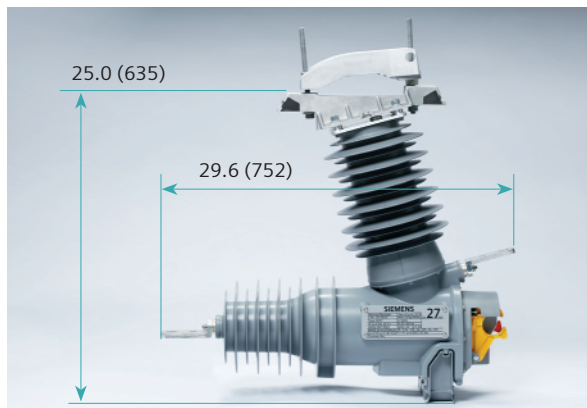
The CMR is suitable for all sites where the system voltage is less than 38 kV and the prospective short-circuit level is less than 12.5 kA (6.3 kA at 38 kV), even those with inconsistent or no line current. Featuring fully configurable protection and four operations in a sequence, the CMR presents the ideal solution for clearing transient faults on long rural distribution lines.

The system design facilitates uninterrupted operation for reliable service. Unlike hydraulic reclosers, the CMR has no need for periodic inspection and maintenance.

CMR compact modular recloser ratings

Type tested according to IEC 62271-111 / IEEE C37.60

Rating description	Model ¹				
Rated maximum voltage	kV	17.5	27	27	38
Rated power-frequency withstand – dry	kV	50	60	60	70
Rated impulse-withstand voltage	kV	110	125	150	170
Switch unit parameters	Rating				
Rated frequency	Hz				50/60
Rated continuous current	A				630
Rated short-time withstand current	kA	12.5	12.5	12.5	6.3
Rated peak-withstand current	kA	32.5	32.5	32.5	16.4
Rated duration of short circuit	s				3
Rated symmetrical interrupting current	kA	12.5	12.5	12.5	6.3
Rated symmetrical fault-making current	kA	12.5	12.5	12.5	6.3
Rated operating sequence					O – 0.3s – CO – 2s – CO – 2s – CO
Clearing time	ms				<50 ms
Rated line-charging interrupting current	A				5
Rated cable-charging interrupting current	A	25	25	25	40
Minimum number of operations at rated short-circuit current					240
Minimum number of load-break operations at rated current/mechanical operations					10,000
IP rating					67
Service environment	Rating				
Operating temperature range					-40 to +131 °F (-40 to +55 °C)
Humidity					0 to 100%
Maximum altitude					13,124 ft (4,000 m) ²
Pollution class					Very heavy



Footnotes:

1. "Correct model must be selected for the applicable system voltage (27 kV model cannot be used on a 12 kV network).
2. "Derating required above 13,124 ft (4,000 m).

ISO 9001
AS/NZS 4801
OHSAS 18001
ISO 14001
BUREAU VERITAS
Certification



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please contact our Customer Support Center.
Phone: +1 (800) 333-7421

usa.siemens.com/cmrecloser

Order no.: EMMS-B40116-04-4AUS

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Product comparison

Medium-voltage CMR compact modular recloser
and Fusesaver™ overhead circuit breaker

This document is intended to compare the [CMR compact modular recloser](#) to the [Fusesaver overhead circuit breaker](#) to help a reader identify the right product for their application.

CMR compact modular recloser

Applications:

- Single-phase, oil-filled recloser replacement.



Problems solved:

- Reduces routine maintenance OPEX.
- Reduces risk of injury to the public and operators, and damage to the environment from burning oil should it fail catastrophically.

Fusesaver circuit breaker

Applications:

- Helps save fuses from transient faults and mitigates wildfire risk.



Problems solved:

- Reduces OPEX spend on rolling trucks to replace unnecessarily blown fuses. This saved OPEX could then be used elsewhere in the system.
- Improves distribution system's reliability performance beyond the improvement already provided by traditional reclosers.
- Provides a better understanding of what is happening on the system beyond the feeder recloser.
- Reduces insurance premiums by reducing the risk of assets igniting a fire where the distribution system runs through a wildfire risk zone.

Needs fulfilled

CMR

- Eliminates hydraulic (oil-filled) single-phase reclosers from the network.



Fusesaver

- Improves reliability in remote or lightly loaded areas of the network, such as spur lines and laterals.
- Gives a better situational awareness of the remote parts of the distribution system.
- Reduces the wildfire risk from fault-protection devices on the distribution system.

