HO scale magnetic knuckle couplers

A survey of the current crop of couplers

By Jim Hediger • Photos by the author

Operating automatic knuckle couplers were the dream of HO modelers since the 1930s, but it took the ingenuity of Dale and Keith Edwards to make them a reality. The Kadee Magne-Matic coupler they introduced in 1960 combined good looks, easy installation, and reliable magnetic uncoupling. Modelers quickly accepted this magnetic coupler, and its widespread use has made it the defacto standard of the hobby.

Recently, as Kadee's patents expired, a number of competitors entered the market with a variety of operating knuckle couplers. These newcomers are designed to function with the Kadee coupler and uncoupling magnets.

This survey will describe each of the magnetic couplers, show what's offered in each product line, and take a look at the manufacturers' instructions. I'll also show how compatible the different couplers are with each other.

Terminology

The couplers are made of cast zinc alloy or molded in tough acetal plastic. In order to be compatible, the coupler head must have an appropriate contour and size. Table 1 shows how the various HO coupler dimensions compare to the prototype sizes. Most of these couplers bear only a passing resemblance to the prototype because of their knuckle contours, exposed actuating springs, and uncoupling levers.

Except for the Kadee old-time and Accumate couplers, all of the others have a movable knuckle pivoting on a ferrous wire "air hose" that actuates the knuckle. A small knuckle spring made of acetal plastic or coiled metal wire holds the knuckle closed until pressure from another coupler forces the knuckles open to make a coupling. A tiny lip cast at the inside end of the knuckle engages the mating coupler to prevent uncoupling when they're pulled across a concealed magnet.

National Model Railroad Association Standard S-1 requires the coupler's vertical center line to be located 25⁄64" above the rails. Most coupler shanks are attached to the back of the head on this vertical center line. However, special couplers are also made with shanks that are attached to the head below center (underset) or above center (overset) to fit unusual installations. See fig. 1.

Shank length is measured from the back of the coupler head to the center line of the mounting pin as shown in fig. 2. Couplers range in length from about ¼" to 25⁄64" (just over ⅜"). Most couplers are designed with shanks

Table 1: COUPLER COMPARISONS

	Accumate	Bachmann	InterMountain	Kadee	McHenry	P-2000	Prototype
HEAD SIZES:							
Width:	22"	21"	20"	22"	21"	21"	18"
Height:	11"	12"	15"	14"	12"	14"	14"
Length:	22"	23"	19"	19"	19"	21"	14½"
STRENGTH (Pull required for knuckle failure):							
	8.13 lbs.*	5.36 lbs.*	5.02 lbs.	10.99 lbs.+	6.0 lbs.	2.78 lbs.*	
EQUIVALENT TRAIN SIZE (14 cars per ounce of drawbar pull):							
	1,821 cars	1,200 cars	1,124 cars	2,461 cars	1,344 cars	622 cars	

* Knuckle distorted under pressure to release load
\+ Test exceeded maximum load meter capacity

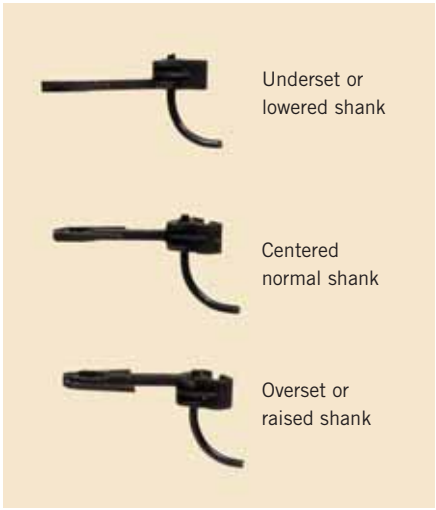

Fig. 1 SHANK POSITIONS. Three different shank heights are offered for unusual floor heights.

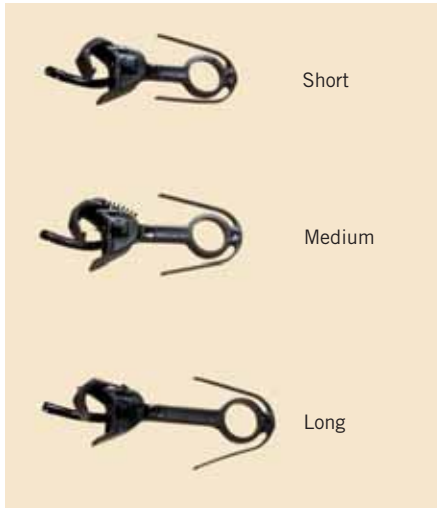

Fig. 2 SHANK LENGTHS. Three shank lengths accommodate different coupler box locations.

shaped to fit a specific coupler mounting box and centering spring.

