STORAGE SHED PROJECT



DESIGN & CONSTRUCTION DOCUMENTATION

APRIL – JULY 2016

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INTRODUCTION

This is the story of our own shed. It is not meant to be copied, but hopefully will inspire you with your own projects.

In April 2016 the thought came into my head (from God?) to build a storage shed behind our home in Ventura, CA. See the Epilogue section for the significance of this.

When I asked, "What are your rules for a storage shed?", the people at the Ventura (California) Building and Safety Office told me, "If it is under 120 square feet and under 8 ½ feet high then we do not want to hear about it." And so it is. No permits and no fees were required.

Next came a drawing of the "back 40" here, with all its odd angles, to locate and orient the shed.



ARCHITECTURE

After several other designs were looked at, it was decided to imitate the architecture of the house here and to imitate the paint colors as well. Hence the 10-degree peaked roof and the brown roof beams and blue fascia. And, the roof slant needed to face south for the solar panels.

CONCRETE PAD

The concrete pad forms were placed for a level 4-inch pad with a 6-inch deep and wide perimeter footing around the pad edge for weight bearing. 3/8-inch rebar, spaced off the ground and with the joints wire-tied, was used about every 2-feet in a grid pattern. The 20-foot lengths of rebar were bent with a conduit bender rather than cutting them.

A friend was hired to pour the concrete pad based on his tools and experience. We used about 1.6 yards of U-Cart 5-sack mix hauled from the nearest source in Oxnard.







FRAMING

The doors (discussed below) were purchased early on and the framing was designed around them. After counting how many studs were required for the project, one day Lowe's had a pallet of rejected Redwood studs on sale for the price of Douglas Fir. I bought them all and put them in the back yard until needed. They were inspected for bending and stacked so gravity would help unbend them. In the end, all 45 studs were used.

Our grandson Keith and I framed the back and side walls, building each lying flat on the concrete slab and then standing them up. Then we made the door wall the same way. The door header is a laminated beam consisting of two 2x6 lumber with a ½-inch plywood spacer. Because the roof beam is supported at one end by the door header, after the photo was taken a piece of 1 ½-inch steel Unistrut, 8-feet long, was lagged to the top of the header and the roof beam now rests on the Unistrut to distribute its weight. Temporary diagonal bracing ensured the walls remained vertical!

The 2x4 treated sills were attached to the 14-day cured concrete using fifteen 1/2" x 4 1/4" Red Head Wedge Anchors. A ¹/₂-inch hammer drill and two ¹/₂-inch concrete drill bits were required!







805.827.5171

DOORS AND SKYLIGHT

We decided to skip any windows and have a skylight for daytime lighting in the shed. We also decided to have a five-foot door opening by using two 30-inch doors side by side. A CraigsList ad led me to a fellow who had two storage sheds full of doors and windows for sale (his wife works for Home Depot). The 24" by 32" double dome skylight with a self-flashing frame (special order) was purchased for \$100. The doors (special order) are a story all by themselves. Originally purchased from Home Depot in 2013 for \$1,824, they were apparently installed, then removed and returned to Home Depot. The doors and casing were unfinished, and the "prehung" door casing came in four parts with all the staples sticking out. I got the doors and casing for \$375. After much TLC and final installation we learned the doors are NOT SQUARE! Lots of shimming and planing made them work just fine. Now we know why they were returned!

SIDING

The siding is T-111 plywood with 8-inch groove spacing and 0.578 inches thick. It is attached using Hillman #8 by 1 3/4" Premium Exterior wood screws spaced about 12-inches. These have a T-20 star drive and were easy to drive with a 3/8-inch cordless drill. The T-111 surface proved pretty hard to start the screws in, so pilot holes were drilled first. To imitate the corners on our stucco house, the wall corners were cut flush and caulked and no trim is used.

ROOFING

The roof is 23/32-inch plywood on 6-foot long 2x4 rafters each supported by one wall cap and the laminated center beam consisting of two 2x6 lumber with a ½-inch plywood spacer. The roof plywood is screwed to the rafters with the same Hillman #8 by 1 3/4" Premium Exterior wood screws spaced about 12-inches.