Value proposition

CMR



OPEX reduction:

CMR is a drop-in replacement for single-phase oil-filled reclosers to reduce oil in the distribution system. By offering a vacuum interrupting, lightweight, fully insulated, reduced-maintenance alternative that matches the protection speeds of hydraulic reclosers, CMR minimizes the operator learning curve. Equipped with operating levers that match those on oil-filled reclosers, CMR is intuitive to use.



Fusesaver

OPEX reduction:

As the world's fastest circuit breaker, Fusesaver pays itself back in four operations by reducing unnecessary truck rolls. Clearing faults in less than one cycle, Fusesaver clears transient faults before the fuse blows unnecessarily. Its light weight and short installation time (less than 30 minutes) makes it ideal for quick deployment and rapid ROI.



Improve distribution system reliability:

Fusesaver improves distribution system reliability by clearing transient faults before they blow a fuse unnecessarily. Fusesaver is a self-powered, lightweight, ultra-fast circuit breaker (the world's fastest) that can work in single-phase or multi-phase configurations.



Wildfire risk mitigation:

As a CAL FIRE exempt device, Fusesaver is a vacuum interrupting, ultra-fast circuit breaker that extinguishes an arc in less than one cycle. Fusesaver breaks the arc before the arc has enough energy to ignite surrounding fuel (in less than 20 ms). Optional remote control allows Fusesaver to be tripped remotely to shut off power on high-risk days. While it is a short-sequence reclosing device to further minimize wildfire ignition risk, reclose can be turned off remotely if desired.



Advantages, applications, and technical data

CMR

Fusesaver

Key advantages:

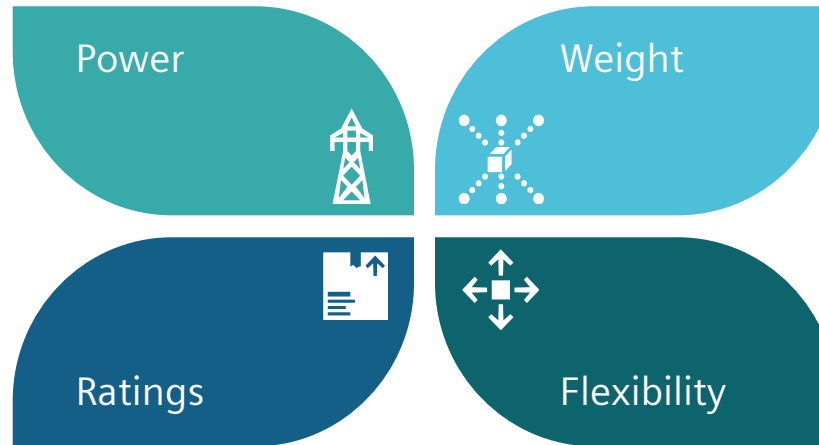
- Ratings: 12.5 kA, 630 A, insulated housing
- Hydraulics: <6 kA, <280 A
- Light weight, wireless peer-to-peer communications for multi-phase operation, remotely resettable.

Item	Compact modular recloser (CMR)	Fusesaver overhead circuit breaker
Applications	<ul style="list-style-type: none"> • High-volume replacement • Up to 12.5 kA 	<ul style="list-style-type: none"> • Improve rural reliability • Reduce unnecessary outages in remote areas • Minimize wildfire ignition risk
Function	Recloser	Reclosing circuit breaker
Interrupting medium	Vacuum	Vacuum
Rated operating sequence	O-0.3 s-CO-2 s-CO-2 s-CO	O-1 s-C with partner fuse; O-2s-CO without partner fuse
Manual control	Hookstick; computer	Hookstick (Communications Module required); computer
Grounding required	Yes	No
Design	Insulated housing	Live housing
I_{cc}	630 A	100 A/200 A depending upon model
I_{sc}	6.3 kA/12.5 kA depending on model	4 kA/6.3 kA depending on model
U_n	Up to 38 kV	Up to 27 kV
Lightning impulse withstand (BIL)	110 kV/125 kV/150 kV/170 kV	110 kV/125 kV
Weight in lbs	44	12
Mounting	Pole/crossarm	Conductor/pole/crossarm
Number of operations at I_{cc}	10,000	2,000
Number of operations at 100% I_{sc}	70/240 depending on model	70/30 depending on model
Voltage sensing – line	Yes	No
Voltage sensing – load	No	No
Actuator	Magnetic	Magnetic
Power source	Line voltage	Line current (0.35/0.5/1 A minimum) depending on model
Battery backup	Rechargeable	Primary cell or rechargeable
GPS time-sync - standard	Yes	No
GPS location – standard	Yes	No
Non-reclosing (NR) lever	Yes	Yes, external lever is configured for NR function
Color	Red	Brushed metallic
Manual trip/close lever	Yellow	Trip and close in Communications Module
Mechanical trip	Yes	No
Base protection curves	Recloser curves	Fuse curves