A variety of centering devices are employed to return the coupler to the car's longitudinal center line. Some couplers use separate metal springs while others have integral plastic springs molded into the shanks.

Many different coupler boxes are offered to mount the couplers and centering springs. Some are generic while others are designed to fit specific cars or locomotives. All of these mounting systems are designed to maintain the standard coupler height.

Since they set the pattern everyone's following, let's begin with a look at the extensive line produced by Kadee.

Kadee Magne-Matic couplers

Kadee's Magne-Matic couplers are made of a hard, cast zinc alloy with a small bronze coil spring on the outside that gently holds the knuckle closed. A curved soft iron actuating lever, shaped roughly like an air hose, hangs down nearly to the rails beneath the coupler.

Kadee Magne-Matic couplers

Uncoupling is accomplished with a magnet, polarized across the rails, that pulls the actuating pins in opposite directions to open the knuckles.

Acetal plastic shanks are used in the 20- and 30-series insulated couplers, but their knuckles are cast metal.

Over the past 40 years, Kadee has developed a comprehensive system of couplers, mounting methods, and hardware to fit virtually every model locomotive or car ever built. The firm presently produces 40 different coupler and hardware sets in both metal and acetal plastic, numerous conversion kits for popular locomotives, a height gauge, shims and washers, trip pin adjusting pliers, assembly fixtures, nonmagnetic wheelsets, and four uncouplers.

Besides top product performance, what really sets the Kadee line apart is its excellent documentation beginning with a well-illustrated 52-page 8½" x 11" catalog that explains everything in detail. It includes dimensioned drawings of every coupler and box Kadee makes, standard and inverted mounting methods, hints for optimum performance, and a coupler conversion guide.

Of all the couplers Kadee makes, the no. 5 universal metal coupler is by far the most popular. It has a flat bronze centering spring and a 9⁄32" shank length that fits easily into the coupler boxes of most popular plastic and resin car kits made by A-Line, Accurail, Athearn, Atlas, Bowser, Life-Like, Model Die Casting, Red Caboose, Stewart Hobbies, Sunshine Models, Tichy Train Group, and Walthers.

Kadee also offers three sample test kits which include one example of each coupler along with installation instructions. Test kit no. 13 covers 25 different couplers, no. 91 has the entire 20-series acetal group, and no. 92 covers the 30-series acetal couplers.

Accumate couplers

Accurail's Accumate coupler consists of two molded acetal plastic shank pieces that are stacked on a center post and actuated with a curved mild steel pin. Each shank half has an integral molded spring that loops around the rear of the shank to keep the coupler closed and centered.

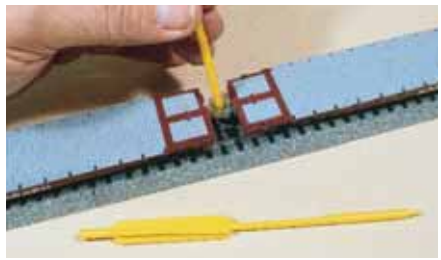

Fig. 3 ACCUMATE SWITCHMAN. Inserting and gently twisting this Switchman tool provides manual uncoupling of Accumate couplers.

The lower shank half contains the rigid knuckle and steel actuating pin, while the top half carries the guard arm. A small interlocking pin limits the motion between the shank halves to provide a pushing surface at the center line of the coupler. The inside of the knuckle profile is curved to accept a Switchman manual uncoupling tool. See fig. 3. There is no draft angle inside the Accumate knuckle. This minimizes any tendency to lift one knuckle out of the other under heavy pulling pressure.

Accumate couplers

Accurail offers universal Accumate couplers, with centered shanks 9⁄32" long that fit into the same plastic cars as the Kadee no. 5. Two other sizes with ¼" medium and 25⁄64" long shanks are also available along with the Switchman manual uncoupling tool shown in fig. 3.

Small pictorial drawings and concise instructions are printed on the back of each Accumate package and a printed installation tip sheet is available to explain their use.

