

Wildlife Exclusion Fence or Directional Control Barrier for Special-Status Small Vertebrates (E-Fence™)

- **Construction Site Wildlife Exclusion Fence**
- **Directional Control in Fragmented Habitat**
- **Perimeter Control for Surveys**

GUIDE SPECIFICATION

PRODUCT:

E-Fence™ (US Patent #8402630, other applications pending)

MANUFACTURER:

ERTEC®
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1.0 Description:

E-Fence™ is a Wildlife Exclusion Fence or Directional Control Barrier for special-status small vertebrates and shall conform to the details shown on the plans and these special provisions. It shall be installed around the perimeter of construction sites and/or survey areas, or as per biologist layout plans to control movement in fragmented habitat as a directional barrier. The primary function of E-Fence is to exclude special-status small vertebrates from construction sites where they can be killed, injured or isolated or provide directional control within fragmented habitat.

2.0 Material:

Provide E-Fence as shown on the plans.

- A. **Product and Installation Sheets.** A copy of the manufacturer's product data sheet together with instructions for installation of specified options shall be furnished to the Engineer 5 days before installation.
- B. **Barrier Configuration.** Furnish E-Fence with a configuration based on the species or combination of species to be controlled as per Table B. Furnish barrier in minimal 100 to 150 foot segments (10" width at 150 feet, 20" width at 150 feet, 24" at 150 feet, 30" width at 150 feet, 40" width at 100 feet, 48" width at 100 feet or 60" width or greater at 100 feet to minimize segment overlaps.
- C. **Barrier Materials & Structure.** Furnish E-Fence manufactured from non-biodegradable materials which are UV and dimensionally stable for a minimum of 5 years. The system shall:
 - a. comprise a monolithic rigid polymer matrix
 - b. be thermally extruded into an apertured sheet with rigid and thermally bonded strands
 - c. be made from virgin or recycled HDPE (high density polyethylene) feedstock which has a readily available recycle stream
 - d. have greater than 50% open Area (POA) to prevent damage from wind and stormwater runoff

- e. be durable, so that it can be reused on several projects
- f. be recyclable at the end of life – zero waste.
- g. conform to the requirements in Table A below

D. Options and Accessories

- a. **No-Trench Ground Seal Options:** No-Trench Ground Seal options are available for soil and or hard surfaces. Submit copy of the manufacturer's installation guidelines for the type of No-Trench Ground Seal option found on plans.
 - i. **Clam-shell style or**
 - ii. **Apron style**
- b. **Sediment Control Panel:** The E-Fence Sediment Control Panel is available in 100' rolls, mates to E-Fence during installation, is installed in the same trench and can eliminate the requirement for a separate silt fence and or wattles (fiber rolls). While Wildlife Exclusion Fence is often installed around the perimeter of the job site, sediment control is required only on the down-stream areas of the project (typically less than half the footage required for exclusion fence). Submit copy of the manufacturer's installation guidelines.
- c. **Climber Barrier Options:**
 - i. 5" Climber Barrier Lip (reptiles/amphibians)
 - ii. 8" Climber Barrier Lip (small mammals)
 - iii. HDPE smooth belly band (small mammals)
- d. **Temporary Gates:**
 - i. Consider entrance opening. For large equipment 16' openings (double 8' swing gates) are required. Personnel gates are 4 or 6' single swing gate. Submit copy of Manufacturer's installation guidelines.
- e. **Exclusionary Gate Panels:**
 - i. Exclusionary Gate panels fit to Temporary Gates and provide seal around the entrance with a ground sweep while at the same time allow opening and closing of the gates. Submit copy of Manufacturer's installation guidelines.

E. **Posts.** Installations requiring metal T-Posts shall use reusable metal T-Posts (0.95 lbs/ft minimum). Posts should be spaced as indicated on installation guidelines (see installation instructions for specific configuration and species). Spacing of posts is dependent on length of time the fence will be installed, the height of the fence and exposure to wind. In general, install posts on 5 foot centers (max) in areas of very high wind or for long-term or permanent installations and on 8 foot centers (max) for majority of installations. Install posts on 10 foot centers (max) when fence height is 40 inches or less. It is permissible to use wooden stakes (1"x2"x36") for E-Fence™ width (height) of 30" or less, on 10 foot centers (max) for projects lasting 2 years or less.