Features and benefits

	CMR	Fusesaver
Feature	Voltage powered	Powered by as little as 350 mA
Benefit	No load current required	Low cost, but high availability

	CMR	Fusesaver
Feature	630 A/12.5 kA	200 A/6.3 kA
Benefit	Reduced inventory	Reduces roll-outs to the remotest, most lightly loaded parts of the network



	CMR	Fusesaver	
Feature	Only 44 lbs	Only 12 lbs	Feature
Benefit	Single bucket installation	Single bucket installation	Benefit

	CMR	Fusesaver	
Feature	Behaves like a hydraulic recloser	Configurable behavior	Feature
Benefit	Familiar functionality so minimal operator learning curve	Can be adapted to the system conditions in remote network locations	Benefit

Where found



CMR	Fusesaver
<ul style="list-style-type: none"> Anywhere on rural overhead distribution outside the substation: feeders, spurs, laterals. 	<ul style="list-style-type: none"> On overhead distribution at the start of spur/laterals/taps some distance from the substation. At the top of a riser or a dip (transition from underground cable to overhead line).

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www.usa.siemens.com/mediumvoltage

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SIEMENS

Ingenuity for life



Minimising the risk of bushfires with Fusesaver[®]

The world's fastest MV outdoor vacuum circuit breaker

High-risk bushfire days are primarily determined by the temperature, humidity, prevailing wind conditions and the amount of dry fuel on the ground. With just a spark from an electrical arc a bushfire can be ignited, affecting landscapes and lives for years. On extreme risk bushfire days, it is critical to eliminate any probability of faults on the electrical network igniting a fire.

www.siemens.com/fusesaver

Fact

Between 1967 and 2013, major Australian bushfires have resulted in over 8,000 injuries and 433 fatalities with a cost of approximately A\$4.7 billion².

Findings of a study¹ show that overhead distribution network operators can significantly reduce the risk of bushfires by implementing these actions:

1. Eliminate protective devices that expel molten material during operation

Traditional fuses should be removed from high risk bushfire zones as arc by-products can start fires. Fusesaver[®] provides a cost effective alternative with fully encapsulated vacuum interrupter switching fully eliminating this risk.

A Remote Control Unit (RCU) allows for easy SCADA integration and gives the ability to change protection settings and to disable reclosing without the need to be on-site.

2. Utilise ultra-fast fault clearing circuit breakers to reduce electrical arc hazards

Arc duration is a significant variable in the probability of an electrical fault causing ignition of a fire. With clearing times in the range of 30–50ms traditional reclosers are too slow to prevent an arc causing fire ignition. The Fusesaver[®] is unique in having a clearing time in as little as 10ms (or one half-cycle) and with this speed the probability approaches zero.

4. Synchronise operation to ensure compatibility with resonant earthing schemes

Single phase protective devices, such as fuses, can cause instabilities on networks using resonant earthing schemes. Fusesaver[®] provides a synchronised three-phase switching operation for both protection and manual switching activities.

Save Money and reduce risk

With a lower capital cost than traditional reclosers, compact design, fast installation time and an unrivalled fault clearing time, the Fusesaver[®] represents a quantum leap in reclosing technology. Whilst minimising the risk of bushfires it supports utilities to:

- Keep down insurance premiums
- Avoid litigations
- Protect the distribution network
- Increase network reliability.

3. Provide remote access to disable reclosing on high fire risk days

To enable remote monitoring and operating capabilities, the Fusesaver[®] can be conveniently accessed from the control room.

Key benefits



Minimising the risk of bushfires



Increased network reliability



Improved operator safety



Future proof asset



Fast ROI

To find out more, contact us via fusesaver.au@siemens.com

¹ Conducted for Energy Safe Victoria by HRL Technology Pty Ltd, "Probability of Bushfire Ignition from Electric Arc Faults" D. Coldham, A. Czerwinski and T Marxsen.