Bachmann E-Z Mate couplers

Bachmann's line of knuckle couplers is made in China under license from McHenry. Both the knuckle and shank are molded Celcon plastic with integral centering springs curving around both sides from the back. The regular E-Z Mate coupler has an integral plastic knuckle spring while the E-Z Mate

Bachmann E-Z Mate couplers

Table 2: COUPLING ON CURVES

18" RADIUS

	Accumate	Bachmann	InterMountain	Kadee	McHenry	P-2000
Accumate	No					
Bachmann	No	No				
InterMountain	Fair*	Fair*	No			
Kadee	Fair*	Fair*	Fair*	Yes		
McHenry	No	No	Fair*	Fair*	No	
Proto 2000	No	No	No	Fair*	No	No

22" RADIUS

Accumate	No					
Bachmann	Fair*	Fair*				
InterMountain	Fair*	Fair*	No			
Kadee	Fair*	Fair*	Yes	Yes		
McHenry	Fair*	No	Fair*	Fair*	No	
Proto 2000	Fair*	No	Fair*	Fair*	Fair*	No

* Coupling depended upon which knuckle was on the inside of the curve

Mark II has a metal coil spring secured with a tiny spring retainer. Both couplers have a soft iron uncoupling lever.

Standard E-Z Mates come in nine versions with centered, overset, and underset shanks in lengths from ¼" to 25⁄64." Mark IIs are only offered with a centered medium length shank. An uncoupling magnet with a brakeman figure is also available.

Basic instructions are provided on the back of each coupler package.

InterMountain couplers

InterMountain's coupler is nicely proportioned and comes only with a centered 9⁄32" shank shaped like the Kadee no. 5. The knuckle and shank are molded in acetal plastic with integral centering springs that look like tiny whiskers on each side. A similar small plastic spring holds the knuckle closed and it has a steel actuating lever.

InterMountain couplers

This coupler fits in all of the common plastic kit coupler boxes, but shims are needed for proper centering if the box is more than ¼" wide.

InterMountain sells these couplers in either black- or rust-colored plastic.

Basic instructions are provided on the back of each coupler package.

McHenry couplers

McHenry's couplers are made in China with the knuckle and shank molded in acetal plastic. Integral centering springs curve around both sides from the back and a tiny plastic spring holds the knuckle closed. A soft iron wire serves as the actuating lever.

McHenry couplers

McHenry's standard couplers come in the same nine versions as the Bachmann E-Z Mates, plus three very long shank versions which are made as snap-in replacements for Rivarossi passenger cars and locomotives. See fig. 4. An uncoupling magnet is also available.

The McHenry KS coupler is also made of acetal plastic, but it has a metal knuckle spring, a spring retainer, and is only available with a centered medium length shank like Kadee's no. 5.

McHenry's standard couplers are sold in bulk packages of 25 or 250 pairs and the KS series coupler is offered in bulk packs of 25 pairs.

Basic instructions are provided on the back of each coupler package.

Fig. 4 SPECIAL COUPLERS. McHenry offers extra long shank couplers designed for easy conversion of Rivarossi passenger cars.

Proto 2000 couplers

Life-Like's couplers are also produced in China. They're molded in acetal plastic and are only offered with a 9⁄32" centered shank shaped like the

Proto 2000 couplers

Kadee no. 5. An integral plastic whisker spring holds the knuckle closed and the coupler has a steel actuating lever. A flat bronze spring provides the centering.

No instructions are provided.

Compatibility testing

The obvious question is how well do all these couplers work together since they're advertised as being compatible with earlier designs, Kadee in particular.

I devised a tight-radius test using Atlas code 83 True-Track for the 18"-radius and 22"-radius curves. Two curved sections, two straights, and two more curves were assembled into a large S shape and a Kadee under-track uncoupling magnet was added to one straight to test the uncoupling and delay features.

Walthers 52-foot GSC flatcars served as the test cars. Pairs of each type of coupler were installed in the stock Walthers coupler boxes so all of the test combinations were available. Ten tests were made with each combination on the inside curves, straightaways, and outside curves and the results are shown in Table 2.

All of the couplers and combinations worked fine on the straightaway including the delayed uncoupling feature shown in fig. 5. However, curves were another story.

Kadee's couplers were the only ones which actually coupled reliably on the curves in Table 2. On contact, the others shifted off center toward the outside of the curve in positions where both knuckles could not open to complete a coupling. See fig. 6. A little manual assist from the outside of the curve completed these couplings.