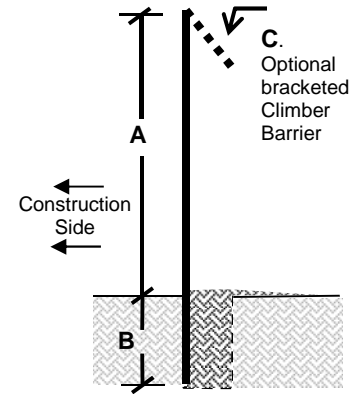
Table A: Barrier Type: E- Fence material property requirements

Specification	Design Focus	Material Requirements HDPE or Recycled HDPE
Barrier Height	Specific Animal	See Configuration Table B column 2
Roll Length (for widths 20", 24", 30", 40", 48", 60") (LF)	Minimize joints	150, 150, 100, 100, 100
Strand Deformation – 0.375" sphere pull-through at 68°F (lbs) (minimum)	Intrusion resistance, entrapment resistance	38
Distance between strands (in) (maximum)	Intrusion resistance, entrapment resistance	0.185
Strand thickness (in) (maximum)	Intrusion resistance, entrapment resistance	0.10
Distance between strand centers (in) (maximum)	Intrusion resistance, entrapment resistance	0.25
Mass per Unit Weight range (lbs/ft ²)	Installation ease	0.16 to 0.19
Tensile Strength – machine direction ASTM D4595 (lbs) (minimum)	Dimensional Stability	400
Tensile Strength – transverse direction ASTM D4595 (lbs) (minimum)	Dimensional Stability	325
Aperture Size – Cylinder PASS (dimensional range within which a cylinder will pass thru) (in)	Allow wind & water passage	0.141 - 0.156
Aperture Size – Cylinder NO PASS (smallest dimension that will not pass) (in)	Confine juvenile vertebrates	0.212
Ultraviolet stability - percent tensile strength retained ASTM D 4355	Long term property retention	96%
Thickness ASTM 5199 minimum (in)	Deformation and intrusion resistance	0.115
Life in application minimum (yrs) Black / Orange	Durability, Reusability	10 / 4
Friction Coefficient (published base polymer data)	Climbing resistance, Resist accumulation of organic materials	<0.3
Shore Hardness (base polymer data) at 68°F	Burrowing resistance	95
CBR Puncture strength ASTM D 6241 nominal (lbs)	Burrowing resistance, Intrusion resistance	237
Flow Rate ASTM D 4491 minimum gal/min/ft ²	Washout prevention	650
Percent Open Area (ASTM D 6767) (min)	Washout prevention	50%
Low Temperature Brittleness (published base polymer data) ASTM D 746 (°F)	Extreme cold weather durability	-106
Operating Temp (base polymer data) range (°F)	All weather durability, Property retention	-30 to 160
Separation of stand planes (distance) (in - nominal)	Climbing resistance	0.02 - 0.04
Angle of strands (°)	Climbing resistance	70 to 80

3.0 Wildlife Exclusion Fence: Configurations by species –Current Approved Best Practices

Table B: Configuration requirements (Please note: 2 or more special-status-species are often in the same habitat. The design configuration should address the species with the highest capabilities (the design determinate species). If required, please call ERTEC for design guidance (510-521-0724).

Common Name (Scientific Name)	A. Barrier Height (in)	B. Trench Depth (min) (in)	C. Climber Barrier Type/Size	D. TPost or Wood Post / Depth (min) (in)	E. One-Way Gateway / Funnel (Y/N)	Exclusion Fence Designation EF = E-Fence Digits = Sheet width (in) Letters: L = Climber Barrier, F = Funnel
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Frog Fence

Notes

California red-legged frog (<i>Rana draytonii</i>)	38	5	L5	T18	N	EF48L	EF40L is an approved configuration, but most specifiers call for 48" width
Foothill yellow-legged frog (<i>Rana boylei</i>)	30	5	L5	T18	N	EF40L	
Northern cricket frog (<i>Acris crepitans</i>)	30	5	L5	T18	N	EF40L	
Chiricahua leopard frog (<i>Rana chiricahuensis</i>)	38	5	L5	T18	N	EF48L	
Sierra Nevada yellow-legged frog (<i>Rana sierrae</i>)	30	5	L5	T18	N	EF40L	
Sierra Madre yellow-legged frog (<i>Rana muscosa</i>)	30	5	L5	T18	N	EF40L	
Northern leopard frog (<i>Rana pipiens</i>)	30	5	L5	18	N	EF40L	
Lowland leopard frog (<i>Rana yavapaiensis</i>)	30	5	L5	T18	N	EF40L	
Oregon spotted frog (<i>Rana pretiosa</i>)	30	5	L5	T18	N	EF40L	
Northern red-legged frog (<i>Rana aurora</i>)	30	5	L5	T18	N	EF40L	