² 2013 Australian dollars, including deaths and injuries but excluding most indirect losses, Source: Ladds M, Keating A, Handmer J and Magee L (2017), "How much do disasters cost? A comparison of disaster cost estimates in Australia".

Transformer Riser Wire

Copper Transformer Riser Wire. Black Polyethylene Covered.
Solid or Stranded Soft Drawn Copper Conductor.



APPLICATIONS

Used on transformers as connection between line conductor and transformer primary bushing in applications where protection from momentary contact from wildlife is needed. Although not treated as an insulation, the covering on transformer riser wire does provide an increased level of protection from momentary grounded contacts caused by wildlife, excessive wind and tree limbs or other grounded objects in the proximity of the high voltage lead. May be used on distribution system voltages up to 35kV line-to-line.

SPECIFICATIONS

Southwire's transformer riser wire meets or exceeds the following ASTM specifications:

- B 3 Soft or Annealed Copper Wire
- B 8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

Southwire's transformer riser wire also meets all applicable requirements of ANSI/ICEA S-70-547.

CONSTRUCTION

Conductors are solid or stranded soft drawn copper. Stranded conductors are concentrically stranded, compressed. The covering is high molecular weight polyethylene, black. Standard conductor sizes are AWG 8, AWG 6 and AWG 4, however larger sizes are available upon request. Available in hand coils, spools or reels.

Size (AWG)	Stranding	Covering Thickness (mils)	Diameter (mils)		Weight per 1000 ft. (lbs)
			Bare	Covered	
8	Solid	110	128.5	348.5	83
6	Solid	110	162.0	382.0	117
4	Solid	110	204.3	424.3	170
8	7	110	142.0	362.0	87
6	7	110	178.0	398.0	123
4	7	110	225.0	445.0	178
2	7	110	283.0	503.0	263

3-Layer 15kV ACSR Tree Wire

An Alternative and Robust Design to Bare ACSR Conductors to Harden the Electrical Grids.

3-Layer 15kV ACSR Tree Wire Concentrically Stranded ACSR Track-Resistant Crosslinked Polyethylene (HDTRXLPE).

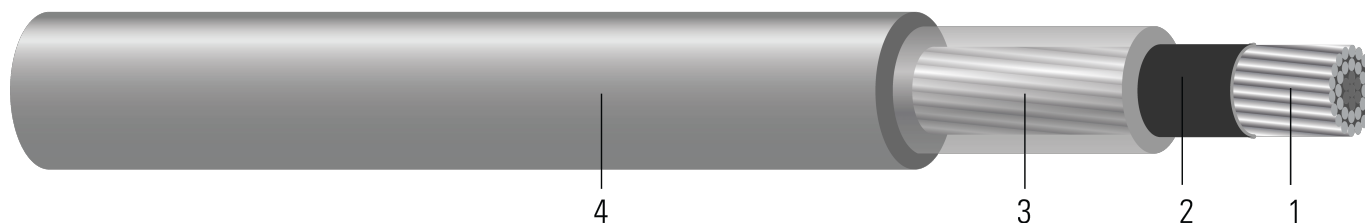


Image not to scale. See Table 1 for dimensions.

CONSTRUCTION:

1. **Conductor:** Concentrically stranded ACSR
2. **Strand Shield:** Semi-conducting cross linked polymer
3. **Inner Layer:** Low-Density Track-Resistant Crosslinked Polyethylene (HDTRXLPE)
4. **Outer Layer:** High-Density Track-Resistant Crosslinked Polyethylene (HDTRXLPE)

APPLICATIONS AND FEATURES:

Used for primary and secondary overhead distribution where limited space is available or desired for rights-of-way. Installed the same as bare conductors, however, covering is effective in preventing direct shorts and instantaneous flashovers should tree limbs or other objects contact conductors in such close proximity.

- Tree Wire - Used for spans where trees crowd the right-of-way, such as in wooded residential areas, when a minimum of interference with the environment is desired. Covering minimizes power outages due to conductor contact with tree limbs, reducing the need for frequent or severe trimming.
- Covered Aerial MV Cable - Installed with other Covered Aerial MV cables and a supporting messenger through a series of space- maintaining devices (spacers). The resulting close-proximity configuration minimizes the amount of space and hardware required for line installation, particularly useful in congested areas.
- Covering Rated 90°C Normal and 130°C Emergency Operation. Unless adequate knowledge of the thermal characteristics of the environment is known, the permissible conductor temperature should be reduced by 10°C or in accordance with available data.