Fig. 5 DELAYED UNCOUPLING. A wide magnet uncouples the cars, then the cars are separated and brought together again with the couplers offset as shown so a car can be shoved and left at a distant location.

Fig. 6 BAD ANGLE. A bad gathering angle forces different brands of couplers off center toward the outside of a curve so they cannot couple. A manual assist toward the center lets the knuckles open and couple properly.

Many of the mismatched coupler combinations worked only part of the time depending upon the orientation of the knuckles in the curve. Certain positions allowed one knuckle to slip into the other on an inside curve but not on an outside curve, so they're rated as fair.

While these curves are admittedly sharp, they were chosen because many modelers have them in HO layouts. Wider curves naturally improve the overall performance as the couplers aren't being pushed to their limits.

Modelers using plastic couplers have reported problems with the integral springs failing to close the knuckles when they've been stored under pressure for long periods of time.

Coupler strength

Model knuckle couplers are made oversize to provide as much gathering range as possible for coupling. Knuckle strength isn't a factor as all of the couplers are far stronger than anything most modelers will ever require.

Table 1 includes the results of MODEL RAILROADER's strength tests using pairs of matched couplers and a commercial strain gauge. In each case, several couplers were pulled to the failure or breakaway point and the results averaged.

The acetal plastic Accumate, Bachmann, and Proto 2000 knuckles all eventually distorted and opened under the extreme pull without breaking. InterMountain and McHenry knuckles broke off under extreme pressure. The Kadee metal knuckle also broke, but it failed at a point well beyond the strain gauge's 11-pound measuring capacity!

Enhancing performance

Good installation is the key to obtaining the top performance from all of these couplers. Study and follow the instructions carefully as they represent a lot of research and testing. Regular inspections and maintenance will keep operations running smoothly.

• Kadee sells a coupler height gauge that makes it easy to check every car. It measures the NMRA standard coupler height and has a small shelf that ensures the actuating pin has the proper 1/32" clearance over the railheads.

• When you install couplers, use shims in the coupler boxes to minimize any vertical play while maintaining free movement from side to side. Adjust the coupler heights to exactly match the NMRA standard.

• Cars traveling near the head end of heavy trains on grades are subject to an amazing amount of pull which can force one knuckle up and out of the other. This forces the opposite coupler down and may loosen it until the actuating pin can snag things between the rails. Remove any cars with drooping couplers until they are repaired.

• Concealed permanent magnet uncouplers and delayed action couplers work reliably in yards and sidings. However, experienced modelers prefer to use electromagnets on main tracks wherever there's a possibility of accidental uncoupling if the train stops over an uncoupler.

Overall, HO modelers now enjoy the greatest selection of operating automatic knuckle couplers ever. Even so, it still takes some careful installation and regular maintenance to obtain the top performance that's available.

EXACT SCALE SIZE COUPLERS

The trend toward ever better rolling stock has created a demand for exact scale working knuckle couplers. See Table 3. Three model railroad manufacturers, Accurail, Kadee, and Sergent Engineering Co., have responded to the challenge.

• Accurail's Proto HO Accumate scale size coupler is a replica of the prototype AAR type E coupler. It's a two-piece acetal plastic design that follows the principles used in the firm's regular Accumate coupler. It uses a special detailed coupler box designed to fit inside the typical plastic kit's oversize coupler box. This forces modelers to use the matching parts for improved reliability. The special box is also sized to fit properly in a scale underframe.

• Kadee has offered its 3/4-size no. 711 coupler for many years. It's made of acetal plastic for use on old-time equipment and has a split shank and special coupler box. Even though it's much lighter in appearance, it will work with regular Kadee couplers.

• Kadee has announced a new scale version of its Magne-Matic coupler that's made of metal with the same shank as a no. 5. It's designed to fit in the same coupler boxes, uses the same metal centering spring, and is compatible with Kadee's normal size couplers.

• The Sergent Engineering coupler is a cast metal scale size automatic that works like a prototype coupler using an internal ball bearing as a locking device. Its knuckle has open and closed positions, but there's no actuating lever underneath nor a visible knuckle spring. Both knuckles have to be open for coupling to take place. Uncoupling is done by reaching between cars with a magnetic wand. – *Jim Hediger*

Table 3: SCALE SIZE COUPLER HEAD SIZES

	Accumate	Kadee	Kadee Old time	Sergent	Prototype
Width:	18"	18"	15"	16"	18"
Height:	14"	14"	12"	15"	14"
Length:	15"	18"	15"	15"	14½"