Toad Fence

Notes

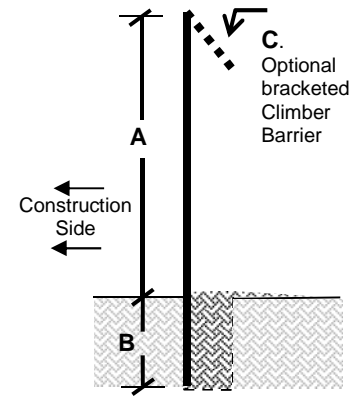
Colorado River toad (<i>Bufo alvarius</i>)	18	12	N	T24	N	EF30	Below are the lowest cost approved configurations for these Toads but designers often call for 4' width and High Visibility Construction Safety.
Arroyo toad (<i>Bufo microscaphus californicus</i>)	25	5	N	W18	N	EF30	
Boreal toad (<i>Bufo boreas boreas</i>)	18	12	N	T24	N	EF30	
Yosemite toad (<i>Bufo canorus</i>)	25	5	N	W12	N	EF30	
Coach's spadefoot toad (<i>Scaphiopus couchii</i>)	18	12	N	T24	N	EF30	
Western spadefoot toad (<i>Spea hammondi</i>)	18	12	N	T24	N	EF30	

Turtle/Terrapin/Tortoise Fence

Notes

Western pond turtle (<i>Actinemys marmorata</i>)	15	5	N	W18	N	EF20	Below are the lowest cost approved configurations for these Turtles/Terrapins but designers often call for 4' width and High Visibility Construction Safety.
Northwestern pond turtle (<i>Clemmys marmorata marmorata</i>)	15	5	N	W18	N	EF20	
Desert tortoise (<i>Gopherus agassizii</i>)	18	12	N	T30	N	EF30	UV Resistant black is best choice for DT Habitat.

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Salamander / Newt Fence

Notes

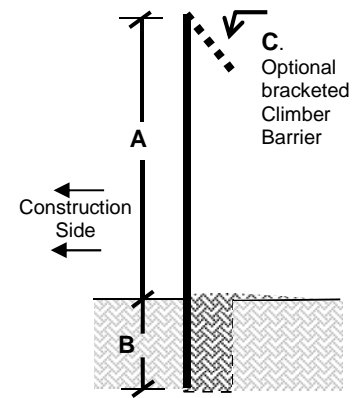
California tiger salamander (<i>Ambystoma californiense</i>)	15	5	N	W18	Y	EF20F	Below are the lowest cost approved configurations for these Salamanders but designers often call for 4' width and High Visibility Construction Safety.
Santa Cruz long-toed salamander (<i>Ambystoma macrodactylum croceum</i>)	15	5	See note	W18	Y	EF20F	Install with HDPE Climber Barrier
Barton Springs salamander (<i>Eurycea sosorum</i>)	19	5	N	W18	Y	EF24F	
Austin blind salamander (<i>Eurycea waterloensis</i>)	19	5	N	W18	Y	EF24F	
Southern torrent salamander (<i>Rhyacotriton variegates</i>)	14	6	N	W18	Y	EF20F	
California Coast range newt (<i>Taricha torosa</i>)	14	6	N	W18	Y	EF20F	
Inyo Mountain slender salamander (<i>Batrachoseps campi</i>)	14	6	N	W18	Y	EF20F	
Yellow-blotched salamander (<i>Ensatina eschscholtzii croceater</i>)	14	6	N	W18	Y	EF20F	
Large-blotched salamander (<i>Ensatina eschscholtzii klauberi</i>)	14	6	N	W18	Y	EF20F	
Limestone salamander (<i>Hydromantes brunus</i>)	14	6	N	W18	Y	EF20F	
Mt. Lydell salamander (<i>Hydromantes platycephalus</i>)	14	6	N	W18	Y	EF20F	
Shasta salamander (<i>Hydromantes shastae</i>)	14	6	N	W18	Y	EF20F	
Owens Valley web-toed salamander (<i>Hydromantes platycephalus</i>)	14	6	N	W18	Y	EF20F	
Scott Bar salamander (<i>Plethodon asupak</i>)	14	6	N	W18	Y	EF20F	
Del Norte salamander (<i>Plethodon elognatus elongatus</i>)	14	6	N	W18	Y	EF20F	
Coast range Newt (<i>Taricha torosa torosa</i>)	14	6	N	W18	Y	EF20F	