SPECIFICATIONS:

- ASTM B230 Aluminum, 1350-H19 Wire for Electrical Purposes
- ASTM B232 Concentric-Lay-Stranded, Aluminum Conductors, Coated Steel Reinforced (ACSR)
- ASTM B498 Zinc-Coated (Galvanized) Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR)
- ASTM B500 Metallic Coated Stranded Steel Core for use in overhead Electrical Conductors
- ICEA S-121-733 Tree Wire and Messenger Supported Spacer Cable



Table 1 – Weights and Measurements

Cond. Size	Cond. Strands	Diameter Over Conductor	Conductor Shield Thickness	Inner Layer Thickness	Outer Layer Thickness	Approx. OD	Approx. Weight	Rated Strength
AWG/ Kcmil	#	inch	mil	mil	mil	inch	lb/1000ft	lb
4	6/1	0.250	15	75	75	0.555	125	1767
2	6/1	0.316	15	75	75	0.646	202	2708
1/0	6/1	0.398	15	75	75	0.728	278	4161
2/0	6/1	0.447	15	75	75	0.777	330	5045
3/0	6/1	0.502	15	75	75	0.832	393	6289
4/0	6/1	0.563	15	75	75	0.893	471	7933
266.8	18/1	0.609	15	75	75	0.939	474	6536
266.8	26/7	0.642	15	75	75	0.972	553	10735
336.4	18/1	0.684	15	75	75	1.014	570	8246
336.4	26/7	0.720	15	75	75	1.050	669	13395
336.4	30/7	0.741	15	75	75	1.071	935	16435
397.5	18/1	0.743	15	75	75	1.073	653	9443
397.5	24/7	0.772	15	75	75	1.102	707	13870
397.5	26/7	0.783	15	75	75	1.113	770	15485
477	24/7	0.846	15	75	75	1.176	824	16340
477	26/7	0.858	15	75	75	1.188	899	18525
477	30/7	0.877	15	75	75	1.213	1037	22610
556.5	18/1	0.879	20	75	75	1.219	874	13015
556.5	24/7	0.914	20	75	75	1.254	949	18810
556.5	26/7	0.927	20	75	75	1.267	1274	21470
636	18/1	0.940	20	75	75	1.280	1200	14915
636	26/7	0.990	20	75	75	1.330	1373	23940

All dimensions are nominal and subject to normal manufacturing tolerances



Fuse-Safe™



Lightweight, Portable Protection.

The Fuse-Safe™ is a portable current-limiting fuse and fault protection tool. It offers better protection than temporary cutouts, and is easier to install. The Fuse-Safe™ can also add fault protection to our BREAK-SAFE® Load Break & Pick-up Tools.

The Fuse-Safe™ uses full-range current-limiting fuses from Thomas & Betts. Their fuses offer superior protection without out-gassing or expelling hot molten byproducts associated with traditional cutout fuses.



Faults can generate damaging effects to both equipment and personnel. Using our temporary Fuse-Safe™ adds protection to any hot line work area.

The Fuse-Safe™ consists of an upper duckbill attachment and a lower conductor bar (available in 5/8" or 3/8" diameter). Both ends easily attach to any current limiting fuse using a 1/8" Allen wrench (provided).



Duckbill Clamp

- **Add protection when servicing a fault**
- **Add protection to our BREAK-SAFE® Tool**
- **Lower risk of fire & loud noises**
- **Lighter, quieter, safer than temporary cutouts**

Available as a single unit with or without a fuse or as a complete 3-phase kit. Visit our website for a complete list of options.

HOW TO ORDER

ITEM NUMBER	DESCRIPTION
USFS-001	FUSE-SAFE™ 5/8" CONDUCTOR BAR WITHOUT CURRENT LIMITING FUSE
USFS-002	FUSE-SAFE™ 5/8" CONDUCTOR BAR WITH FUSE INCLUDED
USFS-003	FUSE-SAFE™ 3/8" CONDUCTOR BAR WITHOUT CURRENT LIMITING FUSE
USFS-004	FUSE-SAFE™ 3/8" CONDUCTOR BAR WITH FUSE INCLUDED