Roofing starts with 1 ¹/₂-inch white flashing around the perimeter. Then comes one layer of Premium Gold #15 Asphalt Felt, ASTM D226 Type 1, overlaid with one layer of sand colored roll roofing, tarred and nailed according to Internet directions for "exposed nailing".

PAINTING

My son was hired to do the painting, based on his over 30 years of professional skill at that trade. The entire shed was first caulked and cracks filled and sanded for a smooth surface. The shed was primed using one gallon of "Kills-2" and three gallons of other latex paints scrounged from various sources. Final paint was three gallons of Olympic "Navajo White" from Lowe's. The brown beams and blue fascia used leftover paint from the garage and details are unknown at this writing. The doors and casing were stained using Olympic Redwood 704 semi-transparent stain. The alder wood does not stain evenly and considerable sanding, steel-wool rubbing and re-staining were required for a uniform appearance. Final coat on the doors is Watco Danish Oil "Natural" clear finish.

ELECTRICAL AND SOLAR SYSTEM

The shed needed interior night lighting. A review of 12-volt LED lighting fixtures showed high prices and difficult availability. Then on Amazon I learned about "strip lights". These are many-feet-long skinny (5/16-inch) strips of flexible printed circuit on which are soldered bare LEDs and resistors. A HitLights SMD3528-60LED/M strip, consisting of 300 LEDs on a 16.4-foot strip, was purchased "used" for under \$2. Its 1,345 lumen output is equivalent to a 100-watt incandescent bulb but the HitLights strip uses only about 25 watts at 12 volts DC.

A study of low-power solar systems led to WindyNation located here in Ventura, CA. They offer 100-watt polycrystalline solar panels and controllers for a 12-volt DC off-grid electrical system. Their 200-watt system with a TrakMax 30L controller is more than adequate for the shed's needs.

The two Group-24 flooded deep-cycle batteries are rated at 75 ampere-hours each and are housed in a plastic storage box. Because they give off hydrogen gas when charging, if used indoors (like these are) they must be vented. A 2-inch ABS pipe leads straight up from the top of the battery box into the bottom of the Whirly Bird wind-powered roof ventilator.

The system performs as advertised and as needed. All fuses are readily available automotive type ATO. One cigarette lighter outlet offers 12 volts DC (fused at 15A) for other uses. A 2,000-watt sine-wave DC to AC inverter is available as needed.







SHED SOLAR SYSTEM DIAGRAM

Revised 11 June 2023



EPILOGUE

Just as the final paint was drying, son John and grandson Keith were given 24-hours notice they had to move from where they had been living for over a year. All their belongings were quickly moved into the shed! The shed was finished *just in time*.

Our son who did the painting finished a week before he suffered a serious ischemic stroke.

UPDATE: As of July 2022 (72 months use) the shed meets all expectations, is completely dry inside and the solar system continues to perform as desired. Battery posts are shiny and free of corrosion. Each year in July we added 4 ounces of de-ionized water to each cell.

On 19 July 2022, after 6 years of service, the two Duracell SLI24MDC 12-volt deep cycle batteries were replaced with the same model. They could still be charged but would not hold a charge very long.

STORAGE SHED MISC. INFO

HOUSE ROOF ANGLE	10.04 DEGREES	Measured & Calculated
CITY OF VENTURA BUILDING DEPT.	805-654-7869	<120SF, <8'6" high, NO PERMIT, NO FEE

WEBSITES

http://www.mathwarehouse.com/trigonometry- calculators/inverse-tangent-calculator-online.php	ARCTAN CALCULATOR
http://www.windynation.com/	200 WATT SOLAR KIT USED ON THE SHED

EXPENSES

Labor and Materials

Concrete Pad (Only)	\$ 660.89
Shed structure (Only)	\$2,521.97
Solar System Wiring & Lighting (Only)	\$743.62
TOTAL SHED COST	\$3,926.48 (\$32.72 per square foot)

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STUD PLAN



BACK WALL STUD DESIGN



LONG WALLS STUD DESIGN



DOOR WALL STUD DESIGN



DOOR CASING & OPENING CALCULATIONS