Snake Fence

Notes

Alameda Whip Snake (<i>Masticophis lateralis euryxanthus</i>)	43	5	N	T18	Y	EF48F	Most designers call for 48" width due to AWS speed and climbing ability
San Joaquin Whip Snake (<i>Masticophis flagellum ruddocki</i>)	43	5	N	T18	Y	EF48F	Most designers call for 48" width due to SJWS speed and climbing ability
Giant Garter Snake (<i>Thamnophis gigas</i>)	25	5	N	T18	Y	EF30F	Below are the lowest cost approved configurations for these Snakes but designers often call for 4' width and High Visibility Construction Safety.
Southern boa (<i>Charina umbratica</i>)	25	5	N	T18	Y	EF30F	
Butler's garter snake (<i>Thamnophis butleri</i>)	25	5	N	T18	Y	EF30F	
San Diego ringneck snake (<i>Diadophis punctatus similis</i>)	25	5	N	T18	Y	EF30F	
California mountain kingsnake (<i>Lampropeltis zonata</i>)	25	5	N	T18	Y	EF30F	

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Santa Cruz Island gopher snake (<i>Pituophis catenifer pumilis</i>)	25	5	N	18	Y	EF30F	
Coast patch-nosed snake (<i>Salvadora hexalepis virgultea</i>)	25	5	N	18	Y	EF30F	
Two-striped garter snake (<i>Thamnophis hammondi</i>)	25	5	N	18	Y	EF30F	
Santa Catalina garter snake (<i>Thamnophis hammondi</i> ssp.)	25	5	N	18	Y	EF30F	
South Coast garter snake (<i>Thamnophis sirtalis infernalis</i>)	25	5	N	18	Y	EF30F	
Western hognose snake (<i>Heterodon nasicus</i>)	25	5	N	18	Y	EF30F	
San Francisco Garter Snake (<i>Thamnophis sirtalis tetrataenia</i>)	38	5	L5	T18	Y	EF48LF	Always found in same habitat as CA Red legged frog. Determinant species is CRLF. Follow CRLF configuration.
Northern red-diamond rattle snake (<i>Crotalus ruber</i>)	43	5	N	T18	Y	EF48F	
Timber rattlesnake (<i>Crotalus horridus</i>)	43	5	N	T18	Y	EF48F	



Lizard, Skink Fence

Notes

Blunt-nosed leopard lizard (<i>Gambelia sila</i>)	30	5	L5	T18	N	EF40L	
Coachella Valley fringe-toed lizard (<i>Uma inornata</i>)	24	24	L5	T36	N	EF60L	
Texas horned lizard (<i>Phrynosoma cornutum</i>)	13	6	L5	W18	N	EF24L	
Coast (San Diego) horned lizard (<i>Phrynosoma coronatum blainvillii</i>);	13	6	L5	W18	N	EF24L	
Coastal western whiptail (<i>Cnemidophorus tigris multiscutatus</i>)	30	5	Y	T18	N	EF40L	
Panamint alligator lizard (<i>Elgaria panamintina</i>)	30	5	L5	T18	N	EF40L	
Black legless lizard (<i>Anniella pulchra (nigra)</i>)	19	5	N	W18	N	EF24	

Bird Fence

Notes

Least Tern (<i>Sternula antillarum</i>)	10	5	Y	18	N	EF20L	For Nestling or Fledgling Containment
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Small Mammal Fence

Notes

San Joaquin kit fox (<i>Vulpes mutica mutica</i>)	60	12	N	24	N	EF48+EF30	The fence can be extended to a height of 5' above ground to exclude SJKF. However, SJKF habitat is typically home to other special-status species. Most designers design to exclude the other species but keep the barrier low enough to allow SJKF to pass both ways. Wood ramps can be placed for cubs to pass.
Tipton kangaroo rat (<i>Dipodomys nitratoideus nitratoideus</i>)	40	6	N	T18	N	EF48	

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Stephens' kangaroo rat (<i>Dipodomys stephensi</i>)	40	6	N	T18	N	EF48	
San Bernardino kangaroo rat (<i>Dipodomys merriami parvus</i>)	40	6	N	T18	N	EF48	
Giant kangaroo rat (<i>Dipodomys ingens</i>)	40	6	N	T18	N	EF48	
Preble's meadow jumping mouse (<i>Zapus hudsonius preblei</i>)	30	5	L5	18	N	EF40L	
Northwestern San Diego pocket mouse (<i>Chaetodipus fallax fallax</i>)	30	5	L5	18	N	EF40L	
San Joaquin Antelope ground squirrel (<i>Ammospermophilus nelsoni</i>)	35	5	L8	18	N	EF48L	There's an option to add a smooth HDPE Belly-Band barrier in combination with 8" Climbing Barrier Lip.
Mojave ground squirrel (<i>Xerospermophilus mohavensis</i>)	35	5	L8	18	N	EF48L	There's an option to add a smooth HDPE Belly-Band barrier in combination with 8" Climbing Barrier Lip.
Salt Marsh Harvest Mouse (<i>Reithrodontomys raviventris</i>)	30	5	L5	18	N	EF40L	There's an option to add a smooth HDPE Belly-Band barrier in combination with 5" Climbing Barrier Lip.
San Diego desert woodrat (<i>Neotoma lepida intermedia</i>)	30	5	L5	18	N	EF40L	
San Francisco dusky-footed woodrat (<i>Neotoma fuscipes ssp. annectens</i>)	37	6	L5	18	N	EF48L	There's an option to add a smooth HDPE Belly-Band barrier in combination with 5" Climbing Barrier Lip.
Mount Lyell shrew (<i>Sorex lyelli</i>)	35	5	N	18	N	EF40	
Buena Vista Lake shrew (<i>Sorex ornatus relictus</i>)	35	5	N	18	N	EF40	
Monterey shrew (<i>Sorex ornatus salarius</i>)	35	5	N	18	N	EF40	
Southern California salt marsh shrew (<i>Sorex ornatus salicornicus</i>)	35	5	N	18	N	EF40	
Suisun shrew (<i>Sorex ornatus sinuosus</i>)	35	5	N	18	N	EF40	
Santa Catalina shrew (<i>Sorex ornatus willetti</i>)	35	5	N	18	N	EF40	
Salt-marsh wandering shrew (<i>Sorex vagrans halicoetes</i>)	35	5	N	18	N	EF40	
Monterey vagrant shrew (<i>Sorex vagrans paludivagus</i>)	35	5	N	18	N	EF40	
Pygmy rabbit (<i>Brachylagus idahoensis</i>)	35	5	N	18	N	EF40	
Riparian brush rabbit (<i>Sylvilagus bachmani riparius</i>)	35	5	N	18	N	EF40	

(Revision Date: January 3, 2017* (check www.ertecsystems.com for most current version))

4.0 Installation:

Contact ERTEC for a consultation or an approved installation diagram and guideline for each species, or combination of species. (510-521-0724 info@ertecsystems.com).

5.0 Maintenance:

Perform maintenance as required. Inspect areas of concentrated rainwater run-off following rainfall events and after high-wind events. Damage to the special-status-species exclusion barrier resulting from weather or the construction site vehicles, equipment, or operations shall be repaired immediately.

Split or torn segments shall be repaired with zip-ties or 16 gauge galvanized wire ties or replaced. Rills, gullies and other evidence of concentrated runoff which has undercut the SSSEB shall be corrected. Locations needing repair shall be repaired or replaced immediately after identifying the deficiency.

6.0 Method of Measurement:

Quantities of E- Fence to be paid for will be determined by the linear foot measured along the centerline of the installed barrier. Where E- Fence segments are joined and overlapped, the overlap will be measured as a single installed strip.

7.0 Basis of payment:

The contract price paid per linear foot for E- Fence shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing the E-Fence, complete in place, including trench excavation and backfill, and maintenance, as shown on the plans, and in these special provisions, and as directed by the Project Manager.